Appendix 9A

FLOOD RISK ASSESSMENT

MWP

Flood Risk Assessment

Brittas Wind Farm
Thurles, Co. Tipperary

BRITTAS WIND FARM LTD

SEPT 2024

Contents

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Project No.	Doc. No.	Rev.	Date	Prepared By	Checked By	Approved By	Status
23318	MWP-XX-XX-RP-Z-6013-S0	P01	12/09/2024	BM	MF	MF	ISSUE

MWP, Engineering and Environmental Consultants
Address: Park House, Bessboro Road, Blackrock, Cork, T12 X251
www.mwp.ie

Glossary of Acronyms and Terms

AEP	Annual Exceedance Probability
API	Antecedent Precipitation Index
CFRAMS	Catchment Flood Risk Assessment and Management Study
DEFRA	Department for Environment, Food and Rural Affairs
DTM	Digital Terrain Model
EPA	Environmental Protection Agency
FFL	Finished Floor Level
FRA	Flood Risk Assessment
FSR	Flood Studies Report
FSU	Flood Studies Update
GDSDS	Greater Dublin Strategic Drainage Study
HEP	Hydrological Estimation Point
HEFS	High End Future Scenario
LAP	Local Area Plan
M aOD	Metres Above Ordnance Datum
MRFS	Mid Range Future Scenario
MWP	Malachy Walsh & Partners
OPW	Office of Public Works
PSFRM	The Planning System and Flood Risk Management Guidelines, November 2009
SAAR	Standard Average Annual Rainfall
SuDS	Sustainable Urban Drainage Systems

1. General

1.1 Introduction

MWP Engineering and Environmental Consultants have been commissioned to carry out a Flood Risk Assessment on behalf of Brittas Wind Farm Ltd. (the Applicant) who proposes to develop a wind farm (named Brittas Wind Farm) comprising ten (10) No. wind turbines and new 110kv substation approximately 3km to the north of Thurles, Co. Tipperary.

1.2 Overview of Existing Site

The proposed project area is located 3km north of Thurles town in the following townlands: Brittas, Rossestown, Clobanna, Brownstown, Killeenleigh and Kilkillahara in County Tipperary. Figure 1-1 shows the proposed main wind farm development.

The affected lands are made up of agricultural fields bounded by hedgerows and treelines. An area of broadleaf forestry is located at the southwest of the site. The River Suir transects the site from north to south. The N62 is located west of the site, running north to south, connecting Templemore to Thurles. The N62 provides a link to the M6, M7 and M8 motorways. The L8017 local road traverses the centre of site from east to west, crossing the River Suir at a bridge point.

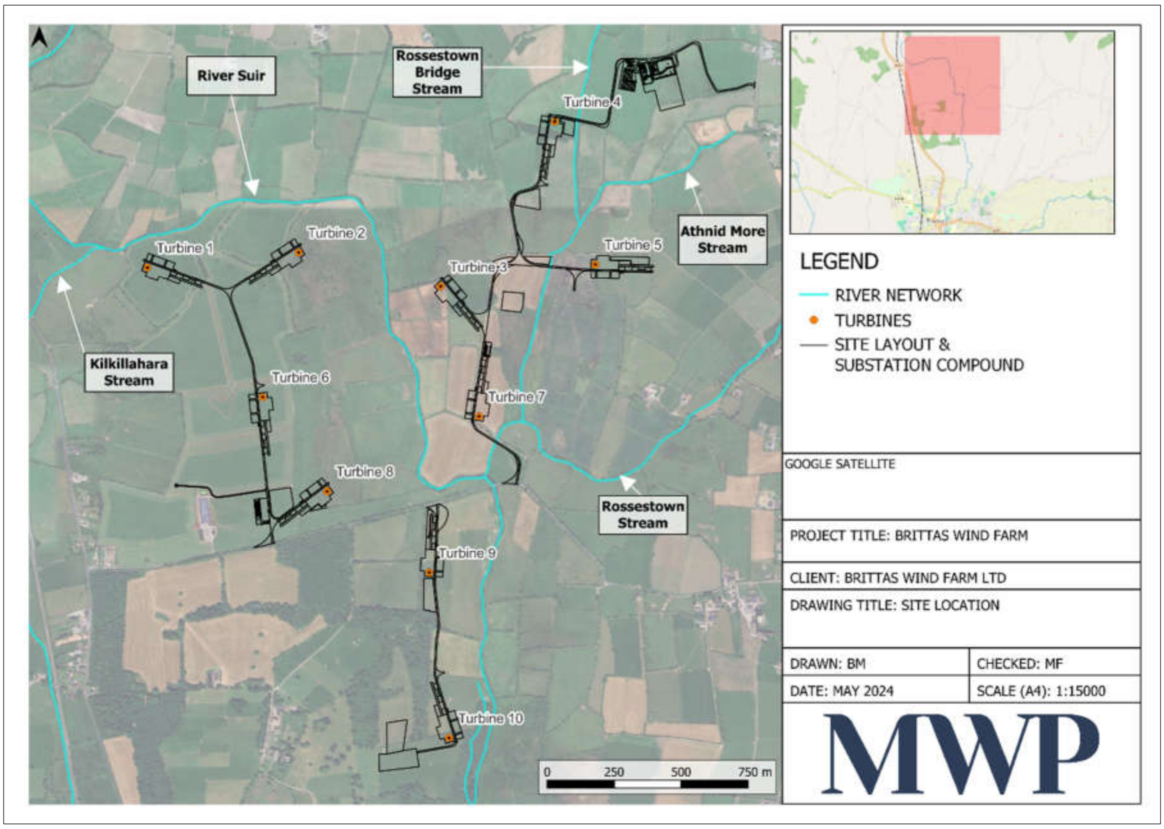


Figure 1-1: Site Location

1.3 Overview of Proposed Development

The development for which planning permission is sought in the planning application (the proposed development) consists of the following (see Figure 1-1 for site layout):

- 10 No. Wind Turbines with a blade tip height of 180m, hub height range from 102.5 to 105.5m and a rotor diameter range from 149m to 155m;
- 10 No. Wind Turbine foundations and Hardstand areas and associated drainage infrastructure;
- 1 No. Permanent Lidar unit and associated foundation, hardstand area and compound for Meteorological Monitoring;
- 1 No. 110kV Electrical Substation including 2 No. control buildings, electrical plant and equipment, welfare facilities, carparking, water and wastewater holding tanks, security fencing, lightening protection and telecommunications masts, security cameras, external lighting and, all associated infrastructure;
- Installation of medium voltage underground electrical and communication cabling connecting the wind turbines to the proposed onsite substation and associated ancillary works;
- Installation of approximately 7km of underground electricity and communication cabling between the proposed onsite substation and the nearby existing Thurles 110kV substation in the townland of Ballygammane, Co. Tipperary. The cabling will be laid primarily within the public road and will connect the proposed wind farm to the national grid;
- 4 No. Site Entrances from the public road and associated fencing and signage;
- Construction of new permanent site access tracks, turning heads and associated drainage infrastructure;
- The upgrading of existing access tracks and associated drainage infrastructure;
- 2 No. Temporary construction site compounds and mobile welfare facilities;
- 1 No. Borrow pit and associated drainage infrastructure to be used as a source of stone material during construction;
- Spoil deposition areas;
- Associated surface water management systems;
- Tree felling and hedgerow removal to accommodate wind farm infrastructure;
- Replanting of trees on site;
- Temporary accommodation works at 2 no. locations adjacent to the public road to facilitate delivery of turbine components to site within the townlands of Brittas and Brittasroad, Co. Tipperary. The works primarily relate to trimming and clearing of vegetation, temporary removal of street furniture and fencing, and installation of temporary stone hard standing; and
- All related site works and ancillary development;

Other elements of the project which are assessed throughout the EIAR but are not the subject of this SID planning application are as follows:

- Battery Energy Storage Facility (BESS)

- Rerouting of on-site ESB 38kV overhead powerline (OHL)
- Accommodation works along the turbine delivery route which includes temporary removal of traffic signs and lights, electricity poles, bollards and lamp posts, fences, and hedge and tree removal/trimming.

1.4 Objectives

The purpose of the report is to establish the flood risk associated with the proposed development and, if appropriate, to recommend mitigation measures to prevent any increase in flood risk within the site or externally in the wider area.

The report has been prepared in the context of *The Planning System and Flood Risk Management – Guidelines for Planning Authorities, November 2009*, published by the Office of Public Works and the Department of Environment, Heritage and Local Government. Flood Risk Assessments are carried out at different scales by different organisations. The hierarchy of assessment types are Regional (RFRA), Strategic (SFRA) and Site-specific (FRA). This report is site-specific.

1.5 Methodology

The Flood Risk Management Guidelines document outlines three stages in the assessment of flood risk as follows:

Stage 1 Flood risk identification – to identify whether there may be any flooding or surface water management issues related to a plan area or proposed development site that may warrant further investigation;

Stage 2 Initial flood risk assessment – to confirm sources of flooding that may affect a plan area or proposed development site, to appraise the adequacy of existing information and to determine what surveys and modelling approach is appropriate to match the spatial resolution required and complexity of the flood risk issues. The extent of the risk of flooding should be assessed which may involve preparing indicative flood zone maps. Where existing river or coastal models exist, these should be used broadly to assess the extent of the risk of flooding and potential impact of a development on flooding elsewhere and of the scope of possible mitigation measures; and

Stage 3 Detailed risk assessment – to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of potential flood risk to a proposed or existing development, of its potential impact on flood risk elsewhere and of the effectiveness of any proposed mitigation measures. This will typically involve use of an existing or construction of a hydraulic model or a river or coastal cell across a wide enough area to appreciate the catchment wide impacts and hydrological processes involved.

This report has been prepared generally in accordance with these stages.

1.6 Flood Risk & Zones

In the Planning System and Flood Risk Management Guidelines document, the likelihood of a flood occurring is established through the identification of Flood Zones which indicate a high, moderate or low risk of flooding from fluvial or tidal sources. Table 1-1 below includes the definition of Flood Zones as well as the implications for planning. The flood zone type is determined based on current water surface levels without allowance for climate change and without the benefit of any flood defences. It is important to note that the Flood Zones do not take other sources of flooding, such as groundwater or pluvial, into account, so an assessment of risk arising from such sources should also be made, where appropriate.

Flood Zone	Description & Summary of Planning Implications
Zone A High probability of flooding	More than 1% probability (1 in 100) for river flooding and more than 0.5% probability (1 in 200) for coastal flooding. Most types of development would be considered inappropriate in this zone.
Zone B Moderate probability of flooding	0.1% to 1% probability (between 1 in 100 and 1 in 1,000) for river flooding and 0.1% to 0.5% probability (between 1 in 200 and 1 in 1,000) for coastal flooding. Highly vulnerable development, such as hospitals, residential care homes, Garda, fire and ambulance stations, dwelling houses and primary strategic transport and utilities infrastructure, would generally be considered inappropriate in this zone.
Zone C Low probability of flooding	This zone defines areas with a low risk of flooding from rivers and the coast (i.e. less than 0.1% probability or less than 1 in 1,000). Development in this zone is appropriate from a flooding perspective (subject to assessment of flood hazard from sources other than rivers and the coast).

Table 1-1: Definition of Flood Zones

The Guidelines have outlined three Vulnerability Classifications for developments based on the proposed land use and type of development. These classifications and particular examples of development types which would be included in each classification are summarised as follows;

- Highly Vulnerable Development: This would include emergency services, hospitals, schools, residential institutions, dwelling houses, essential infrastructure, water & sewage treatment etc.
- Less Vulnerable Development: Retail, leisure, commercial, industrial buildings, local transport infrastructure.
- Water-compatible development: Docks, marinas and wharves. Amenity and open space, outdoor sports and recreation and essential facilities such as changing rooms.

The Guidelines include a matrix that determines the appropriateness of different types of development based on their vulnerability classification and the Flood Zones in which they are located. The matrix is reproduced in Table 1-2 below.

Where the matrix indicates that a development is not appropriate it may still be justified based on a procedure described as a Justification Test.

The proposed wind farm development is classed as Highly Vulnerable Development and development in Flood Zone C is appropriate. If the Justification Test is passed, development within Flood Zone A/B could be appropriate.

Vulnerability Classification	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

Table 1-2: Vulnerability Matrix

2. Flood Risk Identification (Stage 1)

Possible sources of flood risk were identified by;

- Geology & Soil Mapping
- Flood History - examination of available information on the OPW website (www.floodinfo.ie)
- National Indicative Fluvial Mapping
- Suir Catchment Flood Risk And Management Study (Suir CFRAMS)
- GSI Winter 2015/2016 Surface Water Flooding
- Internet Searches
- Walkover survey of the subject site and the nearby watercourses

2.1 Geology & Soil Mapping

The geology and soils at the site have been reviewed using the Geological Survey of Ireland database. The proposed site location is predominantly underlain by *AlluvMIN - Alluvial (mineral)* soil and *BminPDPT - Peaty poorly drained mineral (Mainly basic)* soil according to Teagasc soil data. The presence of Alluvium soils can be an initial indicator of an area which has been subject to flooding in the geological past but cannot be used to determine flood risk to an area. The quaternary sediment map indicates that the site is underlain by Alluvium and Till derived from limestones. The bedrock geology in this area is dominated by Ballysteen Formation and Waulsortian Limestones which is described as *Dark muddy limestone, shale* and *Massive unbedded lime-mudstone* respectively.

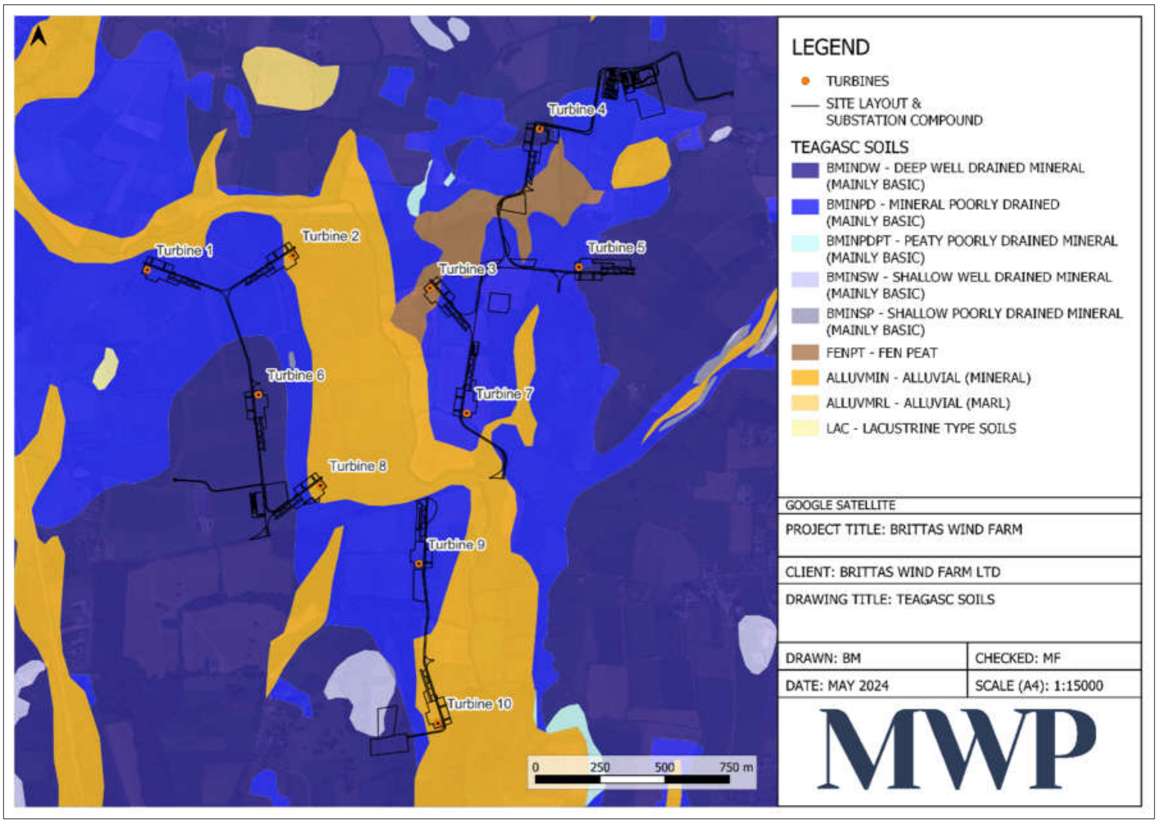


Figure 2-1: Teagasc Soil Map

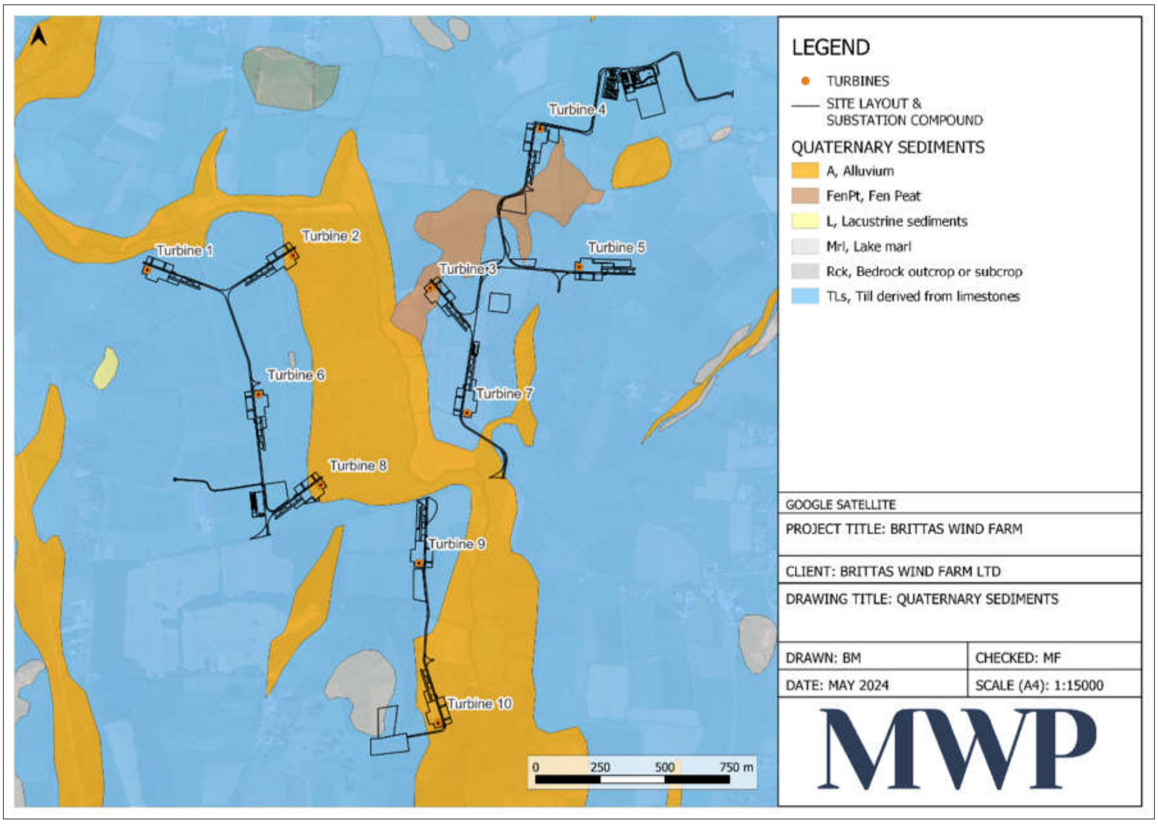


Figure 2-2: Quaternary Sediment Map

2.2 Flood History – OPW Local Area Summary Report

The Past Flood Event Local Area Summary Report which was obtained from the Office of Public Works (OPW) floodinfo.ie website is included on Figure 2-3 below. This report summarises all recorded past flood events near the site. There are two flood events near the site which have been reported and are summarised as follows;

ID-3751: Rossestown to Loughmoe Recurring (North of Thurles) - River Suir floods land along right bank and intermittently on left bank most winters.

ID-10571: Flooding took place along the river Suir in January 2008. Using aerial photography and video footage OPW staff digitised a portion of the flood extents as seen in Figure 2-4 below.

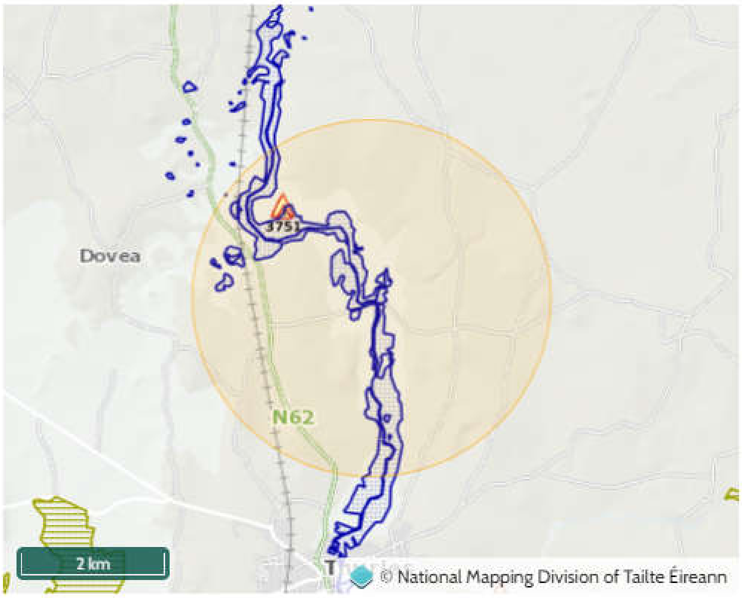
Past Flood Event Local Area Summary Report

Oifig na nOibreacha Poiblí
Office of Public Works

Report Produced: **16/1/2024 10:25**

This Past Flood Event Summary Report summarises all past flood events within 2.5 kilometres of the map centre.

This report has been downloaded from www.floodinfo.ie (the "**Website**"). The users should take account of the restrictions and limitations relating to the content and use of the Website that are explained in the Terms and Conditions. It is a condition of use of the Website that you agree to be bound by the disclaimer and other terms and conditions set out on the Website and to the privacy policy on the Website.



Map Legend

- Single Flood Event
- Recurring Flood Event
- Past Flood Event Extents
- Drainage Districts Benefited Lands*
- Land Commission Benefited Lands*
- Arterial Drainage Schemes Benefited Lands*

* Important: These maps do not indicate flood hazard or flood extent. Their purpose and scope is explained on Floodinfo.ie

2 Results

	Name (Flood_ID)	Start Date	Event Location
1.	Rossestown to Loughmoe Recurring (ID-3751)	n/a	Approximate Point
	Additional Information: Reports (2) Press Archive (0)		
2.	Suir Flood Jan 2008 (ID-10571)	10/01/2008	Area
	Additional Information: Reports (1) Press Archive (0)		

Figure 2-3: OPW Past Flood Event Local Area Summary Report

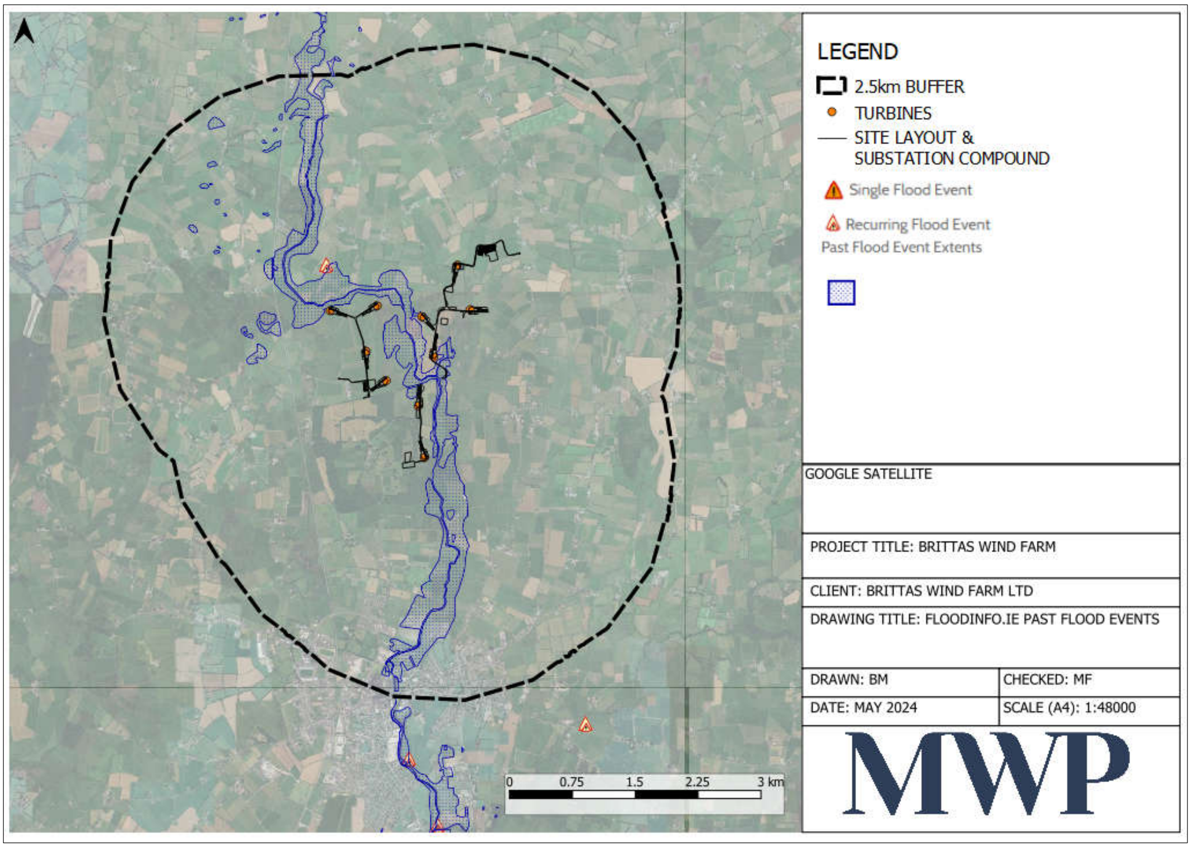


Figure 2-4: Past Flood Event Locations

2.3 National Indicative Fluvial Mapping

The National Indicative Fluvial Flood Maps have been produced for catchments greater than 5km² in areas for which flood maps were not produced under the National Catchment Flood Risk Assessment and Management Programme (CFRAM). As the River Suir was assessed under the Suir CFRAM study, no National Indictive Fluvial Flood Maps are available.

However, there is a tributary of the River Suir, the Rossestown Stream that converges with the River Suir downstream of Turbine 7. The tributary has been mapped under the National Indicative Fluvial Mapping program. An extract of the fluvial flood mapping for the current scenario is shown in Figure 2-5. These maps are not the best achievable representation of projected flood extents, such as those that could be generated through detailed hydraulic modelling, and are only indicative of the predicted flood extent of any given probability at any particular location. They should not be used for local decision-making or any other purpose without verification and seeking the advice of a suitable professional.

The flood maps may be used in the Stage 1 Flood Risk Assessment (Flood Risk Identification) to identify areas where further assessment would be required if development is being considered within or adjacent to the flood extents shown on the maps. Similarly, the maps may be used to identify whether flood risk might be a relevant issue when considering a planning application, or when discussing a potential application at pre-planning stage. Local site inspections, and / or making use of the knowledge of staff familiar with a particular area, are essential to determine if the maps for a given area are reasonable. For the purposes of flood zoning, or making decisions on planning applications, it is strongly recommended that a Stage 2 Flood Risk Assessment (Initial Flood Risk Assessment), as set out in the Planning System and Flood Risk Management Guidelines, is undertaken (where there are proposals for zoning or development, and where the area may be prone to flooding, as described above). These maps are 'predictive' flood maps showing indicative areas predicted to be inundated during a theoretical fluvial flood event with an estimated probability of occurrence, rather than information for actual floods that have occurred in the past, which is presented, where available, on the 'past' flood maps.

The maps refer to flood event probabilities in terms of a percentage Annual Exceedance Probability, or 'AEP'. This represents the probability of an event of this severity occurring in any given year. They are also commonly referred to in terms of a return period (e.g. the 100-year flood). The flood extents for the 1% and 0.1% AEP Present Day Scenario (Current Scenario) flood events are illustrated below in Figure 2-5 below.

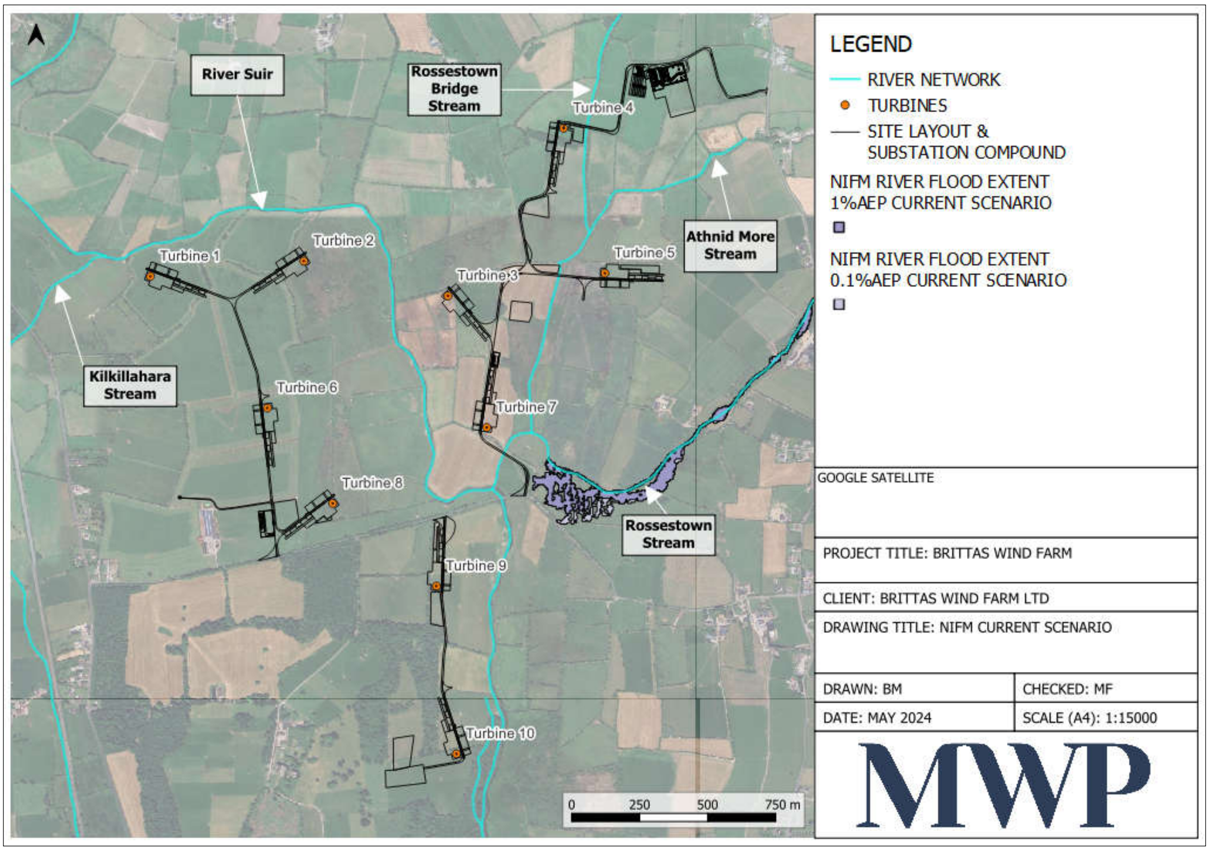


Figure 2-5: National Indicative Fluvial Mapping

2.4 Suir Catchment Flood Risk and Management Study (Suir CFRAMS)

The OPW Suir CFRAM study is the most detailed mapping in the area. The Suir CFRAM involved detailed hydraulic modelling of rivers and their tributaries along with coastal flooding. Flood extents have been generated for the River Suir. The mapping indicates that part of the proposed site is at risk of flooding during the 1% AEP and 0.1% AEP Fluvial Flood event. An extract of the flood extent map for the present-day scenario is shown in Figure 2-6 below.

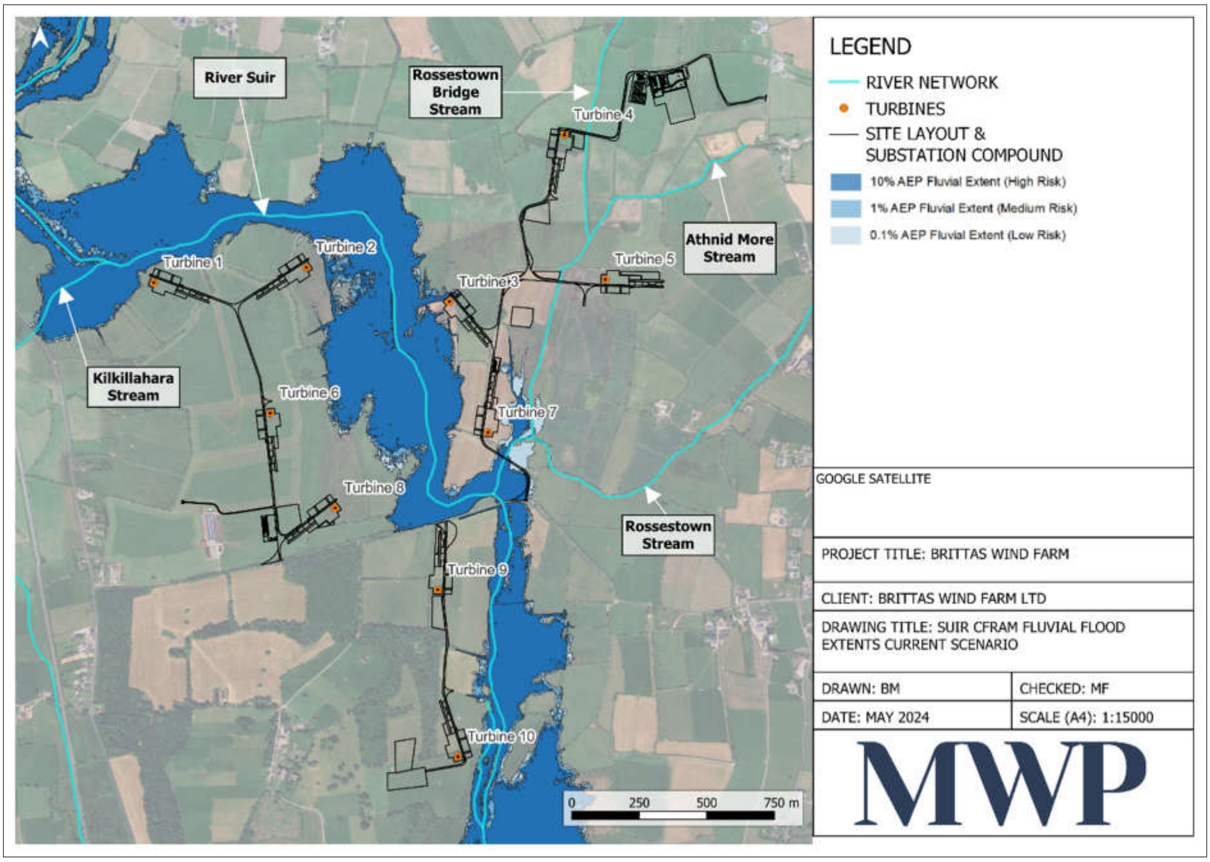


Figure 2-6: Southwestern CFRAM 10%, 1%AEP and 0.1%AEP Fluvial Flood Extent Map

2.5 GSI Winter 2015/2016 Surface Water Flooding

The Winter 2015/2016 Surface Water Flooding map shows fluvial (rivers) and pluvial (rain) floods, excluding urban areas, during the winter 2015/2016 flood event. There is flooding indicated within close proximity to the proposed development site during this flood event as seen in Figure 2-7 below.

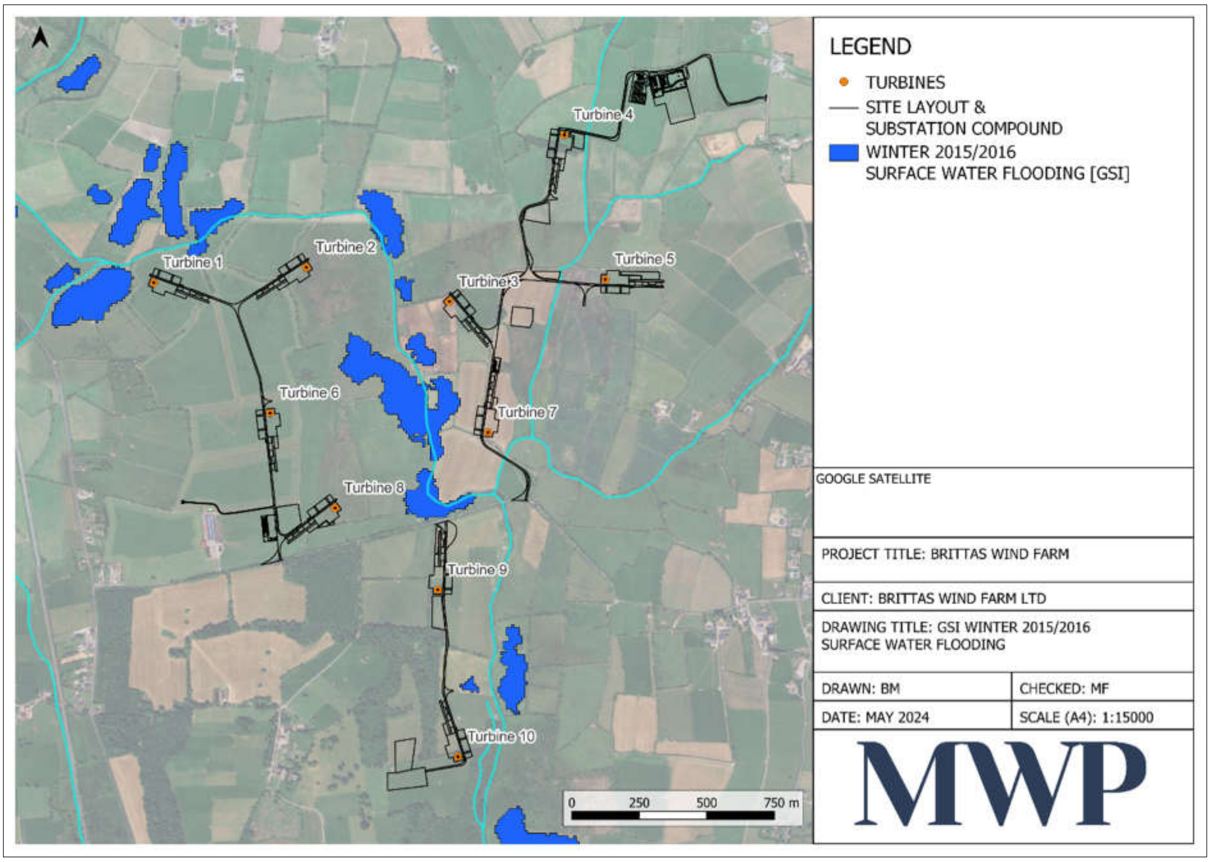


Figure 2-7: GSI Winter 2015/2016 Surface Water Flooding

2.6 Internet Searches

An internet search was conducted to gather information about whether the site was affected by flooding previously. There were no reports of flooding.

2.7 Walkover survey of the subject site and the nearby watercourse

A site walkover was carried out by MWP within the site boundary, upstream & downstream of the site on the 22nd June 2023 and the 29th September 2023. The main purpose of the site walkover was to identify any features that have not already been identified in the desktop study. No significant features pertinent to this flood risk assessment were identified on site during the walkover. Appendix A provides several photographs, which demonstrate the characteristics of the main channel, left overbank and right overbank.

2.8 Summary of Stage 1 FRA

The Stage 1 FRA has identified a potential flood risk at this site. Notwithstanding this, a Stage 2 FRA will be carried out to provide a more comprehensive assessment of the flood risk.

3. Initial Flood Risk Assessment (Stage 2)

The purpose of Initial Flood Risk Assessment is primarily to ensure that the relevant flood risk sources are identified so that they can be addressed appropriately in the Detailed Flood Risk Assessment.

3.1 Flooding Sources

The potential sources of flooding and their relevance to the flood risk at the site are outlined in the following sub-sections.

3.1.1 River Flooding

Fluvial flooding occurs when the capacity of a river channel is exceeded and water flows onto the adjacent land or floodplain. The main watercourse in the proximity of the site is the River Suir which flows from north to south through the site.

The Suir CFRAM has included detailed modelling of the River Suir. Although there is flood extents available for the proposed site, no flood maps have been produced for this area. Flood maps are available further south for Thurles town with a series of nodes which give the 10%AEP, 1%AEP and 0.1%AEP flow(m^3/sec) and water level (mOD). The flood extents in Figure 2-6 indicate that part of the proposed development is located within Flood Zone A/B.

An updated hydraulic model of the River Suir and tributaries of the River Suir will be required. It will be necessary to complete a Stage 3 - Detailed Flood Risk Assessment for this site. The Stage 3 assessment will determine freeboard for proposed turbines and associated hardstanding areas and any internal access tracks that could be potentially at risk of flooding. The Stage 3 Assessment will deliver flood extent maps, water surface elevations (mOD), depth(m) and flow(m^3/sec) for the proposed site.

3.1.2 Pluvial Flooding

Overland flow or pluvial flooding occurs when rainfall intensity exceeds the infiltration capacity of the ground. The excess water flows overland to the nearest watercourse or piped drainage system. Intense rainfall events can result in ponding in low areas or upstream of physical obstructions. Overland flow is most likely to occur following periods of sustained and intense rainfall when the ground surface becomes saturated. Flood risk from pluvial sources exists in all areas. The existing site is a greenfield site. Increase in hardstanding area will increase the risk of pluvial flooding. There is history of pluvial or surface water flooding on the site.

3.1.3 Estuarial Flooding

Estuarial or tidal flooding is caused by higher-than-normal sea levels which occur primarily due to extreme high tides, storm surges, wave action or due to high river flows combining with high tides. This risk is not relevant to this site as the proposed site is located inland. Therefore, this does not require further consideration in this report.

3.1.4 Groundwater Flooding

Groundwater flooding occurs when the water table rises to the level of the ground surface due to rainfall and flows out over the surface. Groundwater flooding occurs relatively slowly and generally poses a low hazard to people. There is no known history of such an occurrence in the vicinity of the site or no karstic landforms within the site. For these reasons this source of flooding will not be considered further in this report.

3.2 Stage 2 Summary of Identified Flood Risk

The information collected during the Stage 2 FRA indicates that the flood risk at this site is high and a Stage 3 Flood Risk Assessment is required.

Flooding Source	Stage 3 Requirement	Comment
Fluvial	Required	Suir CFRAM indicates that there is a risk of fluvial flooding within the site for the present day 1% AEP event and above.
Pluvial/Overland Flow	Not Required	Pluvial flooding exists in all areas. Adequate storm water drainage systems will minimise pluvial flood risk.
Estuarial/Coastal	Not Required	The site is located inland. Therefore, this flood risk is not relevant to this site
Groundwater	Not Required	There is also no known history of such an occurrence in the vicinity and no features associated with groundwater flooding were identified within or in close proximity of the site

Table 3-1: Summary of Identified Flood Risk

3.3 Appraisal of Availability and Adequacy of Existing Information

Reliable gauged flow data is available for the River Suir. It will be necessary to estimate the design flows at suitable locations along the reach for input to the hydraulic model. The Suir CFRAM Study includes detailed information with regard to the River Suir flood flows and flood elevations for Thurles town but does not extend as far north to the proposed site. A topographical survey of the site has been provided. Survey data exists for the River Suir that would have been collected during the Suir CFRAM Study. River survey data has been commissioned to improve the accuracy of the hydraulic model. A hydrographic survey of the river channel of the River Suir and Rossesstown Stream was carried out by Murphy Geospatial in Mach 2023, which includes open channel cross sections of the watercourses flowing through the project site. An additional hydrographic survey of the Rossesstown Stream tributaries was also carried out by Murphy Geospatial in January 2024, which also included open channel cross sections of the river channels. The client has provided Malachy Walsh & Partners with 2m Photogrammetric DTM. However, a comparison of the 2m Photogrammetic DTM and the topographical survey was carried out. The results indicated that the 2m Photogrammetric DTM was approximately 700mm higher on average when compared with the topographical survey. It was confirmed by the provider of the 2m Photogrammetric DTM that the variances observed are within the expected tolerances from a 2m DTM generated using photogrammetric processes namely with a 0.5m to 1m accuracy. LiDAR is required for floodplain modelling. The National Floodplain DTM – Combined DTM was made available to MWP. The National Floodplain DTM has a 2m resolution. A comparison between the National Floodplain DTM and the topographical survey was carried out as can be seen in Figure 3-1 and Figure 3-2 below. The results indicated that the National Floodplain DTM and topographical survey have a reasonable match for the overbank areas of the River Suir, Rossestown Stream and its tributaries. Therefore, the National Floodplain DTM data will be used to create a digital terrain model of the floodplain, allowing MWP to model overland flows and create flood extent and flood depth maps.

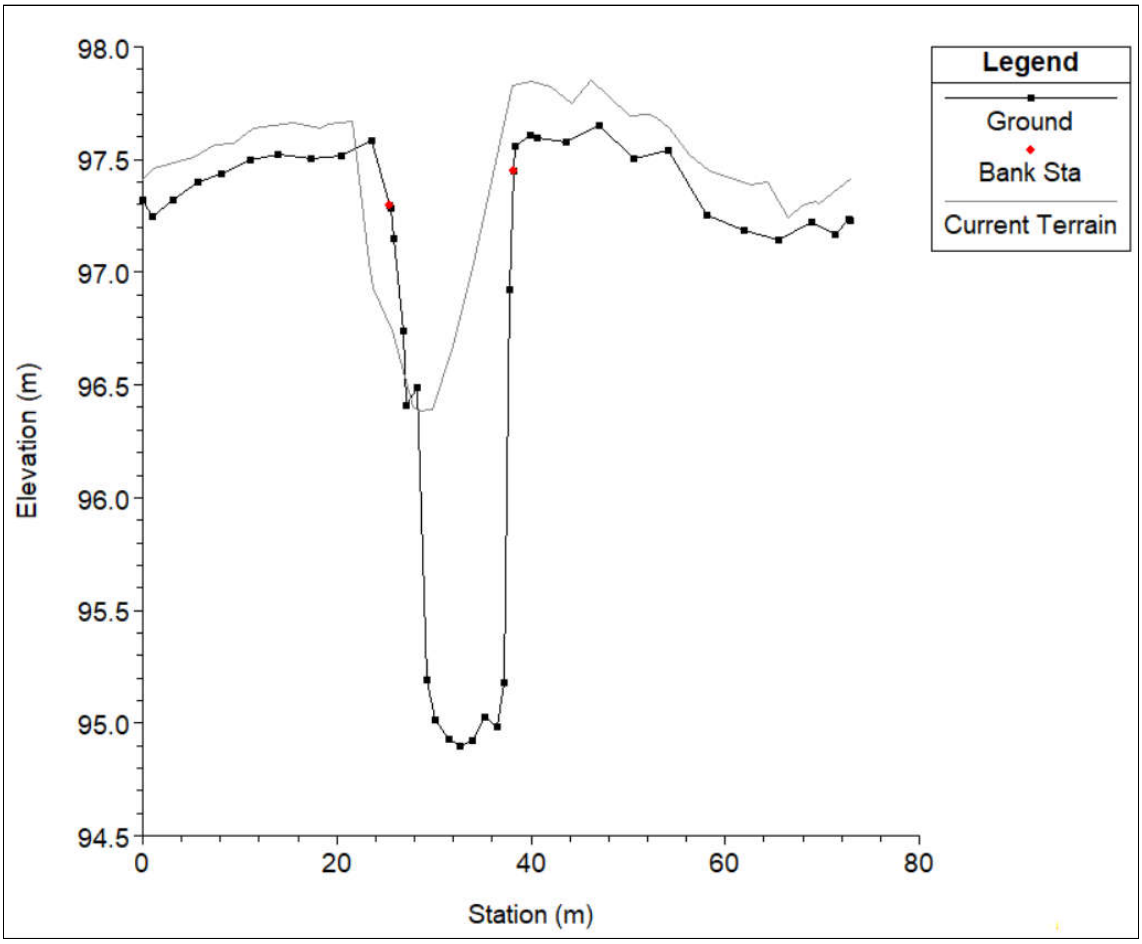


Figure 3-1: National Floodplain DTM and Topographical Survey River Cross Section (Upper River Suir Reach)

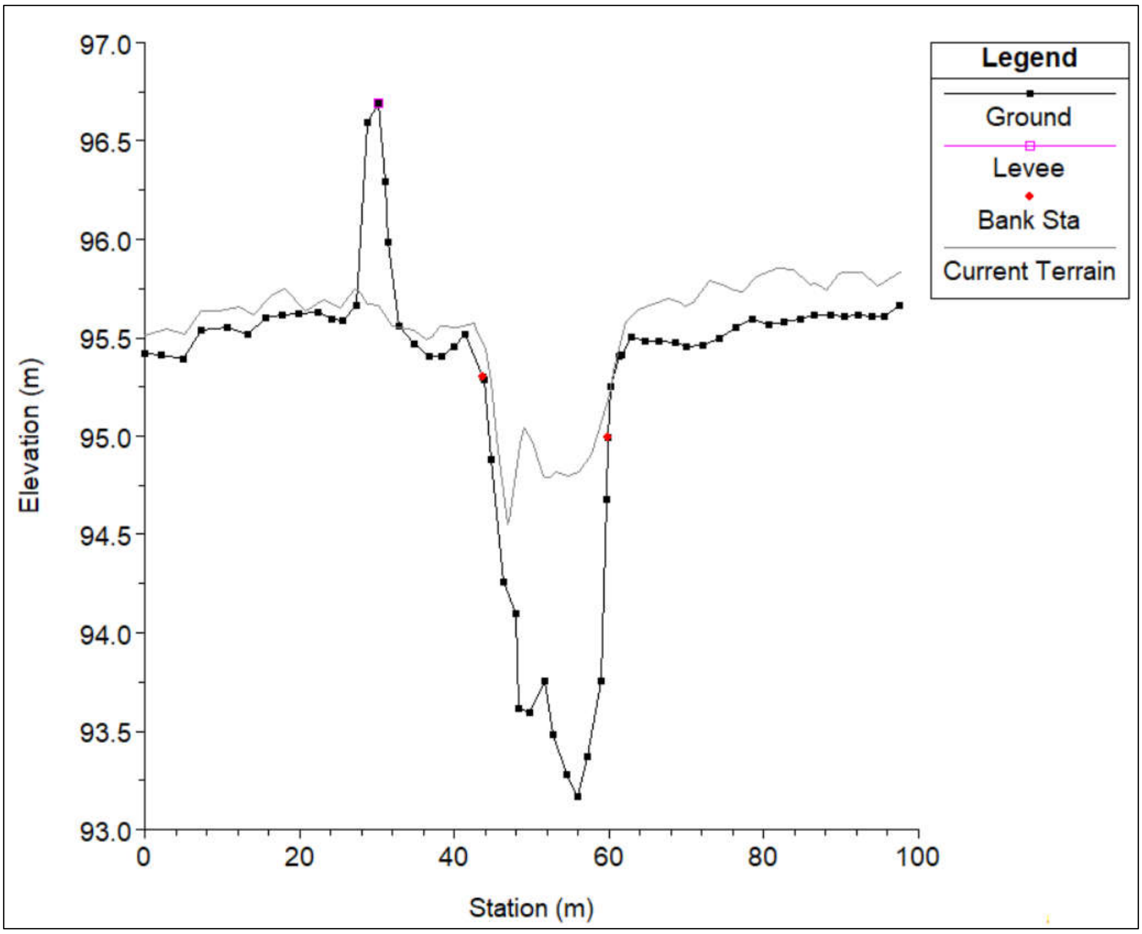


Figure 3-2: National Floodplain DTM and Topographical Survey River Cross Section (Lower River Suir Reach)

3.4 Flood Zone Identification

The Suir CFRAM Fluvial Mapping suggests that part of the proposed Wind Farm would be flooded in the current scenario during the 1% and 0.1% AEP fluvial events. This places the site within Flood Zone A/B.

3.5 Potential Impacts of Flooding Elsewhere

Depending on the findings of the State 3 FRA, the proposed development may have the following potential impacts on flooding outside of the site;

- Construction on or filling up of existing floodplains would result in a reduced floodplain storage volume which could increase the flood risk downstream of the site.
- It is generally considered that new developments constructed without flood attenuation on greenfield sites will result in an increased outflow from the site. This could cause an overall increase in the flood level (and hence flood risk) downstream of the site, particularly if large portions of the catchment are developed over time.

A Stage 3 FRA will be required to confirm the flood risk mitigation required for this site and to confirm the proposed development will not adversely impact flood risk elsewhere.

3.6 Requirements for a Stage 3 FRA

A Stage 3 detailed flood risk assessment will be carried out in Section 3.6 of this report in order to provide a quantitative appraisal of potential flood risk to the site and to examine the potential impact of the development on flood risk elsewhere. This will require the construction of a hydraulic model of the River Suir and tributaries of the River Suir and the completion of a hydrological assessment of the catchments. Any relevant mitigation measures will be reviewed and residual risks will be assessed.

4. Detailed Flood Risk Assessment (Stage 3)

4.1 Introduction

The purpose of this Stage 3 FRA is to assess flood risk issues in sufficient detail to provide a quantitative appraisal of potential flood risk to the site, of the potential impact of the development on flood risk elsewhere and to establish what mitigation measures, if any, may be required. The Stage 3 FRA will therefore require carrying out a detailed review of the River Suir and tributaries of the River Suir catchment hydrology to establish appropriate flood flows for various scenarios. A hydraulic model of the river reaches will then be created to determine key flood risk parameters such as flood levels and flood extents.

4.2 Fluvial Flooding - Hydrology & Flow Estimation

4.2.1 Overview

In this section a detailed assessment will be carried out to estimate the flood flows at the site for various Annual Exceedance Probabilities (AEP's). The AEP is the likelihood or probability of a flood of a given magnitude occurring or being exceeded in any given year. The results of this analysis will then form a key input into the subsequent hydraulic modelling of the study area which will enable the flood levels and extents to be determined.

4.2.2 Catchment & River Reach Description

The catchment delineations for the proposed site are shown in Figure 4-1 below. The catchments area are summarised in Table 4-1 below.

Catchment	Area (km^2)
001	0.67
002	2.29
003	3.33
004	30.84
005	189.6

Table 4-1: Catchment Characteristics

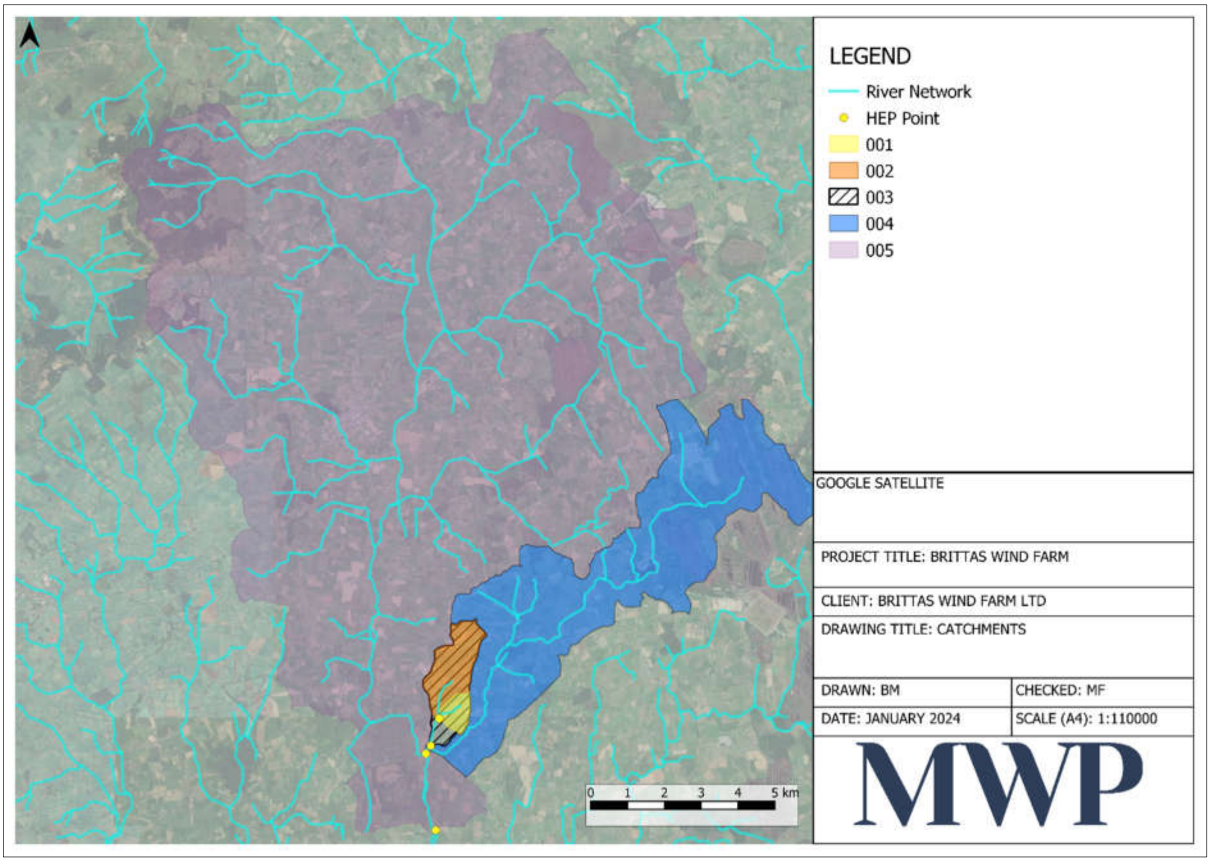


Figure 4-1: Catchment Delineation

4.3 Hydrological Estimation Point

Five hydrological estimation points (HEP) have been considered for the hydraulic design.

4.3.1 Design Confidence Levels

Where flows have been estimated using statistical methods, the design flow has been derived using the 95% confidence level flow, given the vulnerability of the proposed development and to demonstrate the acceptability of the proposed design. This is considered to provide a conservative upper bound estimate of design flow and associated flood risk.

4.3.2 Climate Change Allowance

In order to allow for the effects of climate change, the calculated flows have been increased by a factor of 1.2. This corresponds to the Mid-Range Future Scenario (MRFS).

4.4 Flow Estimation

4.4.1 Overview of Methodology

The Flood Studies Update (FSU) programme was undertaken by the OPW in order to provide improved extreme rainfall and flood estimation methods for Ireland.

It is the most recent major study of its kind to be carried out in Ireland and is broadly recognised as the best practice method for estimating peak flood flows. One of the key outputs from the FSU was the 7 variable regression equation for estimating the Index Flood (i.e. Q_{MED}) based on Physical Catchment Descriptors (PCD's). The Index Flood is the flow that can statistically be expected to be equalled or exceeded once in a 2 year period. Ideally the application of this equation would be limited to catchments greater than 25km^2, although it has been shown to perform reasonably well for smaller catchments. Given that two out of the five catchment areas are larger than this threshold, the FSU equation is deemed suitable for flow estimation. The initial PCD estimate can be improved by using data from a hydrologically and/or geographically similar gauged site, referred to as a Pivotal Site.

The general procedure for estimating the Index Flood at any HEP can be summarised as follows;

1. Review the Physical Catchment Descriptors at each HEP and identify suitable pivotal site(s);
2. Estimate the Index Flood at the potential pivotal site(s) using annual maxima data;
3. Estimate the Index Flood at the potential pivotal site(s) using Physical Catchment Descriptors and determine the appropriate adjustment factor (i.e. Q_{MED} Gauged / Q_{MED} PCD Rural);
4. Estimate the Index Flood at each HEP using Physical Catchment Descriptors;
5. Estimate the Design Index Flood flow at each HEP using the relevant gauging station as a pivotal site and adjust the rural estimate for urbanisation.

In order to estimate flows for various Annual Exceedance Probabilities (AEP's) it is necessary to derive a suitable flood growth curve which is used to scale Q_{MED} for the required return period. The growth curve can be derived from a single site analysis or from a pooled analysis, depending on the record length and data reliability.

4.4.2 Beakstown (16002) Annual Maxima

The catchment area of Catchment 005 and Beakstown (Station 16002) is estimated to be 189.6km^2 and 512km^2 respectively.

The FSU Web Portal (opw.hydronet.com) can typically be used to determine Q_{MED} from gauged flow data and to derive appropriate growth curves using either a single site or pooled analysis. At present the gauged data available on the Web Portal typically only includes up to hydrometric year 2004. There have been some significant flood events in the intervening period which would potentially influence the flood estimation therefore it was considered prudent to obtain the updated annual maxima series for Station 16002, rather than relying on the FSU Web Portal database.

Having reviewed the annual maxima flow for Beakstown (16002), a QMED of 52.66m^3/s is recorded.

4.4.3 Clobanna (16051) Annual Maxima

The catchment area of Catchment 004 and Clobanna (Station 16051) is estimated to be 30.84km^2 and 34.19km^2 respectively. It can reasonably be expected that peak flows experienced at the site for the Rossestown Stream will be comparable to Clobanna which is located c.1km upstream. Therefore, key to establishing a reliable flow estimate for the Rossestown Stream at the site is validation of the flow data available for 16051.

The FSU Web Portal (opw.hydronet.com) can typically be used to determine Q_{MED} from gauged flow data and to derive appropriate growth curves using either a single site or pooled analysis. However, at present the gauged data available on the Web Portal typically only includes up to hydrometric year 2004. There have been some significant flood events in the intervening period which would potentially influence the flood estimation therefore it was considered prudent to obtain the updated annual maxima series for Station 16051, rather than relying on the FSU Web Portal database.

Having reviewed the annual maxima flow for Clobanna (16051), a QMED of 2.38m³/s is recorded.

4.4.4 FSU 7-Variable Equation

The FSU method for ungauged catchments uses Physical Catchment Descriptors (PCD's) to establish an initial estimate of the Index Flood (i.e. Q_{MED}) based on a seven variable regression equation.

The Index Flow Q_{MED} is estimated using the following seven variable regression equation which was presented in FSU WP2.3:

$$Q_{MED} = 1.237x10^{-5}AREA^{0.937}BFIsoils^{-0.922}SAAR^{1.306}FARL^{2.217}DRAIND^{0.341}S1085^{0.185}(1 + ARTDRAIN2^{0.408})$$

Where relevant, the adjustment for urbanisation is made by applying the following equation:

$$Q_{MED\ URBAN} = Q_{MED}(1 + URBEXT)^{1.482}$$

The factorial standard error (FSE) of this equation is 1.37.

The initial PCD estimate can be improved by using data from a hydrologically and/or geographically similar gauged site, referred to as a Pivotal Site. The PCD estimate at Thurles was used in conjunction with the gauged Q_{MED} value to establish the adjustment factor for the site. The analysis is summarised on Table 4-2 and **Error! Reference source not found.** below.

	Data Description	Units	HEP	Source
1a	Catchment Area	sq km	512.00	OPW
1b	Urban Catchment Area	sq km	0.01	FSU
2c	Stream Slope S1085	m/km	1.29	FSU
3	BFIsoil		0.63	FSU
4	SAAR	mm	932.15	FSU
5	FARL		1.00	FSU
6	DRAIND	km/km²	0.89	Measure/FSU
7	ARTDRAIN2		0.00	FSU
8	URBEXT		0.01	Calculate
9	QMED Rural PCD Estimate	m³/s	47.15	FSU WP2.3
10	QMED Urban PCD Estimate	m³/s	47.92	FSU WP2.3
12	QMED Gauged		52.66	

13	Adjustment Factor		1.10	

Table 4-2: Station 16002 – Pivotal Site Adjustment Factor

	Data Description	Units	HEP	Source
1a	Catchment Area	sq km	34.19	Measure
1b	Urban Catchment Area	sq km	0.00	Measure
2c	Stream Slope S1085	m/km	1.62	FSU
3	BFIsoil		0.68	FSU
4	SAAR	mm	895.27	FSU
5	FARL		1.00	FSU
6	DRAIND	km/km^2	0.76	Measure/FSU
7	ARTDRAIN2		0.00	FSU
8	URBEXT		0.01	Calculate
9	QMED Rural PCD Estimate	m^3/s	3.46	FSU WP2.3
10	QMED Urban PCD Estimate	m^3/s	3.46	FSU WP2.3
12	QMED Gauged (Annual Maxima)		2.38	
13	Adjustment Factor		0.69	

Table 4-3: Station 16051

4.4.5 Institute of Hydrology 124 Method

The Institute of Hydrology Report 124 method has been widely used in Ireland and the UK for flood estimation in small catchments. The equation uses three variables from the FSR to determine the mean annual flood flow Qbar, namely SOIL, SAAR and AREA. This is the flow that can statistically be expected to be equalled or exceeded once in a 2.33 year period. The FSR's regional growth curve for Ireland was used to determine the extreme flood flows for various return periods. A summary of the calculations carried out to determine the design flow for catchments 001, 002 and 003 is included in Table 4-4.

Data Description	Catchment 001	Catchment 002	Catchment 003
AREA (km^2)	0.67	2.29	0.37
URBAN AREA (km^2)	0.00	0.00	0.00
SAAR (mm)	940.00	940.00	940.00
SOIL	0.47	0.47	0.47
Q_{Bar} Rural (m^3/s)	0.44	1.32	0.26
Q_{Bar} Urban (m^3/s)	0.44	1.32	0.26

Table 4-4: Institute of Hydrology Report 124 method

4.4.6 Flood Frequency Analysis

Based on the FSU guidance, an improved growth curve can generally be derived by pooling a number of station records. For this study a pooling group has been selected based on the most hydrologically similar gauged sites using the ranked list provided on the FSU Web Portal. For a target design event of 100 year return period, the 5T rule adopted by FEH 1999 and the FSU requires a minimum record length of 500 years.

The growth curves derived from the pooled analysis using both 2 parameter and 3 parameter distributions are plotted on Figure 4-2 along with the FSR Regional growth for Ireland and the Suir CFRAM Study growth curve. FSU research indicates that 3-parameter distributions are generally more suitable for ungauged sites. The GEV distribution fitted by L-moments has a downward trend and implies an upper bound value which is only 33.5% greater than the largest observation. The GLO coincides well with the Suir CFRAM Study curve for return periods up to 50 years.

QT	POOLED - EV1	POOLED - GEV	POOLED - GLO	POOLED - LO	SUIR MAIN CHANNEL CFRAM	SUIR MAJOR TRIBUTARY GROUP A CFRAM	FSR REGIONAL
2	1	1	1	1	1	1	0.95
5	1.23	1.22	1.2	1.31	1.22	1.22	1.2
10	1.38	1.35	1.33	1.48	1.35	1.35	1.37
20	1.52	1.46	1.45	1.65	1.47	1.48	1.6
30	1.61	1.52	1.52	1.74	1.53	1.54	1.65
50	1.71	1.59	1.62	1.86	1.61	1.63	1.77
100	1.85	1.67	1.76	2.01	1.72	1.74	1.96
200	1.99	1.75	1.9	2.17	1.82	1.84	2.14
1000	2.32	1.9	2.27	2.52	2.05	2.08	2.6

Table 4-5: Flood Growth Curves

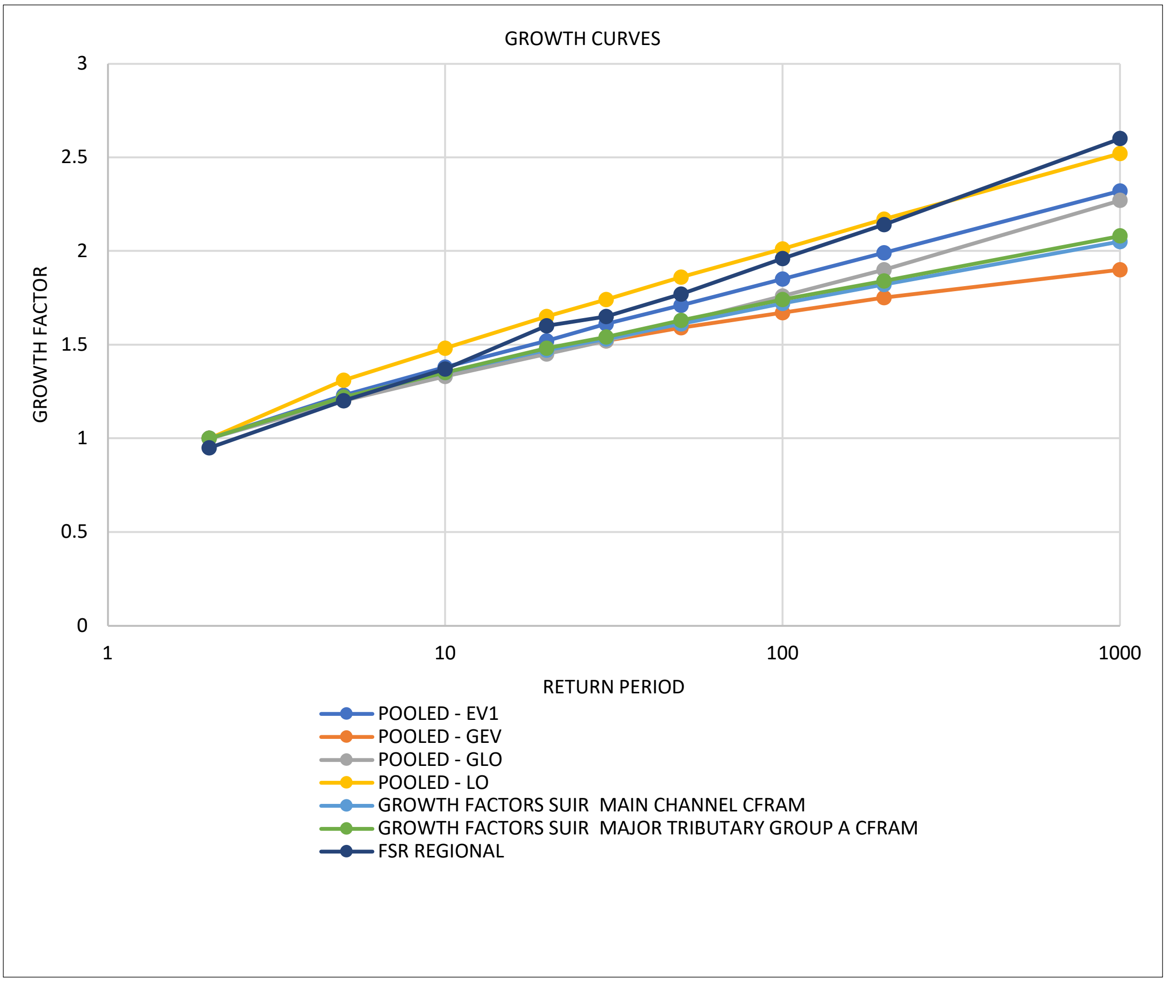


Figure 4-2: Flood Growth Curve Comparison

4.4.7 Summary of Design Flows

The design peak flows at the site for the catchments are summarised on for variois AEP's in Table 4-6 to Table 4-10 below.

Return Period, T	AEP(%)	Growth Factor	Peak Flow (m³/sec)	Peak Flow + Climate Change MRFS (m³/sec)
2	0.50	0.95	0.42	0.50
5	0.20	1.20	0.53	0.64
10	0.10	1.37	0.61	0.73
20	0.05	1.55	0.69	0.85
30	0.033	1.65	0.73	0.88
50	0.02	1.77	0.78	0.94

Return Period, T	AEP(%)	Growth Factor	Peak Flow (m³/sec)	Peak Flow + Climate Change MRFS (m³/sec)
100	0.01	1.96	0.87	1.04
200	0.005	2.14	0.95	1.14
1000	0.001	2.60	1.15	1.38

Table 4-6: Summary of Design Flows for Catchment 001

Return Period, T	AEP(%)	Growth Factor	Peak Flow (m³/sec)	Peak Flow + Climate Change MRFS (m³/sec)
2	0.50	0.95	1.25	1.51
5	0.20	1.20	1.58	1.90
10	0.10	1.37	1.81	2.17
20	0.05	1.60	2.05	2.46
30	0.033	1.65	2.18	2.61
50	0.02	1.77	2.34	2.80
100	0.01	1.96	2.59	3.11
200	0.005	2.14	2.83	3.39
1000	0.001	2.60	3.43	4.12

Table 4-7: Summary of Design Flows for Catchment 002

Return Period, T	AEP(%)	Growth Factor	Peak Flow (m³/sec)	Peak Flow + Climate Change MRFS (m³/sec)
2	0.50	0.95	0.25	0.30
5	0.20	1.20	0.31	0.38
10	0.10	1.37	0.36	0.43
20	0.05	1.60	0.40	0.48
30	0.033	1.65	0.43	0.52
50	0.02	1.77	0.46	0.55
100	0.01	1.96	0.51	0.61
200	0.005	2.14	0.56	0.67
1000	0.001	2.60	0.68	0.81

Table 4-8: Summary of Design Flows for Catchment 003

Return Period, T	AEP(%)	Growth Factor	Peak Flow (m^3/sec)	Peak Flow + Climate Change MRFS (m^3/sec)
2	0.50	1.00	2.42	2.91
5	0.20	1.20	2.91	3.49
10	0.10	1.33	3.22	3.87
20	0.05	1.45	3.52	4.22
30	0.033	1.52	3.69	4.42
50	0.02	1.62	3.93	4.71
100	0.01	1.76	4.27	5.12
200	0.005	1.9	4.61	5.53
1000	0.001	2.27	5.50	6.60

Table 4-9: Summary of Design Flows for Catchment 004

Return Period, T	AEP(%)	Growth Factor	Peak Flow (m^3/sec)	Peak Flow + Climate Change MRFS (m^3/sec)
2	0.50	1.00	25.97	31.17
5	0.20	1.20	31.17	37.40
10	0.10	1.33	34.54	41.45
20	0.05	1.45	37.66	45.19
30	0.033	1.52	39.48	47.38
50	0.02	1.62	42.08	50.49
100	0.01	1.76	45.71	54.86
200	0.005	1.9	49.35	59.22
1000	0.001	2.27	58.96	70.75

Table 4-10: Summary of Design Flows for Catchment 005

4.5 Hydrograph Derivation

In order to produce a design hydrograph to provide input to the unsteady-state hydraulic modelling, a hydrograph shape is required in addition to a design peak flow. The FSU Webportal module allows the user to derive a hydrograph for an ungauged site from a statistical analysis of the continuous flow records for gauged sites. Based on this approach, the design flow hydrographs are plotted on Figure 4-3 and Figure 4-4 below for several return periods.

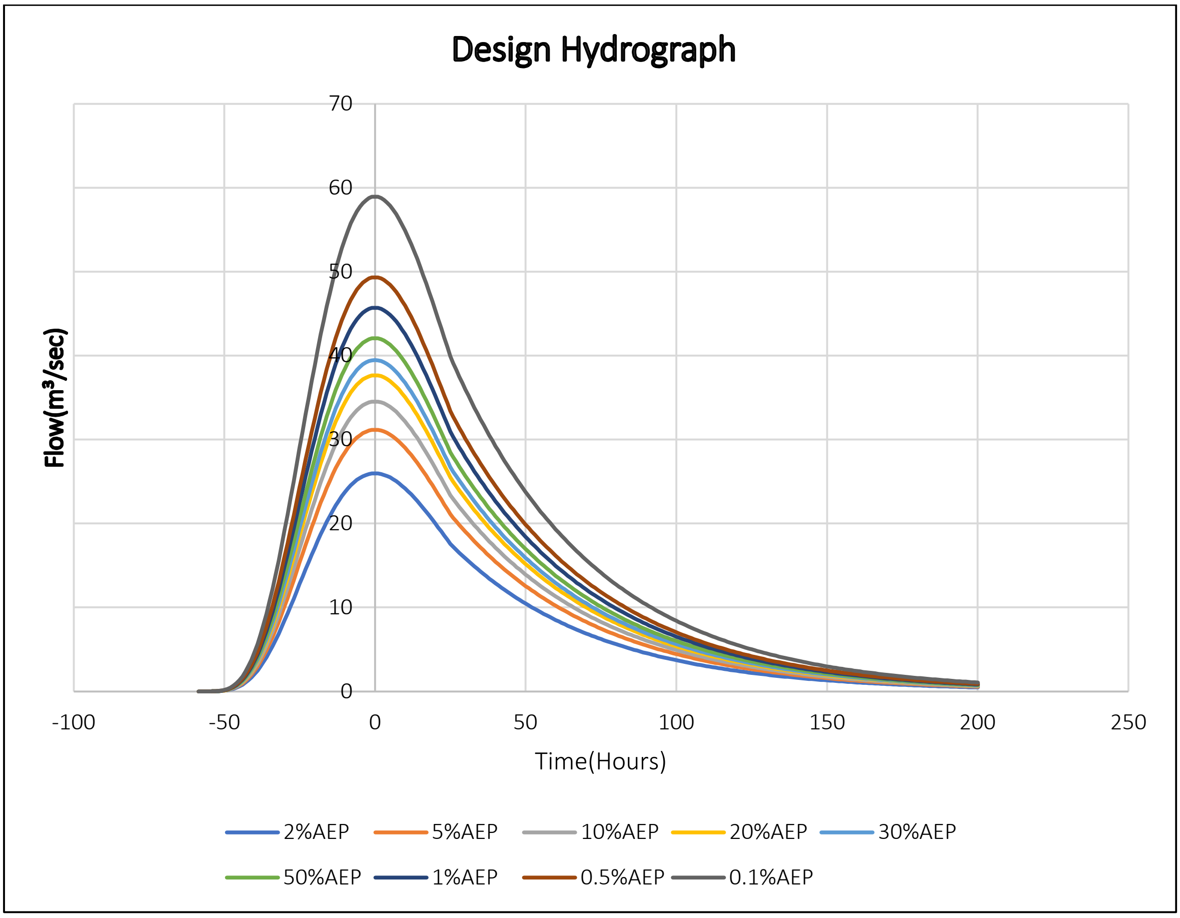


Figure 4-3: Design Flow Hydrographs for Catchment 005 (m^3/s)

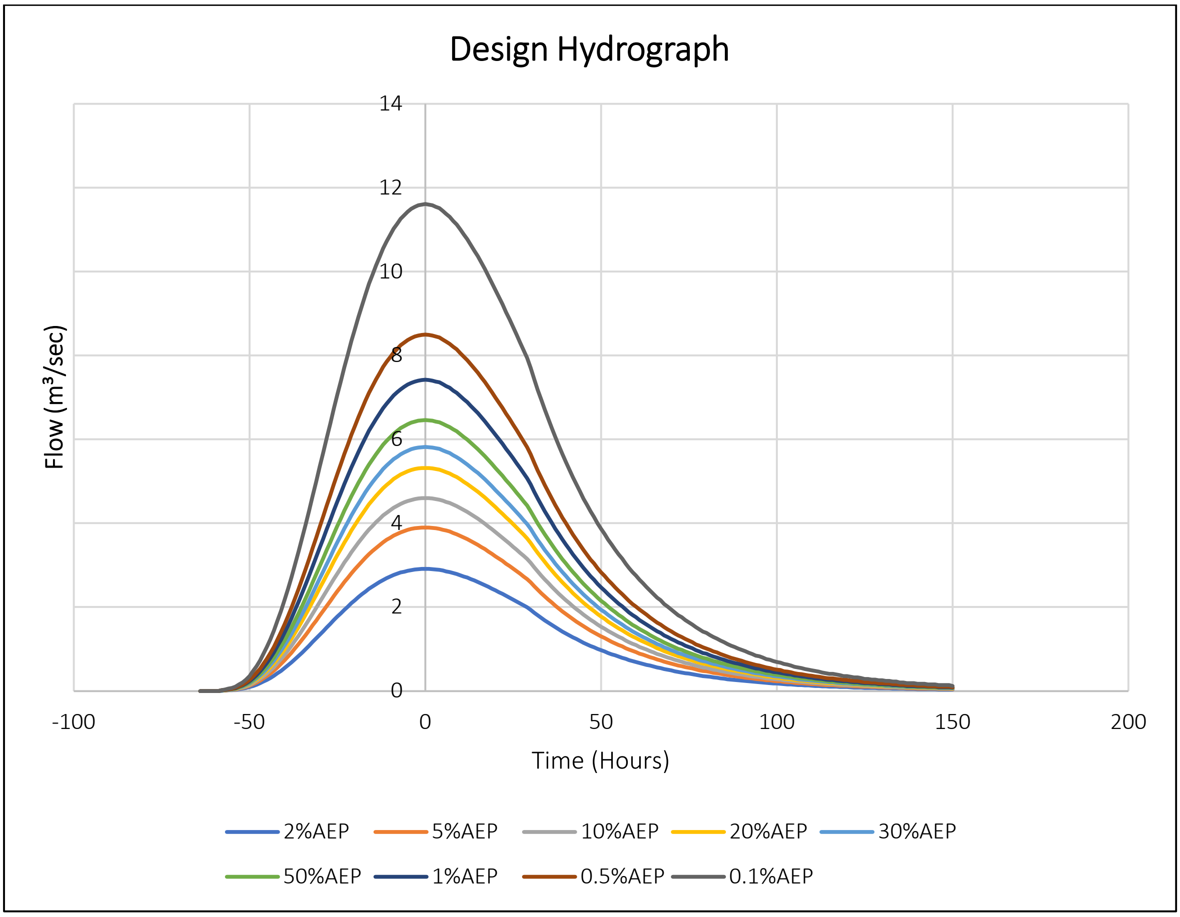


Figure 4-4: Design Flow Hydrographs for Catchment 004 (m^3/s)

5. Hydraulic Modelling

5.1 Modelling Approach

The hydraulic analysis was carried out using the Hydraulic Engineering Centre River Analysis System (HEC-RAS 6.3.1) software which was developed by the US Army Corps of Engineers.

It was identified at an early stage that there is potential for complex overland flow paths to exist within the site boundary, therefore a 1D-2D hydraulic model was created.

The 1-dimensional (1D) model incorporates approximately 46 cross sections representing 6.74km of the River Suir, the Rossestown Stream and its tributaries. The model includes the Rossestown triple arch bridge along the reach. The 1D domain is intended to model the in-bank flows.

The 2D model domain includes the floodplains surrounding the proposed project. Its purpose is to model overland flows towards the turbines and other complex flow paths within the proposed wind farm which cannot be adequately represented by a 1D model. A 10m x 10m cell size was adopted however this was refined along roads and other areas for a more accurate assessment of flow paths.

The 1D and 2D models are linked by lateral weirs positioned adjacent to the main banks of the river. The weir elevation was set to coincide with the ground elevation at the interface between the 1D and 2D domains and positive or negative flow is permitted so that any water which enters the floodplain at one location could potentially flow back into the main channel at another location. A weir coefficient of 0.28 was generally adopted. This represents an upper bound value for non-elevated overbank terrain and a lower bound value for natural high ground 0.3 to 1m high.

The hydraulic model schematic is included in Figure 5-1.

An unsteady flow analysis was performed using flow hydrographs which were derived during the hydrological analysis. The downstream boundary condition was set as the average bed slope in the vicinity of the boundary condition.

Based on a walkover of the river reach, Manning's 'n' values were assigned based broadly on land use type and terrain. These are summarised on Table 5-1 below.

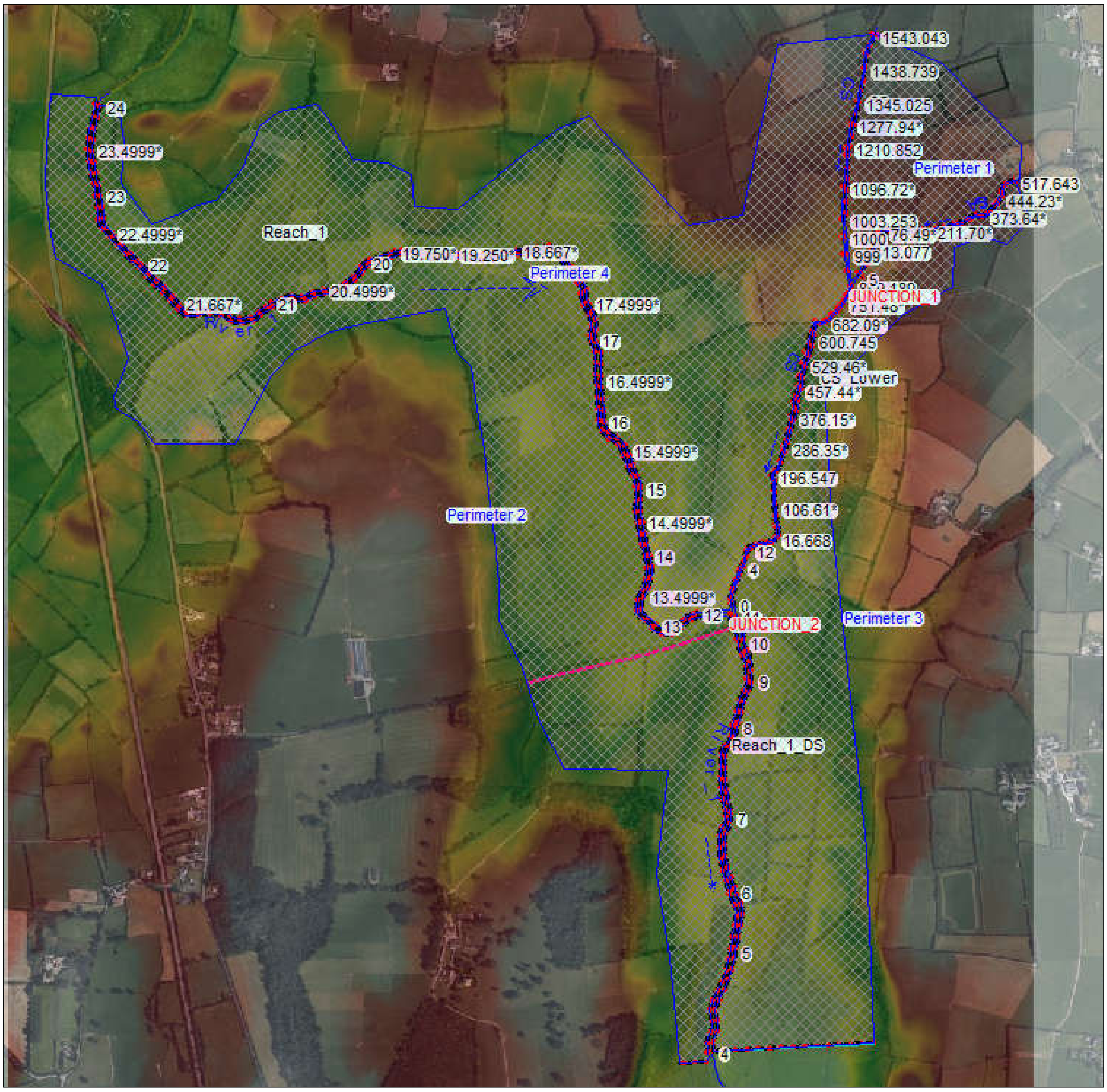


Figure 5-1: Model Schematic

Location	Manning's n
River Channel	0.04
Overbank and 2D Areas	0.05

Table 5-1: Manning's n Values

5.2 Flood Zone Mapping – Baseline Situation

The PSFRM Guidelines document defines three flood zone types as follows:

> *Flood Zone A* – where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% 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% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding); and
>
> *Flood Zone C* - where the probability of flooding from rivers and the sea is low (less than 0.1% 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.

The flood zones are defined without taking the effects of future climate change into account.

The hydraulic model was used to establish the design flood levels at the site for the 1% AEP and 0.1% AEP flows and these were used to produce a flood zone maps for the site and surrounding floodplains. The Flood Zone Maps, which indicate the extent of Flood Zones A and B is shown on Figure 5-2 to Figure 5-6 below.

The turbine locations are in all three flood zones as defined in the Flood Risk Management Guidelines. As can be seen in Figure 5-2 the proposed Brittas Sub-station is located within Flood Zone C. The majority of the turbines are located outside of Flood Zone A and Flood Zone B, therefore placing the turbines in Flood Zone C.

The hardstand associated with Turbine 4 is shown to be within Flood Zone A. However, the depth of flooding at the hardstand for Turbine 4 is negligible.

The zoning of each of the turbines is summarised in Table 5-2.

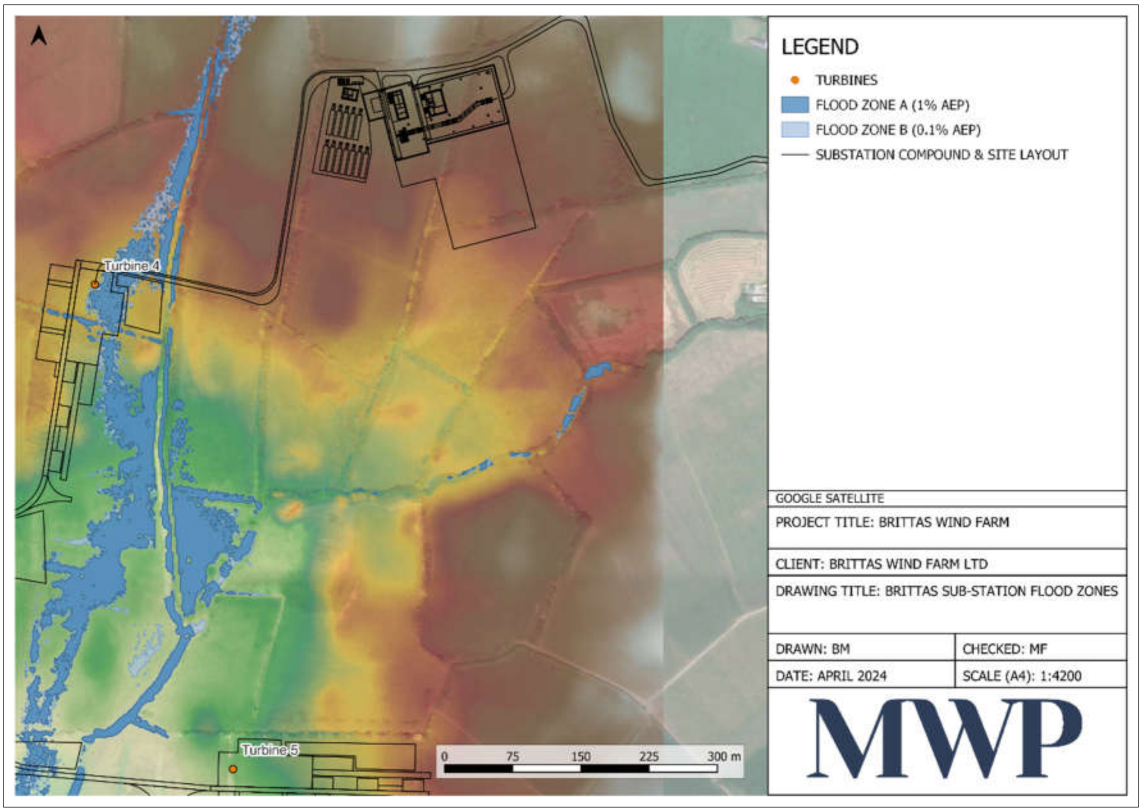


Figure 5-2: Brittas Sub-station Flood Zones – Existing Scenario

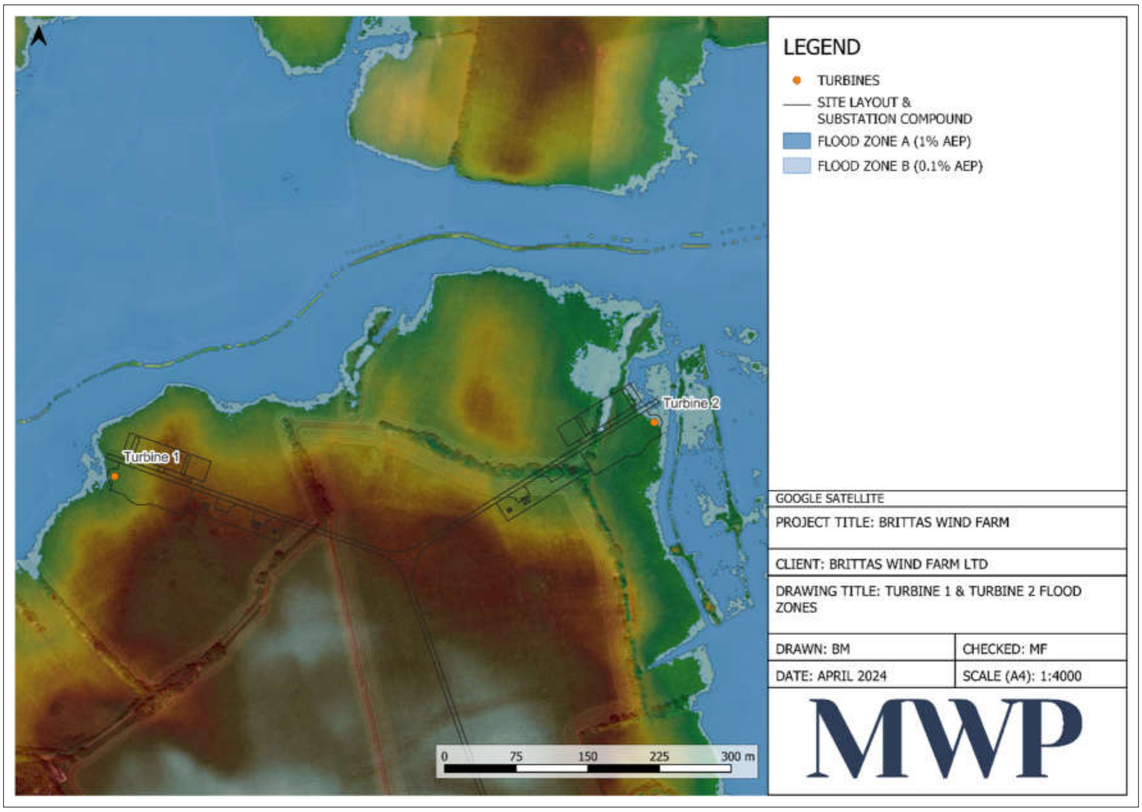


Figure 5-3: Turbine 1 & Turbine 2 Flood Zones – Existing Scenario

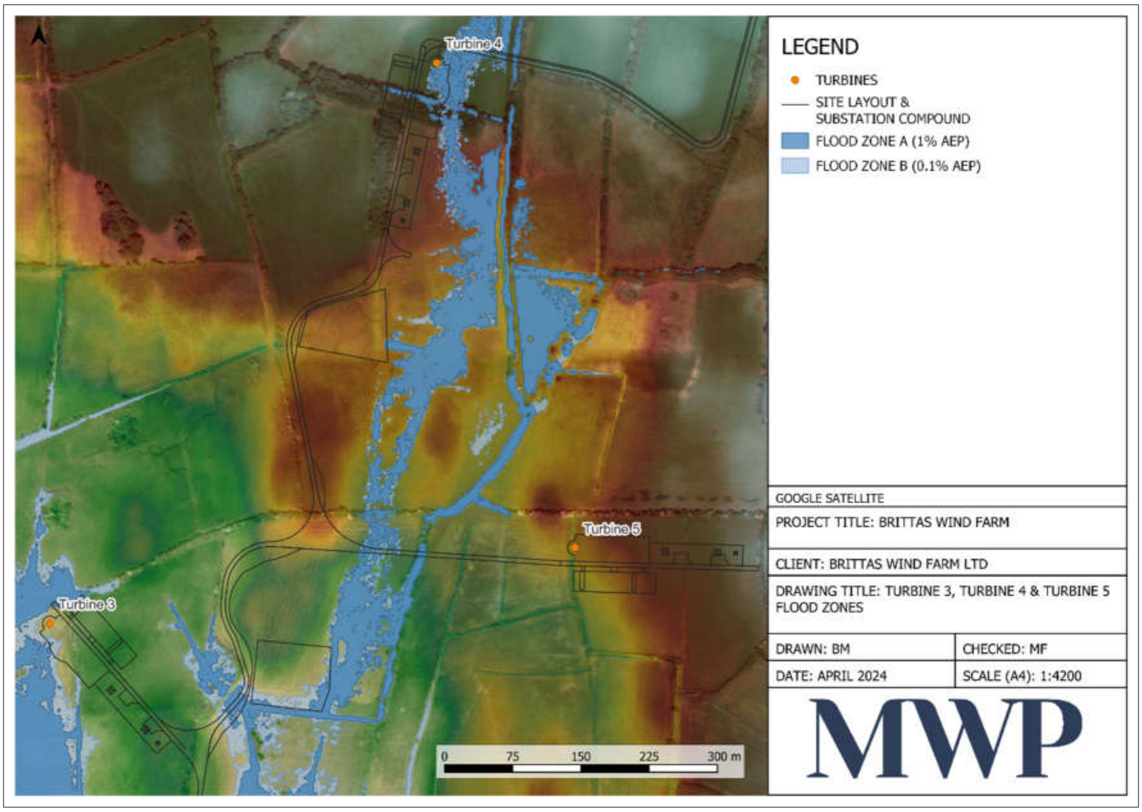


Figure 5-4: Turbine 3, Turbine 4 & Turbine 5 Flood Zones – Existing Scenario

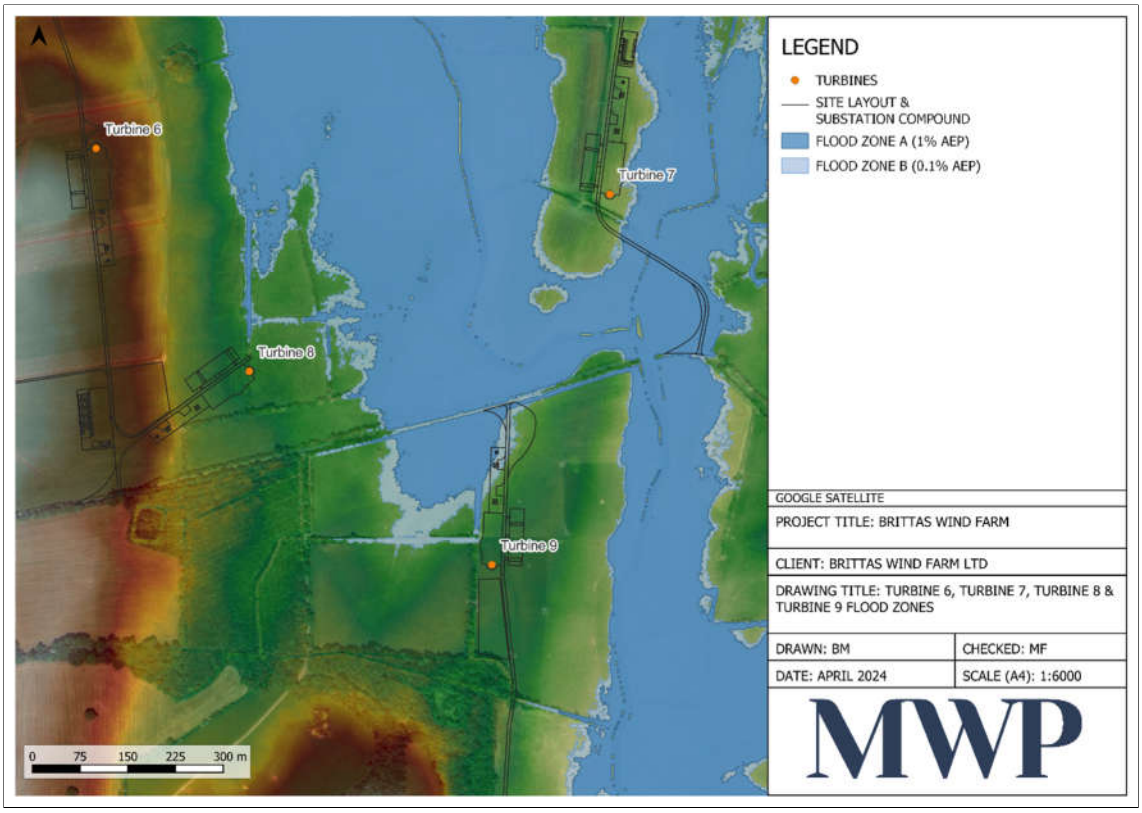


Figure 5-5: Turbine 6, Turbine 7, Turbine 8 & Turbine 9 Flood Zones – Existing Scenario

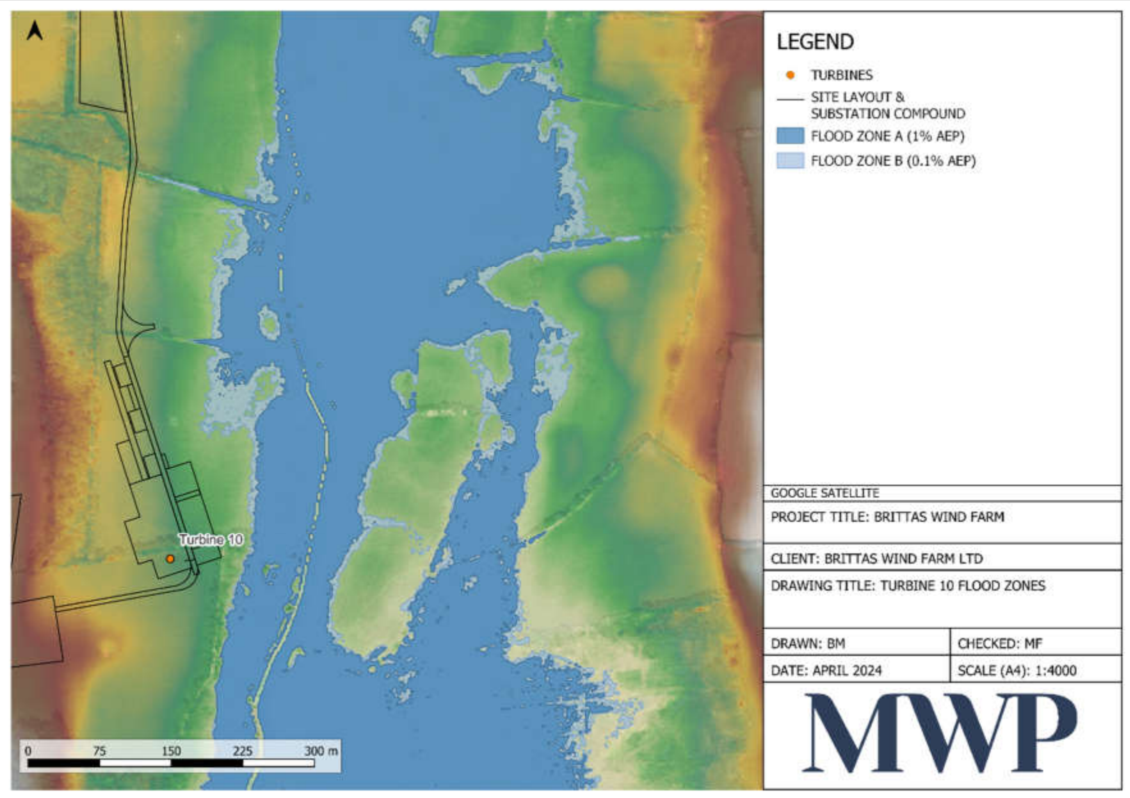


Figure 5-6: Turbine 10 Flood Zones – Existing Scenario

Turbine	Flood Zone
Turbine 1	B
Turbine 2	B
Turbine 3	B
Turbine 4	A
Turbine 5	C
Turbine 6	C
Turbine 7	B
Turbine 8	C
Turbine 9	C
Turbine 10	C

Table 5-2: Flood Zoning

5.3 Vulnerability of the Proposed Development

The PSFRM Guidelines have outlined three Vulnerability Classifications for developments based on the proposed land use and type of development. These classifications and particular examples of development types which would be included in each classification are summarised as follows;

1. Highly Vulnerable Development: This would include emergency services, hospitals, schools, residential institutions, dwelling houses, essential infrastructure, water & sewage treatment etc.

2. Less Vulnerable Development: Retail, leisure, commercial, industrial buildings, local transport infrastructure.

3. Water-compatible development: Docks, marinas and wharves. Amenity and open space, outdoor sports and recreation and essential facilities such as changing rooms.

The Guidelines also include a matrix of vulnerability versus flood zone to differentiate between developments which are appropriate in various flood zones and those which require a Justification Test. This table is reproduced as Table 5-3 below.

Vulnerability Classification	Flood Zone A	Flood Zone B	Flood Zone C
Highly Vulnerable Development	Justification Test	Justification Test	Appropriate
Less Vulnerable Development	Justification Test	Appropriate	Appropriate
Water Compatible Development	Appropriate	Appropriate	Appropriate

Table 5-3: Vulnerability Matrix

The proposed Brittas Sub-station falls under the essential infrastructure category. As the proposed Brittas Sub-station is within Flood Zone C, the development is considered to be appropriate. The Guidelines state that development types not listed should be considered on their own merits. The construction of wind turbines and the associated infrastructure are not listed, therefore the assumption is that they can be constructed in any of the flood zones provided that they are protected from flooding and that their presence does not increase flood risk elsewhere. A design water surface level was established along the River Suir, Rossestown Stream and its tributaries. The turbines will be set with a freeboard above the adjacent calculated 100-year flood level taking a 20% climate change factor into account. Since the development is considered to be an appropriate type in all three flood zones, a Justification Test, as described in Chapter 3 of the Guidelines, is not required for the 10 no. turbines.

5.4 Climate Change

The design flood level is the 1% AEP plus the mid-range future scenario (MRFS) which corresponds to a 20% increase in flow. A scenario was run to assess the risk from the 1%AEP MRFS. The 1%AEP flood extent and 1%AEP MRFS flood extent are presented in Figure 5-7 to Figure 5-11 below.

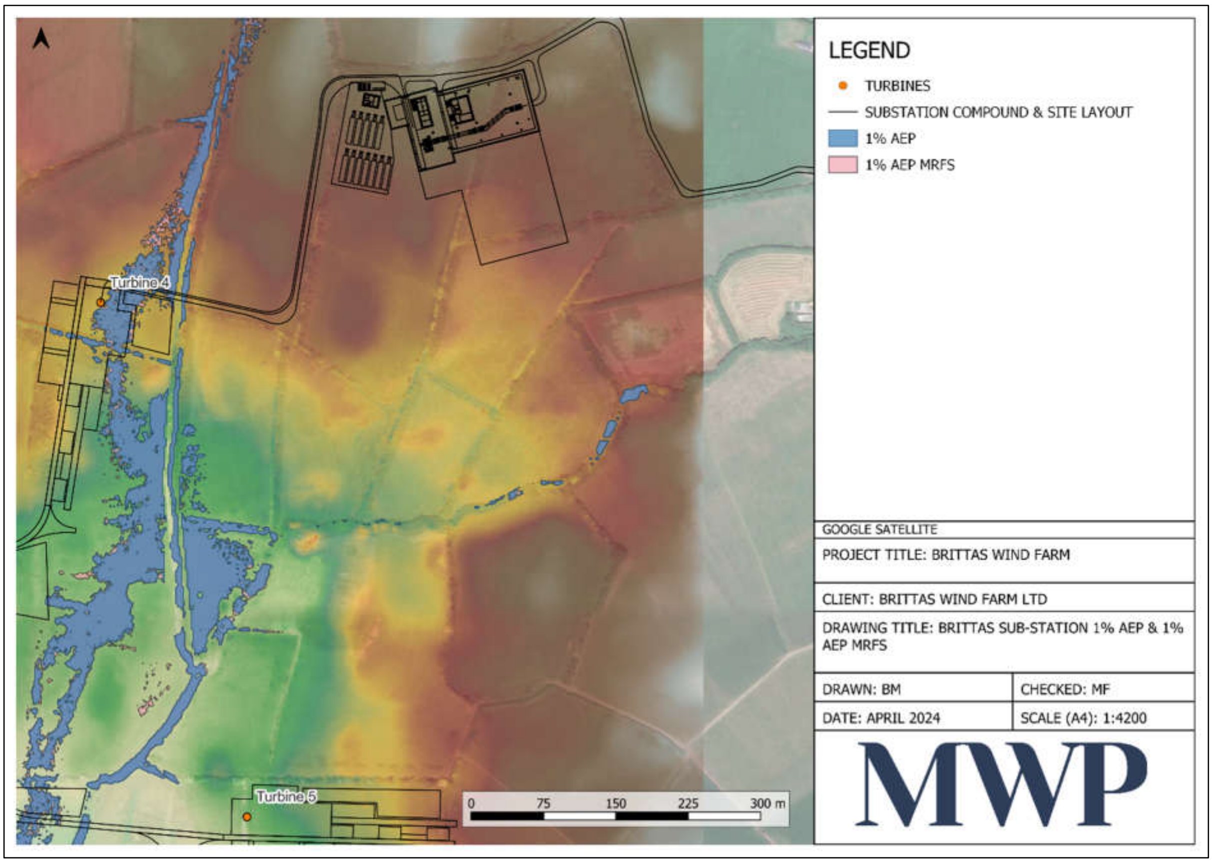


Figure 5-7: Brittas Sub-station 1% AEP Existing Scenario Flood Extent & 1% AEP MRFS Flood Extent

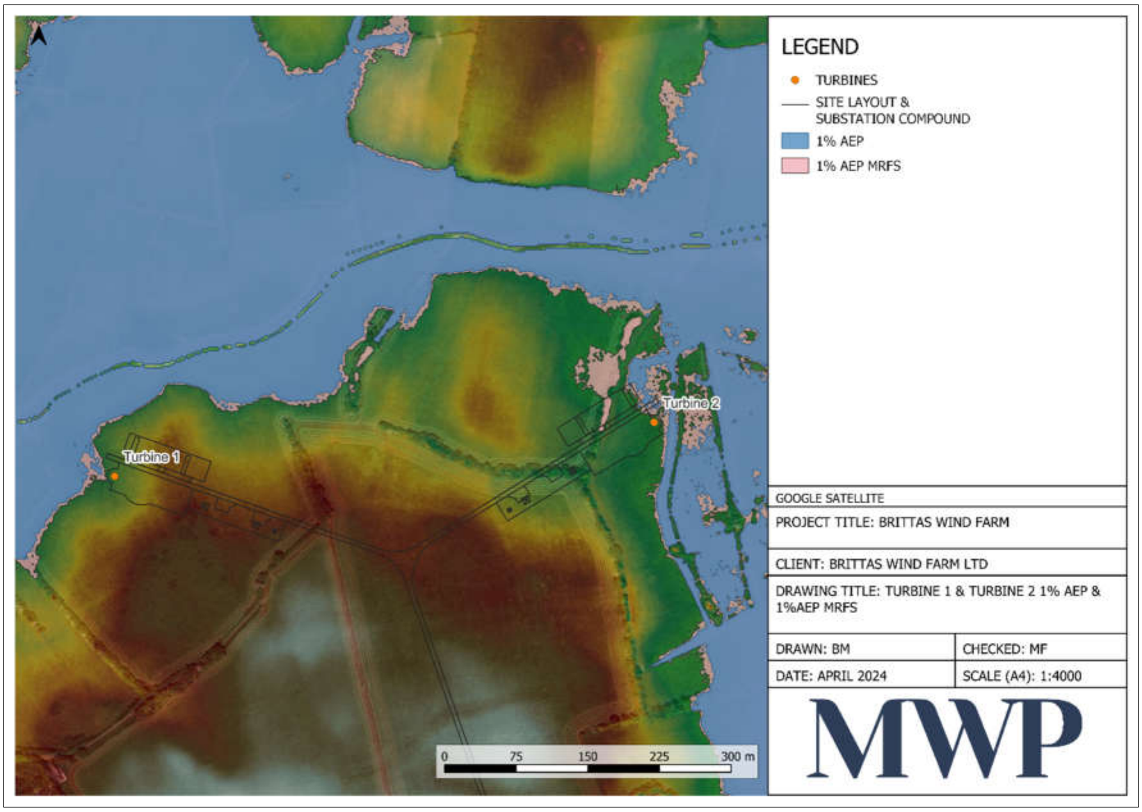


Figure 5-8: Turbine 1 & Turbine 2 1% AEP Existing Scenario Flood Extent & 1%AEP MRFS Flood Extent

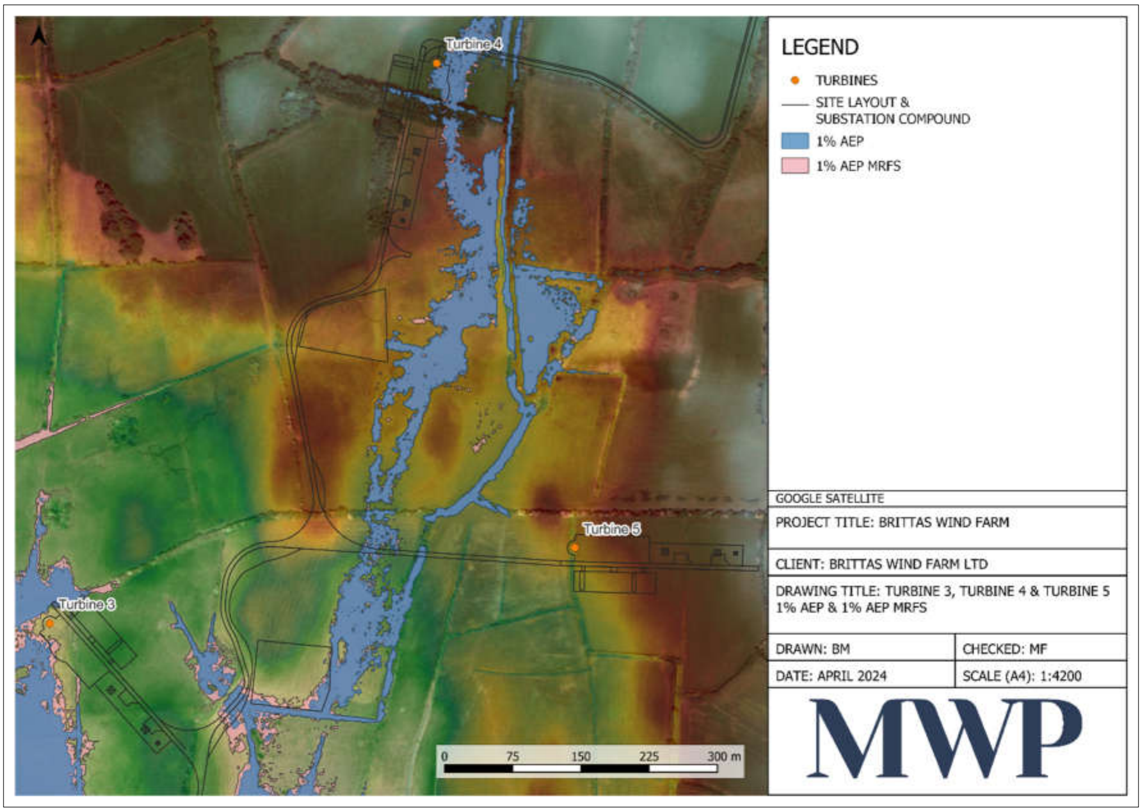


Figure 5-9: Turbine 3, Turbine 4 & Turbine 5 1% AEP Existing Scenario Flood Extent & 1%AEP MRFS Flood Extent

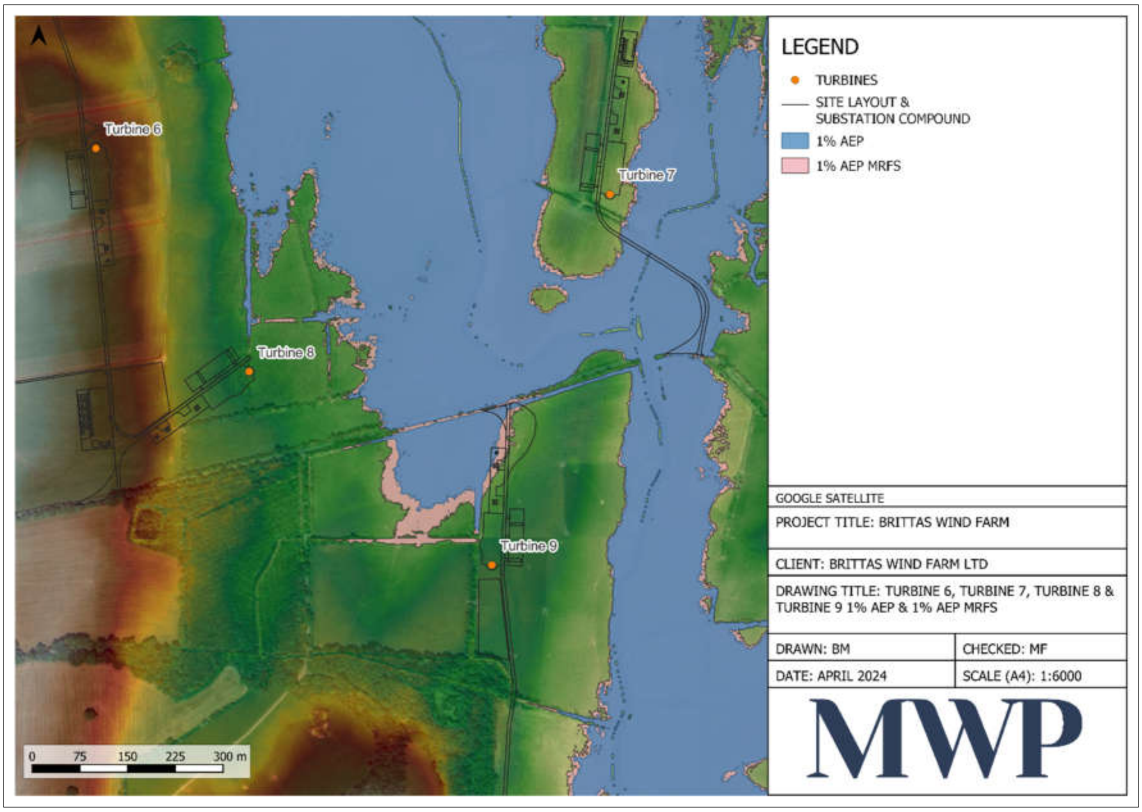


Figure 5-10: Turbine 6, Turbine 7, Turbine 8 & Turbine 9 1% AEP Existing Scenario Flood Extent & 1%AEP MRFS Flood Extent

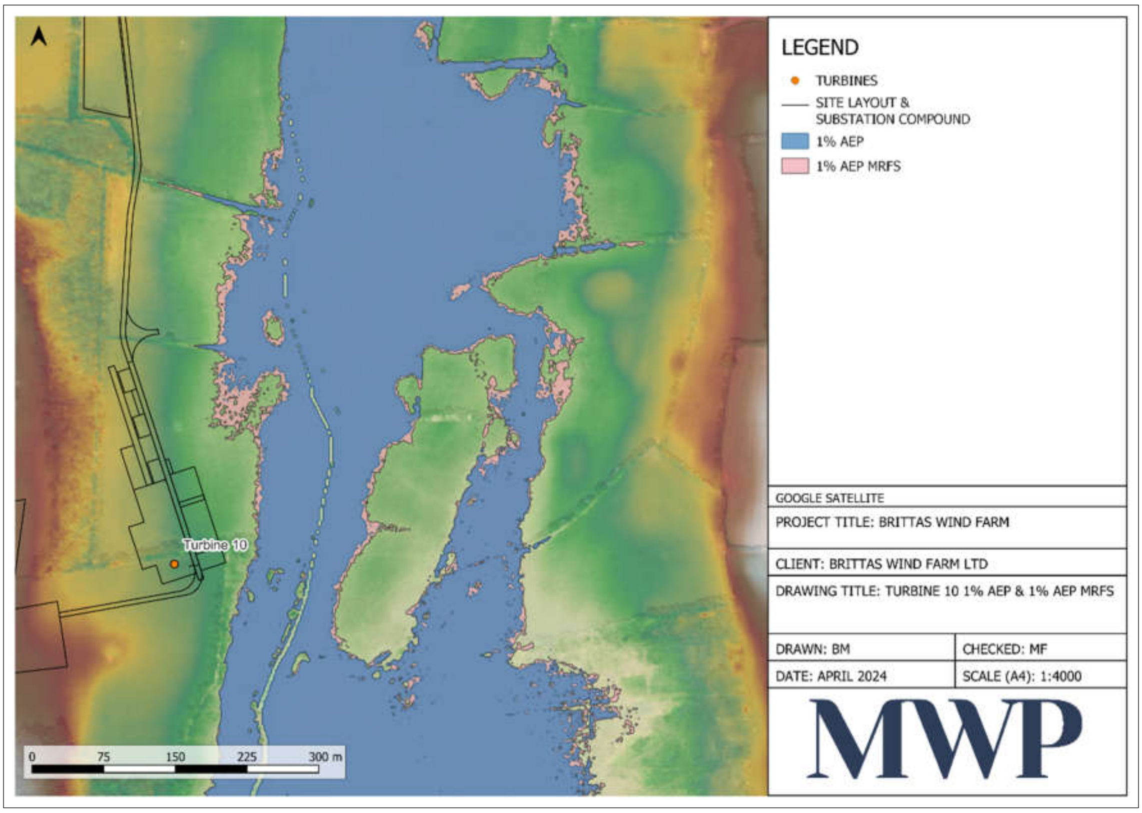


Figure 5-11: Turbine 10 1% AEP Existing Scenario Flood Extent & 1%AEP MRFS Flood Extent

5.5 Post Development Situation

The post-development situation includes for the proposed Brittas Sub-station, turbine hardstands, access tracks and turning heads. The hydraulic model was adjusted to include the proposed access track alignment and hardstands. This involved adjusting the DTM to include new internal site access tracks, 5.5m wide and 6480m in length and 10 No. Wind Turbine foundations and Hardstand areas. The revised DTM of the model is indicated on below Figure 5-12.

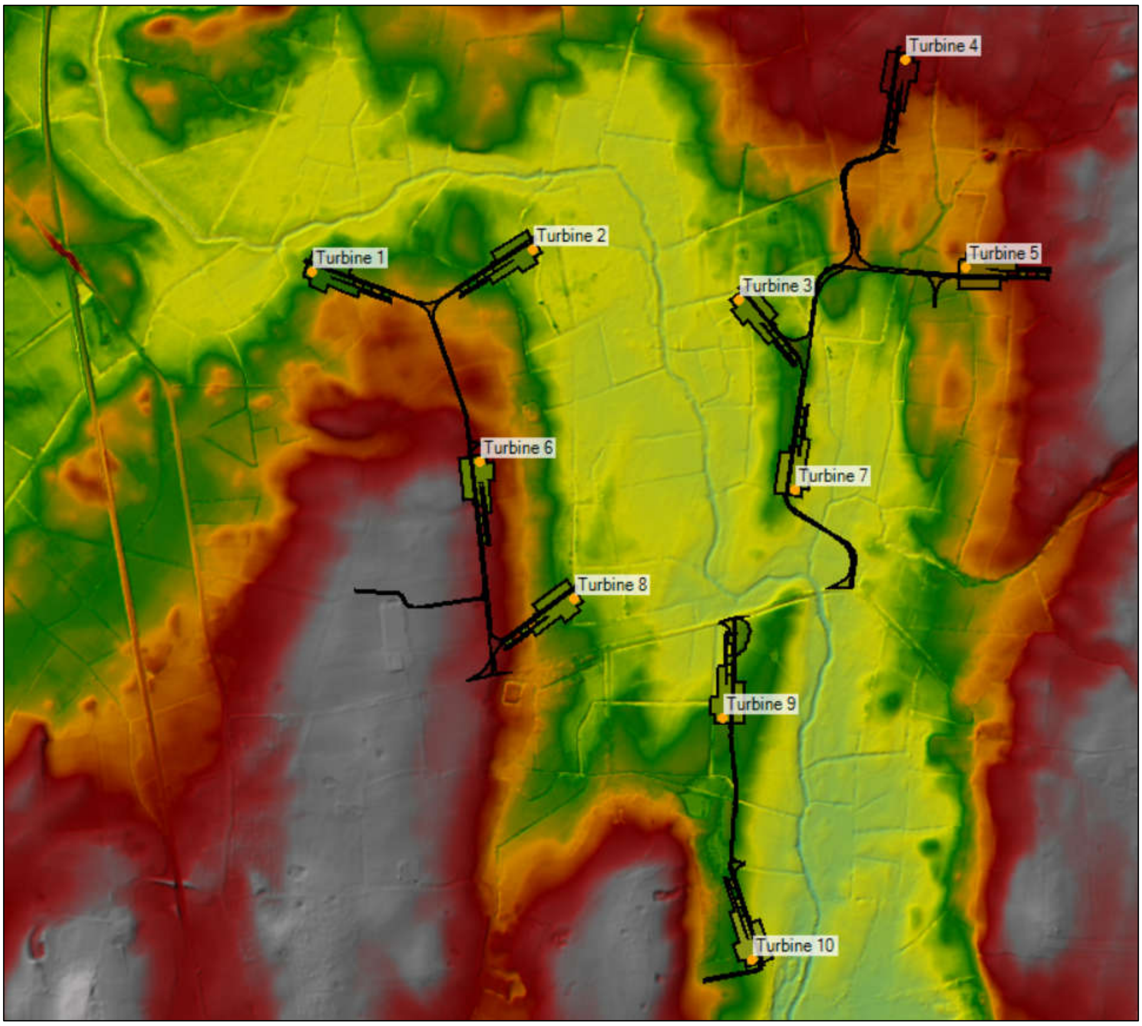


Figure 5-12: Post Development Revised DTM

The changes to the flood extents are highlighted on Figure 5-13 below. The increase in flood extent is insignificant. The impact of the proposed development on flood levels is mapped on Figure 5-14 below for the 0.1% AEP event, as this provides a slightly more conservative value when compared to the 1% AEP MRFS. The difference in water surface elevation is predominantly <= 10mm for the proposed development. However, there is a localised area south east of Turbine 7 which indicates an increase in water surface elevation of approximately 40mm to 50mm. This afflux can be attributed to the proposed access track which intersects the floodplain at this location. However, the afflux as a result of the proposed access track is well within the 300mm, which is a recommendation of the OPW for land affected by the construction of a bridge/culvert and at locations where properties are not at risk of flooding. The flood levels upstream and downstream of the site will not be adversely affected. Figure 5-15 below shows the existing and proposed flow hydrograph downstream of Turbine 10. As can be seen, there is no appreciable difference in hydrograph shape and the peak flow passed downstream is unchanged. Therefore, it is concluded that the proposed development will not adversely impact flood risk elsewhere.

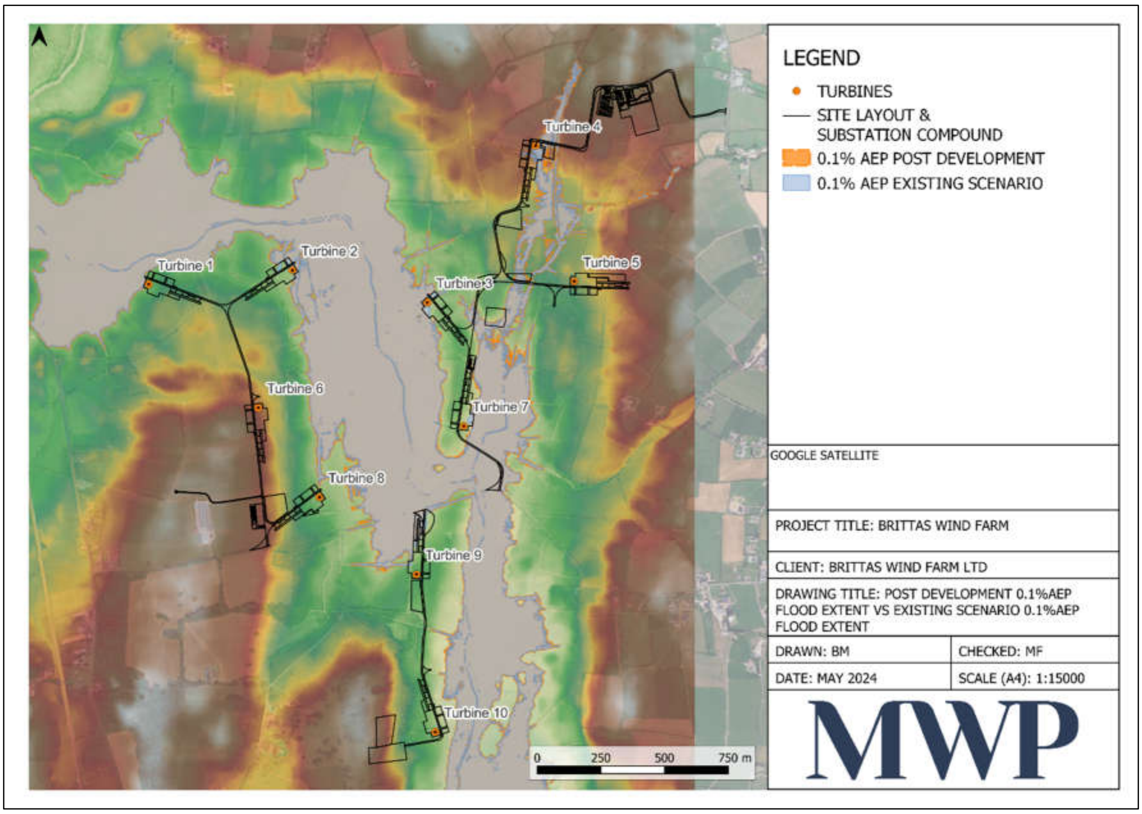


Figure 5-13: Post Development 0.1%AEP Flood Extent vs Existing Scenario 0.1%AEP Flood Extent

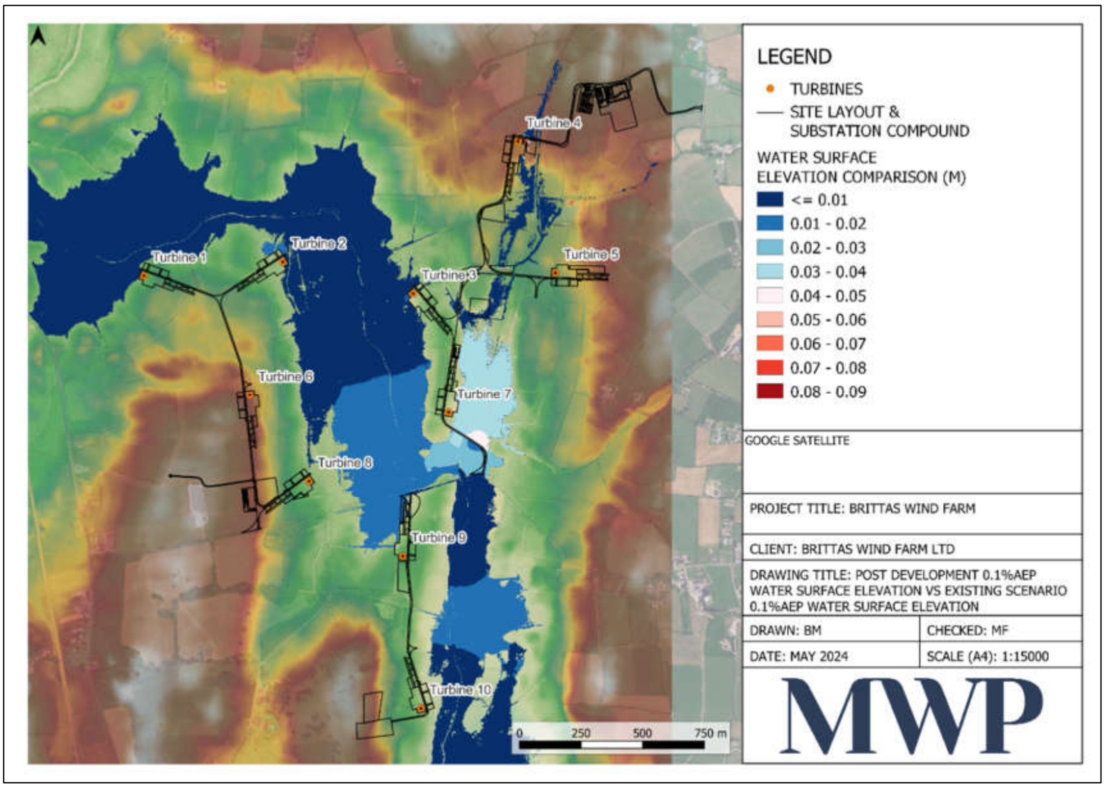


Figure 5-14: Post Development 0.1%AEP Water Surface Elevation vs Existing Scenario 0.1%AEP Water Surface Elevation

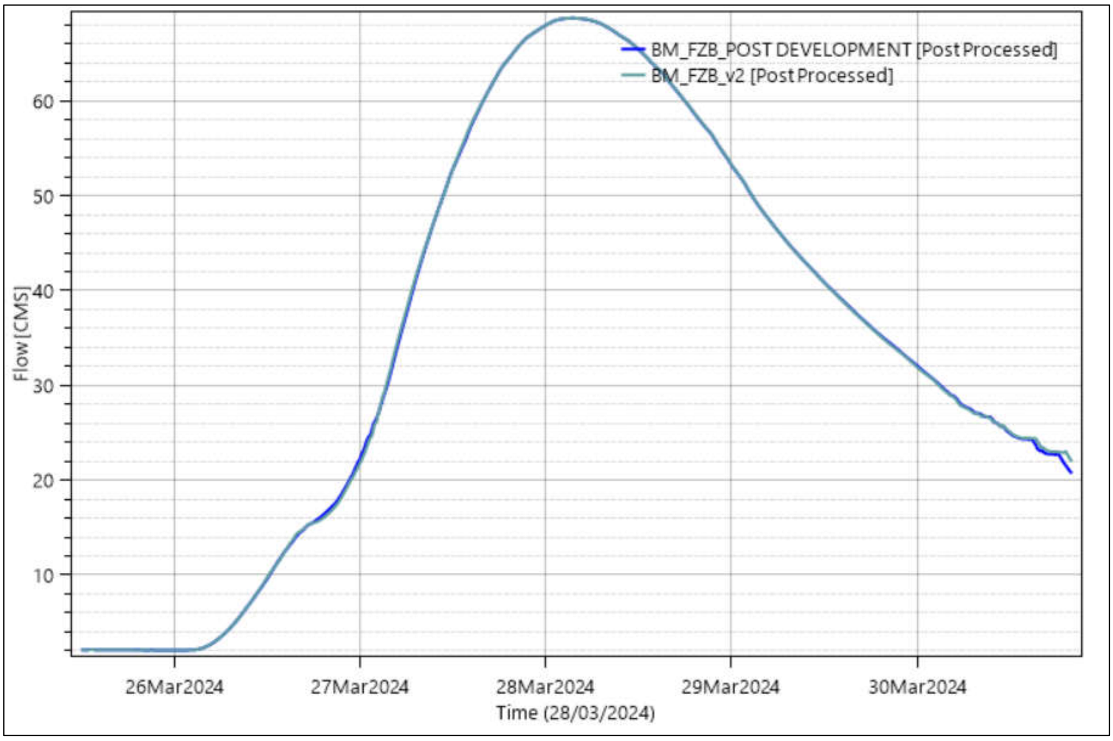


Figure 5-15: 0.1% AEP Existing Scenario Flow Hydrograph & 0.1%AEP Post Development Scenario Flow Hydrograph

5.6 Mitigation Measures

The PSFRM Guidelines recommend a precautionary approach be taken to allow for various uncertainties therefore requirements for flood mitigation would generally be assessed using higher confidence interval flows.

To ensure that there is no unacceptable flood risk to the proposed Brittas Sub-station and 10 no. turbines, the following mitigation measures are recommended:

1. The proposed Brittas Sub-station should be set above the 0.1% AEP MRFS 95% Confidence Interval flood level of 107.3mOD, plus 500mm freeboard. Therefore, the minimum proposed finished floor level of the proposed Brittas Sub-station is 107.8mOD. However, as per planning drawings the proposed finished floor level of the proposed Brittas Sub-Station is 107.85mOD.

2. The proposed 10 no. turbines should be set above the 1% AEP MRFS flood level plus 300mm freeboard. The minimum proposed finished levels for the 10 no. turbines are also presented in Table 5-4.

Turbine	Flood Level 1% AEP MRFS (mOD)	Proposed Finished Turbine Level - 300mm Freeboard Included (mOD)
Turbine 1	97.80	98.10
Turbine 2	97.40	97.70
Turbine 3	97.30	97.60
Turbine 4	103.80	104.10
Turbine 5	99.50	99.80
Turbine 6	97.25	97.55

Turbine	Flood Level 1% AEP MRFS (mOD)	Proposed Finished Turbine Level - 300mm Freeboard Included (mOD)
Turbine 7	97.00	97.30
Turbine 8	97.25	97.55
Turbine 9	97.15	97.45
Turbine 10	96.10	96.40

Table 5-4: Turbine Flood Levels

5.7 Residual Risks

The following residual risks have been identified;

1. Climate change effects larger than currently estimated
2. Flood Flows Larger than estimated

5.7.1 Climate Change Effects & Larger Flood Flows

During the sensitivity analysis an assessment was carried out to determine the impact a 0.1% AEP flood event for the MRFS (i.e. 20% increase in flows to allow for climate change). As would be expected, this event would result in an increase in flood level and extent throughout the proposed development. At most locations the increase would not cause flooding to the turbines and hardstanding areas and the extents would not differ significantly from the current scenario. However there are certain locations where an exceedance flow could have a more significant impact on flood risk. This includes:

1. Turbine 4 and the Turbine 4 hardstanding areas. However, the design event for the proposed 10 no. turbines is the 1% AEP MRFS flood level plus 300mm freeboard as discussed in Section 5.6.

6. Conclusions & Recommendations

A summary of the main findings of this FRA is as follows;

1. This report has been prepared in the context of *The Planning System and Flood Risk Management – Guidelines for Planning Authorities, November 2009 (PSFRM)*, published by the Office of Public Works and the Department of Environment, Heritage and Local Government.
2. The proposed development includes for the construction of no.10 turbines, hardstands, foundations, access tracks, internal underground connector cable, substation, battery storage, Lidar compound, borrow bit, felling areas and soil deposition areas.
3. The Stage 1 and 2 flood risk assessments indicated that there is potential for flooding at this site. The potential source of flooding was identified as fluvial flooding from the River Suir, the Rossestown Stream and its tributaries.
4. In particular, the Suir CFRAMS published flood extents which indicate that this site may be vulnerable to flooding.
5. A Stage 3 Detailed Flood Risk Assessment (FRA) was carried out to assess flood risk issues in sufficient detail to provide a quantitative appraisal of potential flood risk to the site.
6. There are flow records available for the River Suir and Rossestown Stream. The Flood Studies Update (FSU) was selected as the most appropriate flood estimation method to calculate the flood flows for catchments with an area >5km². The IH124 flood estimation method was adopted for catchments that have an area <5km².
7. In order to predict the flood extents and flood levels at the site, a combined 1D-2D hydraulic model was created using HEC-RAS river modelling software.
8. The model was used to create a flood zone map of the existing site which indicates the extent of Flood Zones A and B. Areas of the site outside of these Flood Zones are in Flood Zone C.
9. The flood zone map is included on Figure 5-2. It indicates that the proposed Brittas Sub-station is located within Flood Zone C. The majority of the 10 no. turbines are located in Flood Zone C which has a low probability of flooding (less than 0.1% annual exceedance probability or 1 in 1000).
10. Some of the 10 no. turbines are located within Flood Zone A/Flood Zone B, therefore having a high to medium probability of flooding during the 1% and 0.1% AEP events respectively.
11. To ensure that there is no unacceptable flood risk, the following mitigation measures are recommended:
    a. The design flood level for the proposed Brittas Sub-station is the 0.1%AEP MRFS 95% CI flood level plus 500mm freeboard.
    b. The design flood level for the proposed 10 no. turbines is the 1%AEP MRFS flood level plus 300mm freeboard
12. It was concluded that, once the above mitigation measures are implemented, the proposed development will not have an adverse impact on flooding elsewhere.
13. Residual risks associated with the development were also assessed and are considered to be acceptable.

Appendix A

Photographs

Figure 0-1: Main Channel north east of turbine 1

Figure 0-2: Left Bank north east of turbine 1

Figure 0-3: Right Bank north east of turbine 1

Figure 0-4: Upstream face of triple arch bridge Rossestown Road

Figure 0-5: Left Bank Upstream face of triple arch bridge Rossestown Road

Figure 0-6: Right Bank Upstream face of triple arch bridge Rossestown Road

Figure 0-7: Main Channel north of turbine 10 & turbine 11

Figure 0-8: Left Bank north of turbine 10 & turbine 11

Figure 0-9: Right Bank north of turbine 10 & turbine 11

Appendix 9B

WATER FRAMEWORK DIRECTIVE REPORT

MWP

BRITTAS WIND FARM

Water Framework Directive Assessment

Orsted

July 2024

Contents

Tables

Figures

Project No.	Doc. No.	Rev.	Date	Prepared By	Checked By	Approved By	Status
23318	WFD Assessment	A	29/05/2024	KC	MT		Draft

MWP, Engineering and Environmental Consultants
Address: Park House, Bessboro Road, Blackrock, Cork, T12 X251
www.mwp.ie

QUALITY
I.S. EN ISO 9001:2015
NSAI Certified

HEALTH & SAFETY
I.S. ISO 45001:2018
NSAI Certified

ENVIRONMENT
I.S. EN ISO 14001:2015
NSAI Certified

1. Introduction

1.1 Background

This report presents an assessment in accordance with the requirements of the EU Water Framework Directive (WFD) (2000/60/EC). The Directive requires all Member States to protect and improve water quality in all waters so that good ecological status is achieved by 2027 at the latest and establishes an integrated and coordinated framework for the sustainable management of water. The Directive has been transposed into Irish Law by Article 4 and 7 of the European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003) (as amended).

In accordance with the WFD, proposals that have the potential to impact 'water bodies' as designated by the WFD are required to demonstrate that actions would not result in a deterioration in 'Good' status. This report screens for water bodies within proximity to the Brittas Wind Farm (referred to as the proposed project) that have the potential to be impacted on by the development. Refer to Chapter 02 of the EIAR for a detailed project description.

The assessment is carried out in the following stages as set out UK guidance (in the absence of an equivalent in Ireland):

- Stage 1 – WFD Screening;
- Stage 2 – WFD Scoping; and
- Stage 3 – WFD Impact Assessment.

The WFD considers both the environmental status of surface water and groundwater. The purpose of this assessment is to provide the regulators with an overview of possible effects that may occur during the construction and operation of the proposed facility.

This WFD Assessment is contained as an Appendix to the **Environmental Impact Assessment Report** (**EIAR**) and specifically to supplement the **Chapter 09 Water** of the **EIAR** and should, therefore, be read together with this chapter.

1.2 Competency of Assessor and Reviewer

The assessment was completed by Kate Cain, Environmental Scientist with MWP. Kate holds an BSc in Environmental Management and has over 15 years; of experience. Kate has authored Environmental Impact Assessment Reports, Detailed Site Assessments, Environmental Reports and Construction and Environmental Management Plans for a wide range of projects.

This assessment has been reviewed by Olivia Holmes. Olivia is a Chartered Engineer and Chartered Environmental Practitioner with over twenty years' experience in Environmental Engineering focussing primarily on Environmental Impact Assessment (EIA), Appropriate Assessment (AA) and planning. She has prepared and reviewed a number of chapters for EIARs over her career for a broad range of projects.

2. Legislative Context

2.1 Water Framework Directive (WFD) (2000/60/EC)

The EU Water Framework Directive (WFD) (2000/60/EC) was transposed into Irish law by the S.I. No. 722/2003 - European Communities (Water Policy) Regulations 2003 (as amended). These Regulations cover governance, the characterisation of WFD river basins and the development of River Basin Management Plans (RBMP), environmental objectives and programmes of measures for achieving the latter, and criteria for determining quality standards.

The Regulations provide for the implementation of the WFD in Ireland, providing for the designation of all waters (rivers, lakes, estuarine waters, transitional coastal waters, and groundwaters) as 'water bodies', and setting objectives for the achievement of Good Ecological Status (GES) or Good Ecological Potential (GEP) and Good Chemical Status (GCS).

2.2 WFD Objectives

There are two principal objectives of the WFD:

- The first objective requires that all water bodies must reach at least 'good' overall status by 2027, at the latest. For surface waters, good status is a combination of good ecological status (or potential) and good chemical status; and
- The second objective requires that the status of each water body, including all the quality elements which make up overall status, must not deteriorate relative to the baseline reported in the relevant RBMP.

The current baseline quality (referred to as the current 'status') of all water bodies is reported every six years as part of the RBMP cycle in Ireland. The first RBMP cycle in Ireland covered the period 2009 to 2015. The second cycle plan covered the period 2018-2021. The draft third cycle RMBP covering the period 2022-2027 was launched for public consultation in 2020 and is still to be published.

The plan sets out key actions required to effectively implement mitigation measures to significantly improve water quality and identify where these measures should be deployed. In addition, the potential impacts of climate change on water resources, the planning for droughts and water scarcity is increasingly crucial.

2.3 WFD Classification

The information used in the classification of the status of our water bodies is collected in the national WFD monitoring programme. Information on a range of different elements is collected (EPA, 2022):

- Biology (plants and animals living in and around water bodies);
- Water quality (concentrations of nutrients such as nitrogen and phosphorus and harmful chemicals such as pesticides);
- Water quantity (flows and levels of surface waters and groundwaters); and
- Hydromorphology (the physical habitat conditions of water bodies).

Rivers, lakes, estuaries and coastal waters can be awarded one of five statuses and groundwater just two (**Figure 2-1**) (Catchments.ie, 2024). High status is the reference condition, and it is defined as the biological, chemical, and morphological conditions associated with no or very low human pressure. The reference condition is considered to be the best status achievable or benchmark for a given water body. The reference conditions will vary depending on the water body type, whether it is man-made or natural (or a combination of the two), and the local biodiversity of the region (EIRGRID, 2021).

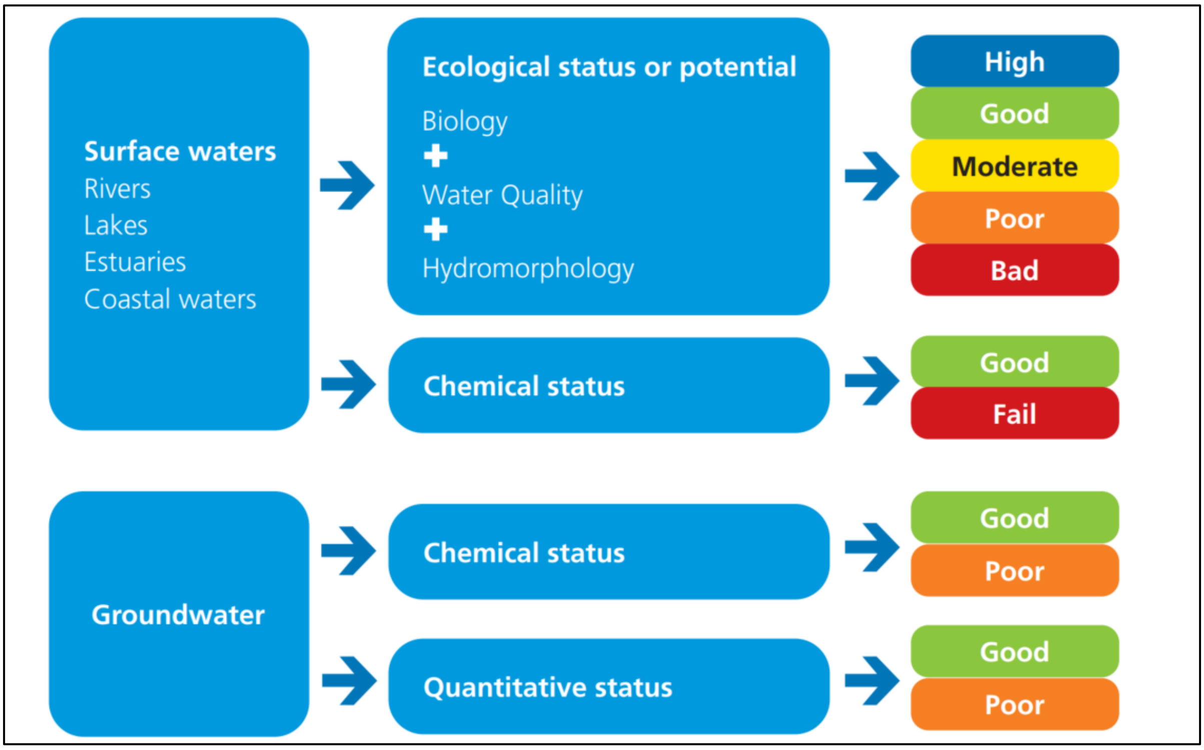


Figure 2-1: WFD Classification (Catchments.ie, 2022)

2.3.1 Ecological Status

There are 18 biological assessment methods used to assess ecological status (EPA, 2019-2021) (**Table 2-1**). The ecological status classification for the water body, and the confidence in this, is determined from the worst scoring quality element. This means that the condition of a single quality element can cause a water body to fail to reach its WFD classification objectives (EIRGRID, 2021).

Table 2-1: Biological assessment methods used to assess ecological status

Water Category				
Biological quality elements (BQE)	Rivers	Lakes	Transitional	Coastal

Macroinvertebrates	Quality Rating System (Q-value) *AWICS* *(Acidification)*	LAMM (acidification)	Infaunal Quality Index (IQI)	Infaunal Quality Index (IQI)
Aquatic Plants	*Mean Trophic Rank (MTR)* *LEAFPACS*	Free Macrophyte Index	Intertidal Seagrass tool Saltmarsh Angiosperm Assessment Tool for Ireland (SMAATIE)	Intertidal Seagrass tool Saltmarsh Angiosperm Assessment Tool for Ireland (SMAATIE)
Macroalgae	*Mean Trophic Rank (MTR)* *LEAFPACS*	Not applicable	Opportunistic Green Macroalgal Abundance (OGA Tool)	Opportunistic Green Macroalgal Abundance (OGA Tool) RSL - Rocky Shore reduced species List
Phytoplankton	Not applicable	Lake Phytoplankton Index Phytoplankton biomass (chlorophyll)	Phytoplankton biomass (chlorophyll) Phytoplankton composition	Phytoplankton biomass (chlorophyll) Phytoplankton composition
Phytobenthos	Trophic diatom Index (TDI)	Lake Trophic Diatom Index	Not applicable	Not applicable
Fish	Fish Classification Scheme 2 Ireland (FCS2)	Fish in lakes 2 (FIL2)	Transitional Fish Classification Index (TFCI) Estuarine Multi-metric Fish Index (EMFI)	Not applicable

**Italics indicate new method or method under development*

The current status and measures designed to achieve the water body objectives are set out by the EPA in the draft RBMP (2022-2027). For this RBMP cycle, a single national River Basin District has been defined for Ireland. This is broken down into 46 catchment management units and the proposed developed is located within Catchment 16 (Suir Catchment) within the sub catchment 16_22 (Suir_SC_000). Refer to**Figure2-2** for the WFD Sub catchments and **Figure 3-2** showing the location of the Suir Catchment within the River Basin District.

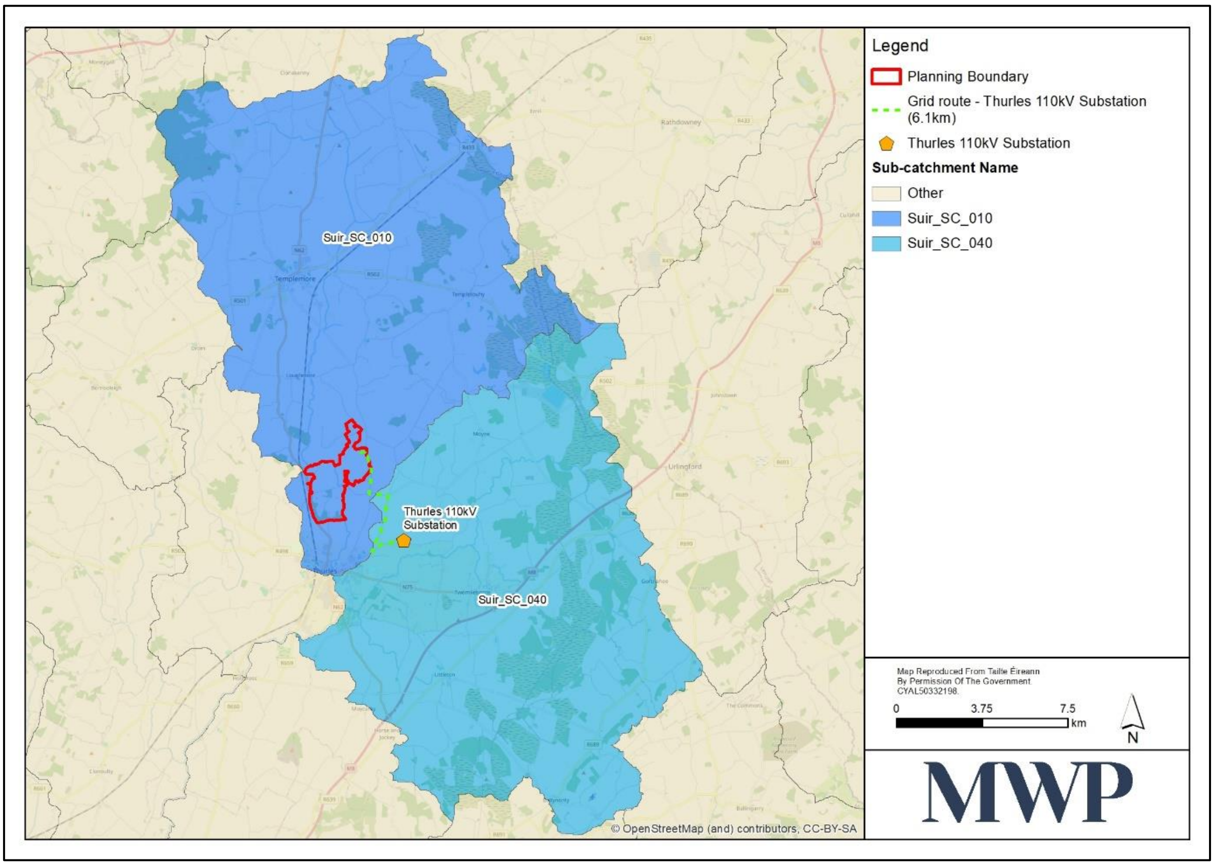


Figure2-2: Sub Catchment Locations (EPA Maps, 2024)

2.3.2 Chemical Status

Chemical status is assessed by compliance with environmental standards for chemicals that are listed in the EC Environmental Quality Standards Directive (2008/105/EC); transposed in Ireland by the European Communities Environmental Objectives (Surface Waters) Regulations 2009 S.I. No. 272/2009 (as amended).

These chemicals include priority substances, priority hazardous substances, and eight other pollutants carried over from earlier directives. Chemical status is recorded as 'good' or 'poor'. The chemical status classification for the water body is determined by the worst scoring chemical (EIRGRID, 2021).

2.3.3 Hydromorphology Status

The WFD requires the assessment of the ecological status, which includes hydromorphological quality elements. Hydromorphology is the study of physical form, condition and processes within a surface water body, that create and maintain habitat. Where the Hydromorphology of a surface water body has been significantly altered for anthropogenic purposes, such as water supply, flood protection or navigation, it can be designated as an Artificial or Heavily Modified Water Body (HMWB).

An alternative environmental objective, Good Ecological Potential (GEP) applies in these cases. In practice, this means that ecology must be as close as possible to that of a similar natural water body, but without compromising its human use. The water bodies of relevance to this project are not classified as HMWB so the classification of these is not discussed further (EIRGRID, 2021).

2.4 WFD Protected Areas

The WFD requires a register of protected areas. These are protected for their use (such as fisheries or drinking water) or because they have important habitat and/or species that directly depend on water. The register includes areas identified by the WFD itself or other European Directives. These may include the following:

- Areas used for water abstraction - European Union (Water Policy) (Abstractions Registration) Regulations 2018 (S.I. No. 261 of 2018);
- Areas designated for the protection of economically significant aquatic species (Freshwater Fish Directive 78/659/EEC; Shellfish Directive 79/923/EEC);
- Recreational waters (Bathing Waters Directive 76/160/EEC);
- Nutrient Sensitive Areas (Nitrates Directive 91/676/EEC; Wastewater Treatment Directive 91/271/EEC);
- Areas of protected species or habitats where water quality is an important factor in their protection (Natura 2000 sites under Birds Directive 79/409/EEC and Habitats Directive 72/43/EEC); and
- Surface waters (The European Communities Environmental Objectives (Surface Waters) Regulations [S.I. No 272 of 2009], and amendment regulations 2012 [S.I. 327 of 2012]).

Surface waterbodies draining the proposed project eventually flow into the Lower River Suir SAC (Site Code: 002137) after Thurles. At its closest point this designated site is located approximately 5.5km downstream of the proposed project site and is hydrologically connected with the site via the River Suir.

Potential impacts of the proposed project on Special Areas of Conservation (SAC) and Special Protection Areas (SPA) are addressed in Chapter 06 Biodiversity, Chapter 07 Ornithology of this EIAR and in the Natura Impact Statement (NIS) submitted with the planning application.

2.5 Compliance with the WFD and Purpose of the WFD Assessment

All new developments in Ireland that may have an impact on the water environment are required to comply with objectives of the WFD, under European Communities Environmental Objectives (Surface Waters) Regulations 2009 S.I. No. 272/2009 (as amended).

This includes ensuring that no changes occur that cause a deterioration of the current status of any water body, and that the development does not prevent the achievement of the future status objectives of any water body. Water body status deterioration can occur as a result of deterioration of any of the quality elements that make up the overall status (e.g., biological, physicochemical or hydromorphological elements for surface waters) even where this does not result in a lowering of overall water body status.

The purpose of the WFD Assessment is to assist developers and regulators understand the impact that the development may have on the immediate water body and any linked water bodies and to ensure that the development will not prevent compliance with the WFD Objectives. This report presents the findings of the WFD assessment process undertaken for the proposed Brittas Wind Farm.

3. Project Description and Catchment Area

3.1 Project Description

Brittas Wind Farm Ltd. (the Applicant) propose to develop a wind farm (named Brittas Wind Farm) comprising ten (10) No. wind turbines approximately 3km to the north of Thurles, Co. Tipperary. The wind farm is proposed in the townlands of Brittas, Rossestown, Clobanna, Brownstown, Killeenleigh and Kilkillahara.

The main components of the project are ten (10) wind turbines with a height of 180m, an on-site 110kV electrical substation, a Battery Energy Storage System (BESS) and an underground electrical connection to an existing 110kV substation at Thurles which is connected to the National Grid. Should it become operational, this wind farm will be capable of providing over 57 megawatts (MW) of renewable electricity to the National Grid.

Refer to **Figure 3-1** for the location of the proposed project. A detailed description of the proposed site location and description of the proposed project is provided in **Chapter 02 Project Description** of this **EIAR.**

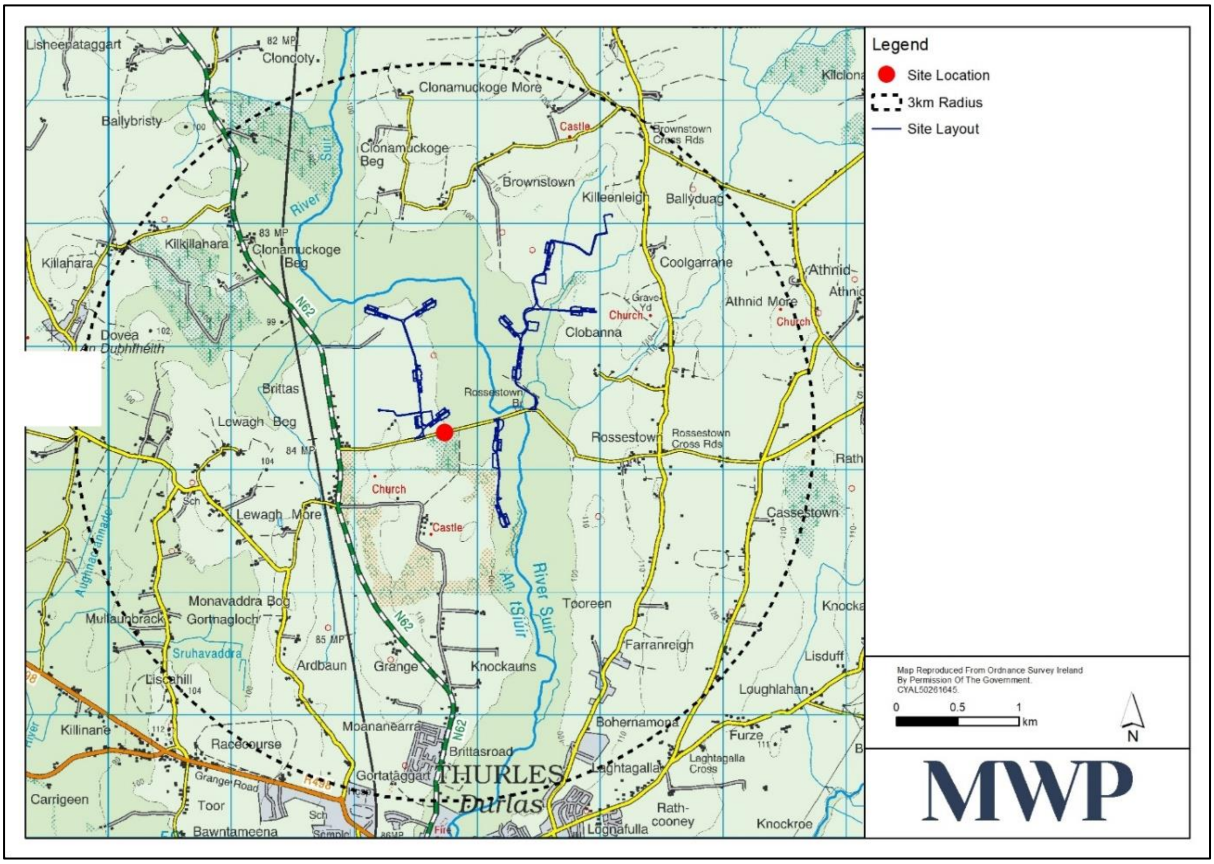


Figure 3-1: Project Location

The subject site is located within Hydrometric Area No. 16, also known as the Suir Catchment. The Suir catchment is divided into 29 sub catchments with 168 river waterbodies, seven lakes, four transitional waterbodies and 43 groundwater bodies (EPA Catchments, 2021). There are coastal waterbodies in the catchment (**Figure 3-2**).

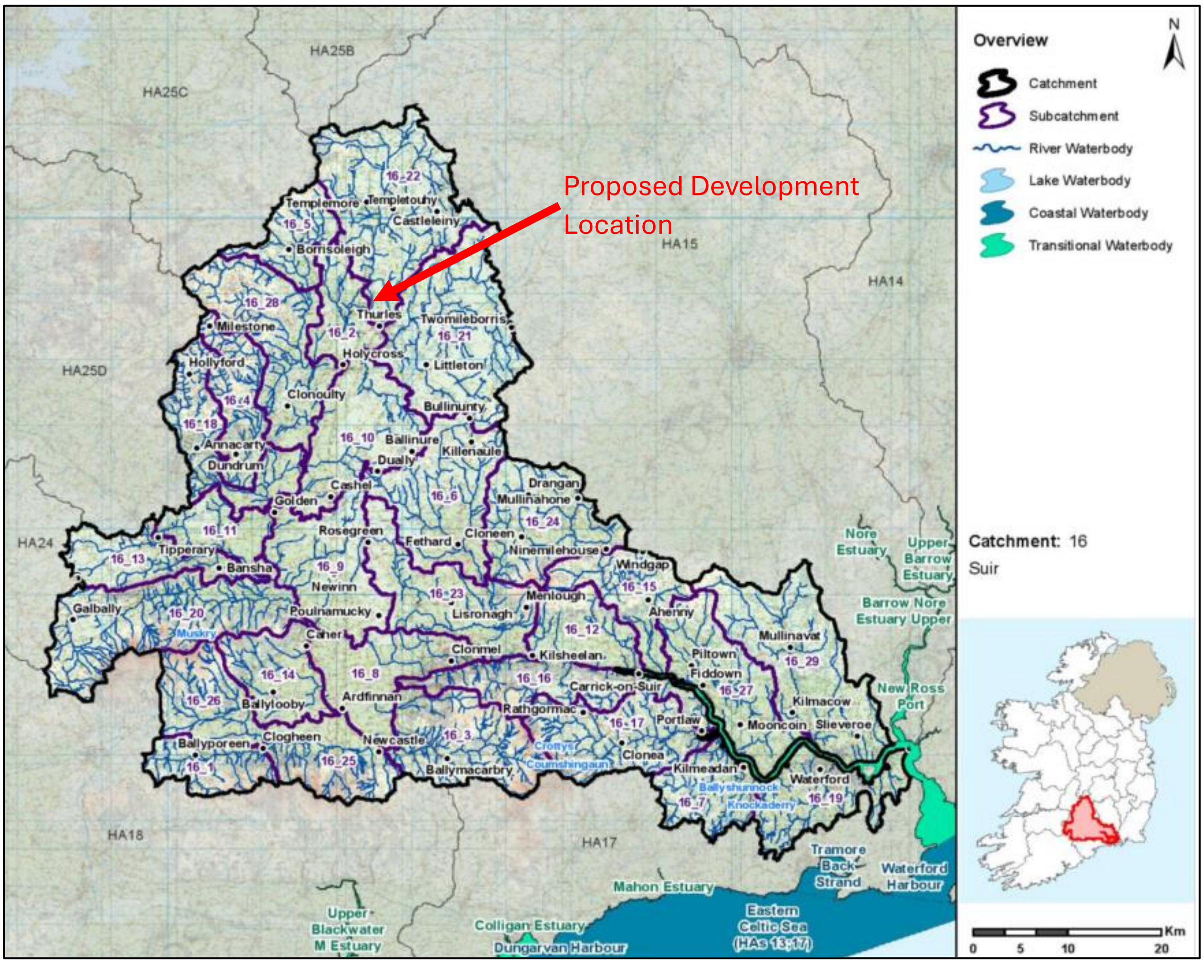


Figure 3-2: Suir Catchment Area (EPA, 2021)

The proposed project is located within sub catchments 16_22 (Suir_SC_010) and 16_21 (Suir_SC_040) and within the following river sub basins:

- Suir_050; and
- Suir_060.

Refer to **Figure2-2** for overview of the sub-catchment extents.

3.2 Relevant Surface Water Body and Status

The River Suir (IE_SE_16S020500 and IE_SE_16S020600) flows in an easterly direction north of Turbine 1 and 2. The river then bends and flows in a southerly direction between Turbines 3, 6, 7 and 8. It continues in a southerly direction and flows to the east of Turbine 9 and 10.

The Rossestown Bridge Stream (IE_SE_16S020500) flows to the east of Turbine 4. The Athnid More Stream (IE_SE_16S020500) then confluences this stream to the north of Turbine 5 which flows in a southerly direction to the East of Turbine 3 and 7 before the confluence with the River Suir passing Turbine 9 and 10. The grid connection route crosses this stream over a single span arch stone bridge.

The Rossestown Stream (IE_SE_16R010300) flows to the east of the proposed project site and confluences with the Rossestown Bridge Stream. Refer to **Figure 3-3** for the location of these streams in relation to the proposed project infrastructure.

The Farranreigh 16 Stream (IE_SE_16D020400) is located to the east of Thurles and is crossed by the grid connection over a single span arch bridge before connecting into the Thurles substation.

The River Suir is designated for a Natura 2000 site downstream of the proposed projects site after Thurles. This protected area is named the Lower River Suir SAC (Site code 002137). Refer to **Chapter 05 Biodiversity** of this **EIAR** and the **Natura Impact Statement (NIS)** submitted with the planning application package for further details on these sites.

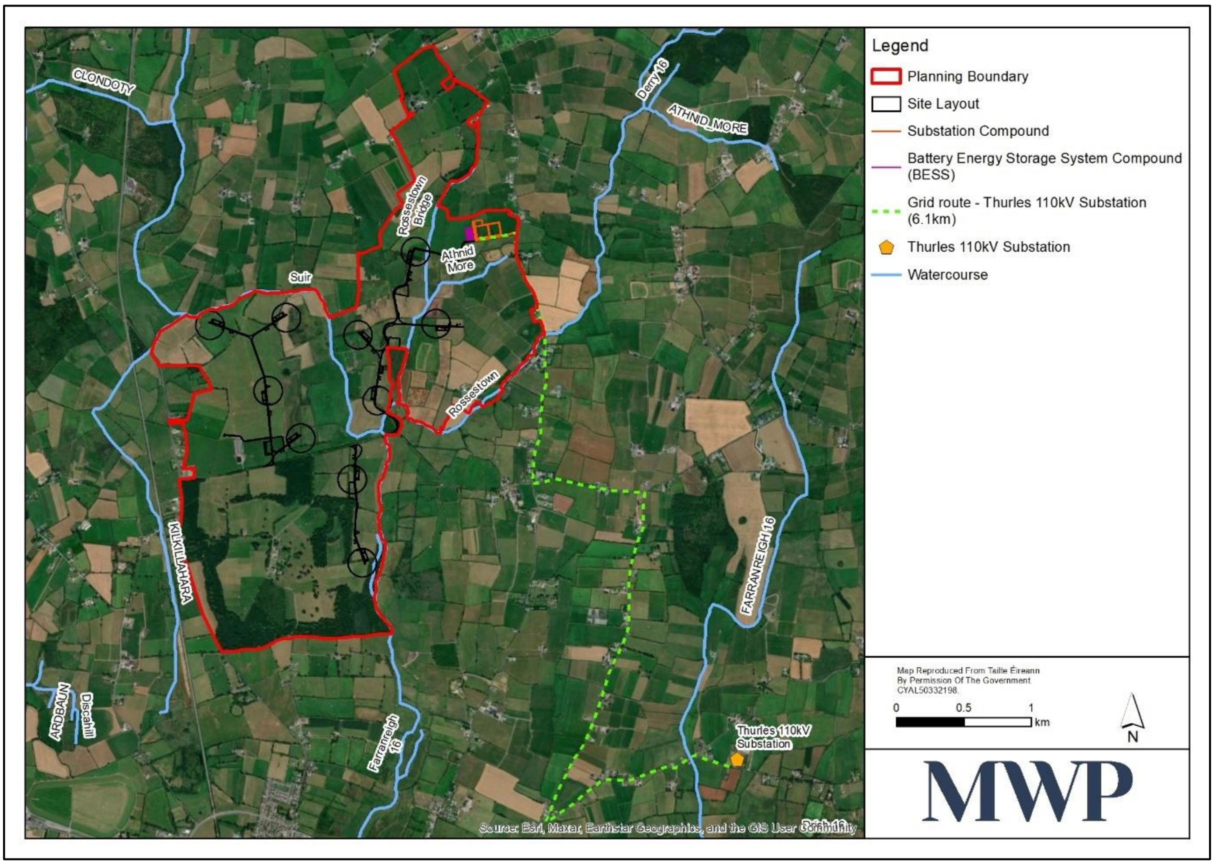


Figure 3-3: Location of Surface Water Bodies

Table 3-1 provides a summary of the WFD status for the surface water bodies applicable to the proposed project. The water quality for the Suir_050 (surface water features located to the north of the L8017) has been consistently 'good' since monitoring commenced in 2007 and classified as 'not at risk' of meeting the WFD objectives. The Suir_060 (from the L8017 and flowing south towards Thurles) has fluctuated between 'poor' and 'moderate' with the latest monitoring cycle resulting indicating a 'poor' water quality. This portion of the Suir River is also 'at risk' of meeting the objectives of the WFD. Refer to **Figure 3-4** for the river waterbody risk status (EPA Maps, 2024).

Table 3-1: River Status

Surface Water										
River Waterbody Code	Segment Code	Flow Network Name	River waterbody Risk Name	Type	WFD Risk*	Water Quality Status (Q Value)				
						2007-2009	2010-2012	2010-2015	2013-2018	2016-2021
IE_SE_16S020500	16_502	Suir	Suir_050	River / Stream	Not at Risk	Q4 (Good)	Q4 (Good)	Q4 (Good)	Q4 (Good)	Q4 (Good)
IE_SE_16S020600	16_10663		Suir_060		At Risk	Q3, Q2-3 (Poor)	Q3, Q2-3 (Poor)	Q3-4 (Moderate)	Q3-4 (Moderate)	Q3, Q2-3 (Poor)
IE_SE_16S020500	16_2671	Rossestown Bridge	Suir_050	River / Stream	Not at Risk	Q4 (Good)	Q4 (Good)	Q4 (Good)	Q4 (Good)	Q4 (Good)
	16_3294		Suir_050		Not at Risk	Q4 (Good)	Q4 (Good)	Q4 (Good)	Q4 (Good)	Q4 (Good)
IE_SE_16S020500	16_135	Athnid More Stream	Suir_050	River / Stream	Not at Risk	Q4 (Good)	Q4 (Good)	Q4 (Good)	Q4 (Good)	Q4 (Good)
IE_SE_16S020500	16_2380	Rossestown Stream	Suir_050	River / Stream	Not at Risk	Q4 (Good)	Q4 (Good)	Q4 (Good)	Q4 (Good)	Q4 (Good)
	16_10692				Not at Risk	Q4 (Good)	Q4 (Good)	Q4 (Good)	Q4 (Good)	Q4 (Good)
IE_SE_16D020400	16_2885	Farranreigh 16	Drish_060	River / Stream	At Risk	Q3, Q2-3 (Poor)	Q3-4 (Moderate)	Q3-4 (Moderate)	Q3-4 (Moderate)	Q3-4 (Moderate)
Water bodies for Review are not considered to be At Risk but require further evidence that the objectives are being met, typically with ongoing monitoring and/or possibly modelling.										

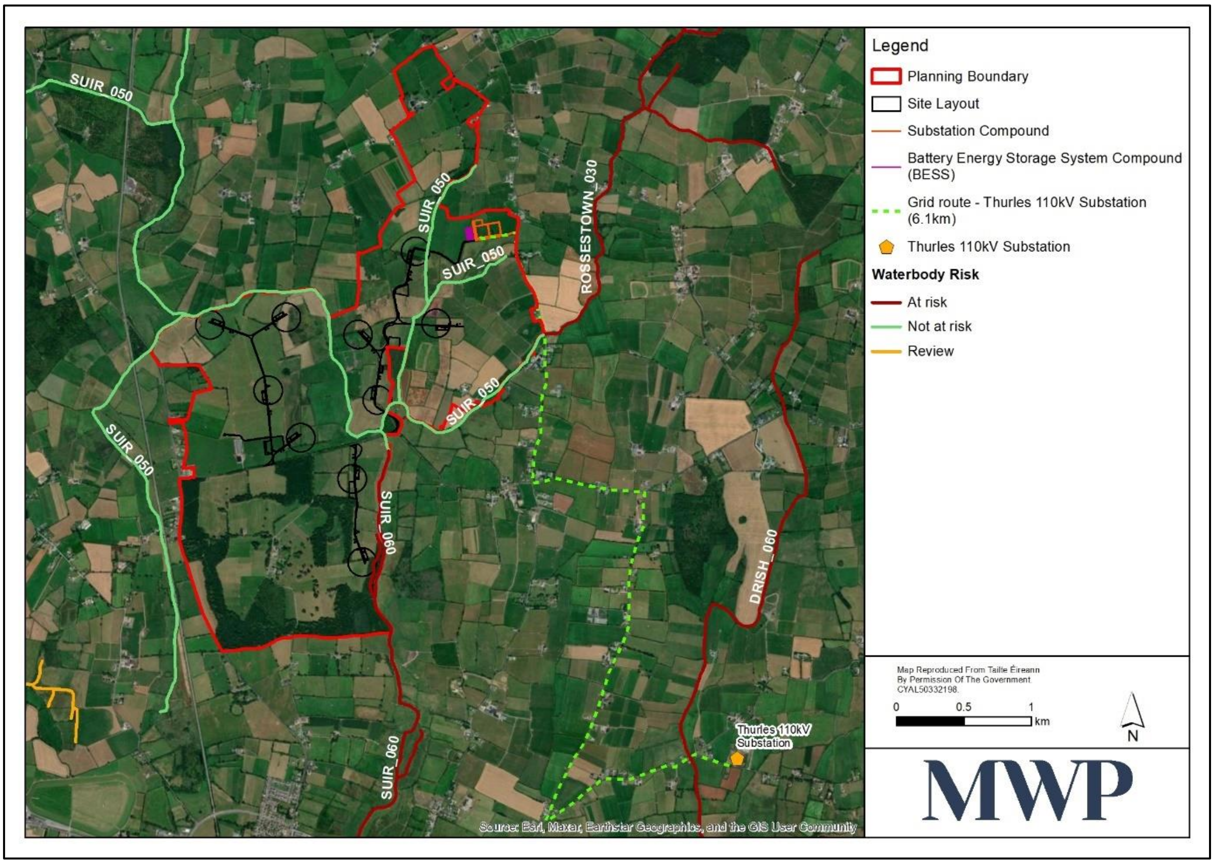


Figure 3-4: River Waterbody Risk (Source: EPA)

3.3 Relevant Groundwater Body and Status

The Groundwater Bodies (GWB) underlying proposed project site and grid connection are the Templemore (EU Cide: IE_SE_G_131) GWB and the Thurles (EU Code: IE_SE_G_158) GWB. Refer to **Figure 3-5** for a map showing the location of the GWBs in relation to the proposed project.

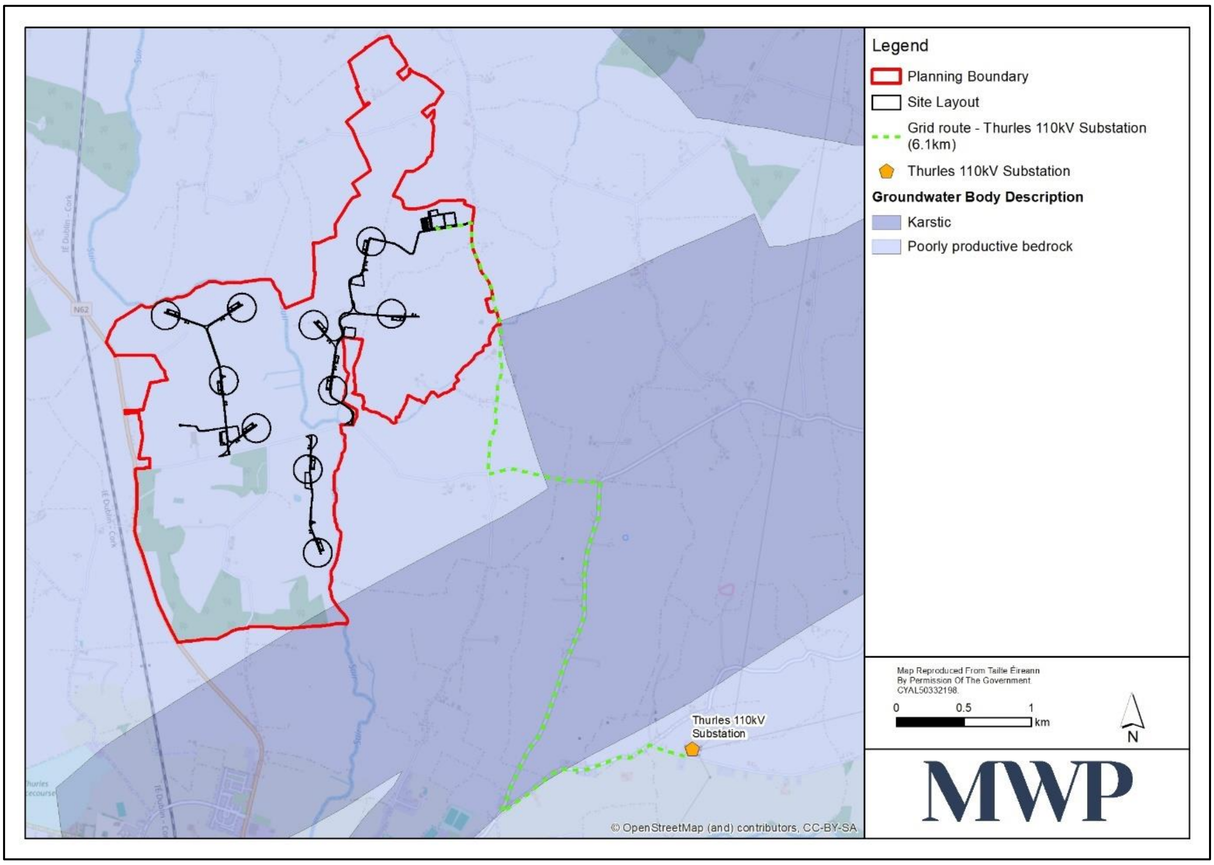


Figure 3-5: Groundwater Bodies

At present, the EPA classifies the Templemore GWB as having a WFD Status (2016-2021) of 'good', with a current WFD risk score of 'at risk' (**Figure 3-6)**. This water body had not achieved the WFD objective of good status in terms of water quality for the following:

- Chloride has an increasing trend indicating deterioration. It has exceeded the Indicative Quality Guide1 since 2015 (**Figure 3-7**); and
- Conductivity has a decreasing trend but is above the Indicative Quality Guide (**Figure 3-8**).

The Thurles GWB is classified as having a WFD Status (2016-2021) of 'good', with a current WFD risk score of 'not at risk' (**Figure 3-6)**. This GWB therefore meets the objective of good status for quality elements monitored by the EPA.

[1] EPA: Indicative water quality for the parameter being trended only, as determined using the aggregated concentrations for the baseline period, i.e. 2007-12 for groundwater.

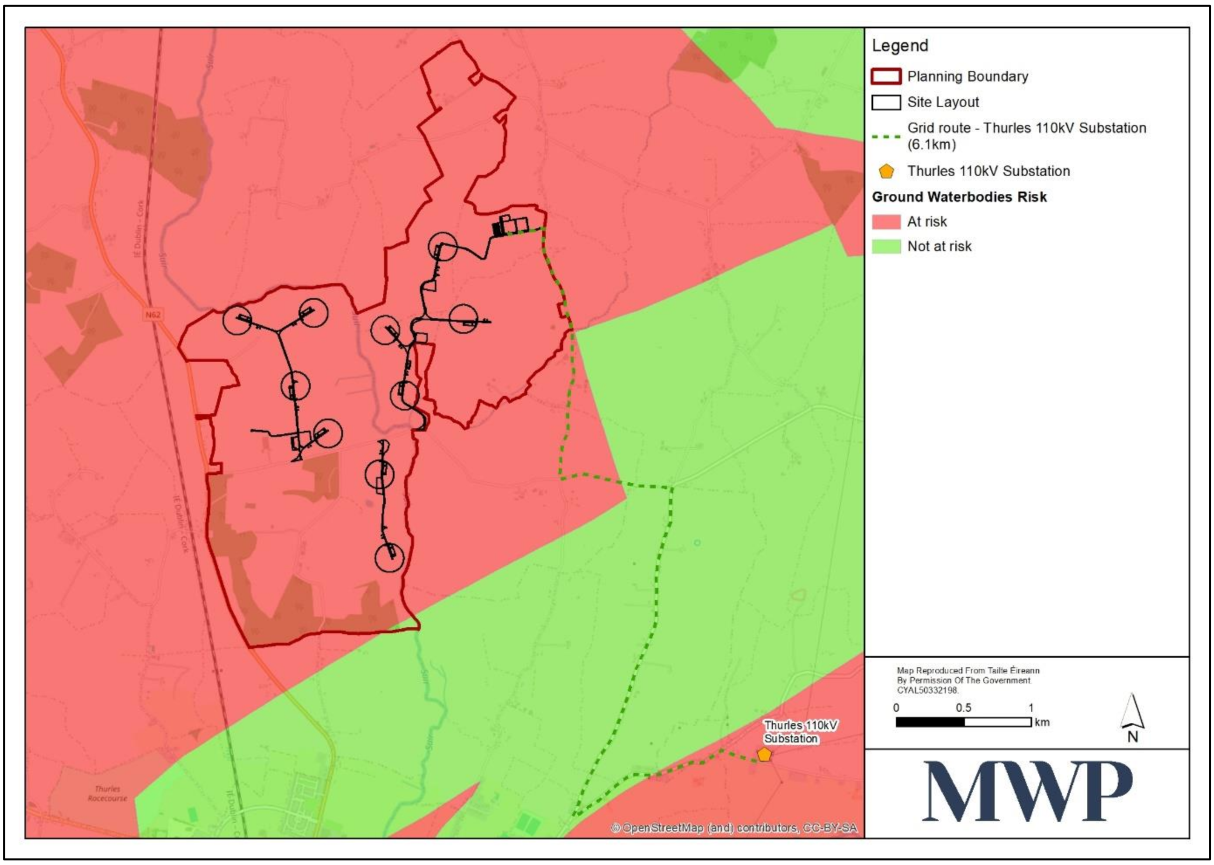


Figure 3-6: EPA Groundwater Body Risk

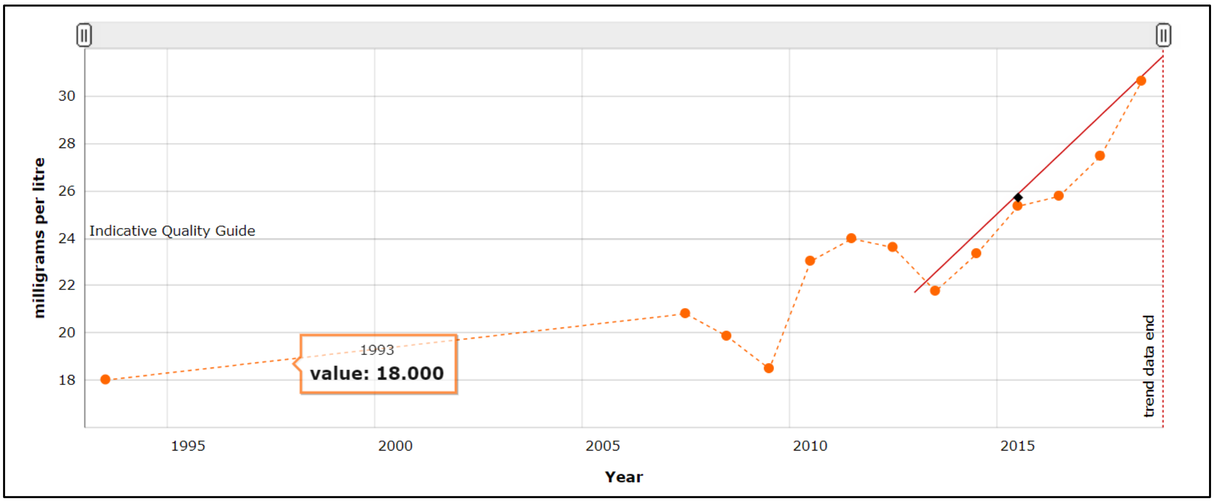


Figure 3-7: Groundwater Trend Graph Chloride

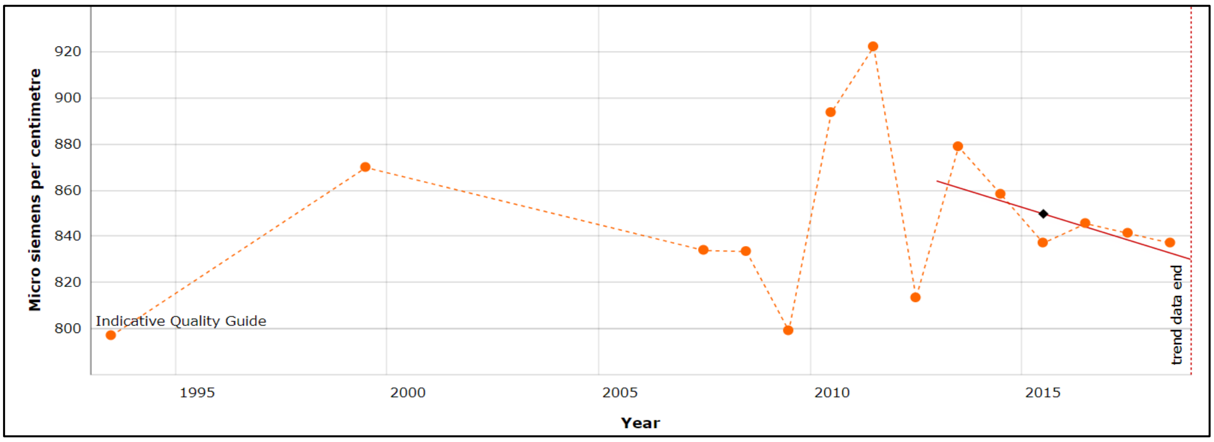


Figure 3-8: Groundwater Trend Graph Conductivity

The majority of the proposed project site and grid connection are situated within an aquifer that is described by Geological Survey Ireland (GSI) as a Locally Important Bedrock Aquifer, which is Moderately Productive only in Local Zones (Category Ll) (**Figure 3-9**). Parts of the grid connection route to Thurles is situated within an aquifer which is described as a Regionally Important Aquifer, which comprises of bedrock which is Karstified (diffuse) (Category Rkd) and a locally important aquifer with bedrock that is generally moderately productive (Category Lm).

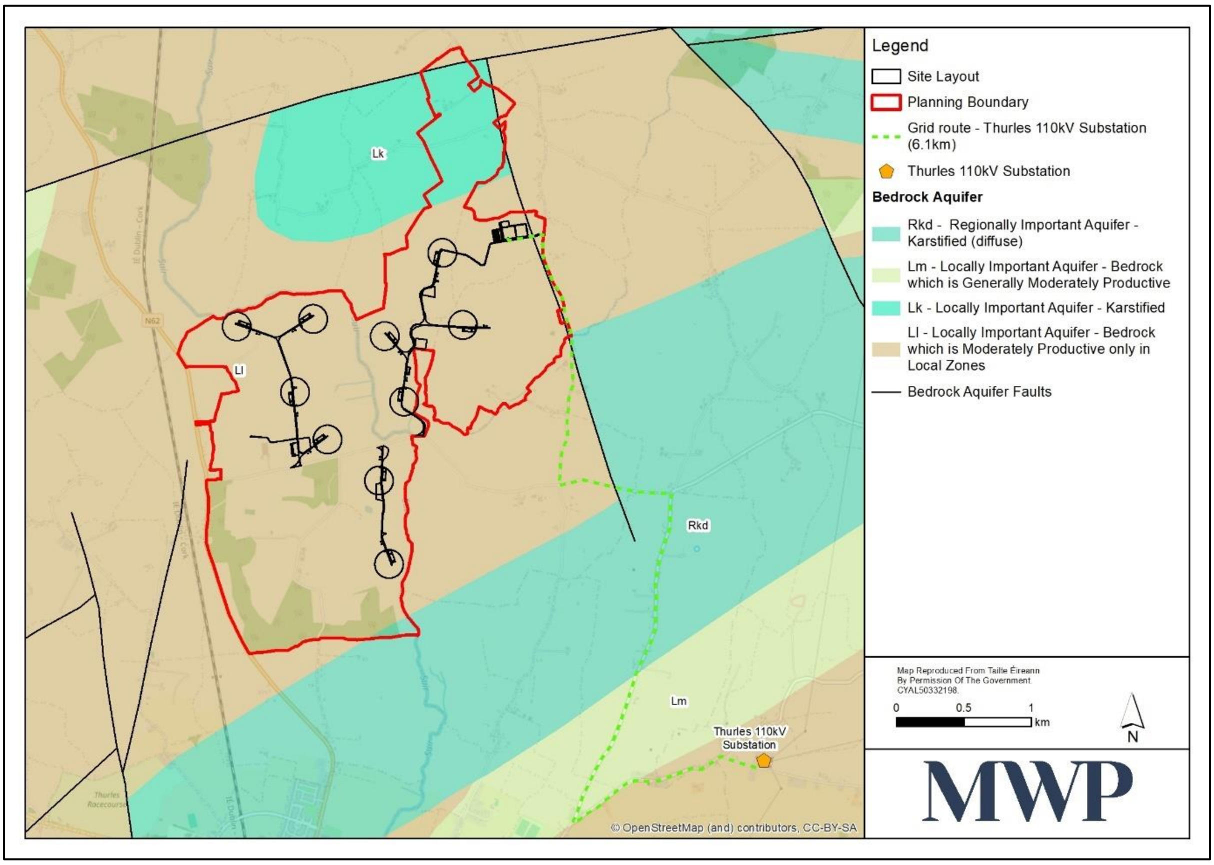


Figure 3-9: EPA Bedrock Aquifer Classification

Groundwater vulnerability is a term used to represent the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated generally by human activities. Mapping provided by the GSI indicates that the majority of the site is underlain by an aquifer of high vulnerability. Refer to **Figure 3-10** illustrates the groundwater vulnerability beneath the site and within the greater area.

Groundwater Vulnerability is used to represent the natural ground characteristics that determine the ease with which groundwater may be contaminated by human activities. Groundwater vulnerability maps are based on the type and thicknesses of subsoils (sands, gravels, glacial tills (or boulder clays), peat, lake and alluvial silts and clays), and the presence of karst features. Groundwater is most at risk where the subsoils are absent or thin and, in areas of karstic limestone, where surface streams sink underground at swallow holes. All land area is assigned one of the following groundwater vulnerability categories:

- Rock near surface or karst (X);
- Extreme (E);
- High (H);
- Moderate (M); and
- Low (L).

Refer to **Figure 3-10** for the groundwater vulnerability applicable to the proposed project. As can be seen from the figure, the groundwater vulnerability ranges from moderate to extreme. contaminants may reach groundwater in a vertical or sub-vertical direction and is categorised as 'at risk'.

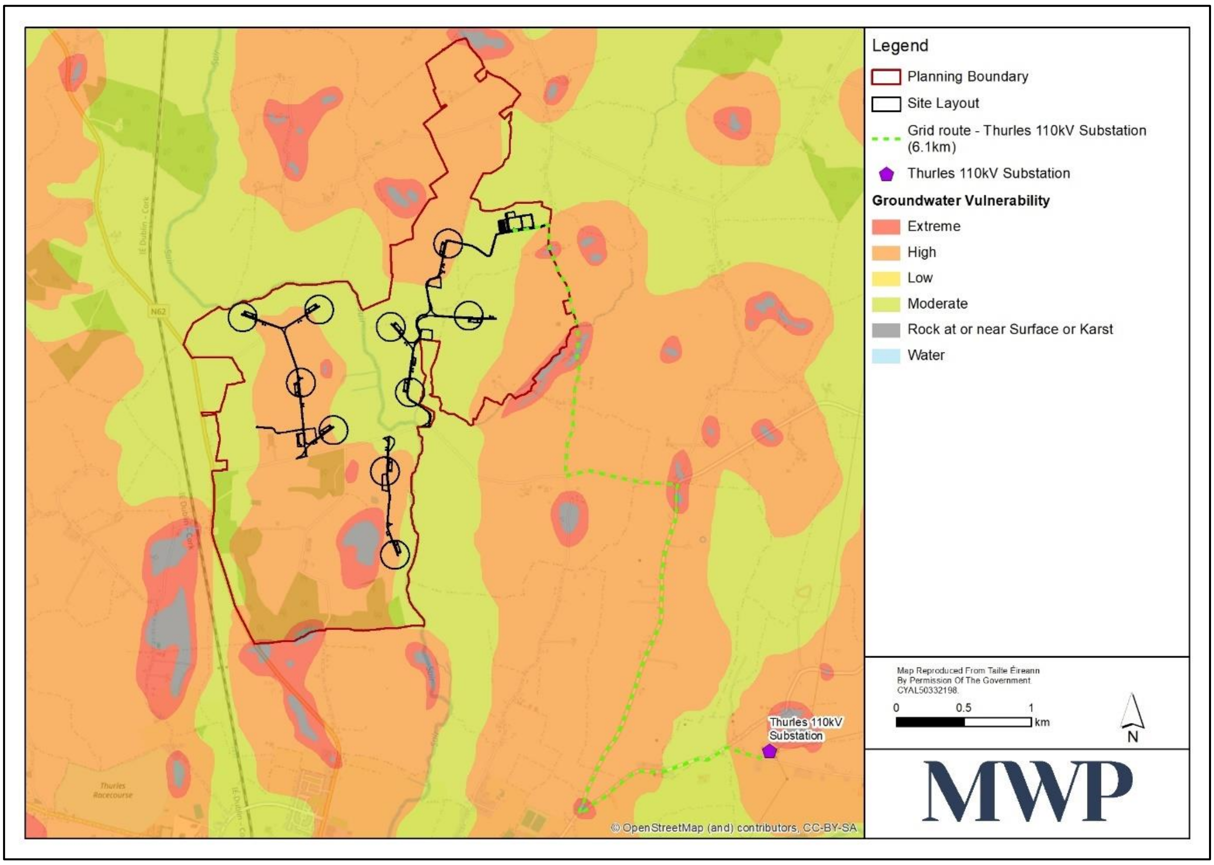


Figure 3-10: Groundwater Vulnerability

Table 3-2 provides a summary of the WFD status for the groundwater aquifer under the site. The water quality has remained of a good quality from 2007 to the latest results in 2021. The Templemore aquifer is however at risk in terms of the WFD status. This means that there may be exceedances of quality standards and thresholds that would result in failure to achieve the environmental objectives of associated surface waters.

Table 3-2: Groundwater Status

Code	Name	Type	WFD Risk*	Water Quality Status			
				2007-2012	2010-2015	2013-2018	2016-2021
IE_SE_G_131	Templemore	Groundwater	At Risk	Q4 (Good)	Q4 (Good)	Q4 (Good)	Q4 (Good)
IE_SE_G_158	Thurles	Groundwater	Not at Risk	Q4 (Good)	Q4 (Good)	Q4 (Good)	Q4 (Good)

** At risk means not achieving the environmental objectives related to point sources or exceedances of quality standards and thresholds that would result in failure to achieve the environmental objectives of associated surface waters*

The GSI database lists sixteen boreholes and one dug well in proximity to the proposed project site. The current use of most (10) of these boreholes is unknown with the remainder for agricultural and domestic use (**Figure 3-11**). The Yield Class ranges between poor and moderate for these boreholes with some of them having an unknown yield class.

The current turbine locations are not located within any Groundwater Group Schemes or Public Supply Source Protection Area. The closest turbine to a Group Scheme is approximately 500m.

As no groundwater will be abstracted as part of the proposed project, these schemes will be unaffected by any activity associated with the proposed site development.

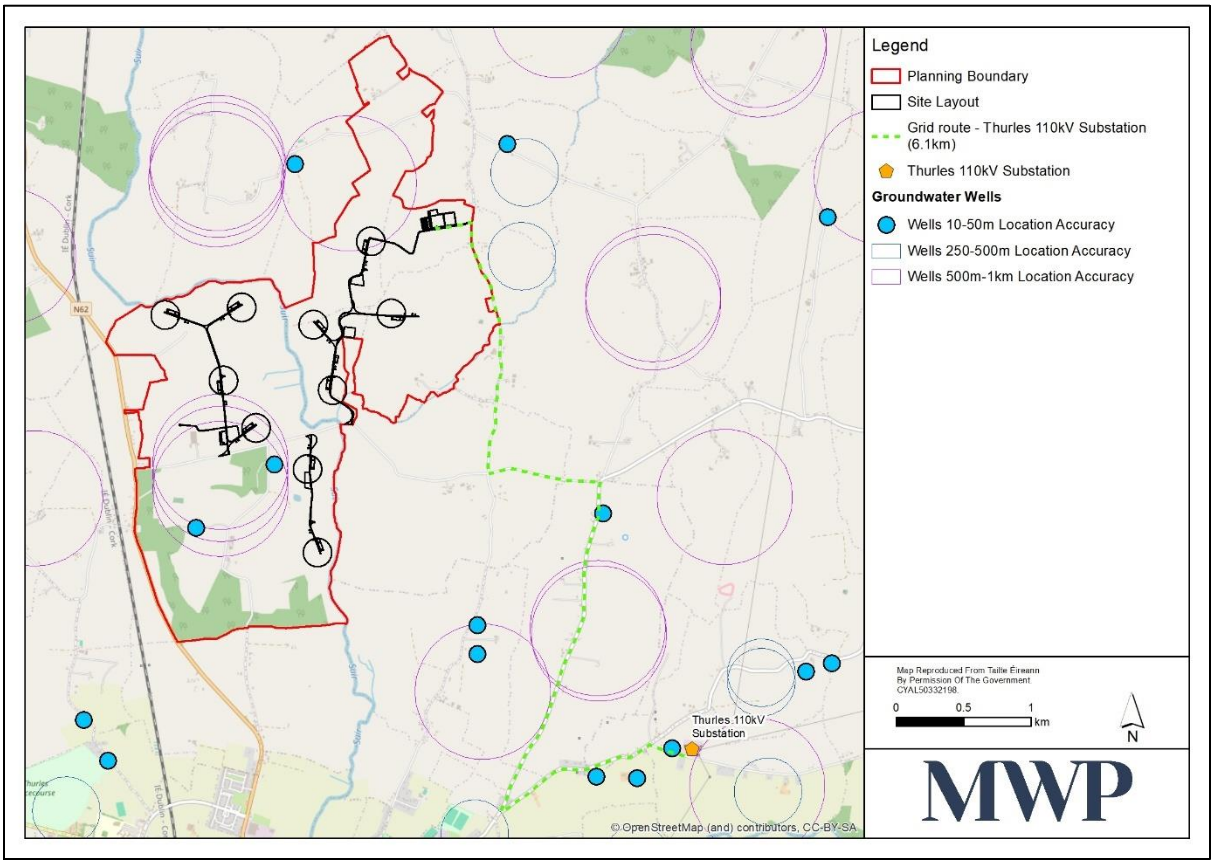


Figure 3-11: GSI Groundwater Wells and Springs

4. Methodology and Findings

Any activity that is part of the facility and that could have the potential to lower the status of any of the quality elements of a water body or preclude the measures necessary to achieve good status must be assessed to determine its compliance with the WFD.

This section details the WFD assessment methodology for the surface water and groundwater components of the facility. For each of the stages, a description of the process adopted is provided, together with initial relevant information that may facilitate early decision-making.

Published methodologies for the assessment of plans or projects in relation to undertaking WFD assessments across all types of water bodies that are specific to Ireland are currently not available. There is however an EU-level guidance document of relevance titled “Water Framework Directive Project assessment checklist tool” (2018), published by the Joint Assistance to Support Projects in European Regions (JASPERS). In addition, the Planning Inspectorate Advice Note 18: The WFD (PINS, 2017) provides guidance on the WFD process, and the information required.

There are also several guidance documents from the UK that have been developed in relation to undertaking such assessments for the different water body types, predominantly written by the UK’s Environment Agency. These have been used as far as possible in the compilation of this assessment report.

The WFD assessment process consists of various assessment stages as follows:

- Stage One: Screening;

- Stage Two: Scoping; and
- Stage Three: Detailed Impact assessment.

4.1 Stage One: Screening

4.1.1 Objectives and Approach

This stage aims to determine if the Proposed project has impact pathways to WFD water bodies. This includes collating available information on the project and baseline environment of the water bodies which could potentially be impacted. Should it be determined during this phase that there are no impact pathways to WFD water bodies, Stage 2 and 3 are not required.

Stage One requires the following main tasks to be undertaken:

- Initial screening to identify relevant water bodies in the study area. The following criteria are used to select water bodies for inclusion in the early stages of the assessment:
    - All surface water bodies that could potentially be directly impacted by the proposed project;
    - Any surface water bodies that have direct connectivity (e.g., upstream and/or downstream from the proposed project) and could therefore potentially be indirectly affected by the proposed works; and
    - Any groundwater bodies that underlie the proposed project and therefore have the potential for direct impacts, and any hydraulically connected groundwater bodies that may receive indirect impacts.
- Review the RBMP and determine the water bodies to be included in the assessment area;
- Collection of water body baseline data; and
- Collection of information in respect of the Proposed project, broken down in sufficient detail so that the compliance of each activity can be considered in the assessment.

The screening process considers the potential risk to WFD objectives as a result of the proposed project. It draws on the relevant information concerning the design and implementation proposals for the proposed project and the WFD baseline data from the data collation stage.

The activities associated with the proposed project have been broken down into the following phases (described fully in Chapter 02 Project Description of the EIAR):

- Construction; and
- Operation.

The screening has been based on a qualitative assessment utilising expert knowledge to assess potential risks from elements of the proposed project to the WFD objectives.

4.1.2 Findings

In order to undertake the screening assessment and identify the water bodies that are potentially at risk, the project was divided into phases and activities (Table 4-1). The operational life of the proposed project is expected to be 35 years. The WFD status of the water bodies of interest are likely to have changed within a 40-year timescale so the potential for decommissioning activities to affect the WFD status of Irish water bodies is not included in this assessment.

Table 4-1: Project Phases and Activities

Project Phase	Potential Effect	Activity
Construction Phase	Increased Surface Runoff	Progressive replacement of the vegetated surface with impermeable surfaces (turbine hardstanding, access tracks, spoil depositions areas, an electrical sub-station compound, BESS, and two temporary construction compounds)
	Increase in Suspended Solids	Activities including earthworks (removal of vegetated material), excavation, cut and fill activities and trenches for laying of cables.
	Deterioration of water quality	Use of machinery during construction Spillage or leakage of fuels (and oils) stored on site Spillage or leakage of fuels (and oils) from construction machinery or site vehicles Spillage of oil or fuel from refuelling machinery on site Use of cement on site and entry of cement based products into the site drainage system to surface water resources Construction of structures over watercourses within the proposed project site has the potential to interfere with water quality during the construction phase Potential Biological contamination from leaking sanitary waste from welfare facilities
	Morphological Changes to Surface Water Courses & Drainage Patterns	Diversion, culverting and bridge crossings of surface watercourses can result in morphological changes, changes to drainage patterns and alteration of aquatic habitats
	Lowering of Groundwater Levels and decrease in Local Well Supplies	Groundwater levels may be lowered as a result of dewatering due to excavation works and dewatering of the proposed borrow pit
Operational Phase	Increased Surface Runoff	Slight increase in run-off from a storm event to the streams within the site due to a minor decrease in ground permeability at the turbine hardstands, grid connection, BESS and substation compound
	Hydrocarbon Spill	During the operational phase, oil will be used in cooling the transformers

As part of the EIAR, mitigation measures will be implemented to reduce the effect of the proposed project on the surface water and groundwater bodies. In addition to the mitigation measures developed through design of the wind farm, the following control measures are proposed:

<u>Site Clearance (Tree Felling):</u>

- Felling of 1.4 ha of forestry and removal of 4086m of hedgerow is required within and around the proposed wind farm infrastructure to accommodate the construction of foundations, hardstands and access tracks as well as to facilitate assembly of turbines and provide ecological buffers;
- It is proposed to fell to a distance of up to 105m around turbines;
- All forestry felling will be undertaken in accordance with a forestry felling licence, using good working practices as outlined by the Department of Agriculture, Food, and the Marine (DAFM) Standards for Felling and Reforestation (2019).

River Crossings:

- No work will take place within 50m buffer zones of EPA mapped watercourses except for construction works detailed in **Section 9.4.2.4 of Chapter 09 Water**;
- Any works taking place in the vicinity of unmapped watercourses or land drains will be undertaken in accordance with the mitigation measures set out in this Chapter and in the **CEMP** (attached as **Appendix 2B** of **Volume III**);
- Working near watercourses during or after intense or prolonged rainfall events will be avoided and work will cease entirely near watercourses when it is evident that there is a risk that pollution could occur;
- All construction method statements will be developed in consultation with Inland Fisheries Ireland and in accordance with the details in the **CEMP** accompanying this application; and
- The selection criteria and other details of the proposed crossings can be found in **Chapter 03 Civil Engineering**. These crossings will be subject to a Section 50 application to ensure flood risk upstream and downstream of the crossing is not increased.

Concrete Control:

During the pouring of concrete, the following measures will be implemented to avoid spilling concrete outside construction areas and to prevent concrete entering any part of the drainage system:

- Concrete pours will be supervised by the construction manager, who will ensure the area of the pour is completely drained of water before a pour commences;
- Pours will not take place during heavy rainfall; and
- There will be a dedicated concrete chute washout area on site. Concrete trucks will be washed out off site at the source quarry. Wet concrete operations are not envisaged for the proposed development within or adjacent to watercourses or aquatic zones. No batching will take place on site. However, if wet concrete operations are required in such locations, a suitable risk assessment will be completed prior to works being carried out.

Plant and Refuelling:

The following will be undertaken in relation to plant and refuelling:

- Only qualified persons shall operate machinery or equipment;
- Machinery and equipment shall be checked on a regular basis to ensure they are working properly (no oil/fuel leaks etc.);
- No refuelling shall take place within 50m of any watercourse;
- Fuel will be stored in doubly-bunded bowsers or in bunded areas at the site compound;

- Plant nappies and spill kits will be readily available on plant equipment or when working with fuel operated heavy tools;
- To mitigate against sources of contamination, refuelling of plant and vehicles will only take place within designated areas of the site compound or in other areas specifically designated for this purpose;
- Only emergency breakdown maintenance will be carried out on site;
- Appropriate containment facilities will be provided to ensure that any spills from breakdown maintenance vehicles are contained and removed off site;
- There will be no discharge of any priority or hazardous substances to groundwater and surface waters; and
- A suitable permanent fuel and oil interceptor will be installed to deal with all substation surface water drainage. Temporary petrol and oil interceptors will be installed at the site compound for plant repairs/storage of fuel/temporary generator installation.

Inspection and Maintenance:

- The drainage and treatment system for the proposed wind farm will be continuously managed and monitored and particularly after heavy rainfall events during the construction phase;
- The drainage and treatment system will be regularly inspected and maintained to ensure that any failures are quickly identified and repaired so as to prevent water pollution;
- A programme of inspection and maintenance will be designed and dedicated construction personnel assigned to manage this programme as outline in the CEMP. A checklist of the inspection and maintenance control measures will be developed, and records kept of inspections and maintenance works; and
- These drainage controls will be kept in place during the operational phase of the proposed wind farm until the vegetation is re-established.

Weather Monitoring:

- Weather monitoring is a key input to the successful management of the drainage and treatment system during the construction of the proposed wind farm. This will involve 24 hour advance meteorological forecasting (Met Éireann download) and on site rain gauge linked to a trigger-response system. When a pre-determined rainfall trigger level is exceeded (e.g., 1 in 5 year storm event), planned responses will be undertaken. These responses will involve control measures including the cessation of construction until the storm event has passed over and flood flows have subsided. Dedicated construction personnel will be assigned to monitor weather. Refer to the CEMP attached as Appendix 2B of Volume III for further details of the control measures and relevant personal.

Wheel Washes:

- Wheel washes will be provided for heavy vehicles exiting the site to ensure that tracks outside of the site boundary are clean. These can take the form of dry or wet wheel wash facilities. In the case of a wet wheel wash a designated bunded and impermeable wheel wash area will be provided, and the resultant wastewater will be diverted to a settlement pond for settling out of suspended solids.

Water Quality Monitoring

- A programme for water monitoring will be prepared in consultation with Inland Fisheries Ireland prior to the commencement of the construction of the proposed wind farm. The plan will include monitoring of water during the pre-construction, throughout and post construction phases;
- Further baseline water quality monitoring of all streams near the development site will be undertaken prior to construction to confirm existing conditions at the time of construction. This baseline data will include the main components of a full hydrograph for the streams including both high spate flow and base flow where possible;
- During the construction phase of the project, a surface water monitoring schedule, finalised prior to construction, will be followed. In summary, weekly field monitoring of surface water quality chemistry will be carried out at the identified and agreed surface water quality monitoring locations;
- Continuous, in-situ, monitoring equipment will be installed at selected locations upstream and downstream of the proposed project. The monitoring equipment will provide continuous readings for turbidity levels, flow rate and water depth in the watercourses;
- Each month, the EcoW (refer to the **CEMP** in **Volume III** of the **EIAR** for details of the person to be appointed) will take samples from each location and bring to a laboratory for analysis on a range of parameters with relevant regulatory limits and EQSs. This will be compared with the baseline data obtained prior to construction from the EPA and from sampling. If the measured value exceeds the baseline values, the cause will be determined, and remedial measures put in place as necessary.
- Periodic visual observations at each of the monitoring points will be recorded with specific reference to flow, stream substrate and water colour. Photos will be taken to support visual observation, and inspection sheets including visual observation results and photographic records will be kept on site; and
- Visual observations will also be completed after major rainfall events along with photographs which will be collected and assessed by the EcoW.

Detailed mitigation measures are provided in **Chapter 03 Civil Engineering**, **Chapter 09 Water** and the **CEMP** (attached to the **EIAR** as an **Appendix 2B**).

Effects on groundwater and surface water have been identified and detailed in **Chapter 09 Water** of the **EIAR**. The criteria, their explanations and the effect rating methodology outlined in **Chapter 01 Introduction** of the **EIAR** have been used to assess the effects.

Using the water bodies identified in **Section 3** and the activities and mitigation measures to be implemented, a WFD screening exercise was undertaken to determine any potential effects of the proposed project on the ability of these water bodies to reach the objectives of the WFD. The results of the screening assessment are summarised in **Table 4-2**.

From the justification in **Table 4-2** and the detailed impact assessment undertaken and the mitigation proposed in **Chapter 09 Water of the EIAR** and the **CEMP**, it is unlikely that the development will cause any significant deterioration or change in water body status or prevent attainment, or potential to achieve, future good status.

No further assessment (scoping or detailed impact assessment) of the WFD is recommended given that no significant deterioration or change in water body status is anticipated due to the implementation of mitigation measures and the fact that there is no groundwater was intercepted during the test pits and hydrologic connectivity to the surface water body.

Table 4-2: Results of the Screening Exercise

Activity	Water Resource	Water Body Name and ID Number	Water Aspect (Quality / Quantity)	Effect	Screening for further assessment	Justification
Construction Phase						
Progressive replacement of the vegetated surface with impermeable surfaces (turbine hardstanding, access tracks, spoil depositions areas, an electrical sub-station compound, BESS, and two temporary construction compounds)	Surface Water	Suir_050 (IE_SE_16S020500) Suir_060 (IE_SE_16S020600) Drish_060 (IE_SE_16D020400)	Quality	<u>Increased Surface Run-off</u> Increase in the proportion and speed of surface water runoff reaching the surface water drainage network.	Screened Out	The creation of impermeable areas within a development site has the effect of increasing rates of runoff into the downstream drainage system and this may increase flood risk and flood severity downstream. The proposed wind farm is located within a large rural catchment with an open drainage system. The footprint of the impermeable areas and the associated increase in runoff rate is very small in the context of the catchment size and therefore represents a negligible increase in downstream flood risk. However, it is proposed to provide attenuation to limit the flow rate into the settlement ponds during high intensity storm events so that they do not become overloaded. This will also attenuate the flow to the downstream watercourses. The site drainage system was designed integrally with the proposed wind farm infrastructure layout as a measure to ensure that the proposal will not change the existing flow regime across the site, will not deteriorate water quality and will safeguard existing water quality status of the catchments from sediment runoff. The design elements have been outlined in detail in Chapter 03 Civil Engineering including drainage and surface water management and run off on site. The water impact assessment undertaken (Chapter 09 Water of the EIAR) and the project specific CEMP detail robust mitigation measures to protect the hydrological environment. With the implementation of these measures, the proposed project will not cause significant deterioration or change in water body status to prevent attainment to achieve the WFD objectives.

Activity	Water Resource	Water Body Name and ID Number	Water Aspect (Quality / Quantity)	Effect	Screening for further assessment	Justification
Activities including earthworks (removal of vegetated material), excavation, cut and fill activities and trenches for laying of cables.	Surface Water	Suir_050 (IE_SE_16S020500) Suir_060 (IE_SE_16S020600) Drish_060 (IE_SE_16D020400)	Quality	<u>Increase in suspended solids</u> Potential impact on surface water quality as a result of discharge of sediment to surface water during construction activities and dewatering of excavations.	Screened Out	The site drainage system was designed integrally with the proposed wind farm infrastructure layout as a measure to ensure that the proposal will not change the existing flow regime across the site, will not deteriorate water quality and will safeguard existing water quality status of the catchments from sediment runoff. A fundamental principle of the drainage design is that clean water flowing in the upstream catchment, including overland flow and flow in existing drains, is allowed to bypass the works areas without being contaminated by silt from the works. This will be achieved by intercepting the clean water and conveying it to the downstream side of the works areas either by piping it or diverting it by means of new drains or earth mounds. The dirty water from the works areas will be collected in a separate drainage system and treated by removing the suspended solids before overland dispersal. Dirty water drains will be provided on one or both sides of the access tracks and along the periphery of the turbines, crane hardstands, substation compound, met mast, borrow pit and the temporary site construction compound. The implementation of sediment and erosion control measures is essential in preventing sediment pollution and an increase of suspended solids. The settlement ponds and check dams will provide the essential mechanism for the removal of silt from construction related runoff and the controlled return of the treated runoff to the downstream watercourses. The design elements have been outlined in detail in **Chapter 03 Civil Engineering** including drainage and surface water management on site. The water impact assessment undertaken (**Chapter 09 Water** of the **EIAR**) and the project specific **CEMP** detail robust mitigation measures to protect the hydrological environment from an increase in suspended solids entering the watercourses. With the implementation of these measures, the proposed project will not cause significant deterioration or change in water body status to prevent attainment to achieve the WFD objectives.
	Groundwater	Templemore (IE_SE_G_131) Thurles (IE_SE_G_158)	Quality	Potential impact on groundwater quality as a result of excavations	Screened Out	The timing of the construction phase soil stripping and excavation works will take into account predicted weather, particularly rainfall. Soil stripping activities will be suspended during periods of prolonged rainfall events. The area of exposed ground will be kept to a minimum by maintaining where possible existing vegetation that would otherwise be subject to erosion in the vicinity of the wind farm infrastructure.

Activity	Water Resource	Water Body Name and ID Number	Water Aspect (Quality / Quantity)	Effect	Screening for further assessment	Justification
				that may extend to the groundwater table.		The design elements have been outline in detail in **Chapter 03 Civil Engineering** and include management of water during excavation activities. The water impact assessment undertaken (**Chapter 09 Water** of the **EIAR**) and the **CEMP** detail mitigation measures to protect the geohydrological environment during excavation activities. Following the implementation of these mitigation measures, the proposed project will not cause significant deterioration or change in water body status to prevent attainment to achieve the WFD objectives.
Activities relating to the use of machinery on site, potential for spillage / leakage of hydrocarbons / oils / cement and biological contamination	Surface Water	Suir_050 (IE_SE_16S020500) Suir_060 (IE_SE_16S020600) Drish_060 (IE_SE_16D020400)	Quality	Potential impact on surface water quality from hydrocarbons entrained in surface water run off from open excavation areas.	Screened Out	The primary method of reducing the potential effect from cementitious material on the hydrology of the proposed wind farm is the selection of ready-mixed concrete as opposed to site batching of concrete. By removing cement in its raw state from the site the potential for a significant effect from hydrolysis of cement in the surrounding watercourses is eliminated. Concrete truck washouts for Brittas will be limited to washing down chutes only. The chute wash down area, which will retain the washout water, will be located within the construction compound and there will be no other chute wash down activity on any other part of the proposed wind farm. The storage of fuels / oils will include the following:

Activity	Water Resource	Water Body Name and ID Number	Water Aspect (Quality / Quantity)	Effect	Screening for further assessment	Justification
from leaking sanitary waste from welfare facilities and the construction of structures over watercourses	Groundwater	Templemore (IE_SE_G_131) Thurles (IE_SE_G_158)	Quality	Potential impact on groundwater quality beneath the site as a result of spillage / leaks of hydrocarbons.	Screened Out	• Any storage of fuels/oil will be located at least 50m from any identified watercourses and fuel containers will be stored within a secondary containment system e.g. bund for static tanks or a drip tray for mobile stores; • Collision with the oil stores will be prevented by locating oils within a steel container in a designated area of the site compound away from vehicle movements; • Leakages of fuel/ oil from stores will be prevented by storing these materials in bunded tanks which have a capacity of 110% of the total volume of the stored oil; • Ancillary equipment such as hoses and pipes will be contained within the bunded storage container; • Taps, nozzles or valves will be fitted with a lock system to prevent any potential leaks; and • The long term storage of waste oils will not be allowed on site. These waste oils will be collected in leak-proof containers and removed from the site for disposal or re-cycling by an approved service provider. Plant nappies or absorbent mats will be placed under refuelling points during all refuelling to absorb drips. Mobile bowsers, tanks and drums will be stored in secure, impermeable storage areas, at least 50m away from drains and open water. To reduce the potential for oil leaks, only vehicles and machinery will be allowed onto the site that are mechanically sound. An up to date service record will be required from the main contractor. Should there be an oil leak or spill, the leak or spill will be contained immediately using oil spill kits, all oil and any contaminated material will be removed and properly disposed of in a licensed facility. Immediate action will be facilitated by easy access to oil spill kits. An oil spill kit that includes absorbing pads and socks will be kept at the site compound and also in site vehicles and machinery. Correct action in the event of a leak or spill will be facilitated by training all vehicle/machinery operators in the use of the spill kits and the correct containment and cleaning up of oil spills or leaks. This training will be provided by the Environmental Manager at site induction. In the event of a major oil spill, a company who provide a rapid response

Activity	Water Resource	Water Body Name and ID Number	Water Aspect (Quality / Quantity)	Effect	Screening for further assessment	Justification
						emergency service for major fuel spills will be immediately called for assistance, their contact details will be kept in the site office and in the spill kits kept in site vehicles and machinery. As part of the water impact assessment undertaken (**Chapter 09 Water** of the **EIAR**) and the project specific **CEMP** detail robust mitigation measures to protect the hydrological and geohydrological environment from hydrocarbons or cement spills. After implementation of these mitigation measures, the proposed project will not cause significant deterioration or change in water body status to prevent attainment to achieve the WFD objectives.

Activity	Water Resource	Water Body Name and ID Number	Water Aspect (Quality / Quantity)	Effect	Screening for further assessment	Justification
Diversion, culverting and bridge crossings of surface watercourses can result in morphological changes, changes to drainage patterns and alteration of aquatic habitats	Surface Water	Suir_050 (IE_SE_16S020500) Suir_060 (IE_SE_16S020600) Drish_060 (IE_SE_16D020400)	Quantity / Quality	Morphological Changes to Surface Water Courses & Drainage Patterns and potential effect on surface water quality during construction of watercourse crossings	Screened Out	The site drainage system was designed integrally with the proposed wind farm infrastructure layout as a measure to ensure that the proposal will not change the existing flow regime across the site, will not deteriorate water quality and will safeguard existing water quality status of the catchments from sediment runoff. No work will take place within 50m buffer zones of watercourses identified in **Chapter 09 Water** of the **EIAR** except for drainage/stream crossings and associated road construction. Working near watercourses during or after intense or prolonged rainfall events will be avoided and work will cease entirely near watercourses when it is evident that there is a risk that pollution could occur. All construction method statements will be developed in consultation with Inland Fisheries Ireland and in accordance with the details in the CEMP accompanying this application. The grid connection will require two watercourse crossings. The watercourse crossing on L4120-18 (Rossestown Road) and L8015-0 (Furze Road) are single span masonry arch bridges. The 110kV cable will cross the bridge in a flatbed formation or alternatively a horizontal directional drill (HDD) methodology will be used. Descriptions of the methodologies suitable for crossing these bridges are detailed in Chapter 03 Civil Engineering of this EIAR. No instream works will be required. Five water crossings will be required at the Wind Farm site for the internal access roads and underground cables. Where an open drain or watercourse is encountered during the installation of the internal site cable trenches; the cable trenches will cross the open drain or watercourse within the road carriageway via new or existing road crossing points to minimise the requirement for in-stream works. The design elements for these crossings have been outlined in detail in **Chapter 03 Civil Engineering** of this **EIAR** and the effect of these crossings on the surface water features has been undertaken (**Chapter 09 Water** of the **EIAR**). These chapters and the project specific **CEMP** detail robust mitigation measures to protect the hydrological environment from the proposed watercourse crossings. With the implementation of these measures, the proposed project will not cause significant deterioration or change in water body status to prevent attainment to achieve the WFD objectives.

Activity	Water Resource	Water Body Name and ID Number	Water Aspect (Quality / Quantity)	Effect	Screening for further assessment	Justification
	Groundwater	Templemore (IE_SE_G_131) Thurles (IE_SE_G_158)	Quality	Decrease in groundwater quality from directional drilling works as boring may extend below the water table.	Screened Out	The proposed grid connection route will require two (2) watercourse crossings as noted above. The directional drilling process is detailed in **Chapter 03 Civil Engineering** of the **EIAR**. Impact on groundwater quality could result should the borings extend below the water table. The HDD method to be used will however ensure that the boring does not extend below the water table. As part of the water impact assessment undertaken (**Chapter 09 Water** of the **EIAR**) and after implementation of these mitigation measures, the proposed project will not cause significant deterioration or change in water body status to prevent attainment to achieve the WFD objectives.
Dewatering due to excavation works and dewatering of the proposed borrow pit	Groundwater	Templemore (IE_SE_G_131) Thurles (IE_SE_G_158)	Quantity	Lowering of groundwater levels and decrease in local well supplies	Screened Out	It is not anticipated that large volumes of groundwater will be encountered within the borrow pit. Therefore, it is unlikely that there will be any effect on neighbouring wells as a result of the proposed project. As part of the water impact assessment undertaken (**Chapter 09 Water** of the **EIAR**) and after implementation of these mitigation measures, the proposed project will not cause significant deterioration or change in water body status to prevent attainment to achieve the WFD objectives.
Operational Phase						
Operation of the wind farm	Surface Water	Suir_050 (IE_SE_16S020500) Suir_060 (IE_SE_16S020600) Drish_060 (IE_SE_16D020400)	Quality	Slight increase in run-off from a storm event to the streams within the site due to a minor decrease in ground permeability at the turbine hardstands, grid connection, BESS and substation compound could lead to increase to	Screened Out	The runoff control measures for the wind farm site have been designed in the context of storm events of varying duration and intensity. As part of the water impact assessment undertaken (**Chapter 09 Water** of the **EIAR**) and after implementation of the mitigation measures, the proposed project will not cause significant deterioration or change in water body status to prevent attainment to achieve the WFD objectives during the operational phase of the wind farm in relation to increased run off and its effect on surface water quality.

Activity	Water Resource	Water Body Name and ID Number	Water Aspect (Quality / Quantity)	Effect	Screening for further assessment	Justification
				flood risk downgradient of the site		
Generation, use and storage of liquid wastes from lubricating oils, cooling oils, fuels from plant and maintenance vehicles etc. This potential exists within the turbine tower, nacelle, substation, electrical transmission structures and operations maintenance buildings.	Surface Water	Suir_050 (IE_SE_16S020500) Suir_060 (IE_SE_16S020600) Drish_060 (IE_SE_16D020400)	Quality	Impact on surface water quality should contaminated run off from lubricating oils, cooling oils, fuels from plant and maintenance vehicles discharge into surface water courses	Screened Out	During the operation phase there will be no emissions to surface or groundwater. Potential impact on water quality due to the operation and maintenance of the wind farm is principally related to the minor risk of oil spillages. This will have been mitigated by design through the provision of adequate bunding implemented in the construction stage. To ensure effective drainage from the permanent internal road, the drainage network installed for the construction phase will remain in place for the operational life of the wind farm. Routine inspection and preventive maintenance visits will be undertaken to ensure the smooth and efficient running of the wind farm. This will include for inspection of the drainage systems for the Turbine bases, the road network, the river crossing and the substation building. If/where necessary obstructions will be removed from water courses or drains to ensure the drainage system operates in accordance with the design specification. As part of the water impact assessment undertaken (**Chapter 09 Water** of the **EIAR**), and after implementation of the mitigation measures, the proposed project will not cause significant deterioration or change in water body status to prevent attainment to achieve the WFD objectives during the operational phase.
	Groundwater	Templemore (IE_SE_G_131) Thurles (IE_SE_G_158)	Quality	Impact on ground water quality should contamination seep into the soil and reach the groundwater table	Screened Out	

Activity	Water Resource	Water Body Name and ID Number	Water Aspect (Quality / Quantity)	Effect	Screening for further assessment	Justification
Operation of the wind farm.	Groundwater	Templemore (IE_SE_G_131) Thurles (IE_SE_G_158)	Quantity	Potential impact on groundwater recharge due to the loss of infiltration area associated with the construction of hardstand areas around the turbine bases, access roads and the substation building.	Screened Out	Runoff from the hardstand areas will percolate to ground immediately adjacent to the hardstand areas which will greatly reduce the loss of rainfall recharge associated with the hardstand areas. As part of the water impact assessment undertaken (**Chapter 09 Water** of the **EIAR**) and after implementation of these mitigation measures, the proposed project will not cause significant deterioration or change in water body status to prevent attainment to achieve the WFD objectives.

4.2 Stage Two: Scoping

As all activities were screened out on **Section 4.1**, a scoping assessment in terms of the WFD requirements was not undertaken for the project.

4.3 Stage Three: Impact Assessment

As all activities were screened out on **Section 4.1**, a detailed impact assessment in terms of the WFD requirements was not undertaken for the project.

5. Conclusion

The WFD assessment indicates that, based on the current understanding of the proposed project and the mitigation measures proposed in the **EIAR**, the proposed project will not cause significant deterioration or change in water body status to prevent attainment to achieve the WFD objectives, or potential to achieve, future good status.

No further assessment (scoping or detailed impact assessment) of the WFD is recommended given that no significant deterioration or change in water body status is anticipated due to the implementation of mitigation measures.

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