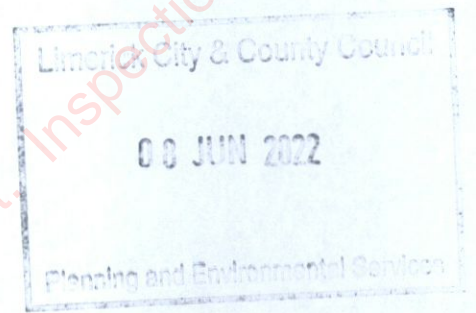


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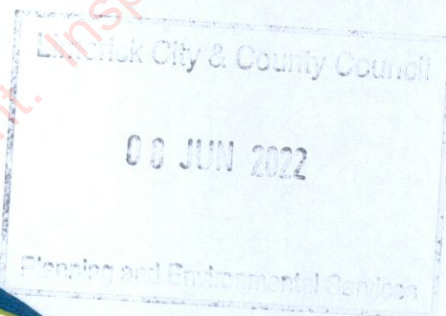


FLOOD RISK ASSESSMENT

Knockastanna Wind Farm, Co. Limerick

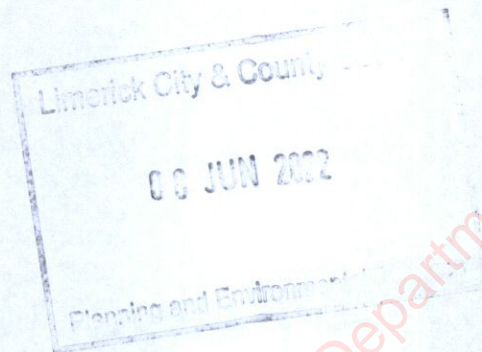
Prepared for: SSE Renewables Generation Ireland
Limited

Annex 7.1



SLR Ref: 501.00482.001
Version No: Final
December 2021





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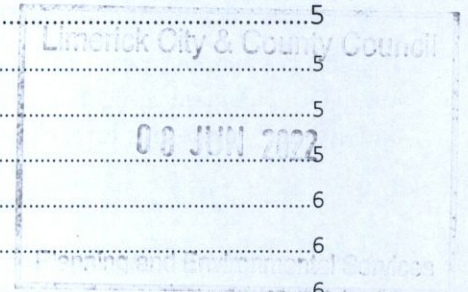
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1.0 INTRODUCTION

SLR Consulting (SLR) has been appointed by SSE Renewables Generation Ireland Limited (SSE) to support a planning application to extend the operational life of the existing Knockastanna Wind Farm. The location of the wind farm is hereafter referred to as the site.

This report comprises a Flood Risk Assessment (FRA) and assess the flood risks associated with the site.

Readers are also referred to **Chapter 7** of the Environmental Impact Assessment Report (EIAR) that has been prepared and submitted as part of this planning application.

1.1 Project Description

SSE is preparing a planning application to extend the operational life of the existing Knockastanna Wind Farm, County Limerick. The site comprises 4 no. wind turbines and associated ancillary infrastructure including foundations, crane hard standings, access tracks, underground electricity cables and electrical switch room.

A detailed description of the site is included in **Chapter 3** of the EIAR.

1.2 Site Location and Setting

The site location and immediate surroundings are shown on **Figure 7.1. (Annex 7.2)**

The site is located c. 27 km east of Limerick City, Co. Limerick, 26 km west of Thurles, Co. Tipperary, and c. 6 km north of the village of Doon, Co. Limerick. It is centred at E585767 N656649 and the overall landholding encompasses a land area of approximately c. 43.3 Ha.

The site is situated in a rural area on the northern flanks of Knockastanna Hill which has a peak elevation of 497m OD. The main vehicular access to the site is located off the L-5029-419 road to the north. Agricultural fields and areas of coniferous forestry surround the site area on all sides.

1.3 Existing Site Drainage

The site currently comprises an existing operational wind farm and open upland.

Local minor drains at the site which are around the turbines, hard stand areas and along the access track, drain to the surrounding lands where storm runoff goes to existing channels and then to the headwaters of the local stream network.

1.4 Nominated Hydrologists

This FRA report has been prepared by:

- *Katy Rainford BSc (Geology and physical Geography), MCIWEM and FGS – Project Hydrologist; and*
- *EurGeol Dr. Peter Glanville PGeo. PhD (Geomorphology) MSc (GIS) - SLR TD Hydrology.*

Katy is a hydrologist with SLR with over 3 years' experience in the sector, specialising in hydrology and hydrogeology environmental assessments for planning applications. She has undertaken and prepared flood risk assessments and the water environment chapters of EIARs for a wide range of projects across Ireland and the UK, including numerous wind farm and electricity transmission projects.

Peter is a Technical Director (Hydrology) with SLR and has over 20 years' experience in the area of Hydrology and Flood Risk Assessments. Peter has undertaken and prepared flood risk assessments for a wide range of projects and has also prepared Section 4 Discharge Licences for a variety of developments. He has also been involved as a hydrologist in a range of environmental monitoring projects for Environmental Baseline Studies, exploration operations, quarry site operations and infrastructure projects – this work has typically included hydrology monitoring (flow) and water quality sampling and testing.

A site walkover was undertaken prior to the preparation of this FRA report.

2.0 FLOOD PLANNING GUIDELINES

In November 2009, the Office of Public Works (OPW) and Department of the Environment, Heritage and Local Government (DoEHLG) issued guidelines for planning authorities addressing the management of flood risk in the planning system¹ (hereinafter referred to as the 'Flood Planning Guidelines').

The flood planning guidelines introduced comprehensive mechanisms for the incorporation of flood risk identification, assessment and management into the planning process. Implementation of the guidelines will be achieved through actions at national, regional, local authority and site-specific levels, depending on the plan or development project being considered.

2.1 Planning Objectives in Relation to Flooding

The Flood Planning Guidelines require the planning system at national, regional and local level to:

- Avoid development in areas at risk of flooding by not permitting development in flood risk areas, particularly floodplains, unless where it can be fully justified, there are wider sustainability grounds for appropriate development and unless the flood risk can be managed to an acceptable level, without increasing flood risk elsewhere and, where possible, reducing flood risk overall;
- Adopt a sequential approach to flood risk management based on avoidance, reduction and then mitigation of flood risk as the overall framework for assessing the location of new development in the development planning processes; and
- Incorporate flood risk assessment into the process of making decisions on planning applications and planning appeals.

A sequential approach is adopted in the Flood Planning Guidelines in order to guide development away from areas at risk of flooding, this entails the following actions:

- | | | |
|---|-------------------|---|
| ➤ | Avoid | Locate new development in lower risk flood zones; |
| ➤ | Substitute | Ensure that the type of development is not particularly vulnerable to the adverse impacts of flooding; |
| ➤ | Justify | Ensure that the development is considered for strategic reasons; |
| ➤ | Mitigate | Ensure that flood risk is reduced to acceptable levels; and |
| ➤ | Proceed | Development to proceed only where Justification Test passed and emergency planning measures are in place. |

The sequential approach identifies and defines three different flood zones (designated Zones A, B and C) in order to guide development at a particular site. The flood zones are:

- Zone A** *High probability of flooding. This zone defines areas with the highest risk of flooding from rivers (i.e. more than 1% probability or more than 1 in 100) and the coast (i.e. more than 0.5% probability or more than 1 in 200).*
- Zone B** *Moderate probability of flooding. This zone defines areas with a moderate risk of flooding from rivers (i.e. 0.1% to 1% probability or between 1 in 100 and 1 in 1000) and the coast (i.e. 0.1% to 0.5% probability or between 1 in 200 and 1 in 1000).*
- 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 1000).*

¹ The Planning System and Flood Risk Management Guidelines for Planning Authorities (2009): Office of Public Works and the Department of the Environment, Heritage and Local Government.

2.2 Flood Risk Management

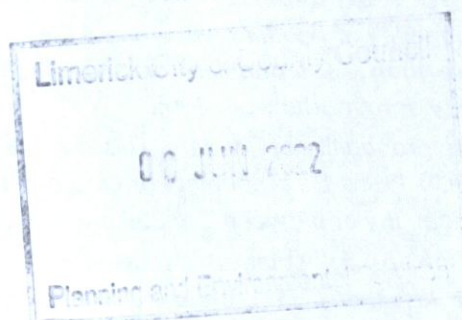
Technical Appendix B of the Flood Planning Guidelines addresses the incorporation of flood risk management in the design of developments, and sets out practical measures, with the aid of design examples, which can be incorporated into the development design in order to reduce the risk of flooding in areas where a potential flood risk has been identified. The design examples match flood risk with appropriate land uses, while also protecting flood conveyance routes and preserving floodplain storage.

A number of core principles are outlined in the Flood Planning Guidelines regarding design for, and management of, flood risk. These follow a sequential approach to flood risk management, and involve:

- Locating development away from areas at risk of flooding, where possible;
- Substitution of less vulnerable land uses for the more vulnerable ones that are to be replaced, where the principle of development within flood risk areas has been established; and
- Identifying and protecting land required for current and future flood risk management, such as conveyance routes, flood storage areas and flood protection schemes etc. where the principle of development within flood risk areas has been established.

In the Flood Planning Guidelines, Section 3.4 of Appendix B outlines practical landscape and drainage measures which can be closely integrated to play a key role in effective flood-reduction measures if incorporated into the design of developments. Key elements which can be incorporated include:

- Creating a permeable network and hierarchy of green space providing for direct access to areas of lower flood risk;
- Planting and shaping the land surrounding individual buildings and groups of buildings to encourage drainage away from a property;
- The use of "higher-risk" low-lying ground in waterside areas for recreation, amenity and environmental purposes;
- Modest land-raising of a part of the area at high risk of flooding accompanied by compensatory provision of flood storage in areas of existing lower risk of flooding having considered other natural and built heritage issues;
- Recontouring of edge of floodplain;
- Use of earth bunds to provide local flood defence;
- The use of surface runoff attenuation measures / sustainable drainage systems (SuDS) to manage run-off from rain falling on a development can be an effective means of reducing its impact reflecting natural drainage processes and removing pollutants from urban run-off at source; and
- Avoiding structures in the floodplain.



3.0 FLOOD RISK ASSESSMENT - METHODOLOGY

A methodology for the identification and assessment of flood risk is outlined in Technical Appendix A of the Flood Planning Guidelines. The aim of the FRA is to identify and quantify the risk of flooding to land, property and people and also to provide sufficient information to assess whether the site is appropriate at a specific site.

The FRA is undertaken over a number of stages which each progressing to a more detailed assessment, dependant on the outcome of each stage, until the level of detail in the FRA is appropriate to support the planning application or it has been demonstrated that flooding is not a relevant issue for the site. The stages in the assessment are typically;

- **Stage 1:** Flood Risk Identification;
- **Stage 2:** Initial Flood Risk Assessment; and
- **Stage 3:** Detailed Flood Risk Assessment (including quantitative model).

At the end of Stages 1 and 2, a decision is taken as to whether it is necessary to proceed to the next stage in the assessment process, in relation to flood risk at a site.

3.1 Flood Risk Assessment Conceptual Model

In order to assess the flood risk for a particular site, it is essential to understand what the risk is. This is undertaken using a conceptual Source-Pathway-Receptor (SPR) model, which is widely used in understanding and managing environmental risks.

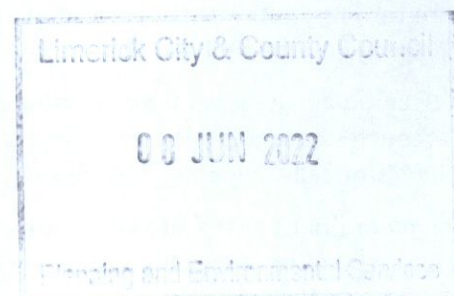
In order to develop a conceptual SPR model for the purpose of risk assessment, it is necessary to understand the origin and magnitude of potential flooding (the **Source**), the mechanism or route of flooding (the **Pathway**) and the nature / scale of the site (the **Receptor**).

3.2 Data Sources

In order to assess the flood risk at a site, it is necessary to understand both the flood Source and Pathway for flooding at a site. This is completed using available desktop data for Stages 1 and 2 of the FRA. Desktop data sources for Stages 1 and 2 include:

- **The Office of Public Works** (Flood Risk Assessment Maps, flood study reports and flood hazard mapping);
- **Environmental Protection Agency** (hydrology flow / levels, catchment boundaries);
- **Ordnance Survey of Ireland** (historical mapping);
- **Geological Survey of Ireland** (soils / subsoil / karst); and
- **Site Walkover and Topographic Surveys** (site water management and topographic survey).

This report follows the methodology for a Stage 1 flood risk identification, Stage 2 initial flood risk assessment and Stage 3 detailed flood risk assessment at the site-specific level; as outlined in the Flood Planning Guidelines.



4.0 STAGE 1: FLOOD RISK IDENTIFICATION

The potential sources of flooding to any site are varied and can include one or more of the following:

- Flooding from rivers (fluvial);
- Flooding from the sea or tidal (coastal);
- Flooding from land (pluvial);
- Flooding from groundwater and karst;
- Flooding from sewers; and
- Flooding from manmade impoundments (reservoirs, canals, and other artificial sources).

A desk top review of potential flooding at the site is undertaken in Section 4.1 and each potential source of flooding at the site are screened in Section 4.2.

4.1 Desktop review of potential flooding sources

4.1.1 Historical Mapping

Available Ordnance Survey of Ireland historical mapping was reviewed on the GeoHive National Geospatial Data Hub (www.geohive.ie) and indicates that several tributaries of the Bilboa River are sourced on the northern flank of Knockastanna hill. Two minor watercourses are noted along the north western and north eastern boundary of the site and continue to flow generally northward, before discharging into the Bilboa River approximately 500m north of the site.

Two other minor watercourses are noted on the historical mapping in proximity to the site. One is located approximately 200m north east of the site, which also continues northward to the Bilboa River, and another is sourced approximately 80m west of the site and flows generally south westwards towards the Bilboa River.

No areas of the site are marked as being liable to flood in the historical past.

4.1.2 Topographic Surveys

Ground elevations range from approximately 497mOD along the southern boundary of the site, near the summit of Knockastanna hill, to 230mOD in the north eastern corner along the L-5029-419.

Locally, elevations continue to fall northwards away from the site towards the banks of the Bilboa River. The river is situated at an elevation of approximately 160mOD and 500m to the north of to the site. The river is approximately 70m lower than the lowest elevation at the site.

There has been slight modification of original ground elevations at the site, particularly along the access track to the turbines, which was required in order to establish the wind farm infrastructure.

4.1.3 Local Surface Water Features

The principal water feature in the vicinity of the site is the Bilboa River, with all watercourses originating at the site discharging to the Bilboa River. The river flows generally westwards approximately 500m north of the site, before turning southwards approximately 1km west of the site. It continues generally south westward before discharging into the Mulkear River c. 9.5km south west of the site.

As discussed above, several minor tributaries of the Bilboa River are located within proximity of the site. These watercourses have not been altered by the development and continue to follow the same routes as highlighted on the historically mapping, flowing away from the site towards to the Bilboa River.

Local minor drains at the site which are around the turbines, hard stand areas and along the access track drain to the surrounding lands where storm runoff goes to existing channels and then to the headwaters of the local stream network.

4.1.4 OPW Flood Mapping

The Office of Public Works (OPW) is the Government agency with statutory responsibility for flooding. The OPW website (www.floodinfo.ie) indicates that there are no recorded recurring flood events at the site.

A review of the OPW national coastal / tidal flood mapping indicates that the site is not at risk from coastal or tidal flooding.

The OPW CFRAM flood mapping indicates that the site is not at any risk from fluvial flooding; and no past flood events are identified within the Bilboa River catchment in proximity to the site. It is considered unlikely that detailed flood modelling of the Bilboa River or its tributaries in proximity to the site has been conducted as part of the OPW CFRAM flood mapping. The nearest flood information along the Bilboa river on the OPW CFRAM flood mapping is located c. 8km south west of the site.

However, as noted above the Bilboa River is located approximately 500m away from the site at its closest extent and is situated some 70m lower than the lowest elevation of the site. In addition, the minor watercourses in proximity to the site do not encroach onto the site itself and are shown to flow away from the site towards the Bilboa River. This was confirmed during the site walkover survey when no evidence of flooding was witnessed. Given the steepness of the topography, any flooding within these channels (either fluvial or pluvial generated) is likely to be routed quickly away from the site and, therefore, it is assessed that the site is not at risk from fluvial flooding.

4.1.5 Soils and Subsoils

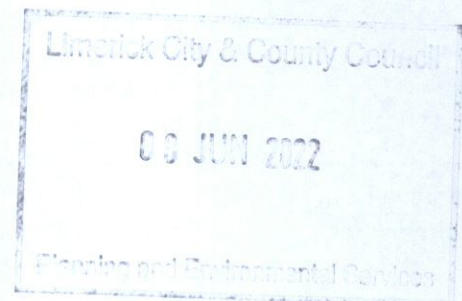
The Environmental Protection Agency (EPA) website publishes soil and subsoil maps created by the Spatial Analysis Unit and Teagasc in collaboration with the Geological Survey of Ireland (GSI). Published soil mapping indicates that the soils at the site are predominately fine loamy deposits over shale or slate bedrock to the north and peat to the south of the site.

There are no Alluvial subsoils present on the site which are laid down by river flood waters; the absence of alluvial subsoils indicates that the site is not at risk of flooding from the local river source.

4.1.6 Groundwater and Karst

There is no indication of any groundwater springs at the site or on the Ordnance Survey of Ireland historical maps, which indicates that there is no potential for, or likelihood of, groundwater flooding to the site. In addition, the bedrock aquifer beneath the site is classified as a poor aquifer and therefore there are unlikely to be any major groundwater bearing conduits present.

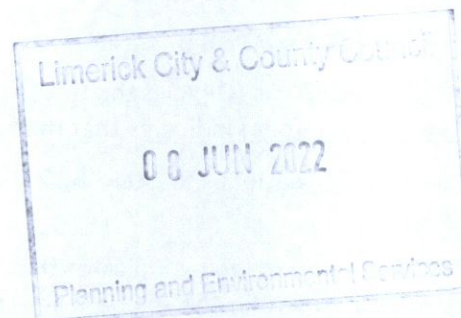
There are no identified karst features beneath the site or in its vicinity and, therefore, there is no risk of groundwater flooding.



4.2 Flood Screening

The potential sources of flooding are:

- Flooding from rivers or fluvial flooding;
- Flooding from the sea or tidal flooding;
- Flooding from land;
- Flooding from groundwater and karst;
- Flooding from sewers; and
- Flooding from reservoirs, canals, and other artificial sources.



With reference to Section 4.1, the sources of flooding and the flood risk from each of these are considered in Table 4-1 below and the potential flood risk from each source is screened here.

Table 4-1
Flood Risk Screening

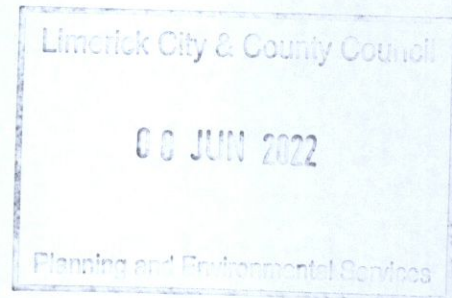
Source of Flooding	Potential to Flood at the Site	Flood Screening – Potential Impact from Flooding
Flooding from rivers (fluvial)	The OPW fluvial flood mapping indicates that the development not at risk from river or fluvial flooding. Due to the steep topography and flow direction of the nearby minor watercourses (away from the site), it is assessed that the site is not at risk from fluvial flooding.	None
Flooding from the sea (coastal / tidal)	The OPW tidal / coastal flood mapping indicates that the site is not at risk from coastal or tidal flooding. Additionally, the site is located approximately 30km from the coast (Limerick City) and is at a significantly greater elevation. Therefore, there is no risk of coastal/tidal flooding.	None
Flooding from land (rainfall - pluvial)	Any rainwater falling directly on the site is drained northwards towards the Bilboa River. The existing development has been designed to shed incident rainfall to local watercourses via on-site drainage infrastructure. The proposed development does not comprise any further construction works or increasing hardstanding areas. It is therefore considered that the site is not at pluvial flood risk.	None
Flooding from groundwater	The site is underlain by a Poor Aquifer. There are no historical groundwater springs in the vicinity of the site which would have resulted in flooding in the past or which are likely to give rise to flooding in the future.	None
Flooding from karst	There are no identified karst features at the site.	None
Flooding from sewers	There are no sewers located within or in the proximity of the site.	None

Source of Flooding	Potential to Flood at the Site	Flood Screening – Potential Impact from Flooding
Flooding from Impoundments - reservoirs and artificial sources	There are no artificial sources of water in the vicinity of the site.	None

4.3 Requirement for a Stage 2 Flood Risk Assessment

The Flood Planning Guidelines state that if a flood risk is identified at this Stage 1, it is necessary to progress and undertake a Stage 2 Initial Flood Risk Assessment for the site. Each of the potential flooding sources have been assessed here based on the findings of a desktop study. The desktop survey has been verified by a site visit.

No potential flood risk sources have been identified and, therefore, there is no requirement to complete Stage 2 Initial Flood Risk Assessment.

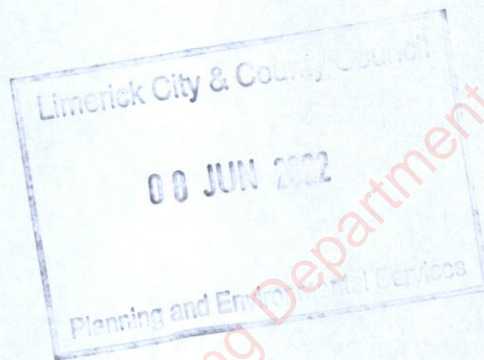


5.0 CONCLUSIONS

A Stage 1 flood risk identification has been completed and concludes that the site is not at risk of flooding from all sources including tidal, fluvial, surface water, groundwater sources, and infrastructure failure.

The existing site benefits from a network of drains that collects and discharges incident rainfall runoff. The drains are subject to a routine programme of inspection to ensure their efficacy and, when required, maintenance works are undertaken to remove sediment or clear the drains of vegetation that may restrict their conveyance capacity.

It is therefore concluded that site is not at risk from flooding and the proposed continuation of operations of the Knockastanna Wind Farm does not result in an increased flood risk offsite.

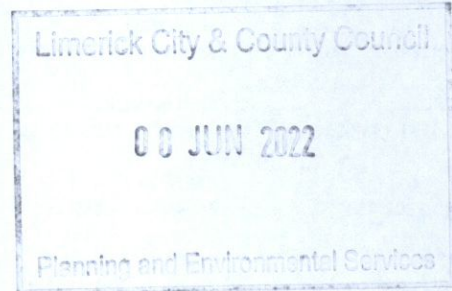


6.0 CLOSURE

This report has been prepared by SLR Consulting (Ireland) with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

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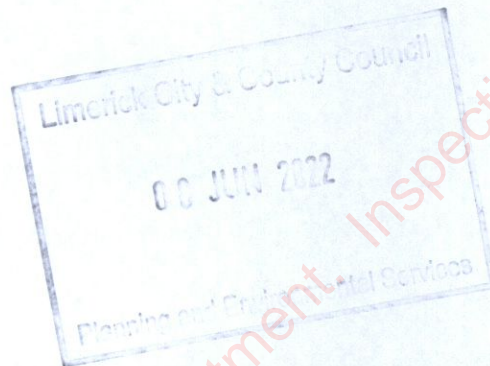
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