GALETECH
ENERGY SERVICES

Pinewoods Wind Farm Substation
& Grid Connection

Chapter 4: Population and Human Health

Pinewood Wind Limited

Galetech Energy Services
Clondargan, Stradone, Co. Cavan Ireland
Telephone +353 49 555 5050
www.galetechenergy.com

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4.1 Introduction

This chapter presents an assessment of the likely effects of the proposed development on population and human health. Human beings comprise a significant element of the environment and any likely effects on the status of population and human health must be comprehensively addressed. This includes the existence, activities and wellbeing of people. Whilst most developments will affect other people, the EIAR concentrates on those topics which are manifested in the environment such as, for example, new land uses, more buildings or greater emissions.

This EIAR also addresses the likely significant effects on population and human health in other specific chapters, including, for example, in respect of Air Quality & Climate (**Chapter 8**), Landscape (**Chapter 9**), Noise & Vibration (**Chapter 11**), Shadow Flicker (**Chapter 12**), Material Assets (**Chapter 13**) and interactions between these environmental issues and population and human health (**Chapter 14**).

Specific issues which are examined in this chapter include *inter alia*:-

- Economic Activity - will the development stimulate additional development and/or reduce economic activity?;
- Social Considerations - will the development change patterns and types of social activities?; and
- Health and Safety - will there be risks of death, risks to public health, disease, discomfort or nuisance?

Likely significant effects may occur as a result of direct interaction between the proposed development and population and human health receptors (e.g. farming operations affected as a result of construction activities) or indirectly such as employment created as a result of the local spending of wages earned by the construction workforce during the construction phase of the proposed development.

As the proposed development forms part of the overall Pinewoods Wind Farm project, this chapter assesses the cumulative effects of the proposed development in-combination with the permitted Pinewoods Wind Farm and all other existing, permitted and proposed developments, including those set out at **Chapter 1**.

4.1.1 Statement of Authority

The assessment of likely significant effects on population and human health, and preparation of this EIAR chapter, has been undertaken by various members of the Galetech Energy Services (GES) Environment & Planning Team. GES has substantial socio-economic/population and human health assessment experience having prepared Population & Human Health (Human Beings) chapters for multiple permitted and proposed developments which have been subject to EIA.

4.1.2 Description of the Proposed Development

A full description of the proposed development is presented in **Chapter 3**. In summary, the proposed development comprises the following main components:-

- 1 no. 110kV loop-in/loop-out air-insulated switchroom (AIS) substation including control buildings, transformers and all ancillary electrical equipment; and
- All associated site development, access and reinstatement works.

The entirety of the proposed development is located within the administrative area of County Laois; while part of the overall project (Pinewoods Wind Farm) is located

within County Kilkenny. Additionally, candidate quarries which may supply construction materials are also located within County Kilkenny and County Carlow.

4.2 Policy and Guidance

The following section sets out the policy and guidance which is assessed to be of relevance to an assessment of the likely significant effects on population and human health for a proposed development of this type.

4.2.1 National Policy

4.2.1.1 Wind Energy Development Guidelines for Planning Authorities 2006

The 2006 Guidelines offer advice to planning authorities in determining planning applications for wind farm developments, including the likely significant effects on population. While the proposed development does not, of itself, comprise a wind farm development; given its close association to same, the Guidelines are also of relevance in assessing the suitability and appropriateness of locations for related ancillary infrastructure.

4.2.1.2 Draft Revised Wind Energy Development Guidelines (December 2019)

The Draft Revised Wind Energy Development Guidelines were published in December 2019. The 2019 Draft Guidelines include updates to several key aspects of wind energy development, including in respect of matters which interrelate with population and human health effects; namely noise, visual amenity and shadow flicker.

4.2.2 Local Policy

Relevant local planning and development policies are derived from the following key documents:-

- Laois County Development Plan 2017-2023;
- Kilkenny County Development Plan 2014-2020; and
- Draft Kilkenny County Development Plan 2020-2026.

4.2.2.1 Laois County Development Plan 2017-2023

The Laois County Development Plan (LCDP) sets out a number of strategic aims, some of which are assessed to be relevant to the consideration of population and human health in this EIAR, namely:-

- Develop the full potential of each part of County Laois to contribute to the optimal performance of the county as a whole economically, socially, culturally and environmentally;
- Facilitate the future sustainable development of County Laois;
- Protect, conserve and enhance the built, natural and cultural environment through promoting awareness, utilising relevant heritage legislation and promoting good quality urban and rural design; and
- Support the development of key infrastructure such as telecommunications, electricity, gas to enable economic development.

The avoidance of impacts on the visual and residential amenities of the area including protected views, scenic routes and designated scenic landscapes and public rights of way are set out as key priorities for County Laois over the lifetime of the LCDP (Section 7). The LCDP also seeks to promote the County as a location for industry that is attractive and competitive in terms of inward investment. Furthermore, the promotion of the wind energy sector is set out as Policy WES1 in the

Wind Energy Strategy (Appendix 5 of LCDP).

4.2.2.2 Kilkenny County Development Plan 2014-2020

The Kilkenny County Development Plan (KCDP) also sets out a number of strategic aims which are assessed to be relevant to the consideration of population and human health in this EIAR, as follows:-

- To provide a framework for the implementation of the Council's economic strategy and the protection of the environment and heritage, to position the county for sustainable economic growth and employment;
- To integrate the planning and sustainable development of the county with regard to the housing, social, community and cultural requirements of the county and its population;
- To manage rural change and guide development to ensure vibrant and sustainable rural areas whilst conserving and sustainably managing our environment and heritage;
- To protect and improve recreational, tourism and arts facilities for the benefit of residents and for the promotion of tourism;
- To promote and facilitate all forms of renewable energies and energy efficiency improvements in a sustainable manner as a response to climate change; and
- To encourage the creation of living and working environments of the highest quality by ensuring a high quality of design, layout and function for all development under the Planning Acts and Regulations, to conserve and build upon positive elements in the built and natural environment, and to protect amenities.

4.2.2.3 Draft Kilkenny County Development Plan 2020-2026

The Kilkenny County Development Plan 2020-2026 is currently under preparation and will seek to guide future development within County Kilkenny in a proper and sustainable manner. The pre-draft Issues Paper, produced in April 2018, was reviewed to evaluate the matters raised as they relate to population and human health including sustainable development, environment and climate change, economic development and employment, rural development, tourism,

4.2.3 Guidance

4.2.3.1 Draft EPA Guidelines on the Information to be contained in Environmental Impact Assessment Reports (2017)

The EPA Guidelines state that an EIAR does not generally require assessment of land-use planning, demographic issues or detailed socio-economic analysis unless the proposed development gives rise to likely significant effects in respect of new developments and infrastructure which affect on economic or settlement patterns.

Whilst the proposed development will not likely result in any such effects, it will lead to the generation of employment during both the construction and operational phases as well as inward investment which may affect local business supply chains.

In relation to likely effects on human health, the Guidelines state that the EIAR should refer to the assessments of those factors under which human health effects might occur e.g. under the relevant environmental factors of air, water, soil. The importance of avoiding duplication of the assessment of likely effects is highlighted i.e. care should be taken to avoid 'double-counting' effects that are identified elsewhere in the corresponding chapter of the EIAR, for example noise or air quality

effects. As a result, likely effects which may arise from these specific environmental topics are addressed in their respective chapters. The likely interactions of these effects, if any, are addressed in **Chapter 14**.

The Guidelines state that assessments of other health and safety issues are carried out under other EU Directives, as relevant e.g. reports prepared under the Integrated Pollution Prevention and Control frameworks. In keeping with the requirement of the EIA Directive, an EIAR should take account of the results of such assessments without duplicating them.

Whilst there are no other environmental permits required for the proposed development in addition to the necessary planning permission, this EIAR does contain elsewhere a detailed consideration of effects related to population and human health, most notably in relation to Air Quality and Climate (**Chapter 8**), Landscape (**Chapter 9**), Noise & Vibration (**Chapter 11**), Shadow Flicker (**Chapter 12**) and Material Assets (**Chapter 13**).

As the 2017 Guidelines have not been adopted and remain in draft format, consideration has also been given to the EPA *Guidelines on information to be contained in Environmental Impact Statements (EIS)' (2002)* and accompanying Advice Note, insofar as they relate to population and human health, and the proposed development.

4.2.3.2 Fáilte Ireland 'Guidelines on the treatment of Tourism in an Environmental Impact Assessment'

The Fáilte Ireland Guidelines recognise that tourism can be affected both by the structures and/or emissions from new developments as well as by interactions between new activities and tourism activities; for example, the likely effects of high volumes of heavy goods vehicles passing through hitherto quiet, scenic, rural areas.

The guidelines set out that an EIAR should indicate the location of sensitive neighbouring tourism resources that are likely to be directly affected, and other premises which may be the subject of likely indirect or secondary effects, such as alteration of traffic flows or increased urban development. A number of typical toursim assets which should fall for assessment are listed, including accommodation, golf courses, visitor sporting facilities and historical and cultural sites, walking and scenic routes. The EIAR should indicate the numbers of premises and visitors likely to be affected directly and indirectly.

4.2.3.3 EMF & You: Information about Electric & Magnetic Fields and the electricity network in Ireland

The provision of electrical apparatus is common practice throughout Ireland and their installation does not give rise to any specific health concerns. The extremely low frequency (ELF) and electrical magnetic fields (EMF) associated with the operation of the electrical equipment will comply fully with the international guidelines for ELF and EMF set by the International Commission on Non-Ionizing Radiation Protection (ICNIRP), a formal advisory agency to the World Health Organisation, as well as the EU guidelines for human exposure to EMF.

The ESB document 'EMF & You' (ESB, 2017)[1] provides further practical information on EMF. Other advice and guidance, reviewed as part of the baseline assessment and in developing the assessment methodology include:-

- Department of Communications, Climate Action and Environment 'Code of Practice for Wind Energy Development in Ireland' (2017);
- IWEA 'Best Practice Guidelines for the Irish Wind Energy Industry' (2012);
- IWEA 'Best Practice Principles in Community Engagement and Community Commitment' (2013); and
- IWEA 'An Enterprising Wind': An economic analysis of the job creation potential of the wind sector in Ireland (2014).

Key socio-economic data for the baseline has been derived from:-

- Central Statistics Office (CSO);
- Laois County Development Plan 2017-2023;
- Kilkenny County Development Plan 2014-2020;
- Pobal Profiling GIS Data (https://maps.pobal.ie/);
- Fáilte Ireland data in conjunction with websites of relevant tourism sites and amenities in the area;
- A Strategic Plan for Tourism in Laois 2018-2023;
- Laois Local Economic & Community Plan 2016-2021; and
- OSI mapping and aerial photography.

4.3 Methodology

4.3.1 Desk Based Research

The majority of effects on population and human health receptors are likely to be experienced during the construction phase. These are likely to include beneficial economic multiplier effects on the local economy, including employment opportunities as a result of increased spend on local services as well as possible adverse effects, such as restrictions on farming operations, neighbouring businesses or general disruption to the amenity of the local area, which may indirectly impact on its recreation or tourism value. Once operational, effects as a result of the proposed development are likely to be primarily related to the visual impact (if any).

In respect of human health, the chapter takes into consideration the results of other assessments in the EIAR which have relevance to health; namely soils, water, air quality and climate, noise, and shadow flicker. The findings of these assessments are cross referenced in this chapter but the effects will not be repeated to avoid duplication of coverage or 'double-counting' in the EIAR.

Employment effects and direct expenditure are quantified using data provided by the Applicant and, where necessary, using standard industry data. Opportunities for local businesses and the local labour market to be involved in supply chain activities will be identified and where possible quantified.

4.3.2 Study Area

Due to the nature of the proposed development, a study area of 5km radius around the proposed development site is assessed to be sufficient to assess the likelihood of significant effects on population and human health. While economic effects on a wider scale are assessed to be likely with regard to the entire Pinewoods Wind Farm,

[1] https://esb.ie/docs/default-source/default-document-library/emf-public-information_booklet_v9.pdf?sfvrsn=0

these effects will be assessed in the cumulative assessment sections of this chapter. Given the scale of the proposed development, it is not intended to assess effects at a national or international level.

4.3.3 Consultation

A range of statutory and non-statutory organisations have been consulted as part of the EIAR scoping process as discussed in **Chapter 1 (Volume I)**. The responses which are relevant to likely effects on population and human health are identified in **Table 4.1** below.

Consultee	Date of Correspondence	Comments	Reference within EIAR
Health & Safety Authority	4 March 2020	No comment.	-
Failte Ireland	18 March 2020	Supplied copy of Guidelines on the treatment of tourism in an Environmental Impact Statement	Incorporated into methodology.

Table 4.1: Scoping feedback relating to Population and Human Health

Separately, the Applicant has previously engaged in an extensive public consultation process in relation to the now-permitted Pinewoods Wind Farm. A comprehensive overview of the Applicant's approach to public consultation is provided at **Annex 1.6 (Volume II)**.

4.3.4 Approach to Assessment of Effects

The chapter assesses the likely construction, operational and decommissioning effects on:-

- the local economy (employment and economic output);
- the local population;
- opportunities for local involvement in the business supply chain and employment, i.e. how the key construction and operational activities will translate into investment;
- jobs; and
- recreation and tourism assets.

4.3.5 Sensitivity Criteria, Magnitude and Significance Thresholds

Likely effects will be assessed in line with the following parameters:-

- beneficial or adverse (or neutral);
- extent (the area over which the effect occurs);
- duration (the time for which the effect is expected to last prior to recovery or replacement of the resource or feature);
- reversibility (permanent or temporary); and
- timing and frequency.

4.3.6 Sensitivity Criteria

There are no published standards that define receptor sensitivity relating to population and human health assessments. As a general rule, the sensitivity of each receptor, or receptor group, is based on its importance or scale and the ability of the baseline to absorb, or be influenced, by the identified effects. In assigning

receptor sensitivity, consideration is given to the following:-

- importance of the receptor e.g. local, regional, national, international;
- availability of comparable alternatives;
- ease at which the resource could be replaced;
- capacity of the resource to recover or adapt to identified effects over a period of time; and
- level of usage and nature of users (e.g. sensitive groups such as people with disabilities).

Based upon expert judgement, four levels of sensitivity are used; High, Medium, Low and Negligible. The proposed sensitivity criteria are set out in **Table 4.2** below.

4.3.7 Magnitude Criteria

The magnitude of impact is evaluated based on the change that occurs with respect to the baseline conditions. Four degrees of magnitude are used; High, Medium, Low and Negligible.

4.3.8 Defining Significant Effects

The significance of an effect is assessed by combining the magnitude of the impact and the sensitivity of the receptor, as shown in **Table 4.2**. Four levels of effect are used; Major, Moderate, Minor and Negligible.

Where an effect is classified as Major, this is assessed to represent a 'significant effect' in terms of the EIA Directive. Where an effect is classified as Moderate, this may be considered to represent a 'significant effect' but is subject to expert judgement and interpretation, particularly where the sensitivity or impact magnitude levels are not clear, or are borderline, between categories or the impact is intermittent.

Sensitivity or Value of Resource or Receptor	Magnitude of Impact			
	High	Medium	Low	Negligible
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible
Negligible	Minor	Negligible	Negligible	Negligible

Table 4.2: Level of Effect Matrix

4.3.9 Approach to Mitigation

Mitigation measures, additional to those environmental mitigation measures inherent to the project design, are also considered in order to mitigate any likely adverse effects that are identified through the assessment process.

4.3.10 Cumulative Effects

Consideration will be given to the likely cumulative effect of the proposed development in combination with other existing, permitted and proposed developments, including those set out at **Chapter 1**.

4.3.11 Limitations of Assessment

Certain information regarding project design, in particular information regarding capital expenditure and construction employment, will not be available until the normal procurement process has been completed. Therefore, this chapter provides estimates, based on experience on other projects, of likely spend and employment during construction sufficient to allow for assessment in this EIAR.

Information on likely inter-related effects is informed by the assessments undertaken on other topics, which are set out in those topic chapters. Any limitations are set out in those chapters.

The status of certain individual receptors, for example, employment status, will be subject to change; however, information reported in this chapter is based on the baseline survey work described in **Section 4.4**.

4.4 Description of Existing Environment

4.4.1 Population

The proposed development site is located within the Electoral Division (ED) of Dysartgallen in County Laois which, according to Census 2016, has a population of 255. Other EDs located within the study area include Clogh (Co. Kilkenny) and Ballinakill and Blandsfort (Co. Laois); and their respective population details are provided at **Table 4.3**.

	2016	2011	Percentage Change
Dysartgallen	255	266	-4.1%
Ballinakill	826	792	+4.2%
Blandsfort	306	318	-3.7%
Clogh	1,221	1,276	-4.3%
County Laois	84,697	80,559	+5.1%
County Kilkenny	99,232	95,419	+3.9%

Table 4.3: Census 2016 - Population Details

Table 4.3 shows that Clogh has the largest population in the study area. The EDs of Clogh and Ballinakill both contain small urban centres, of the same name, which contribute to the larger population numbers.

Table 4.4 shows how the population is distributed in terms of the number of households; with Clogh having the highest number, which is consistent with its relative population size as outlined in **Table 4.3** above.

	No. of Households
Dysartgallen	84
Ballinakill	288
Blandsfort	108
Clogh	447

County Laois	32,794
County Kilkenny	39,226

Table 4.4: Census 2016 - Number of Households

Data on the age of properties in **Table 4.5** indicates an older housing stock with smaller proportions of recent builds. As was typical at national level, the volume of new builds reduced substantially from 2010 onwards. **Table 4.6** does, however, show that vacancy rates are not dissimilar to those of the respective counties, although almost 10% of properties in Ballinakill are unoccupied.

	Dysartgallen	Ballinakill	Blandsfort	Clogh	Co. Laois	Co. Kilkenny
Pre-1945	33	90	29	127	4,134	6,123
1945-1970	5	17	10	68	2,703	4,032
1971-2000	24	66	43	153	9,209	12,578
2001-2010	20	90	20	66	10,702	9,858
2011-later	1	7	3	2	729	713

Table 4.5: Census 2016 - Age of Housing Stock

	Dysartgallen	Ballinakill	Blandsfort	Clogh	Co. Laois	Co. Kilkenny
Occupied	86	295	111	466	29,787	36,231
Vacancy Percentage	4.5%	9.8%	4.3%	7.7%	9.2%	7.6%

Table 4.6: Census 2016 – Household Occupancy

Table 4.7 shows that levels of employment and unemployment within the EDs are not dissimilar to those for counties Laois and Kilkenny as a whole; except in Clogh where there is a higher level of unemployment at 18% and also a high proportion who are not working for reasons of illness or disability.

	Dysartgallen	Ballinakill	Blandsfort	Clogh	Co. Laois	Co. Kilkenny
At Work	102	331	126	462	33,541	41,363
Unemployed	9	46	8	87	6,068	6,044
Student	27	68	31	110	6,492	8,164
Retired	31	79	47	163	8,077	11,819
Not Working (Sickness or Disability)	2	31	4	59	2,970	3,276

Table 4.7: Census 2016 – Economic Status

4.4.2 Human Health

Table 4.8 provides information on people's sense of their own health, revealing that Clogh has a substantially higher proportion of people considering their health to be either 'Bad' or 'Very Bad'.

	Dysartgallen	Ballinakill	Blandsfort	Clogh
Bad or Very Bad	0.8	1.5	1.0	2.5

Table 4.8: Census 2016 – Percentage of Population who reported health of 'Bad' or 'Very Bad'

4.4.3 Tourism

Fáilte Ireland combines counties to form eight different regions across Ireland for which tourism statistics are produced. County Laois is part of the Midlands region along with Longford, Westmeath and Offaly. The latest data for the Midlands region was published in 2017 and indicates that:-

- there was a total of 218,000 overseas visitor trips to the region, generating approximately €85million;
- there was a total of 422,000 trips by Irish residents to the region generating approximately €71million; and
- there was a total of 15,000 trips by residents from Northern Ireland to the region generating approximately €4million.

County Kilkenny is part of the South East region along with Carlow, Wexford, Waterford and South Tipperary. The latest data for the South East region was published in 2017 and indicates that:-

- there was a total of 954,000 overseas visitor trips to the region, generating approximately €271million;
- there was a total of 1.4 trips by Irish residents to the region generating approximately €253million; and
- there was a total of 46,000 trips by residents from Northern Ireland to the region generating approximately €14million.

In the Midlands region, County Laois attracts 43,000 overseas visitors with a revenue of €14million. Within the South East region, County Kilkenny attracts 315,000 overseas visitors with a total revenue of €55million.

It is likely that nearby communities such as Abbeyleix and Durrow have a relatively high proportion of their populations employed in this sector given the presence of local heritage features, hotels and guest houses. Although bypassed by the M7, Abbeyleix is a regular stop for visitors on route to destinations such as Cork or the west of Ireland.

Although not a major tourism destination, County Laois contains various sites of interest to visitors, including the Rock of Dunamaise, Emo Court and the Timahoe Round Tower. County Kilkenny has a somewhat higher tourism profile due to the City of Kilkenny, its heritage and annual festivals, destinations such as Thomastown and Inistoige, and attractions such as Dunmore Cave and the Castlecomer Discovery Park.

4.4.4 Character

Although elevated, the study area is not of great elevation (ranging between c. 200-300 mAOD) and is located on the lower northern slopes of the Castlecomer Plateau (known locally as Cooper's Hill). The dominant land use in the vicinity is agricultural pasture while coniferous forestry and transitional woodland scrub are also amongst the land cover types within the study area.

Residential properties in the study area, outside of settlements, are either single houses (including farmsteads) or occur in the form of scattered linear development, for example in Graiguenahown to the southeast. The nearby community of Knock contains a primary school, a church and a handful of dwellings. Boleybeg is a small community to the west containing a branch of Glanbia and a community field.

The principal communities include Ballinakill on the R432 and Clogh to the east on the R426. The former contains a national school, churches and a mixture of community facilities, including an outdoor swimming pool. There is also a tourist information point. The Heywood Demesne and its historic gardens are located just outside of Ballinakill, to the north, and the village is also located on the Laois Cycle Trail which connects with Durrow to the west. Heywood Community School is located close to the entrance of the demesne. The village of Clogh contains a soccer and GAA club and a local community walk. The Swan is a similar sized community located at the junction of the R430 and R426 to the north of Clogh. A brickworks is located here as well as a community centre and primary school

As well as farmsteads, there are a small number of aggregate/quarrying companies/sites and small family businesses in the vicinity, including organic farms, workshops and dog grooming. There is some equine activity, such as training and breeding, and pony trekking available in the wider area, including an equine stud near Ballinakill. To the west is the town of Abbeyleix located on the N77 which represented the main transport route between Dublin and Cork prior to the completion of the M7.

4.4.5 Significance

The upper elevations of Cooper's Hill and the Spink are largely unoccupied, with land cover which comprises grazing or rough grazing land and commercial forestry. At lower elevations there are dairy enterprises and pockets of broadleaf woodland. These lower elevations include minor roads along which there has been a modest amount of private development as noted above. The overwhelming majority of this development has been residential, although there are instances of family businesses such as vehicle workshops, equine businesses and dog grooming as well as, of course, farms.

There is only a light level of recreation or tourism activity in terms of walking or accommodation, although a circular walking route (Cooper's Hill Walk) using local roads and tracks has been promoted. Another local walking route, the Slieve Margy Way, passes through The Swan to the east. There are also cycle routes. The surrounding area, particularly between Boleybeg and Ballinakill, contains diverse attractive countryside with expansive views.

4.4.6 Significance

Concerns raised by local residents and consultees in previous submissions related to the Pinewoods Wind Farm include visual and landscape, loss of local amenity, noise, shadow flicker, health, effects on wildlife, water quality, equine and livestock, road use and widening, and likely effects on property prices and tourism. Likely effects

relating to visual impact, noise, shadow flicker, biodiversity, traffic, safety and material impacts are addressed elsewhere in this EIAR. It is understood that such perceived concerns can be a cause of anxiety and that this in itself may have implications for the health of sensitive population subsets. This applies in particular to people whose livelihood depends, to some degree, on agriculture or equine activity, or on tourism which has a relationship with the quality of the local environmental resource, including perceptions of environmental quality. People who work night shifts or who have disabilities, including dependents, are among those population subsets that could be described as being sensitive. Children are not a uniquely sensitive subset of the population in this instance, but it is acknowledged that there are primary schools in the area, of which the nearest to the proposed development is Knock National School.

The open land comprising the Spink and Cooper's Hill receive light amenity (walking, cycling) with most activity being on-road/tracks given the nature of the terrain. As noted above, a circular walking route has been described in locally available publications, which uses these roads and tracks. There is currently a low level of tourism activity in the area, although Heywood Demesne is maintained by the OPW and receives small but regular numbers of visitors. The surrounding attractive countryside has potential for tourism activity.

Mount Nugent Stud, which is located at Ironmills to the east of Ballinakill, is involved in the breeding of thoroughbreds and is amongst the sensitive receptors located within 5km of the site of the proposed development. The local Owenbeg (Owveg) River is a tributary of the River Nore and, although lightly fished itself, is important for the spawning of salmon and trout.

A map indicating the locations of key identified local features and resources is provided at **Annex 4.1 (Volume II)**.

4.5 Description of Likely Effects

The following sections assess the effects which are likely to arise during the construction, operational and decommissioning phases.

4.5.1 Construction Phase

4.5.1.1 Population Sustainability & Residential Amenity

Construction of the proposed development is expected to have a duration of 15-18 months with works to occur the hours of 08:00 to 20:00 Monday to Friday and 08:00 to 18:00 hours on Saturday. Except for certain specific works, for example any possible emergency works, construction activity is not expected to occur generally outside of these hours, or on Sundays or Public Holidays.

Construction works will generate noise; with **Chapter 11** concluding that noise levels at properties nearest to the proposed development will be below acceptable limits. It notes that noise levels will be temporary in nature and will diminish with distance. The most significant contribution to noise is likely to arise from lorry movements, particularly movements on uneven surfaces, during the construction phase. In this respect, access to the proposed development site will be by sealed local roads L7800, L78001 and L77951. Construction or transport activities involving higher noise levels (such as vehicular movements on unsealed access tracks) will be intermittent and below noise thresholds required for residential receptors and at distances greater than 100m.

Chapter 13 (Transport & Access section) notes that the construction phase is

estimated to generate 4,773 heavy goods vehicle (HGV) trips during the 15-18 month construction period. It is also estimated that 15 no. light goods vehicle (LGV) trips will be generated daily as staff and personnel travel to and from the proposed development site. Overall, the likely effects are not assessed to be significant and are concluded to be a slight, negative effect of short-term duration and high probability.

No likely significant effects on population sustainability are anticipated and likely effects on residential amenity are expected to be slight to moderate negative, of a temporary nature with the specific effects dictated by the proximity of individual residences to the site or access roads.

4.5.1.2 General Amenity & Well-Being

Construction works will be temporary in nature. As discussed above, these are proposed to occur within daytime hours and not on Sundays or Public Holidays. The proposed development will be located on private lands and no rights-of-way will be affected during construction. The site will be appropriately fenced off with appropriate warning signs to prevent unauthorised access in accordance with health and safety requirements. There will likely be visual effects during construction, but these will be temporary in nature and comparable to those of forestry harvesting operations already occurring periodically in the locality.

While the construction of the proposed development will not require the delivery of abnormal loads, traffic management will be coordinated with the local authority and An Garda Síochana to ensure the minimisation of any likely effects. Most of the projected 4,773 HGV trips will be to transport excavated material from the proposed development site, the transportation of aggregates to the site from existing quarries/sources identified in **Chapter 13** and the importation of electrical apparatus via the principal haul route (L7800, L78001, L77951 and private access tracks from the R430). The precise transportation route to the R430/L7800 junction will depend on the source of materials but all suppliers will be instructed to utilise the motorway, national and regional road network insofar as possible and to avoid the L1828. This is likely to involve traffic movements through small communities but will not add appreciably to the existing volume of traffic on these roads. In all, construction traffic movements are assessed to have a slight-to-moderate negative effect of a temporary nature on general amenity and well-being.

Additionally, whilst it is noted that the construction material haul routes will interact with the Cooper's Hill Walk, provision will be made to ensure that access is not restricted, adequate provision for pedestrians is retained and that the walking route remains free from mud, dust and any other debris associated with the construction of the proposed development.

4.5.1.3 Economic Effects & Employment

During the 15-18 month construction phase of the proposed development, there will likely be economic effects resulting from capital expenditure on items such as site preparation, purchase and delivery of materials, plant, equipment and components. Information provided by the Applicant, based on experience at other wind farms in Ireland, indicates that 100 no. workers are likely to be employed during the construction phase. It is highly likely that a significant percentage of these workers will be sourced from the local labour market within the counties of Laois and Kilkenny, with the remainder being sourced from Ireland as a whole.

The procurement of goods and services is likely to have a significant positive effect

on the local economy. The types of supply chain companies that could benefit from this expenditure are wide ranging, and are likely to include, but not limited to, the following:-

- haulage and transport services;
- traffic management;
- materials supply, e.g. aggregates;
- plant and equipment hire;
- vehicle servicing/tyres;
- fencing;
- fuel;
- security;
- waste management;
- building construction, electrical, plumbing, roofing, flooring, plastering and joinery services;
- signing and lighting;
- telecommunications;
- drainage;
- planting and seeding;
- catering;
- professional services; and
- accommodation.

The appointed contractors will be actively encouraged to develop local supply chains throughout the area, and work with local subcontractors and service providers.

In addition, local businesses and services are likely to experience indirect benefits during the construction phase works as the workforce spend locally on living costs whilst they are based in the area. These effects are further explored in the following section.

4.5.1.4 Effects on Tourism Economy

The construction period is anticipated to last for 15-18 months and is likely to benefit the local economy through expenditure on purchases of accommodation, food, drink, fuel, etc. which will be required to sustain the construction workforce. These beneficial effects will be experienced mainly by businesses already operating within the tourism sector, or those that are partly dependent on tourism for their income, for example the retail sector.

Anecdotal evidence, based on other construction projects, demonstrates that local businesses such as accommodation providers welcome the enhanced level of occupancy that is achieved due to construction contractors using their accommodation on a year round basis, including periods of the year that are traditionally considered 'low season'. The benefits of increased business, although temporary, can allow businesses to invest in improvements that would not otherwise be affordable, leading to a long term enhancement. Where construction staff or personnel are making use of local accommodation, all relevant public health guidelines will be fully adhered to.

Whilst overall likely effects to the tourism economy are assessed to be negligible and not significant (beneficial or adverse), as with any major capital investment in a locality, the benefits to individual businesses is likely to be substantial and may be significant. However, until such time as contracts are agreed, it is not possible to

quantify the precise level of benefit to individual businesses.

4.5.1.5 Accidents or Natural Disasters

As set out within **Chapter 6** and **Chapter 7** of this EIAR, the proposed development is not likely to be a source of pollution during either the construction or operational phases, predominately due to the limited volume of hydrocarbons stored on site and the bunding arrangements ensuring that spillages and/or leaks do not occur. In the event of an accident on-site, mitigation measures, as set out in the above chapters, will ensure that any likely significant environmental effects do not occur.

The likelihood of significant natural disasters occurring at the proposed development site is low. Ireland is a geologically stable country with a mild temperate climate. The possible natural disasters that may occur are therefore assessed to be limited to flooding and fire. The risk of flooding is addressed in **Chapter 7** and, given the nature of the hydrological environment and topography of the site, the risk of flooding is assessed to be negligible.

It is assessed that the risk of significant fire occurring, affecting the proposed development and causing it to have significant environmental effects is limited. There are no habitat types located within the proposed development site, or its immediate environs, which are particularly susceptible to fire and no tracts of forestry are present. The proposed development will be operated to the highest standards, will be regularly inspected and subject to ongoing maintenance. This maintenance schedule will ensure that all electrical equipment is monitored to assess for fire risk. Should a fire occur, standard procedures will be implemented by Eirgrid and emergency services to mitigate the effects of same and ensure that local residents are not adversely affected.

As discussed above, there are no significant sources of pollution associated with the proposed development with the likelihood of causing any likely significant environmental or health effects. Furthermore, one of the core mitigation-by-design features of the proposed development, is maximising the distance to residential dwellings which further limits any likelihood of any significant human health effects in the event of accidents or natural disasters.

Major industrial accidents involving dangerous substances pose a significant threat to human health and the environment. Such incidents can give rise to serious injury to local residents or result in damage to the environment, both within proposed developments sites and in the vicinity. However, the proposed development site is not regulated by, connected with, or proximate to any site regulated under the Control of Major Accident Hazards Involving Dangerous Substances Regulations (i.e. sites regulated in accordance with the SEVESO Directives) and there is no likelihood of cumulative effects or interactions with any such site.

4.5.1.6 Cumulative Effects

This assessment has taken into account the likely cumulative effect of the proposed development with the permitted Pinewoods Wind Farm and all other existing, permitted and proposed developments, including those set out at **Chapter 1**.

It is likely that cumulative effects will arise in relation to the construction of other permitted or proposed developments should the construction phases overlap with the proposed development; however, given the temporary nature of the construction phase, it is assessed that none of these projects are likely to result in significant cumulative beneficial or adverse socio-economic or population and human health effects.

4.5.2 Operational Phase

4.5.2.1 Population Sustainability & Residential Amenity

The assessment of the existing environment (**Section 4.4**) identified that the study area is characterised by a low population density, recent declines in the number of new housing stock and an older housing stock; but also that the age and employment profile is fairly typical of rural areas.

On the basis of specific assessments undertaken in this EIAR, no likely significant effects have been identified in respect of water, air & climate, landscape, or noise which could adversely affect the sustainability of population or residential amenity in the locality

4.5.2.2 General Amenity & Well-Being

There is a light level of walking activity, principally by local people using local roads and tracks. The proposed development itself will be located on private land and no right of ways are affected.

In terms of the specific effect of the development on tourism or amenity, **Chapter 9** identifies the receiving landscape to be of 'Medium-low' sensitivity and that the impact of the proposed development will also be 'Medium-low'. The control building and towers are nestled within the re-contoured terrain and fit within the existing field boundaries. Given this 'Medium-low' sensitivity classification, there are only a few receptor locations where users, such as tourists or hill walkers, are likely to be highly attuned to the landscape. The proposed development, therefore, is assessed as being of slight negative significance in the context of the low, but tangible, level of local amenity activity.

During the operational phase of the proposed development, noise levels sufficient to cause noise induced hearing damage or sleep disturbance are not likely to occur. The full results of this assessment are presented in **Chapter 11**.

All electricity, both natural and man-made, produces two types of fields: electric fields and magnetic fields. The proposed grid connection cables will comply with the international guidelines for ELF-EMF set by the International Commission on Non-Ionizing Radiation Protection (ICNRP), which is an advisory agency to the World Health Organisation.

Electrical equipment and apparatus is located a substantial distance from any residence with no possible EMF impact. The substation, when operational, will also comply with ICNIRP and EU guidelines relating to exposure to EMF.

4.5.2.3 Economic Effects & Employment

When the proposed development is operational, it will require a team of personnel to provide servicing, maintenance, repairs and other operational support. It is estimated that up to 2 no. engineers and technicians (full time equivalent) will be needed to provide operational support to the project.

Further employment is anticipated, directly and indirectly, elsewhere in Ireland during the operational phase. Additional to the likely direct effects on employment during the operational phase, there will also likely be indirect employment effects arising from the placing of contracts with other businesses, both in the local area and elsewhere in Ireland, supplying services and materials to the project during its operational phase. Examples of such supply chain activity would include the procurement of:-

- site and building maintenance;
- waste management;
- general site maintenance including grass cutting and weed control;
- supply of consumable items (e.g. lubricants and oils, spare parts, office supplies, etc.); and
- in addition, local shops, cafes, accommodation providers and hotels often experience an increase in business during the operational phase (e.g. extra technicians onsite for during wind farm maintenance and servicing).

The Applicant will seek to secure positive benefits for the local economy by encouraging the use of local labour, manufacturers and suppliers where possible during the operational phase.

4.5.2.4 Effects on Tourism Economy

Chapter 9 of the EIAR assesses in detail the likely landscape and visual effects of the proposed development. The chapter concludes that the significance of visual impact will be no greater than 'Slight' for any visual receptor and that the proposed development will not give rise to significant landscape and visual effects in EIA terms.

Notwithstanding these considerations, it is assessed that there is no evidence to suggest that an occasional view of the proposed development, including cumulatively with the Pinewoods Wind Farm, might adversely affect the visitor appeal of the area. The proposed development site is relatively remote, is set into the landscape by virtue of its chosen location and split-level design, and is substantially screened from the local road network and visual receptors by vegetation with limited views across the subject site available. Based on the evidence gathered from previous studies, occasional views of the proposed development are not assessed as likely to act as a deterrent to visitors or discourage repeat visits to the area.

4.5.2.5 Cumulative Effects

This assessment has taken into account the cumulative effects of the proposed development with the permitted Pinewoods Wind Farm and all other existing, permitted and proposed developments, including those set out at **Chapter 1**.

It is assessed that none of these projects are likely to result in significant cumulative positive or adverse socio-economic or population and human health effects in combination with the proposed development.

Community Benefit Funds

The operation of the proposed development, in combination with the Pinewoods Wind Farm, will bring about a number of financial benefit packages to the study area. These packages include a proposed community benefit fund and the payment of business rates to Laois County Council.

The Applicant is committed to operating a community benefit fund in accordance with the Irish Wind Energy Association (IWEA) best practice guidance and it will be available to the community at a rate of €2 euro per MWh produced. This will result in an investment of approximately €220,000 per annum for up to 15 years in the local community. The structure for the investment scheme will form part of the Renewable Energy Support Scheme (RESS).

The fund will be administered by a committee set up by the Applicant. Members of the local community are also likely to be appointed to the committee, thus allowing

the local community to prioritise the fund for the projects which matter most to their identified needs. Preference will be given to local projects and initiatives, thereby contributing to the vitality and viability of the local population, and to projects which are considered to represent an environmental benefit or incorporate a renewable energy element. This fund will be made available, and distributed annually, for up to 15 years.

In addition to the above community fund, as part of the permitted Pinewoods Wind Farm development, the Applicant has committed to making a €500 annual contribution towards the electricity/energy costs of all non-involved dwellings located within 1,030m of a permitted wind turbine.

It should also be noted that, over the lifetime of the proposed development (and indeed the entire Pinewoods Wind Farm project), a substantial investment will have been made by the Applicant to the landowner(s) whose landholdings form part of the proposed development. It is highly likely that the landowner(s) will reinvest a significant volume of this sum into the local economy and supply chains through various means which will, in turn, result in further community gains.

Benefits will accrue from these various income streams and, depending on the choices made, is likely to have a positive effect on the material well-being of local residents as well as wider spin-off and multiplier economic benefits.

The long term nature of the income will also allow the community to plan ahead, to draw in other sources of match funding to maximise the benefits, and investment projects could be designed to match local priorities. This will likely result in a positive effect of moderate or major importance to the study area.

4.5.3 Decommissioning Phase

As set out at **Chapter 3 (Sections 3.2 and 3.8)**, the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, decommissioning phase effects will not occur.

4.6 Mitigation & Monitoring

4.6.1 Construction Phase

Allowing for the implementation of mitigation set out elsewhere within this EIAR, no likely significant adverse effects have been identified in respect of socio-economic receptors arising from construction of the proposed development and therefore no mitigation measures are required to reduce or remedy any effect.

4.6.2 Operational Phase

No likely significant adverse effects have been identified in respect of socio-economic receptors arising from the operation of the proposed development and therefore no mitigation measures are required to reduce or remedy any adverse effect.

4.6.3 Decommissioning Phase

As set out at **Chapter 3 (Sections 3.2 and 3.8)**, the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, no decommissioning phase mitigation measures are required.

4.7 Residual Effects

4.7.1 Construction Effects

No significant residual construction effects are assessed as likely to occur.

4.7.2 Operational Effects

No significant residual operational effects are assessed as likely to occur.

4.7.3 Decommissioning Effects

As set out at **Chapter 3 (Sections 3.2 and 3.8)**, the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, residual decommissioning phase effects will not occur.

4.8 Summary

The assessment presented in this chapter has evaluated data from a range of sources, including the findings and conclusions of other assessments within this EIAR, to determine the likely effects of the proposed development on population and human health. In order to avoid 'double-counting', the assessment focuses on those factors which might result in economic, social, and health and safety effects. Other specific assessments on population and human health, including, for example, in respect of noise, visual impact and air quality, are assessed separately elsewhere in the respective chapters of this EIAR

The overall conclusion of this chapter is that any adverse effects of the proposed development on population and human health are assessed as unlikely to be significant. No specific mitigation measures, other than full adherence to all health and safety and public health guidance, have therefore been identified as being required. However, whilst the proposed development will not likely result in any significant adverse effects, it will constitute, alongside the permitted Pinewoods Wind Farm, a major investment in the local economy and will likely lead to the generation of employment during both the construction and operational phases as well as inward investment which will have a likely significant positive effect on the local population and human health.

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Pinewoods Wind Farm Substation and Grid Connection

Chapter 5: Biodiversity

Pinewood Wind Ltd

Galetech Energy Services
Clondargan, Stradone, Co. Cavan Ireland
Telephone +353 49 555 5050
www.galetechenergy.com

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5.1 Introduction

This biodiversity chapter was prepared by SLR Consulting Ltd (SLR) and forms part of the Environmental Impact Assessment Report (EIAR) prepared for the proposed development.

5.1.1 Background

In September 2019, the Applicant was granted planning permission by An Bord Pleanála for a wind farm comprising 11 no. wind turbines, each with a maximum height of up to 136.5 m, and all associated site development and ancillary works. The permitted wind farm development straddles the county boundary between Co. Laois and Co. Kilkenny in the townlands of Knockardagur, Boleybawn Garrintaggart, Ironmills (Kilrush) and Graiguenahown, County Laois and Crutt, County Kilkenny[1,2].

In deciding to grant planning permission, An Bord Pleanála determined that the then-proposed substation constituted Strategic Infrastructure Development (SID) and excluded the substation, by way of condition, from the permitted development. Accordingly, a planning application, which this EIAR supports, is now being made directly to An Bord Pleanála.

5.1.2 Purpose of this Chapter

The purpose of this biodiversity chapter is to provide supporting information to assist the competent authority, in this case, An Bord Pleanála, to carry out an Environmental Impact Assessment (EIA) of the proposed development.

The aim of this chapter is to:-

- Describe the baseline data collection and assessment methodologies used;
- Identify and describe all likely significant effects;
- Set out the mitigation and/or compensation measures required to ensure compliance with nature conservation legislation;
- Provide an assessment of the significance of any residual effects on biodiversity; and,
- Set out the requirements for post-construction monitoring (if required).

5.1.3 General Description of the Site

The proposed development site ("the Site") is located in the townland of Knockardagur, Co. Laois, approximately 4 km north-east of Ballinakill, 8 km south-east of Abbyleix and 8 km north-west of Castlecomer. The Site is centred at approximate Irish Transverse Mercator (ITM) Grid Reference 650427, 682395.

The topography of the landscape surrounding the Site is dominated by an upland area known as the Castlecomer Plateau, characterised by undulating hills and steep escarpments at its fringes. Dissecting the lowlands on either side of the plateau are the rivers Barrow and Nore, which lie to the east and west respectively. The lowlands are a mixture of pasture and tillage with fields bordered by mature broadleaf tree lines and hedgerows. Agricultural land-uses extend into the upland areas in the form of marginal grazing with scrubby hedgerow field boundaries. Conifer plantations are frequent on the slopes of the plateau along with occasional small areas of demesne woodland.

The Knockardagur stream, flows in a westerly direction from the Site to join the

[1] An Bord Pleanála Reference PL11.248518
[2] An Bord Pleanála Reference PL10.248392

Owenbeg (Owveg) River approximately 1.4 km east. The Owenbeg (Owveg) River discharges to the River Nore approximately 10.8 km downstream of the Site. The Knockardagur rises from a small spring approximately 10 m south of the footprint of the proposed substation. Water levels in the Knockardagur stream are highly dependent on prevailing weather conditions and the stream is only likely to contain flow following rainfall events.

5.1.4 Development Description

In summary, the main components of the proposed development are as follows:-

- 1 no. 110 kV 'loop-in/loop-out' air-insulated switchroom (AIS) substation including control buildings, transformers and all ancillary electrical equipment; and
- All associated site development, access and reinstatement works.

Due to the sloping nature of the proposed development site, and in order to minimise the volume of material to be excavated to provide the substation footing; the design of the proposed development has incorporated a split-level approach.

The entirety of the proposed development is located within the administrative area of County Laois; while the overall project (Pinewoods Wind Farm) is partly located within County Laois and County Kilkenny. Candidate quarries that may supply construction materials are located within County Kilkenny and County Carlow.

A full description of the proposed development is presented in **Chapter 3** of the EIAR.

5.1.4 Statement of Authority

SLR Consulting (Ireland) Ltd (SLR) was commissioned to provide ecological services, including the preparation of the biodiversity chapter and Natura Impact Statement (NIS), for the proposed development. SLR has a European Ecology Team of approximately 35 permanent ecologists. The ecologists that provided technical; expertise for the proposed development are based in Ireland and listed below.

Dr Úna Nealon, senior ecologist with SLR, carried out the field surveys, and prepared this chapter . The technical review of the chapter was carried out by Elaine Dromey MCIEEM.

Úna Nealon holds a BSc (Hons) Environmental Science from NUI Galway and a PhD in Ecology from University College Dublin. Úna has prepared Biodiversity chapters, and Natura Impact Statements, for a range of projects in different sectors.

Elaine Dromey holds a BSc in Earth Science from University College Cork and an MSc in Vegetation Survey and Assessment from the University of Reading, UK. She is a full member of the Chartered Institute of Ecology and Environmental Management.

5.1.5 Policy and Legislation

The following legislation are relevant to this report:-

- The EIA Directive (2014/52/EU);
- The Habitats Directive (92/43/EEC);
- The Birds Directive (2009/147/EC);
- The Wildlife Acts 1976 to 2018;
- The Floral (Protection) Order 2015;
- Planning and Development Act 2000, as amended;
- The EU Water Framework Directive (WFD) (2000/60/EC), as amended
- The European Communities Environmental Objectives (Freshwater Pearl Mussel)

Regulations 2009 (S.I. No. 296 of 2009).

Further details of the above legislation is summarised at **Annex 5.1, Volume II.**

This chapter has also been prepared having regard to the relevant policies and objectives of the Laois County Development Plan 2017–2023 which, for ease of reference, have been provided at **Annex 5.1.**

5.2 Methodology

5.2.1 Scope

The study area for field surveys was defined by the planning application boundary. The zone of influence of the proposed development, as identified in **Section 5.2.2** below, was used as, the study area for the desk study and assessment of cumulative effects.

5.2.2 Identification of the Zone of Influence

The 'zone of influence' for a project is the area over which ecological features may be subject to significant effects as a result of activities associated with the project (CIEEM, 2018). This is likely to extend beyond the project site, for example where there are ecological or hydrological links beyond the site boundaries. The zone of influence will vary for different ecological features depending on their sensitivity to an environmental change (CIEEM, 2018).

The zone of influence for the proposed development was identified through a review of the nature, size and location of the project, the sensitivities of the ecological receptors, known impacts likely to arise as a result of the type of project and the potential for in-combination effects with other plans and projects.

Construction activities will be restricted to the Site and will be localised in nature i.e. the works area will be largely contained to the footprint of the development and immediately adjacent. During the operational phase, other than routine maintenance and monitoring, there will be no other activities associated with the proposed development. The Site drains, via the Knockardagur stream, to the Owenbeg (Owveg) River which forms part of the River Barrow and River Nore SAC (002162) located approximately 1.4 km[3] from the Site boundary. Given this surface water connection, the potential for effects on the aquatic environment and the SAC, the potential zone of influence considered to be appropriate for the project is 2 km.

5.2.3 Desk Study

A desk study of the Site and the zone of influence of the proposed development (i.e. within a 2 km radius of the Site), was carried out to collate the available existing ecological information. The Site and the surrounding 2 km area were viewed using existing available satellite imagery including Google maps[4] and Bing maps[5] .

The National Parks and Wildlife Service (NPWS)[6] and the National Biodiversity Data Centre (NBDC)[7] websites were accessed for information on sites designated for nature conservation and on protected habitats and species. Only records for the

[3] Measured in a straight line from the closest point of the proposed development.
[4] https://www.google.ie/maps (last accessed 12 June 2020)
[5] https://www.bing.com/maps (last accessed 12 June 2020)
[6] https://www.npws.ie/ last accessed 12 June 2020)
[7] https://maps.biodiversityireland.ie/ (last accessed 12 June 2020)

past 10 years are considered within this chapter as older records are unlikely to be relevant given their age and the changes in land management that are likely to have occurred in the intervening period. Environmental Protection Agency (EPA) Maps[8] were accessed for other environmental information, such as surface water features, relevant to the preparation of this chapter.

Birds of Conservation Concern in Ireland (BoCCI), published by BirdWatch Ireland and the RSPB NI, is a list of priority bird species for conservation action on the island of Ireland. The BoCCI lists birds which breed and/or winter in Ireland and classifies them into three separate lists; Red, Amber and Green; based on the conservation status of the bird and hence their conservation priority. Birds on the Red List are those of highest conservation concern, Amber List are of medium conservation concern and Green List are not considered threatened. The BirdWatch Ireland website[9] was accessed for information on birds of conservation concern.

All bird species are protected under the Wildlife Acts 1976 – 2018 but, for the purposes of this chapter, only records of species within the last 10 years which are Red or Amber-listed on BoCCI or listed on Annex 1 of the Birds Directive are subject to assessment. Species which are green-listed are considered to be of least conservation priority (Colhoun & Cummins, 2013).

The conservation status of mammals within Ireland and Europe is evaluated using one or more of the following documents; Wildlife Acts (1976 - 2018), the Red List of Terrestrial Mammals (Marnell *et al.*, 2009) and the EU Habitats Directive 92/43/EEC. The importance of the mammal population of the Site was evaluated using these documents.

Laois County Council's website[10] was accessed for information on relevant planning policy. The Laois planning portal[11] was accessed for information on other proposed or permitted developments within the Site and within the zone of influence.

The detailed description of the proposed development (see **Chapter 3**), detailed design drawings of the proposed development and other relevant chapters of this EIAR (e.g. **Chapter 7, Water**) were also reviewed as part of the desk study to fully understand the nature and extent of the proposed development and the likelihood of interactions between biodiversity and other environmental topics.

The Site has previously been subject to comprehensive ecological evaluation as part of the Pinewoods Wind Farm EIAR/EIS (see **Volume III**), all relevant documents associated with this EIAR/EIS; including **Chapter 4 (Flora & Fauna)**, the Natura Impact Statement, preliminary Construction & Environmental Management Plan (CEMP) and Surface Water Management Plan (SWMP); have been reviewed to allow for a comprehensive cumulative assessment of the proposed development in combination with the permitted Pinewoods Wind Farm.

5.2.4 Scoping and Consultation

A scoping request, providing details of the Site and the proposed development, was prepared by GES and circulated to consultees in February 2020. There was no response from consultees on biodiversity matters as of 14 August 2020. Full details of the scoping exercise, including scoping responses, are included in **Chapter 1** of this

[8] http://gis.epa.ie/ last accessed 12 June 2020)
[9] https://birdwatchireland.ie/ last accessed 12 June 2020)
[10] https://laois.ie/ (last accessed 12 June 2020)
[11] http://www.eplanning.ie/LaoisCC/searchtypes (last accessed 12 June 2020)

EIAR.

5.2.5 Field Survey

The Site was visited on 22 April 2020 and walked by Dr Úna Nealon. Weather conditions were clear and dry with a light breeze. The temperature was c. 17 °C. The objective of the site visit was to describe and evaluate the biodiversity of the Site.

Habitats within the Site were identified and classified using '*A Guide to Habitats in Ireland*' (Fossitt, 2000). The dominant plant species present in each habitat type were recorded. Species nomenclature follows Parnell & Curtis (2012) for scientific and English names of vascular plants.

Incidental sightings or evidence of birds, mammals or amphibians, or suitable habitat to support these species, was noted during the habitat survey. The habitats present were evaluated for their potential to support protected flora and fauna including foraging, commuting and roosting bats using Bat Conservation Trust Guidelines (Collins, 2016).

5.2.6 Limitations

Desk study data is unlikely to be exhaustive, especially in respect of species, and is intended mainly to set a context for the study. It is therefore possible that important habitats or protected species not identified during the data search do in fact occur within the vicinity of the Site but have not been previously recorded. Interpretation of maps and aerial photography has been carried out using recent imagery, but it has not been possible to verify the accuracy of any statements relating to land use and habitat context outside of the field study area.

The field survey was carried out under suitable weather conditions and all areas of the Site were accessible. While April is early in the growing season the habitats present are all commonly occurring and floristically species poor, thereby allowing confident habitat classification. The timing of the survey is not considered to be a limitation.

5.2.7 Assessment Methodology

The impact assessment methodology used in this chapter is based on the 2018 *Guidelines for Ecological Impact Assessment in the United Kingdom and Ireland* ("CIEEM guidelines").

5.2.7.1 Important Ecological Features

Ecological features can be important for a variety of reasons. Importance may relate, for example, to the quality or extent of the site or habitats therein; habitat and/or species rarity; the extent to which such habitats and/or species are threatened throughout their range, or to their rate of decline.

5.2.7.2 Determining Importance

The importance of an ecological feature should be considered within a defined geographical context. The following frame of reference has been used in this case, relying on known/published accounts of distribution and rarity where available, and professional experience:-

- International (European);
- National (Ireland);
- Regional (Leinster);
- County (Laois)

- Townland (Knockardagur);
- Local (intermediate area between Site and Townland); and
- Site (the planning application boundary of the development).

The above frame of reference is applied to the ecological features identified during the desk study and field surveys to inform this chapter.

In assigning a level of value to a species, it is necessary to consider its distribution and status, including a consideration of trends based on available historical records. Examples of relevant lists and criteria include species of European conservation importance (as listed on Annexes II, IV and V of the Habitats Directive or Annex 1 of the Birds Directive), species protected under the Wildlife Acts 1976 - 2018 and Birds of Conservation Concern (Colhoun & Cummins 2013).

The approach to impact assessment, as set out in CIEEM guidelines, only requires that ecological features (habitats, species, ecosystems and their functions/processes) that are considered to be important and potentially affected by the project are carried forward to detailed assessment. It is not necessary to carry out detailed assessment of receptors that are sufficiently widespread, unthreatened and resilient to impacts from the project and will remain viable and sustainable. Therefore, for the purposes of this chapter, only ecological features of Local importance or greater and/or subject to legal protection have been subject to detailed assessment.

5.2.7.3 Impact Assessment

The impact assessment process involves the following steps:-

- Identifying and characterising potential impacts;
- Incorporating measures to avoid and mitigate (reduce) these impacts;
- Assessing the significance of any residual effects after mitigation;
- Identifying appropriate compensation measures to offset significant residual effects (if required); and
- Identifying opportunities for ecological enhancement.

When describing impacts, reference has been made to the following characteristics, as appropriate:-

- Positive or negative;
- Extent;
- Magnitude;
- Duration;
- Timing;
- Frequency; and
- Reversibility.

The impact assessment process considers both direct and indirect impacts: direct ecological impacts are changes that are directly attributable to a defined action, e.g. the physical loss of habitat occupied by a species during the construction process. Indirect ecological impacts are attributable to an action, but which affect ecological resources through effects on an intermediary ecosystem, process or feature, e.g. the creation of roads which cause hydrological changes, which, in the absence of mitigation, could lead to the drying out of wet grassland.

Consideration of conservation status is important for evaluating the effects of impacts on individual habitats and species and assessing their significance:-

- Habitats – conservation status is determined by the sum of the influences acting on the habitat that may affect its extent, structure and functions as well as its distribution and its typical species within a given geographical area; and
- Species – conservation status is determined by the sum of influences acting on the species concerned that may affect its abundance and distribution within a given geographical area.

5.2.7.4 Significant Effects

The concept of ecological significance is addressed in paragraphs 5.24 through to 5.28 of CIEEM guidelines. Significance is a concept related to the weight that should be attached to effects when decisions are made. For the purpose of this chapter, a 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives for 'important ecological features' or for biodiversity in general. Conservation objectives may be specific (e.g. for a designated site) or broad (e.g. national/local nature conservation policy) or more wide-ranging (e.g. enhancement of biodiversity). Effects can be considered significant at a wide range of scales from international to Site, and the scale of significance of an effect may or may not be the same as the geographic context in which the feature is considered important.

5.2.7.5 Cumulative Effects

Cumulative effects can result from individually insignificant but collectively significant actions taking place over a period of time or concentrated in a location. Cumulative effects can occur where a project results in individually insignificant impacts that, when considered in-combination with impacts of other proposed or permitted plans and projects, can result in significant effects.

Other plans and projects that should be considered when establishing cumulative effects include:-

- Proposals for which consent has been applied but which are awaiting determination;
- Projects which have been granted consent, but which have not yet been started or which have been started but are not yet completed (i.e. under construction);
- Proposals which have been refused permission, but which are subject to appeal, and the appeal is undetermined;
- Constructed developments whose full environmental effects are not yet felt and therefore cannot be accounted for in the baseline; or
- Developments specifically referenced in a National Policy Statement, a National Plan or a Local Plan.

5.2.7.6 Avoidance, Mitigation, Compensation & Enhancement

Where likely significant effects have been identified, the mitigation hierarchy has been applied, as recommended in the CIEEM Guidelines. The mitigation hierarchy sets out a sequential approach beginning with the avoidance of impacts where possible, the application of mitigation measures to minimise unavoidable impacts and then compensation for any remaining impacts. Once avoidance and mitigation measures have been applied, residual effects are then identified along with any necessary compensation measures, and incorporation of opportunities for enhancement.

It is important for the impact assessment to clearly differentiate between avoidance

mitigation, compensation and enhancement and these terms are defined here as follows:-

- Avoidance is used where an impact has been avoided, e.g. through changes in scheme design;
- Mitigation is used to refer to measures to reduce or remedy a specific negative impact in situ;
- Compensation describes measures taken to offset residual effects, i.e. where mitigation in situ is not possible; and
- Enhancement is the provision of new benefits for biodiversity that are additional to those provided as part of mitigation or compensation measures, although they can be complementary.

5.3 Description of Existing Environment

This section sets out the baseline biodiversity conditions within the Site using the findings of the desk study and field survey.

5.3.1 Sites Designated for Nature Conservation

5.3.1.1 Natura 2000 Sites

The likelihood of significant effects on Natura 2000 sites is addressed in the Appropriate Assessment Screening Report and Natura Impact Statement (NIS) prepared for the proposed development (SLR Consulting, 2020). There are no Natura 2000 sites within or adjacent to the Site.

The Knockardagur stream drains from the Site to join the Owenbeg (Owveg) River c. 1.4 km to the east of the Site. The Owenbeg (Owveg) River forms part of the River Barrow and River Nore SAC 002162.The Site is considered to be connected to this Natura 2000 site via Knockardagur stream.

The next closest SAC is Lisbigney Bog SAC (000869), located c. 5.9 km south-west of the Site. Effects on this SAC are not considered likely given its distance from the Site, the features for which the SAC is designated and the lack of landscape[12] or ecological[13] connectivity.

The closest SPA is the River Nore SPA 004233, located c. 5.7 km west of the Site. This SPA includes the lower reaches of the Owenbeg (Owveg) River, downstream of the Site. The site is designated for the conservation of a single species, kingfisher *Alcedo atthis*. Effects on kingfisher are not considered likely due to the nature and scale of the proposed development, the distance between the Site and the SPA and the absence of suitable habitat features for kingfisher within the development site.

Further distant Natura 2000 sites are located in excess of 5.9 km from the Site and are not considered likely to be affected by the proposed development due to the nature and scale of the proposed development, in addition to their distance from the Site, the absence of landscape or ecological connectivity and the features for which the Natura 2000 sites are designated.

The River Barrow and River Nore SAC 002162 is within 2 km of the Site and is included

[12] Landscape connectivity is a combined product of structural and functional connectivity, i.e. the effect of physical landscape structure and the actual species use of the landscape (Kettunen *et al.* 2007)

[13] Connectivity is defined as *a measure of the functional availability of the habitats needed for a particular species to move through a given area. Examples include the flight lines used by bats to travel between roosts and foraging areas or the corridors of appropriate habitat needed by some slow colonising species if they are to spread* (CIEEM, 2018).

for detailed assessment due to its proximity and the discharge of surface water from the Site to the Knockardagur stream. A map of the Site location relative to Natura 2000 sites is available at **Annex 5.2 (Volume II)**.

5.3.1.2 Natural Heritage Areas/Proposed Natural Heritage Areas

There are no Natural Heritage Areas (NHAs) or proposed Natural Heritage Areas (pNHAs) within 2 km (i.e. zone of influence) of the proposed development. The closest is Lisbigney Bog pNHA (000869), located approximately 5.9 km south-west of the Site. The Site is not connected via ecological or landscape features such as hedgerows or treelines or surface water pathways to any NHA/pNHA.

There is no likelihood of impacts on NHAs/pNHAs given the nature and scale of the project, the localised nature of any likely impacts and the distance between the Site and the NHAs/pNHA. Therefore, NHAs/pNHAs are scoped out and excluded from any further consideration in this chapter.

5.3.2 Habitats

Habitats present within the Site are described in this section. A habitat map for the Site is presented at **Annex 5.2**. Photographs of the sites are provided as plates at **Annex 5.3 (Volume II)**.

Improved agricultural grassland GA1

The dominant habitat type within the Site is improved agricultural grassland used for cattle grazing (**Plate 1**). Plant species recorded within this habitat include sweet-vernal grass *Anthoxanthum odoratum*, Yorkshire fog *Holcus lanatus*, meadow buttercup *Ranunculus acris*, creeping buttercup *Ranunculus repens*, clover *Trifolium* sp., daisy *Bellis perennis*, dandelion *Taraxacum officinale* agg. and ribwort plantain *Plantago lanceolata*.

Small isolated areas of more disturbed grassland contained frequently occurring dock *Rumex obtusifolius*, nettle *Urtica dioica* and common ragwort *Senecio jacobaea*. In areas close to the Knockardagur stream, soft rush *Juncus effuses* was the dominant species.

This habitat type is species-poor, and commonly occurring throughout Ireland. This habitat is evaluated as not important and, as a result, is scoped out and not considered further in this chapter.

Hedgerows WL1

There is approximately 712 m of hedgerows within the Site (**Plate 2**). Hedgerows border the western and southern boundaries and are present along the Knockardagur stream, bisecting the Site from east to west.

Hedgerows are dominated by hawthorn *Crataegus monogyna*, blackthorn *Prunus spinosa*, willow *Salix sp.*, holly *Ilex aquifolium*, gorse *Ulex europaeus* and bramble *Rubus fruticosus* agg. Several mature beech *Fagus sylvatica* and ash *Fraxinus excelsior* trees are also present in the hedgerows.

Hedgerows within the Site are associated with dry drainage ditches.

The dry drainage ditches are vegetated with species such as lesser stitchwort *Stellaria graminea*, bush vetch *Vicia sepium*, bluebell *Hyacinthoides non-scripta*, common mouse-ear *Cerastium fontanum* and herb Robert *Geranium robertianum*.

Hedgerows within the Site are species poor, overgrown, lack a dense base and are

gappy. The hedgerows within the Site are connected to the wider network of hedgerows in the surrounding area. The hedgerows provide ecological connectivity between the Site and the surrounding landscape. Hedgerows within the Site are evaluated as important at the Local level.

Eroding/upland river FW1

The Knockardagur stream is classified as an Eroding/Upland River (FW1) (see **Volume II, Annex 5.3, Plate 3**). The stream rises approximately 10 m south of the substation footprint and flows in a westerly direction to meet the Owenbeg (Owveg) River, approximately 1.4 km east of the Site.

During the field survey in April 2020, water levels in the stream were extremely low with no apparent flow and water present only in muddy or rocky puddles. The substrate in this watercourse is varies between mud and gravel. Given the absence of flow within the stream during the field survey, it is considered that the presence of water is highly dependent on prevailing weather conditions and is only likely to contain flow following rainfall events.

The Knockardagur stream connects to watercourses downstream of the Site and provides connectivity with the River Barrow and River Nore SAC. This habitat within the Site is evaluated as important at the Local level.

5.3.3 Species

5.3.3.1 Rare and Protected Species

The NBDC database was searched for records of rare and/or protected species within the 2 km grid square S58B within which the Site is located. One record was returned for little egret *Egretta garzetta*. Little egret is listed on Annex I of the EU Birds Directive and is green-listed on BoCCI. There was no evidence of little egret recorded during field surveys carried out at the Site and habitats within the Site are unsuitable for this wetland species.

The absence of records of species from the NBDC database does not necessarily imply that a species does not occur within the search area, rather it has not formally been recorded as present. However; there was no evidence of other rare or protected species recorded during the field survey and the habitats present are not likely to support protected species.

5.3.3.2 Amphibians

Common frog *Rana temporia* and smooth newt *Lissotriton vulgaris* are protected under the Wildlife Acts 1976 to 2018. Species protected under the Wildlife Act are those listed on Schedule 5. Since the publication of the Wildlife Act 1976, the list of Schedule 5 species has been extended through the publication of Wildlife Act 1976 (Protection of Wild Animals) Regulations in 1980 and 1990. Common frog and smooth newt were added to the Wildlife Act 1976 by regulations made in SI 282/1980.

During the field survey, no evidence of amphibians was recorded and no habitat suitable for breeding amphibians was noted. Drainage ditches and the Knockardagur stream were dry, offering no suitable amphibian habitat.

Therefore, it is considered that the proposed development will not result in any effect on the amphibian population of the Site. Amphibians can therefore be scoped out of further consideration in this chapter.

5.3.3.3 Birds

Bird species recorded during the site visit include wood pigeon *Columba palumbus*, hooded crow *Corvus cornix*, magpie *Pica pica*, robin *Erithacus rubecula*, blackbird *Turdus merula*, song thrush *Turdus philomelos* and chaffinch *Fringilla coelebs*. All species recorded during the field visit are commonly occurring, widespread in Ireland and are all Green-listed (least concern) species on BoCCI. The bird assemblage of the Site would be evaluated as important at the Site level.

5.3.3.4 Mammals

Bats

All species of bat occurring in Ireland are protected under the Annex IV of EU Habitats Directive, which is transposed into Irish law through the EC (Birds and Natural Habitats) Regulations 2011 - 2015. Bats are also protected under the Wildlife Acts 1976 - 2018. Under this legislation, it is an offence to intentionally kill or injure a bat or intentionally destroy or disturb a breeding place or resting place.

Potential roost features (PRFs) that may be used by bats, in the form of splits, rot holes and butt rot, were noted in mature ash trees within the hedgerow immediately south of the footprint of the proposed substation. These roost features were inspected from ground level and were assessed as moderate suitability for roosting bats (Collins, 2016). In addition, hedgerow habitats within the Site are considered to be moderately suitable for foraging and commuting bats (Collins, 2016). The bat population using the Site is evaluated as important at the Local level.

Otter

Otter *Lutra lutra*, and their breeding and resting places, are protected under the Wildlife Acts. Otter are also listed in Annex II and Annex IV of the EU Habitats Directive.

The Knockardagur stream and drainage ditches within the Site were inspected for signs of otter during the site visit. There was no evidence of otter present and neither the drainage ditches nor the stream offers suitable habitat to support foraging, commuting or breeding otter. Therefore, otter is scoped out and not considered further within this chapter.

Other Mammals

During the field survey, no evidence of the presence of other mammals, such as badger *Meles meles*, were noted within the Site. Due to the intensively farmed nature of the Site, there is not likely to be usage of the Site by mammals for breeding. While mammals such as badger may occasionally use the Site for foraging, there were no signs of this noted during the site visit. Therefore, due to lack of suitable breeding and foraging habitats within the Site, other mammals, such as badger, are excluded from further consideration in this chapter.

5.3.3.5 Invasive Species

The NBDC database was searched for records of non-native invasive species listed under the Third Schedule of the European Communities Regulations 2011 (as amended) (S.I. 477 of 2015) within the 2 km grid square S58B within which the Site is located. No records were returned.

There was no evidence of any invasive species recorded during the walkover survey carried out at the Site and invasive species are excluded from further consideration

within this chapter.

5.3.4 Summary of Important Ecological Features

The ecological features to be carried forward for detailed assessment are summarised in **Table 5.1** below.

Ecological Feature	Scale at which the feature is important	Comments on Legal Status and/or Importance
Natura 2000 sites	International	SACs and SPAs are designated under the EU Habitats Directive and EU Birds Directive. The River Barrow and River Nore SAC 002162 is included for detailed assessment due to its indirect connection to the Site and the discharge of surface water from the Site to the Knockardagur stream.
Hedgerows	Local	This habitat provides connectivity with hedgerows in the surrounding landscape.
Eroding/upland rivers	Local	The Knockardagur stream provides connectivity to watercourses downstream of the Site including the River Barrow and River Nore SAC.
Bats	Local	All species of bat occurring in Ireland are protected under the Annex IV of EU Habitats Directive and the Wildlife Acts 1976 - 2018. Habitats within the Site are suitable for foraging, commuting and roosting bats.

Table 5.1: Summary of Important Ecological Features

5.4 Description of Likely Effects

The iterative design process applied to the development has incorporated a series of design principles, good practice environmental and pollution control measures in line with current industry good practice guidance and 'designed-in' mitigation.

- An outline Construction Environmental Management Plan (CEMP) has been prepared and incorporates site specific environmental protection and pollution prevention measures;
- A site specific surface water drainage design, incorporating the principles of Sustainable Drainage Systems (SuDS), has been prepared for the development. The design includes surface water drainage infrastructure to ensure that deleterious matter will not be discharged to the Knockardagur Stream;
- The lighting design for the development has minimised the number of lamp posts/lights in order to minimise light pollution and light intensity. The proposed lamp posts/lights are cowled to ensure that adjacent vegetation is not illuminated. The substation lighting will only be used when maintenance personnel are present;
- Landscaping measures are incorporated into the design of the proposed development. These are listed in full in **Chapter 9** of this EIAR and include features to minimise loss of biodiversity on-site. Such measures include the following:-
  - Any hedgerows that are to be retained will be protected from damage during construction;
  - The hedgerows will be planted atop the embankment along the northern

and eastern boundaries of the proposed substation. The hedgerow species will reflect the species composition of hedgerows being removed and those being retained;
- The hedgerows along the southern and western boundaries of the proposed substation will be retained and will be supplemented by additional planting as appropriate; and
- Hedgerows within the Site will be managed post-construction to maintain a height of approximately 3-4 m.

Taking the above into account, the principal likely effects of the proposed development are outlined in the following sections.

5.4.1 Do Nothing Impact

In the absence of the proposed development, it is likely that current agricultural activities within the Site will continue and the Do-Nothing Impact will result in no significant change in the ecological interest of the Site.

5.4.2 Likely Effects

5.4.2.1 Natura 2000 Sites

An Appropriate Assessment Screening Report and NIS has been prepared to provide the information necessary for the competent authority, in this case An Bord Pleanála, to undertake an appropriate assessment of the proposed development. The NIS considers that the proposed development, either individually or in combination with other plans or projects, will not have an adverse effect on the integrity of the River Barrow and River Nore SAC.

As per EPA draft Guidance (2017), "a *biodiversity section of an EIAR, should not repeat the detailed assessment of potential effects on European sites contained in a Natura Impact Statement*" but should "*incorporate their key findings as available and appropriate*". This section provides a summary of the key findings with regard to the River Barrow and River Nore SAC.

Construction Phase

The proposed development is not located within the River Barrow and River Nore SAC and will not directly impact on this Natura 2000 site. However, surface water run-off during the construction phase will be discharged to the Knockardagur stream and has the potential to indirectly affect the SAC.

The proposed surface water drainage infrastructure, as described in the SWMP, has been designed with regard to greenfield runoff rates and volumes. The surface water drainage system will mimic these rates and is sufficient to accommodate a 1-in-100 year rainfall event. Therefore, no changes to the flow regime are anticipated and effects from hydrological changes are not considered likely.

There is potential, in the absence of mitigation and good working practices, for the discharge of surface water to affect water quality within the Knockardagur stream during construction and subsequently, the SAC. The discharge of contaminated surface water (silt/sediment laden runoff, hydrocarbons, cementitious water) to the existing surface water network has the potential to cause negative effects through the deterioration of water quality, increases in siltation or suspended solids, changes in water chemistry and reduction in habitat.

The following key aquatic species and habitats of the River Barrow and River Nore SAC were identified as being at risk from a deterioration in water quality:-

- Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260];
- *Austropotamobius pallipes* (White-clawed Crayfish) [1092];
- *Petromyzon marinus* (Sea Lamprey) [1095];
- *Lampetra planeri* (Brook Lamprey) [1096];
- *Lampetra fluviatilis* (River Lamprey) [1099];
- *Alosa fallax* (Twaite Shad) [1103];
- *Salmo salar* (Salmon) [1106];
- *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029]
- *Margaritifera durrovensis* (Nore Pearl Mussel) [1990].

The proposed development is not likely to affect any other features of interest associated with SAC due to the nature and/or distribution of these features of interest within the SAC. The effect on the water quality of the SAC arising from the construction phase, in the absence of mitigation, is likely to be significant at an International (European) level.

Operational Phase

During the operational phase, there is no potential for direct impacts on the River Barrow and River Nore SAC. However, the discharge of surface water from the completed development to the Knockardagur stream has the potential to indirectly affect the SAC.

There will be no storage of oils/fuels/lubricants outside of the substation building and therefore there is no risk to surface water quality from hydrocarbon/chemical spillage during the operational phase. Stormwater, arising from the transformer area and car park areas will be discharged to the Knockardagur Stream via a soakaway (and oil interceptor) to an existing agricultural drain to the west of the Site. Stormwater discharge will be limited to greenfield runoff rates and volumes. The incorporation of these design measures is sufficient to prevent any effects due to stormwater runoff during the operational phase.

Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, decommissioning phase effects will not occur.

5.4.2.2 Hedgerows

Construction Phase

A short section of the hedgerow running from east to west along the southern perimeter of the proposed substation will be removed to facilitate construction of the proposed access track. Similarly, a short section of hedgerow along the southern perimeter of the Site boundary will also require removal to accommodate the construction of the proposed site entrance. The progressive reinstatement and landscaping of the site will remediate any short term adverse effects on hedgerows within and bordering the Site. Therefore, the effect of the loss of hedgerow would be significant at the Site level.

Operational Phase

Hedgerow planting around the perimeter of the proposed development will be implemented during the operational phase resulting in an overall net gain in hedgerow habitats within the Site over the medium term.

Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, decommissioning phase effects will not occur.

5.4.2.3 Knockardagur stream

Construction Phase

The proposed surface water drainage infrastructure has been designed to prevent any changes to the flow regime within the Knockardagur stream. There will be no discharge of wastewater effluent on-site and the proposed development is not likely to generate emissions other than surface water runoff.

The discharge of surface water from the Site during the construction phase is not likely to affect water quality downstream due to the incorporation of environmental protection measures in the drainage design for the development. Measures to protect water quality will be put in place before site clearance works commence. There will be no significant effect on the water quality of the Knockardagur stream during the construction phase of the development.

Operational Phase

Stormwater will be treated prior to discharge to the Knockardagur stream and will be limited to greenfield runoff rates and volumes, ensuring no adverse water quality effects within the local stream. With these measures incorporated into the drainage design, there will be no significant effect due to stormwater runoff during the operational phase.

Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, decommissioning phase effects will not occur.

5.4.2.4 Bats

Construction Phase

Hedgerows within the Site were evaluated as moderately[14] suitable for foraging and commuting bats. The loss of small sections of hedgerow to facilitate access is not likely to affect foraging and commuting bats' use of these hedgerows. Construction activities associated with the project will be temporary and will largely take place during daylight hours when foraging and commuting bats are absent.

Trees within the hedgerow south of the proposed substation footprint contain PRFs of moderate suitability for roosting bats. A number of these trees will be removed to facilitate the construction of the proposed access track. The effect on the bat population of the loss of short sections of some hedgerows and the loss of trees with PRFs would be significant at the Townland level.

Operational Phase

The proposed hedgerow planting will, in the medium term, once established provide replacement foraging and commuting habitat for bats. The majority of maintenance works at the Site will be undertaken during daytime hours. However,

[14] Criteria used for evaluation is from Bat Conservation Trust (BCT) 2016 guidance

occasionally emergency works may be required during night-time hours. Artificial lighting for the development will only be used when maintenance personnel are present at night. Lighting has been designed to incorporate measures to avoid light spill in to surrounding vegetation. The effects on bats during the operational phase will not be significant.

Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, decommissioning phase effects will not occur.

5.5 Mitigation Measures

5.5.1 Natura 2000 Sites

The Surface Water Management Plan (SWMP) and detailed drainage design for the development incorporates a large number of tried and tested measures that are used as standard by industry for protection of water quality. The design and mitigation measures are set out in detail in the SWMP but can be summarised as measures to prevent sediment release to surface water features during the construction phase of the development. The SWMP standard measures also include regulation of flow to prevent scouring and allow settlement of sediment to occur.

Erosion and sediment control will be put in place to protect the Knockardagur stream before commencement of any site clearance and earthworks. Exposed soil is to be kept to a minimum throughout construction to further reduce risk of sediment release during rainfall events. Vegetation cover will be re-established as soon as practical on all areas where soil has been exposed. Erosion and sediment controls will be monitored and maintained on a continuous basis throughout the construction phase.

5.5.1.1 Construction Phase

Measures to be employed during the construction phase to prevent the transport of deleterious substances to the Knockardagur stream and potentially downstream to the River Barrow and River Nore SAC are as follows:

- Surface water will pass through interception, such as silt traps, to ensure suspended solids will not reach any watercourses;
- Silt traps/settlement ponds and temporary interceptors and traps will be put in place on site prior to any site clearance/earthworks and will be used until such time as permanent facilities are constructed;
- All fuels, lubricants and hydraulic fluids will be kept in secure bunded areas, within the permitted Pinewoods Wind Farm construction compound, away from watercourses. The bunded area will accommodate 110% of the total capacity of the containers within it;
- Containers will be properly secured to prevent unauthorised access and misuse. An effective spillage procedure will be put in place and spill kits provided with all staff properly briefed and trained;
- Any waste oils or hydraulic fluids will be collected, stored in appropriate containers and disposed of offsite in an appropriate manner;
- Fuelling and lubrication will not be conducted within 50 m of any surface water feature including the Knockardagur stream;
- Attenuation ponds have been designed to accommodate Greenfield runoff rates + 20% for climate change.

Measures specific to protection of water quality for freshwater pearl mussel

These measures have been included to further reduce any risk of effects on water quality during the construction phase. The specific measures are as follows:-

- The measures described in Altmüller and Dettmer (2006) to protect water quality within freshwater pearl mussel catchments have been adapted for the proposed development and are incorporated in the SWMP. It is not proposed to adopt the measures in full but, instead, to adapt and implement them in accordance with the characteristics of the Site; and
- Disturbed Sediment Entrainment Mats - SEDIMATS (see http://www.hy-tex.co.uk/ht_bio_sed.html) will be used in the Knockardagur stream. These will be installed according to the manufacturer's instructions at suitable locations along the stream.

In advance of any works taking place, the appointed contractor will be required to finalise the CEMP and provide site-specific. Method Statements detailing specific measures to protect the surface water drainage network. The final CEMP, along with the SWMP, will be submitted to and agreed with the Planning Authority.

5.5.1.2 Operational Phase

The following surface water protection measures will be implemented to avoid effects from hydrocarbon/chemical spillage:-

- All storage containers will be labelled appropriately, including hazardous markings;
- All holding tanks will be constructed of material appropriate for fuel/chemical storage and will be bunded to at least 110% of the maximum tank volume or 25% of the total capacity of all the tanks within the bund, whichever is greatest;
- Bunds will be to standard specified in CIRIA Report 163 '*Construction of bunds for oil storage tanks*' and CIRIA Report C535 '*Above-ground proprietary prefabricated oil storage tank systems*';
- Barrels and bunded containers will be stored upright and internally where appropriate and always on drip trays or sump pallets;
- Appropriate spill kits will be available at all storage locations;
- All fuel/chemical storage facilities will be subject to weekly inspection; and,
- Leaking or empty drums will be removed from the Site immediately and disposed of via a registered waste disposal contractor.

5.5.1.3 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, no decommissioning phase mitigation measures are required.

5.5.2 Hedgerows

The loss of small sections of hedgerow during the construction phase will be mitigated by the 'designed-in' measures outlined in **Section 5.4.** These measures involve replanting and, where appropriate, the bolstering or reinforcing of existing hedgerows. There are no further mitigation measures proposed or required for the construction, operation and decommissioning phases.

5.5.3 Eroding/upland river

The protection of water quality during the construction phase will be addressed by the incorporation of surface water management measures, as outlined in **Sections**

5.5.1 and **5.5.1.1**, into the design of the development. These measures are tried and tested and are used as standard by industry for protection of water quality. These measures prevent sediment release to surface water features along with regulation of flow to prevent scouring and allow settlement of sediment to occur. There are no further mitigation measures proposed or required for the construction, operation and decommissioning phases.

5.5.4 Bats

5.5.4.1 Construction Phase

Bats are highly mobile animals that use a number of roost sites within and between years. Bats use different parts of the tree for different reasons, depending on the time of year and temperature. Trees identified with Potential Roost Features (PRF) during the site visit in April 2020 will be clearly marked and at pre-construction stage these trees be visually inspected from the ground, as a minimum, during the daytime to check for signs of use by bats and to revaluate their suitability for bats. This inspection and evaluation will be informed by the findings of the survey work in April 2020. The trees will be inspected by a suitably qualified and experienced ecologist sufficiently in advance of felling so that there is sufficient time to seek a derogation licence, if required, in advance of felling. The appointed ecologist will also advise on the need, if any, for additional pre-construction bat surveys based on the findings of their daytime inspection.

In the event that bats are present, or it is clear that the tree is used by roosting bats, in a tree to be removed, a derogation licence will be obtained from the NPWS prior to tree removal. The licence application would be supported by a Method Statement detailing appropriate measures to ensure no bat is harmed during the felling of the trees. Mitigation measures for the loss of the roost would also be provided. All of the trees will be visually inspected again within 48 hours of tree removal and removal will be carried out under the supervision of the ecologist named on the derogation licence.

5.5.4.2 Operational Phase

Other than 'designed-in' measures relating to hedgerow planting and lighting, as described in **Section 5.4**, no specific mitigation measures are proposed for the operational phase.

5.5.4.3 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, no decommissioning phase mitigation measures are required.

5.6 Residual Effects

5.6.1 Construction Phase

With 'designed-in' measures in place and with the implementation of mitigation measures, as detailed above, residual effects during the construction phase of the proposed development will not be significant.

5.6.2 Operational Phase

With 'designed-in' measures in place and with the implementation of mitigation measures, as detailed above, residual effects during the operational phase of the proposed development will not be significant.

5.6.3 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, residual decommissioning phase effects will not occur.

5.7 Cumulative Effects

Cumulative effects can result from individually insignificant but collectively significant actions taking place over a period of time or concentrated in a location. Cumulative effects can occur where a proposed development results in individually insignificant impacts that, when considered in-combination with impacts of other proposed or permitted plans and projects, can result in significant effects (CIEEM, 2018).

The following plans and projects, located within the 2 km zone of influence and identified in **Chapter 1**, were reviewed for the likelihood of in-combination effects with the proposed development:-

- Pinewoods Wind Farm;
- Laois-Kilkenny Grid Reinforcement Project;
- Laois County Development Plan 2017-2023; and
- Laois County Council planning portal was accessed to examine planning applications in the vicinity of the Site.

5.7.1 Pinewoods Wind Farm

The permitted Pinewoods Wind Farm was reviewed to evaluate the likelihood of cumulative biodiversity effects arising. The construction, operation and decommissioning of the Pinewoods Wind Farm was subject to EIA and AA and is not likely to result in any significant residual effects on the ecological environment.

5.7.2 Laois-Kilkenny Grid Reinforcement Project

The permitted Laois-Kilkenny Grid Reinforcement Project will reinforce the network in the Laois-Kilkenny region through the development of a new transmission line between the two counties. The EIA for the project concluded that, with appropriate mitigation and good practice, ecological impacts of the project are likely to be imperceptible. In addition, the NIS determined the project would not adversely affect the integrity of the River Barrow and River Nore SAC, in view of the site's conservation objectives.

5.7.3 Laois County Development Plan 2017-2023;

There are no strategies or objectives in the County Development Plan that are likely to result in significant effects when considered in-combination with the proposed development.

5.7.4 Projects on Laois County Council Planning Portal

Planning applications within 2 km of the Site typically consist of single rural dwellings, extensions to dwellings and small agricultural developments and are not considered likely to result in any significant effects when considered in-combination with the proposed development.

5.7.5 Assessment of Cumulative Effects

The likelihood of the proposed development interacting with other plans and projects resulting in cumulative effects on water quality within the Knockardagur

stream, the Owenbeg (Owveg) River and hence, the River Barrow and River Nore SAC is considered. The proposed development includes a range of measures to ensure all surface water runoff generated during construction, operation and decommissioning is comprehensively attenuated such that no silt or sediment laden waters or any deleterious material is discharged to the local drainage system. The implementation of these measures ensures that there is no likelihood of significant cumulative effects on any downstream receptors, in combination with other plans or projects.

The proposed development will not result in any significant residual effects on any habitats or species. With 'designed-in' measures in place and with the implementation of the mitigation measures provided, it is not considered likely that the proposed development will result in cumulative effects on any habitats or species.

Taking into consideration the reported residual effects of other plans and projects within the zone of influence and the residual effects of the proposed development, no cumulative effects have been identified with regard to any ecological receptor.

5.8 Summary

The following table presents important ecological features which have been identified as likely to be affected by the proposed development; identifies the impacts which are assessed as likely to occur and outlines the residual impacts predicted to occur following the implementation of mitigation measures. Residual impacts on these features are at the lower end of the significance spectrum and range from 'none' to 'slight-negative'.

Ecological Features	Predicted Effects	Mitigation Measures	Residual Effects
Natura 2000 Sites	Surface water runoff during construction, operation & decommissioning may cause a deterioration of water quality in the Knockardagur Stream & hence the River Barrow & River Nore SAC.	Surface water protection measures to ensure runoff is comprehensively attenuated such that no silt or sediment laden waters or any deleterious material is discharged to the local drainage system or the SAC.	No significant residual effects.
Hedgerows	There will be no significant effect on hedgerows.	The mitigation is 'designed-in'.	No significant residual effects.
Eroding/upland river	Surface water runoff during construction, operation & decommissioning may cause a deterioration of water quality in the Knockardagur Stream & the downstream aquatic environment.	Surface water protection measures to ensure runoff is comprehensively attenuated such that no silt or sediment laden waters or any deleterious material is discharged to the local drainage system.	No significant residual effects.
Bats	There will be no	A pre-construction	No significant

	significant effect on bats due to 'designed-in' measures relating to landscaping and lighting design. The loss of some sections of hedgerow and the potential loss of trees containing PRFs would be significant at the Townland level.	inspection of trees to be removed. In the event that bats are present in one, or more, of the trees then, a bat derogation licence will be required prior to tree removal.	residual effects.

Table 5.2: Summary of impacts, mitigation and residual impacts on Important Ecological Features

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BirdWatch Ireland	https://birdwatchireland.ie/
EPA Mapping	http://gis.epa.ie/
Google Maps	https://www.google.ie/maps

Laois Planning Portal	http://www.eplanning.ie/LaoisCC/searchtypes
NPWS	https://www.npws.ie/protected-sites
NBDC	https://maps.biodiversityireland.ie/

GALETECH
ENERGY SERVICES

Pinewoods Wind Farm Substation and Grid Connection

Chapter 6: Land & Soil

Pinewoods Wind Ltd

Galetech Energy Services
Clondargan, Stradone, Co. Cavan Ireland
Telephone +353 49 555 5050
www.galetechenergy.com

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6.1 Introduction

6.1.1 Background and Objectives

This chapter provides an assessment of the likely effects of the proposed development (110kV substation, access track and associated works) on the land, soil and geological environment.

The assessment provides a description of the baseline environmental setting of the proposed development in terms of land, soils and geology and identifies the likely and significant effects that the construction, operation and decommissioning of the proposed development will have on them. Where required, appropriate mitigation measures to limit any identified effects to land, soils and geology are recommended. The residual effects of the proposed development post-mitigation are also assessed.

6.1.2 Development Description

In summary, the proposed development comprises the following main components:-

- 1 no. 110kV 'loop in-loop out' air-insulated switchroom (AIS) substation including control buildings, transformers and all ancillary electrical equipment; and
- All associated site development, access and reinstatement works.

Due to the sloping nature of the proposed development site, and in order to minimise the volume of material to be excavated to provide the substation footing; the design of the proposed development has incorporated a split-level approach.

The entirety of the proposed development is located within the administrative area of County Laois; while part of the overall project (Pinewoods Wind Farm) is located within County Kilkenny. Additionally, candidate quarries which may supply construction materials are also located within County Kilkenny and Carlow.

The full project description is provided at **Chapter 3** of this EIAR.

6.1.3 Statement of Authority

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

Our core areas of expertise and experience include water and geology. We routinely complete impact assessments for land soils and geology, hydrology and hydrogeology for a large variety of project types, including wind farms and associated grid connections.

This chapter was prepared by Michael Gill and David Broderick.

Michael Gill is an Environmental Engineer with over 18 years' environmental consultancy experience in Ireland. Michael has completed numerous geological, hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland. In addition, he has substantial experience in surface water drainage design and SUDs design and surface water/groundwater interactions. For example, Michael has worked on the EIS for the Oweninny Wind Farm, Cloncreen Wind Farm, and Carrownagown Wind Farm, and over 100 other wind farm related

projects across the country.

David Broderick is a hydrogeologist with over 13 years' experience in both the public and private sectors. Having spent two years working in the Geological Survey of Ireland, working mainly on groundwater and source protection studies, David moved into the private sector. David has a strong background in groundwater resource assessment and hydrogeological/hydrological investigations in relation to developments such as quarries and wind farms. David has also completed numerous geology and water assessments for inclusion within EIARs for a range of commercial developments. David has worked on the EIS for the Oweninny Wind Farm, Cloncreen Wind Farm, Meenbog Wind Farm, Arderroo Wind Farm and Yellow River Wind Farm, and over 80 other wind farm related projects across the country.

6.1.4 Relevant Legislation

This EIAR has been prepared in accordance with the requirements of European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the 'EIA Directive') as amended by Directive 2014/52/EU.

Regard has also been taken of the requirements of the following legislation:-

- S.I. No. 296 of 2018 European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2001-2018;
- European Communities (Environmental Impact Assessment) Regulations 1989 to 2006;
- S.I. No. 30 of 2000 the Planning and Development Act, 2000 as amended; and
- S.I. No. 4 of 1995: The Heritage Act 1995, as amended.

6.1.5 Relevant Guidance

This chapter has been prepared in accordance with the 'EIA Directive' as amended by Directive 2014/52/EU and having regard, where relevant, to guidance contained in the following documents:-

- Environmental Protection Agency (2017): Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports;
- Institute of Geologists Ireland (2013): Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements;
- National Roads Authority (2008): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Wind Energy Development Guidelines for Planning Authorities (2006);
- Forestry Commission (2004): Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh; and,
- COFORD (2004): Forest Road Manual – Guidelines for the Design, Construction and Management of Forest Roads;
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DoHPLG, 2018); and,
- Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU), (European Union, 2017).

6.2 Methodology

6.2.1 Desk Study

A desk study of the proposed development, and its environs, was completed in advance of undertaking the walkover survey (see below). This desk study involved collecting all relevant land and geological information for the proposed development site and the nearby permitted Pinewoods Wind Farm site. Data sources included:-

- Environmental Protection Agency database (www.epa.ie);
- Geological Survey of Ireland - Groundwater Database (www.gsi.ie);
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 18 (Geology of Tipperary). Geological Survey of Ireland (GSI, 1999);
- Geological Survey of Ireland – 1:25,000 Field Mapping Sheets;
- General Soil Map of Ireland 2nd edition (www.epa.ie); and;
- Pinewoods Wind Farm EIS Land, Soils and Water chapters (Galetech, 2016).

Concerns raised by local residents and consultees in previous submissions related to the Pinewoods Wind Farm as they relate to effects on land, soil and the geological environment were also assessed in the preparation of this chapter.

6.2.2 Baseline Monitoring & Site Investigations

A walkover survey and geological mapping of the site was undertaken by HES on 20 March 2020. Trials holes were undertaken by the Applicant within the site of the proposed development on 21 January 2020.

A comprehensive site investigation, comprising trial pits and gouge cores, was previously undertaken by HES on 30 and 31 March 2015 for the then-proposed, and now permitted, Pinewoods Wind Farm.

6.2.3 Receptor Importance/Sensitivity Criteria

In addition to the utilisation of sensitivity and receptor importance criteria outline within the abovementioned EPA Guidance (EPA 2002 and 2017), this assessment, in accordance with National Roads Authority (NRA 2008) guidance, quantifies the importance of the land, soil and geology environments within the study area by applying the criteria set out in **Table 6.1**, with the impact magnitude and impact rating/significance subsequently assessed using **Table 6.2.**

Importance	Criteria	Typical Example
Very High	• Attribute has a high quality, significance or value on a regional or national scale. • Degree or extent of soil contamination is significant on a national or regional scale. • Volume of peat and/or soft organic soil underlying route is significant on a national or regional scale.	• Geological feature rare on a regional or national scale (NHA). • Large existing quarry or pit. • Proven economically extractable mineral resource.
High	• Attribute has a high quality,	• Contaminated soil on site with

	significance or value on a local scale. • Degree or extent of soil contamination is significant on a local scale. • Volume of peat and/or soft organic soil underlying site is significant on a local scale.	previous heavy industrial usage. • Large recent landfill site for mixed wastes. • Geological feature of high value on a local scale (County Geological Site). • Well drained and/or high fertility soils. • Moderately sized existing quarry or pit. • Marginally economic extractable mineral resource.
Medium	• Attribute has a medium quality, significance or value on a local scale. • Degree or extent of soil contamination is moderate on a local scale. • Volume of peat and/or soft organic soil underlying site is moderate on a local scale.	• Contaminated soil on site with previous light industrial usage. • Small recent landfill site for mixed Wastes. • Moderately drained and/or moderate fertility soils. • Small existing quarry or pit. • Sub-economic extractable mineral resource.
Low	• Attribute has a low quality, significance or value on a local scale. • Degree or extent of soil contamination is minor on a local scale. • Volume of peat and/or soft organic soil underlying site is small on a local scale.	• Large historical and/or recent site for construction and demolition wastes. • Small historical and/or recent landfill site for construction and demolition wastes. • Poorly drained and/or low fertility soils. • Uneconomically extractable mineral resource.

Table 6.1: Estimation of Importance of Soil and Geology Criteria (NRA, 2008)

Impact Characteristics		Geological/Hydrological Impacts
Quality	Significance	
Negative only	Profound	• Widespread permanent impact on:- o The extent or morphology of a cSAC. o Regionally important aquifers. o Extents of floodplains. • Mitigation measures are unlikely to remove such impacts.

Positive or Negative	Significant	• Local or widespread time dependent impacts on:- o The extent or morphology of a cSAC / ecologically important area. o A regionally important hydrogeological feature (or widespread effects to minor hydrogeological features). o Extent of floodplains. • Widespread permanent impacts on the extent or morphology of a NHA/ecologically important area, • Mitigation measures (to design) will reduce but not completely remove the impact – residual impacts will occur.
Positive or Negative	Moderate	• Local time dependent impacts on:- o The extent or morphology of a cSAC / NHA / ecologically important area. o A minor hydrogeological feature. o Extent of floodplains. • Mitigation measures can mitigate the impact OR residual impacts occur, but these are consistent with existing or emerging trends
Positive, Negative or Neutral	Slight	• Local perceptible time dependent impacts not requiring mitigation.
Neutral	Imperceptible	• No impacts, or impacts which are beneath levels of perception, within normal bounds of variation, or within the bounds of measurement or forecasting error.

Table 6.2: Additional Impact Characteristics

6.3 Description of the Existing Environment

6.3.1 Site Location & Description

The proposed development site, which has a total area of approximately 5.5ha, is located ~8km to the southeast of Abbeyleix in Co. Laois. The site lies within the townland of Knockardagur, Co. Laois.

This area is part of the Castlecomer Plateau, a broad upland area which straddles the boundaries between counties Laois, Carlow and Kilkenny. It is an upland area with the site elevations ranging from 225 – 250m OD (meters above Ordnance Datum). Due to the sloping nature of the proposed development site and in order to minimise the volume of material to be excavated to provide the substation footing; the design of the proposed development has incorporated a split-level approach (see **Chapter 3** for full details)

Land use at the proposed development site is agricultural grassland/pasture and ground conditions at were noted to be firm under foot. In the wider landscape, agricultural grassland/pasture remains the predominant land use; however, locally, forestry is prevalent particularly to the south east including at the site of the permitted Pinewoods Wind Farm.

The proposed development site is bordered by a hedgerow to the west, by open grassland to the east and north and a public road to the south from where the

proposed site entrance will provide access to the proposed development site.

6.3.2 Superficial Geology

6.3.2.1 Soils and Subsoils

The published soils map (www.epa.ie) for the area shows that poorly draining mineral soil (AminPD) and deep well draining mineral soil (AminDW) are the dominant soil types at the site.

A map of the local subsoil cover is illustrated in **Figure 6.1** (www.gsi.ie). This indicates that Namurian sandstone and shale tills are present on the far west of the proposed development site, with bedrock mapped close to or at the surface over the remainder of the site area.

A trial pit and dynamic probe investigation was undertaken at the proposed development site on 21 January 2019 by Irish Drilling Ltd (IDL). A total of 7 no. trial pits and dynamic probes were carried out at the site. 3 no. were undertaken within the footprint of the proposed substation itself (*i.e.* TP5, TP6 and TP7) and the rest were undertaken along the route of the proposed access track to the south. A dynamic probe was undertaken at each of the trial pit locations.

A summary of the investigation findings is shown in **Table 6.3** below. The locations of the trial pits are also illustrated in **Figure 6.2** The IDL site investigation report, Trial pit logs and dynamic probe logs are included at **Volume II Annex 6.1**.

The subsoils encountered consist mainly of slightly gravelly SILT with some localised CLAY and SAND. Depth to bedrock ranged from 1.3m to 6.6m. Rock is shallowest at the north-eastern corner of the substation footprint and appears to deepen to the west / southwest which is consistent with the topography of the site.

No ground stability issues were identified by the trial pit investigation and all subsoils were found to be firm and cohesive which is generally typical of sandstone tills.

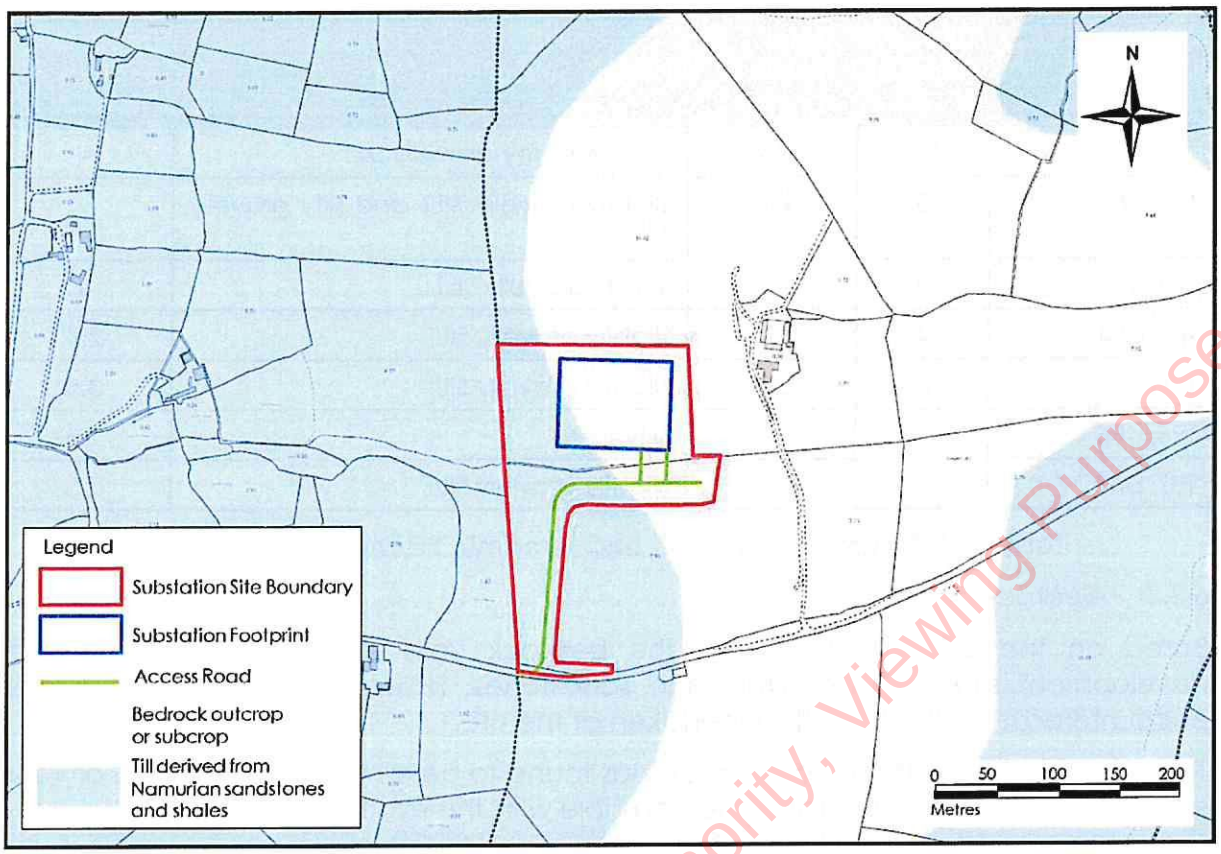

Figure 6.1: Local Subsoils Geology Mapping

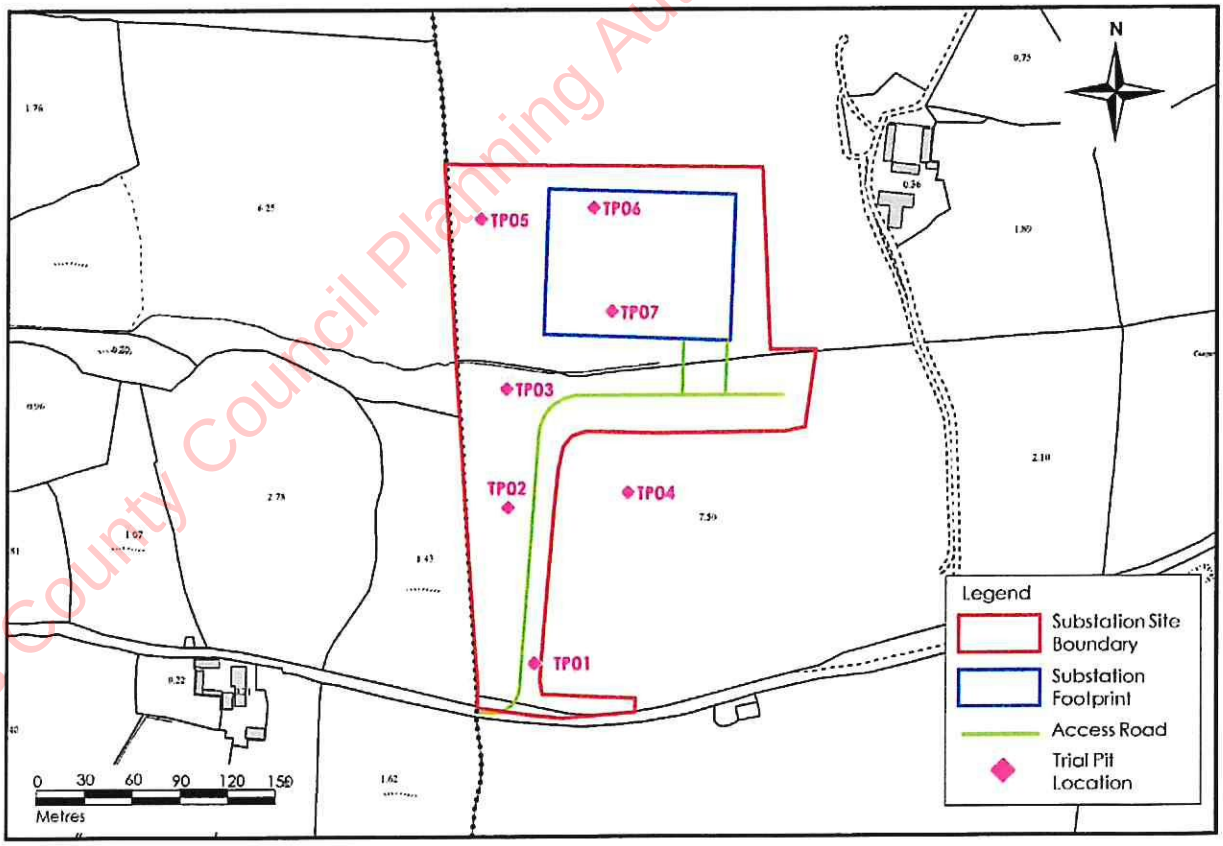

Figure 6.2: Site Investigation Map

Location	Total Depth of TP (m)	Total Depth of DP (m)	Primary Subsoil Lithology	Depth to Bedrock (m)
TP1/DP1	1.5	2.9	SILT over grey gravelly SILT	-
TP2/DP2	3	6.6	Slightly gravelly SILT and silty gravelly SAND	6.6
TP3/DP3	4	4.9	Sandy gravelly SILT	4
TP4/DP4	4	2	Slightly gravelly SILT	2.7
TP5/DP5	3.5	3.5	Slightly gravelly SILT	3.5
TP6/DP6	2.4	2.5	Silty CLAY	1.3
TP7/DP7	3	2.9	Slightly gravelly SILT	2.3

Table 6.3: Summary of Trial Pit and Dynamic Probe Investigations

6.3.3 Bedrock Geology

Based on the GSI bedrock map, the bedrock units underlying the proposed development site comprise Namurian sandstones. However, shale bedrock was encountered in all the trial pits undertaken at the site.

The upper profile of the shale bedrock was found to be generally weathered or very soft with excavation of the rock been possible with the excavator bucket.

The Castlecomer Plateau, which encompasses the proposed development site, is a broad gentle syncline (V-shaped fold) in which the rock strata generally dip towards the centre. The Plateau is then subdivided into a series of compartments by NE-SW and NW-SE trending faults. There are no mapped faults within or in the immediate vicinity of the proposed development site. A bedrock geology map of the area is illustrated in **Figure 6.3**.

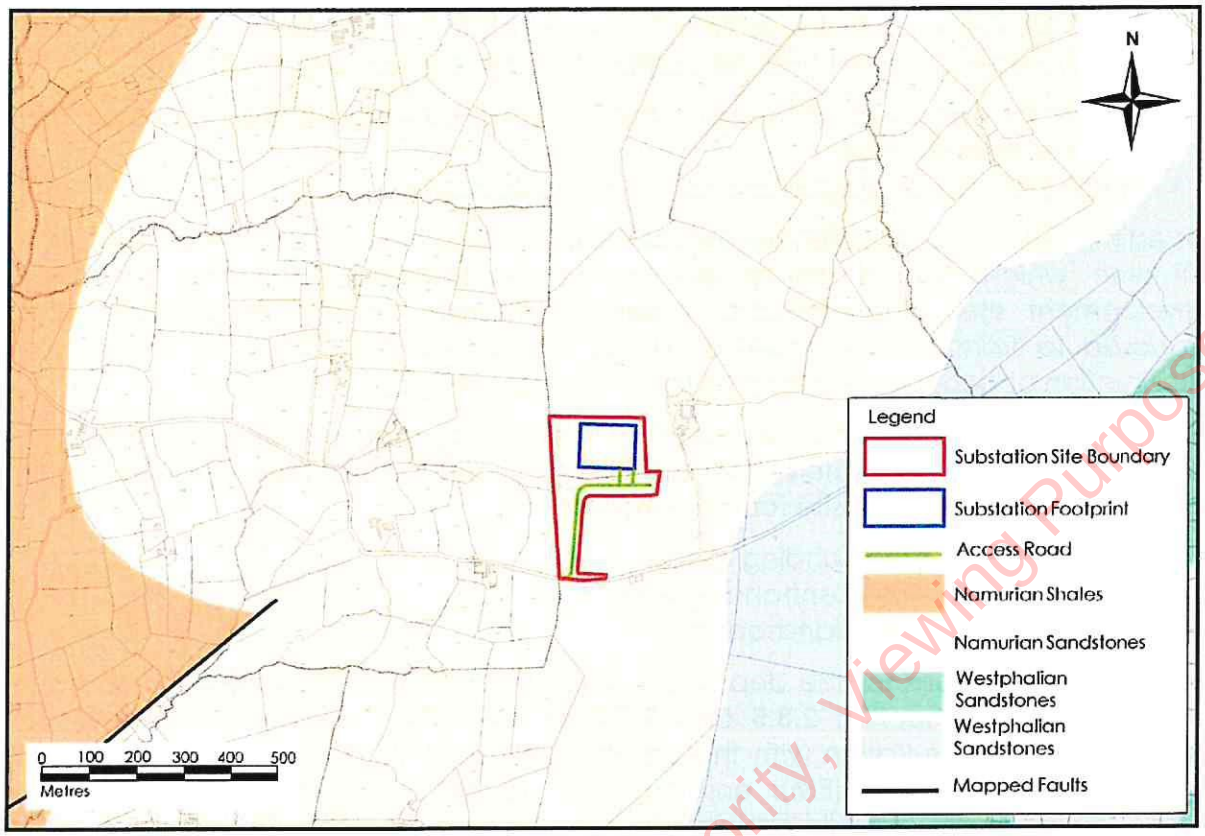

Figure 6.3: Local Bedrock Geology Mapping

6.3.4 Geological Resource Importance

The sandstone bedrock at the site could be classified as "Medium" importance. The bedrock could be used on a 'sub-economic' local scale for construction purposes; however, this bedrock has not been previously used for this purpose.

The mineral subsoil deposits at the site could be classified as "High to Medium" in terms of agricultural usage. Refer to **Table 6.1** for definition of these criteria.

6.3.5 Geological Heritage & Designated Sites

There are no GSI recorded Geological Heritage sites, mineral deposit sites or mining sites (current or historic) within the proposed development area. The proposed development is not located within any designated site. The closest geological heritage sites to the proposed development are located at The Swan, c. 4km to the east of the proposed development site.

6.4 Description of Likely Effects

6.4.1 Characteristics of the Proposed Development

The proposed development will typically involve removal of soil (where present), subsoils and bedrock to facilitate the construction of the proposed substation, access track and ancillary infrastructure. As referred to above and described in detail at **Chapter 3**, the proposed development involves a bespoke 3 step 'split level design' to reduce the volume of material to be excavated to provide the substation footing and, in turn, reduce effects on land and soil.

The overall indicative volume of subsoil excavation for the proposed development has been established as being approximately 62,000m³. The estimated volume of

material to be re-used on site as fill or in the reinstatement/landscaping of the site 28,750m³. Spoil reinstatement will be possible through the following methods:-

- Saving the top layer of the subsoil excavated for landscaping uses over any backfilled areas; and
- Placing the excavated subsoil along roadside berms.

It is estimated that c. 33,250m³ of excess material (topsoil, subsoil and rock material) will arise which cannot be re-used or accommodated within the proposed development site. Where excess material comprises suitable aggregates, it is proposed to transport this material to the Pinewoods Wind Farm for use in the construction of access tracks and areas of hardstanding.

Where excess material comprises topsoil or subsoil, it is proposed, where appropriate to do so, to re-use this material for reinstatement and landscaping purposes within the Pinewoods Wind Farm site for the purposes of:-

- Resurfacing of hardstanding areas;
- Reinstatement of site entrances; and
- Trackside berms and landscaping.

Appropriate locations for the deposition of this material will be carefully selected in accordance with **Section 2.3.5** and **2.3.6** of the CEMP enclosed at **Annex 3.4** (**Volume II**); in consultation with the on-site Ecological Clerk of Works (ECoW) and Environmental Manager (EM); ensuring that, at all times, water quality/siltation mitigation measures are fully implemented in advance and that the receiving site is suitable from a ground stability perspective. Spoil will be transported to these locations where it will be placed in accordance with best-practice methods to ensure the long-term stability of the stored material.

In the event that spoil is encountered which cannot be reused either within the proposed development site or within the permitted Pinewoods Wind Farm, this material will be disposed of in an environmentally sensitive manner by a licensed waste contractor in consultation with the Planning Authority.

6.4.2 "Do Nothing" Impacts

In the event that the proposed development is not progressed, the site will continue to be used as agricultural land and there will be no alteration to the land, soil or geological environment.

6.4.3 Construction Phase

6.4.3.1 Soil, Subsoil Excavation and Bedrock Excavation

The excavation of soil, subsoil and bedrock will be required for the levelling of the site to the requisite gradient and for the installation of building foundations, concrete plinths for electrical apparatus and for the foundations of electricity strain towers. This will result in a permanent removal of soil, subsoil and bedrock at excavation locations. Estimated volumes of soil and subsoils to be relocated are discussed at **Section 6.4.1** above.

The overall impact magnitude is determined not to be significant due to the following:-

- soils and subsoil at the site can be classified as "High to Moderate" importance with the former relating to agricultural land and the latter to forestry;

- The bedrock at the site can be classified as "Medium" importance;
- The soil, subsoil and bedrock which will be removed during the construction phase will be localised to the footprint of the proposed development;
- A minimal volume of soil, subsoil and bedrock, in comparison to the total resource present in the overall landholding will be removed to allow for infrastructural work to take place; and
- No infrastructure will be constructed within or near any designated sites for the protection of geological feature such as NHAs or SACs.

The soil and subsoil excavation final effect is summarised in **Table 6.4** below.

Attribute	Description
Receptor	Soils, subsoils and bedrock
Pathway/Mechanism	Excavations and extraction
Final Effect	Negative, slight/moderate, direct, high probability, permanent effect on peat, subsoil and bedrock.

Table 6.4: Soil and Subsoil Excavation

6.4.3.2 Erosion of Exposed Soil and Subsoil

Exposure of soil and subsoils at excavation areas can increase the likelihood for soil erosion resulting in a direct physical effect on the land and soil environment. The overall effect is determined to be 'Small Adverse' due, predominately, to the small development footprint area in comparison to the overall landholding.

The soil and subsoil erosion pre-mitigation effect is summarised in **Table 6.5** below.

Attribute	Description
Receptor	Soil and subsoils
Pathway/Mechanism	Vehicle movement, surface water erosion, and wind action.
Pre-mitigation Effect	Negative, direct, slight, likely effect on soil and subsoils.

Table 6.5: Soil and Subsoil Erosion

6.4.3.3 Contamination of Soil by Leakages and Spillages and Alteration of Soil Geochemistry

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

The soil contamination pre-mitigation effect is summarised in **Table 6.6** below.

Attribute	Description
Receptor	Soil, subsoil and bedrock
Pathway	Soil, subsoil and bedrock pore space

Pre-mitigation Effect	Negative, direct, slight, short term, medium probability effect on soils, subsoils and bedrock.

Table 6.6: Soil and Subsoil Contamination

6.4.4 Operational Phase

Very few likely direct effects are envisaged during the operational phase of the proposed development. These may include:-

- Some construction vehicles or plant may be necessary for maintenance which could result in minor accidental leaks or spills of fuel/oil; and,
- The transformer in the substation is oil cooled. There is a risk for spills / leaks of oils from this equipment resulting in contamination of soils and groundwater.

In relation to indirect effects, a small amount of granular material may be required to maintain access tracks during operation which will place intermittent minor demand on local quarries.

6.4.5 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, decommissioning phase effects will not occur.

6.4.6 Cumulative Effects

The land and soil effect assessment concludes that significant effects are unlikely to arise predominately due to the localised and near surface nature of the construction works and the absence of likely significant effects during the operation and decommissioning phases.

Therefore, and given the absence of likely significant effects arising from the proposed development individually; there is no likelihood for significant cumulative effects, arising from the entire proposed development, with any existing, permitted or proposed development on land, soils and geology. All effects relating to the proposed development are assessed to be direct and contained within the immediate vicinity of the proposed development and it is assessed that there is no pathway for the development to act in combination with other projects.

All other existing, permitted and proposed developments (including the Pinewoods Wind Farm) in the vicinity of the proposed development have been assessed to determine their likelihood to act in combination with the proposed development; however, it is concluded that there is no likelihood for likely significant cumulative effects.

In relation to the Pinewoods Wind Farm, the residual effects of the permitted wind farm on land, soils and geology were assessed to be not significant. Due to the direct nature of the works with regard the wind farm and substation, the spread out footprint of the wind farm infrastructure and the non-significant effects of the substation (as assessed above), no significant cumulative effects on land, soils and geology will occur.

6.4.7 Assessment of Likely Health Effects

The likelihood of health effects, albeit low, arises mainly from the possibility of soil and ground contamination during construction. A development, such as the proposed, is

not a recognised source of land or soil pollution and so the likelihood for effects during the construction or operational phases are negligible.

Hydrocarbons will be used onsite during construction; however the volumes will be small and will be handled and stored in accordance with best practice mitigation measures. As a result, it is concluded that the likely residual effects associated with soil or ground contamination and subsequent health effects are negligible.

6.4.8 "Worst Case" Effects

Localised contamination of soils and subsoils during the construction phase due to fuels / oils leaks and spillages. Localised soil stability issues due to the movement and storage of peat. The "worst case" effects are not expected to be significant.

6.5 Mitigation & Monitoring

6.5.1 Construction Phase

6.5.1.1 Soil, Subsoil Excavation and Bedrock Excavation

The excavation of soil, subsoil and bedrock will have a direct effect on the geological environment and no specific mitigation measures are proposed. The excavation of materials will be completed in accordance with best practice for the management and treatment of such materials.

6.5.1.2 Erosion of Exposed Subsoils During Construction Work

Proposed Mitigation Measures:-

- Excavated soil will be side cast and stored temporarily adjacent to excavation areas for use during reinstatement and landscaping;
- Silt fences will be installed around all temporary stockpiles and excavated areas to limit movement of entrained sediment in surface water runoff;
- In order to minimise runoff during the construction phase, works will not take place during periods of intense or prolonged rainfall (to prevent increased silt laden runoff). Drainage systems, as outlined in **Chapter 7**, will be implemented to limit runoff effects during the construction phase;
- Bog mats will be used, as necessary, to support construction plant and machinery on soft ground, thus reducing the likelihood for soil and subsoil erosion and avoiding the formation of rutted areas. This will substantially reduce the likelihood for surface water ponding to occur;

6.5.1.3 Contamination of Soil by Leakages and Spillages and Alteration of Peat/Soil Geochemistry

The following mitigation measures are proposed:-

- The volume of fuels or oils stored on site will be minimised. All fuel and oil will be stored in an appropriately bunded area within the temporary construction compound at the Pinewoods Wind Farm. Only an appropriate volume of fuel will be stored at any given time. The bunded area will be roofed to avoid the ingress of rainfall and will be fitted with a storm drainage system and an appropriate oil interceptor;
- All bunded areas will have 110% capacity of the volume to be stored;
- On site re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled at the temporary compound and will be towed around

the site by a 4x4 jeep to where plant and machinery is located. The 4x4 jeep will also be fully stocked with fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations to avoid any accidental leakages;

- All plant and machinery used during construction will be regularly inspected for leaks and fitness for purpose;
- Spill kits will be available to deal with and accidental spillage in and outside the re-fuelling area;
- An emergency plan for the construction phase to deal with accidental spillages is contained within the Outline Construction and Environmental Management Plan (**Annex 3.4**). This emergency plan will be further developed by the contractor prior to the commencement of construction.

6.5.2 Operational Phase

Following the completion of construction activities and the reseeding of exposed soil as a result of excavations, it is assessed that due to the absence of likely soil erosion effects, no mitigation measures are required.

Oil used in transformers (and other electrical apparatus) and storage of hydrocarbons could result in leakages during the operational phase and result in effects on soil and subsoils. The transformer and any hydrocarbon storage areas will be located in a roofed concrete bund capable of holding 110% of the stored oil volume.

The electrical control buildings will be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage of any associated chemicals and to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor.

6.5.3 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, no decommissioning phase mitigation measures are required.

6.5.4 Monitoring Measures

There is no proposed monitoring programme with respect of land and soils. However, during and post construction all excavated or raised areas (i.e. cut and fill) and reinstated/landscaped ground will be inspected for signs of erosion and instability. These inspections will be undertaken on a weekly basis during the construction phase and monthly, for a six-month period, post construction.

6.6 Residual Effects

6.6.1 Construction Phase

6.6.1.1 Soil, Subsoil Excavation and Bedrock Excavation

The importance of the soil at the site can be classified as of "High to Medium" but not designated or unique in any way. The residual effect on the land, soil and geological environment is the disturbance and relocation of c. 62,000m³ of soil, subsoil and bedrock during construction, however, no likely significant effects on the

geological environment are likely to arise from these excavations. Therefore the residual effect is considered to be negative, imperceptible, direct, short term, low probability effect.

No significant residual effects on soils, subsoils or bedrock are assessed as likely.

6.6.1.2 Erosion of Exposed Subsoils During Construction Work

Soil and spoil can be eroded by vehicle movements, wind action and by water movement. To prevent this, all excavation works will be followed by appropriate reinstatement, landscaping and drainage control. Following implementation of these measures, the residual effects are considered to be negative, slight, direct, medium probability effect on soil, subsoils and weathered bedrock.

No significant residual effects on soils, subsoils or bedrock are assessed as likely.

6.6.1.3 Contamination of Soil by Leakages and Spillages and Alteration of Soil Geochemistry

The use and storage of hydrocarbons and small volumes of chemicals is a standard risk associated with all construction sites. Proven and effective measures to mitigate the risk of spills and leaks have been proposed above and will break the pathway between the source and the receptor. The residual effect is considered to be - negative, imperceptible, direct, short term, low probability effect.

No significant residual effects on soils, subsoils or bedrock are assessed as likely.

6.6.2 Operational Phase

No significant residual effects are assessed as likely to occur during the operational phase.

6.6.3 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, residual decommissioning phase effects will not occur.

6.7 Summary

Excavations will be required for site levelling and for the installation of foundations, hardstands and access tracks. This will result in a permanent removal of soil, subsoil and bedrock at excavation locations. Excavated soil and subsoil will be used for reinstatement and landscaping and where excess material arises, this will be disposed at the dedicated spoil disposal areas.

Due to geographically spread out nature of the Pinewoods Wind Farm infrastructure, the proposed development will not result in a significant cumulative effect with the wind farm development.

Furthermore, all other existing, permitted and proposed developments in the vicinity of the proposed development have been assessed to determine their likelihood to act in combination with the proposed development; however, it is concluded that there is no likelihood of significant cumulative effects.

In conclusion, this assessment has determined that the proposed development will not result in any likely significant effects on land and soil. Where effects are likely to occur, such as soil contamination and erosion, the implementation of appropriate mitigation measures will ensure that any effects are negligible and imperceptible.

Where it is not possible to implement mitigation measures, such as in respect of the direct excavation of soil and subsoil, the level of effect is considered to be slight/moderate and will not be significant.

Pinewoods Wind Farm Substation and Grid Connection

Chapter 7: Water

Pinewoods Wind Ltd

Galetech Energy Services
Clondargan, Stradone, Co. Cavan Ireland
Telephone +353 49 555 5050
www.galetechenergy.com

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7.1 Introduction

7.1.1 Background and Objectives

This chapter provides an assessment of the likely effects of the proposed development (110kv substation, access track and associated works) on water aspects (hydrology and hydrogeology) of the receiving environment.

The objectives of the assessment are to:-

- Produce a baseline study of the existing water environment (surface and groundwater) in the area of the proposed development;
- Identify likely positive and negative significant effects of the proposed development on surface and groundwater during construction, operational and decommissioning phases of the development;
- Identify mitigation measures to avoid, reduce or offset significant negative effects;
- Assess significant residual effects; and
- Assess cumulative effects of the proposed development and other local developments.

7.1.2 Development Description

In summary, the proposed development comprises the following main components:-

- 1 no. 110kV 'loop in-loop out' air-insulated switchroom (AIS) substation including control buildings, transformers and all ancillary electrical equipment; and
- All associated site development, access and reinstatement works.

Due to the sloping nature of the proposed development site, and in order to minimise the volume of material to be excavated to provide the substation footing; the design of the proposed development has incorporated a split-level approach.

The entirety of the proposed development is located within the administrative area of County Laois; while the overall project (Pinewoods Wind Farm) is located partly within County Laois and County Kilkenny. Additionally, candidate quarries which may supply construction materials are also located within County Kilkenny and Carlow.

7.1.3 Statement of Authority

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

Our core areas of expertise and experience include upland hydrology and wind farm drainage design. We routinely complete impact assessments for hydrology and hydrogeology for a large variety of project types, including wind farms and associated grid connections.

This chapter was prepared by Michael Gill and David Broderick.

Michael Gill (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 17 years' environmental consultancy experience in Ireland.

Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland. He has substantial experience in surface water drainage design and SUDs design, and surface water/groundwater interactions. For example, Michael was involved in the preparation of Environmental Impact Statements (EIS) for the Oweninny Wind Farm, Cloncreen Wind Farm, Yellow River Wind Farm and over 100 no. other wind farm related projects.

David Broderick (BSc, H.Dip Env Eng, MSc) is a hydrogeologist with over 13 years' experience in both the public and private sectors. David has a strong background in groundwater resource assessment and hydrogeological/hydrological investigations in relation to developments such as quarries and wind farms. David has completed numerous geology and water sections for input into Environmental Impact Assessment Reports/Environmental Impact Statements (EIAR/EIS) for a range of commercial developments. For example, David was involved in the preparation of Environmental Impact Statements (EIS) for the Oweninny Wind Farm, Cloncreen Wind Farm Yellow River Wind Farm and over 100 other wind farm related projects across Ireland.

7.1.4 Relevant Legislation

This chapter has been prepared in accordance with the requirements of European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the 'EIA Directive') as amended by Directive 2014/52/EU.

The requirements of the following legislation are complied with:-

- S.I. No. 349 of 1989: European Communities (Environmental Impact Assessment) Regulations, and subsequent Amendments (S.I. No. 84 of 1994, S.I. No. 101 of 1996, S.I. No. 351 of 1998, S.I. No. 93 of 1999, S.I. No. 450 of 2000 and S.I. No. 538 of 2001, S.I. 134 of 2013 and the Minerals Development Act 2017), the Planning and Development Act, and S.I. 600 of 2001 Planning and Development Regulations and subsequent Amendments. These instruments implement EU Directive 85/337/EEC and subsequent amendments, on the assessment of the effects of certain public and private projects on the environment;
- Directives 2011/92/EU and 2014/52/EU on the assessment of the effects of certain public and private projects on the environment, including Circular Letter PL 1/2017: Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive);
- Planning and Development Act, 2000, as amended;
- S.I. No 296 of 2018: European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 which transposes the provisions of Directive 2014/52/EU into Irish law;
- S.I. No. 293 of 1988: European Communities (Quality of Salmonid Waters) Regulations, resulting from EU Directive 78/659/EEC on the Quality of Fresh Waters Needing Protection or Improvement in order to Support Fish Life;
- S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009 (as amended by S.I. No. 296/2009; S.I. No. 386/2015; S.I. No. 327/2012; and S.I. No. 77/2019 and giving effect to Directive 2008/105/EC on environmental quality standards in the field of water policy and Directive 2000/60/EC establishing a framework for Community action in the field of water policy) and S.I. No. 722 of 2003 European Communities (Water Policy) Regulations which implement EU Water Framework Directive

(2000/60/EC) establishing a framework for the Community action in the field of water policy and provide for implementation of 'daughter' Groundwater Directive (2006/118/EC) on the protection of groundwater against pollution and deterioration. Since 2000 water management in the EU has been directed by the Water Framework Directive (2000/60/EC) (as amended by Decision No. 2455/2011/EC; Directive 2008/32/EC; Directive 2008/105/EC; Directive 2009/31/EC; Directive 2013/39/EU; Council Directive 2013/64/EU; and Commission Directive 2014/101/EU ("WFD"). The WFD was given legal effect in Ireland by the European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003);

- S.I. No. 684 of 2007: Waste Water Discharge (Authorisation) Regulations 2017, resulting from EU Directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances (the Groundwater Directive);S.I. No. 106 of 2007: European Communities (Drinking Water) Regulations 2007and S.I. No. 122 of 2014: European Communities (Drinking Water) Regulations 2014, arising from EU Directive 98/83/EC on the quality of water intended for human consumption (the "Drinking Water Directive") and EU Directive 2000/60/EC;
- S.I. No. 9 of 2010: European Communities Environmental Objectives (Groundwater) Regulations 2010 (as amended by S.I. No. 389/2011; S.I. No. 149/2012; S.I. No. 366/2016; the Radiological Protection (Miscellaneous Provisions) Act 2014; and S.I. No. 366/2016); and,
- S.I. No. 296 of 2009: The European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009 (as amended by S.I. No. 355 of 2018).

7.1.5 Relevant Guidance

This chapter has been prepared in accordance with guidance contained in the following:-

- Institute of Geologists Ireland (2013): Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements;
- National Roads Authority (2008): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Department of Environment, Heritage and Local Government (2006): Wind Energy Development Guidelines for Planning Authorities;
- Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters;
- Scottish Natural Heritage (2010): Good Practice During Wind Farm Construction;
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note);
- CIRIA (Construction Industry Research and Information Association) (2006): Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006);
- CIRIA 2006: Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors (CIRIA C532, 2006).
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DoHPLG, 2018);
- Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU), (European Union, 2017);

- Forestry Commission (2004): Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh;
- Coillte (2009): Forest Operations & Water Protection Guidelines;
- Forest Services (Draft) Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures;
- Forest Service (2000): Forestry and Water Quality Guidelines. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford; and,
- COFORD (2004): Forest Road Manual – Guidelines for the Design, Construction and Management of Forest Roads.

7.2 Methodology

7.2.1 Desk Study

A desk study of the proposed development site and surrounding area, including the site of the permitted Pinewoods Wind Farm, was completed in advance of undertaking the walkover survey, field mapping and site investigations. This involved collecting all relevant geological, hydrological, hydrogeological and meteorological information for the proposed development site and surrounding area. The desk study included consultation of the following data sources:-

- Environmental Protection Agency database (www.epa.ie); Geological Survey of Ireland - Groundwater Database (www.gsi.ie);
- Met Eireann Meteorological Databases (www.met.ie);
- National Parks & Wildlife Services Public Map Viewer (www.npws.ie);
- Water Framework Directive/EPA Catchments Map Viewer (www.catchments.ie);
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 18 (Geology of Tipperary). Geological Survey of Ireland (GSI, 1999);
- Geological Survey of Ireland (2004); Groundwater Body Initial Characterization Reports;
- Office of Public Works (OPW) Flood Hazard Mapping (www.floodinfo.ie);
- Environmental Protection Agency – "Hydrotool" Map Viewer (www.epa.ie);
- CFRAM Flood Risk Assessment (PFRA and CFRAM) maps (www.cfram.ie);
- Department of Environment, Community and Local Government on-line mapping viewer (www.myplan.ie);
- Ordnance Survey Ireland (OSI) – 6 inch and 1;5000 scale basemaps; and,
- Aerial photography (www.bing.com/maps, www.google.com/maps).

Concerns raised by local residents and consultees in previous submissions related to the Pinewoods Wind Farm as they relate to effects on water and the hydrological environment were also assessed in the preparation of this chapter.

7.2.2 Site Investigations

A walkover survey and baseline evaluation of the proposed development site was undertaken by HES on 20 March 2020. The proposed development site was previously visited by HES in February and March 2015 as part of the EIAR/EIS prepared in respect of the Pinewoods Wind Farm.

Specific site investigations, including trial pits and dynamic probes, at the proposed development site (described below) were undertaken by the Applicant on 21 January 2019.

In summary, site investigations to inform the preparation of this chapter comprise the following:-

- Walkover surveys and hydrological mapping of the proposed development site and the surrounding area were undertaken. Water flow directions and drainage patterns were also recorded;
- 7 no. trial pits and dynamic probes were undertaken at the substation location to investigate subsoil depth and lithology along with groundwater conditions (i.e. possible inflows);
- Field hydrochemistry measurements (electrical conductivity, pH, dissolved oxygen and temperature) were taken to determine the origin and nature of surface water flows; and,
- Surface water sampling (2 no. samples) was undertaken to determine the baseline water quality of the primary surface waters originating in the area of the proposed development site.

7.2.3 Receptor Sensitivity / Importance / Impact Criteria

Using the National Roads Authority (NRA 2008) guidance, an estimation of the importance of the water environment within and downstream of the proposed development area are quantified by applying the importance criteria set out in **Table 7.1** and **Table 7.2**; the impact magnitude is assessed using **Table 7.3** and **Table 7.4** and the impact rating using **Table 7.5**.

Importance	Criteria	Typical Example
Extremely High	• Attribute has a high quality or value on an international scale.	• River, wetland or surface water body ecosystem protected by EU legislation, e.g. 'European sites' designated under the Habitats Regulations or 'Salmonid Waters' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988.
Very High	• Attribute has a high quality or value on a regional or national scale.	• River, wetland or surface water body ecosystem protected by national legislation – NHA status. • Regionally important potable water source supplying >2500 homes. • Quality Class A (Biotic Index Q4). • Flood plain protecting more than 50 residential or commercial properties from flooding. • Nationally important amenity site for wide range of leisure activities.
High	• Attribute quality or value on a local scale.	• Salmon fishery Locally important potable water source supplying >1000 homes. • Quality Class B (Biotic Index Q3-4). • Flood plain protecting between 5 and 50 residential or commercial properties from flooding. • Locally important amenity site for wide range of leisure activities.
Medium	• Attribute has a medium quality or value on a local	• Coarse fishery. • Local potable water source supplying

	scale.	>50 homes Quality Class C (Biotic Index Q3, Q2-3). • Flood plain protecting between 1 and 5 residential or commercial properties from flooding.
Low	• Attribute has a low quality or value on a local scale.	• Locally important amenity site for small range of leisure activities. • Local potable water source supplying <50 homes. • Quality Class D (Biotic Index Q2, Q1) Flood plain protecting 1residential or commercial property from flooding. • Amenity site used by small numbers of local people.

Table 7.1: Estimation of Importance of Hydrology Criteria (NRA, 2008)

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

Table 7.2: Estimation of Importance of Hydrogeology Criteria (NRA, 2008)

Magnitude	Criteria	Typical Examples
Large Adverse	• Results in loss of attribute and /or quality and integrity of attribute	• Loss or extensive change to a waterbody or water dependent. • Habitat Increase in predicted peak flood level >100mm. • Extensive loss of fishery Calculated risk of serious pollution incident >2% annually. • Extensive reduction in amenity value
Moderate Adverse	• Results in impact on integrity of attribute or loss of part of attribute	• Increase in predicted peak flood level >50mm. • Partial loss of fishery. • Calculated risk of serious pollution incident >1% annually. • Partial reduction in amenity value.
Small Adverse	• Results in minor impact on integrity of attribute or loss of small part of attribute	• Increase in predicted peak flood level >10mm. • Minor loss of fishery. • Calculated risk of serious pollution incident >0.5% annually. • Slight reduction in amenity value.
Negligible	• Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	• Negligible change in predicted peak flood level. • Calculated risk of serious pollution incident <0.5% annually.

Table 7.3: Magnitude of Hydrology Impact (NRA, 2008)

Magnitude	Criteria	Typical Examples
Large Adverse	• Results in loss of attribute and /or quality and integrity of attribute	• Removal of large proportion of aquifer. • Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems. • Possible high risk of pollution to groundwater from routine run-off. • Calculated risk of serious pollution incident >2% annually.
Moderate Adverse	• Results in impact on integrity of attribute or loss of part of attribute	• Removal of moderate proportion of aquifer Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems. • Possible medium risk of pollution to groundwater from routine run-off. • Calculated risk of serious pollution

		incident >1% annually.
Small Adverse	• Results in minor impact on integrity of attribute or loss of small part of attribute	• Removal of small proportion of aquifer Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems. • Possible low risk of pollution to groundwater from routine run-off. • Calculated risk of serious pollution incident >0.5% annually.
Negligible	• Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	• Calculated risk of serious pollution incident <0.5% annually.

Table 7.4: Magnitude of Hydrogeology Impact (NRA, 2008)

	Magnitude of Impact			
Importance of Tribute	Negligible	Small Adverse	Moderate Adverse	Large Adverse
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant/Moderate	Profound/Significant	Profound
High	Imperceptible	Moderate/Slight	Significant/Moderate	Profound/Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight/Moderate

Table 7.5: Estimation of Impact Rating (NRA, 2008)

7.2.4 Consultation

The scope of this assessment has also been informed by consultation with statutory consultees and other bodies with environmental responsibility in the Republic of Ireland.

This consultation process is outlined in **Chapter 1** of this EIAR. Issues, concerns and recommendations highlighted by the responses in relation to the water environment are summarised in **Table 7.6** below. The full responses from each of the below consultees are provided in **Annex 1.4.**

Consultee	Summary of Consultee Response	Response Addressed in

		Section
Geological Survey of Ireland	• General Groundwater Quality Protection • Flood Risk Management	7.3.5 7.3.8 7.5.1.3 7.5.1.4
Irish Water	• Generic response with respect protection of water supply infrastructure, surface waters and groundwater	7.3.13 7.5.1.1 7.5.1.3

Table 7.6: Summary of Scoping Responses

7.3 Description of the Existing Environment

7.3.1 Site Location and Description

The proposed development site, which has a total area of approximately 5.5a, is located ~8km to the southeast of Abbeyleix in Co. Laois. The site lies within the townland of Knockardagur, Co. Laois.

This area is part of the Castlecomer Plateau, a broad upland area which straddles the boundaries between counties Laois, Carlow and Kilkenny. It is an upland area with the site elevations ranging from 225 – 250m OD (meters above Ordnance Datum). Due to the sloping nature of the proposed development site and in order to minimise the volume of material to be excavated to provide the substation footing; the design of the proposed development has incorporated a split-level approach (see **Chapter 3** for full details).

Land use at the proposed development site is agricultural grassland/pasture and ground conditions at were noted to be firm under foot. In the wider landscape, agricultural grassland/pasture remains the predominant landuse; however, locally, forestry is prevalent particularly to the south east including at the site of the permitted Pinewoods Wind Farm.

The proposed development site is bordered by a hedgerow to the west, by open grassland to the east and north and a public road to the south from where the proposed site entrance will provide access to the proposed development site.

7.3.2 Water Balance

Long term Annual Average Rainfall (AAR) and evaporation data was sourced from Met Éireann. The 30-year annual average rainfall (1981-2010) recorded at Abbeyleix, approximately 8 km northwest of the substation site, are presented in **Table 7.7** below.

Abbeyleix												
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Total
94	67	72	63	63	67	70	87	74	105	91	90	943

Table 7.7: Local Average Long-Term Rainfall Data (mm)

The closest synoptic station where the average potential evapotranspiration (PE) is recorded is at Kilkenny, approximately 26km south of the site. The long-term average PE for this station is 459mm/yr. This value is used as a best estimate of the proposed development site's PE. Actual Evaporation (AE) at the site is estimated as

436mm/year (which is 0.95 × PE).

The effective rainfall (ER) represents the water available for runoff and groundwater recharge. The ER for the site is calculated as follows:-

$$\text{Effective rainfall (ER)} = \text{AAR} - \text{AE}$$

$$= 943 - 436$$

$$\text{ER} = 507\text{mm/year}$$

Based on groundwater recharge coefficient estimates from the GSI (www.gsi.ie), an estimate of 100-130mm/year average annual recharge cap is given for the local aquifers. This means that the hydrology of the study area is characterised by relatively high surface water runoff rates and low groundwater recharge rates. Based on a conservative recharge cap of 100mm/year, the annual runoff rate for the site is estimated to be 407mm/yr.

Table 7.8 presents return period rainfall depths for the area of the proposed development. The data is taken from https://www.met.ie/climate/services/rainfall-return-periods and provides rainfall depths for various storm durations and sample return periods (1-year, 50-year, 100-year). These extreme rainfall depths will provide the basis of the detailed drainage design for the proposed development.

Duration	10-year Return Period (mm)	50-Year Return Period (mm)	100-Year Return Period (mm)
15 min	11	15.3	17.5
1 hour	20	27.7	31.7
6 hour	43.2	59.9	68.6
12 hour	58.1	80.6	92.4
24 hour	78.3	108.6	124.4
48 hour	94.4	127.6	144.6

Table 7.8: Return Period Rainfall Depths for Proposed Development Site

7.3.3 Local and Regional Hydrology

Regionally, the proposed development site itself is located in the Nore River surface water catchment within Hydrometric Area 15 of the South Eastern River Basin District (SERBD). A regional hydrology map is shown as **Figure 7.1**.

In terms of local hydrology, the proposed development site is situated within the Owenbeg River catchment (also named the Owveg River). The Owenbeg River flows in a southerly direction approximately 2km west of the site. A local hydrology map is shown as **Figure 7.2.**

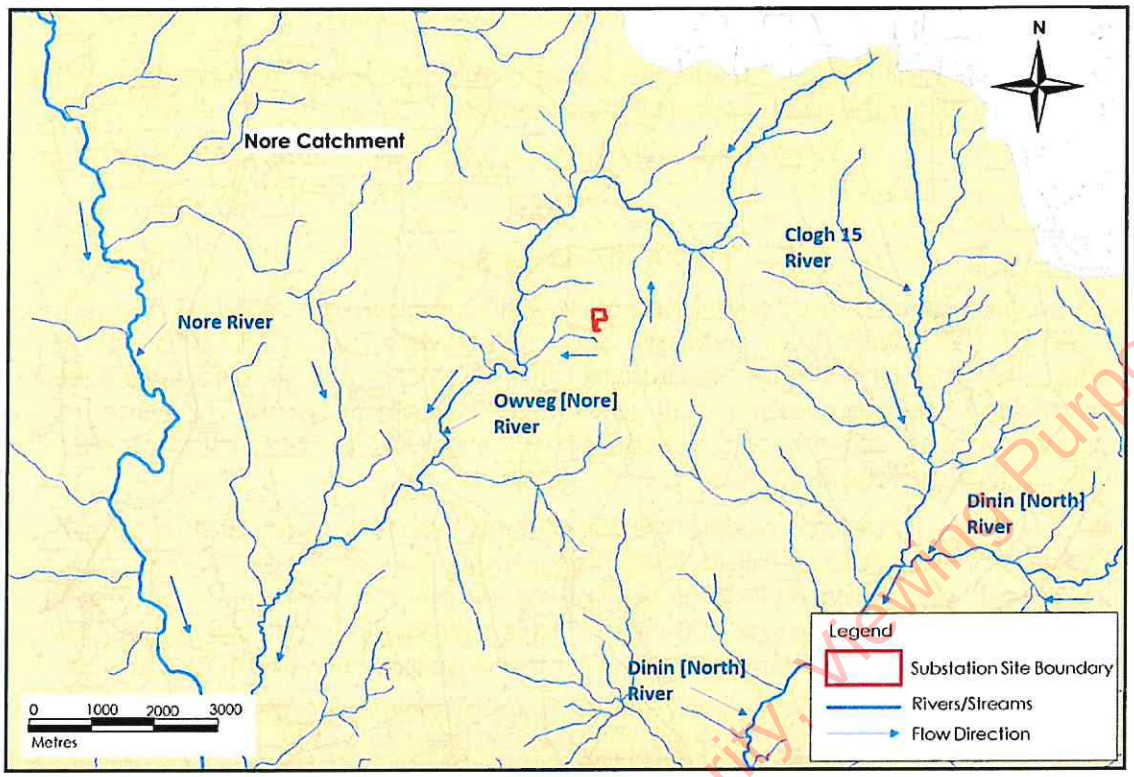


Figure 7.1: Regional Hydrology Mapping

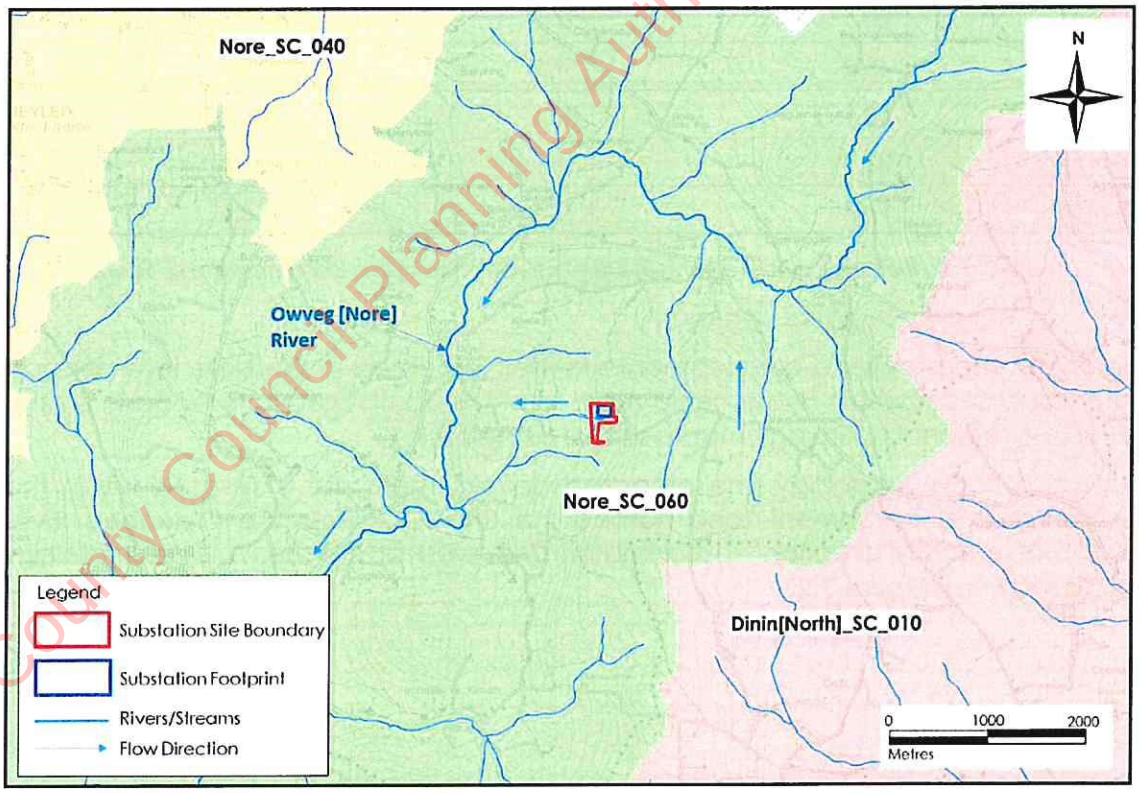


Figure 7.2: Local Hydrology Mapping

7.3.4 Site Drainage

There is 1 no. watercourse within the proposed development site. The watercourse

(the Knockardagur) is a small 1st order stream which flows in a westerly direction within the hedgerow located immediately south of the footprint of the proposed 110kV electricity substation. The stream rises from a small spring which is located ~10m to the south of the substation footprint. Spring flow rates are <5L/s. The proposed development will not interfere with the spring outfall nor will there be a crossing required over the Knockardagur Stream. It is also noted that the Knockardagur Stream is predominately dry and is assessed as only likely to have flow rates following intense of prolonged rainfall.

In addition, a man-made/agricultural drain is located along the western boundary (downslope) of the proposed development site along an existing hedgerow. This drain, which is likely to only have flow during very wet periods, discharges to the Knockardagur to the southwest of the proposed 110kV substation. Furthermore, a second stream flows (<5L/s) along the hedgerow to the west (downslope) of the proposed access track which merges with the Knockardagur at the same location as the abovementioned drain. A site drainage map is shown as **Figure 7.3**.

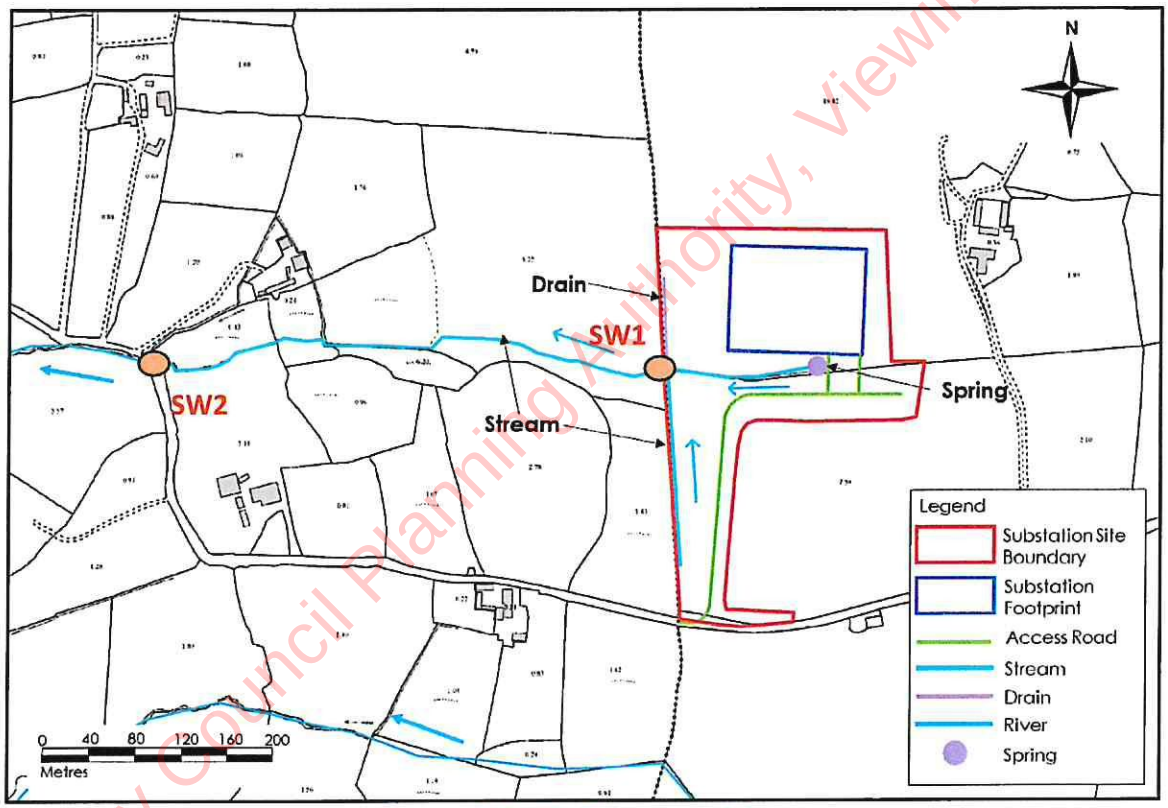


Figure 7.3: Site Drainage Map

7.3.5 Flood Risk Identification

To identify those areas as being at risk of flooding, the OPW's indicative river and coastal flood map (www.floodmaps.ie), CFRAM Preliminary Flood Risk Assessment (PFRA) maps (www.cfram.ie) and historical mapping (i.e. 6" and 25" base maps) were consulted.

No recurring flood incidents were identified from OPW's flood hazard mapping either within the proposed development site or in the surrounding area (**Figure 7.4**). Notably, no flooding incidences are mapped along the Owenbeg River immediately downstream of the proposed development site.

The PFRA mapping demonstrates the extents of the indicative 1 in 100-year flood zone which relates to fluvial (i.e. river) and pluvial (i.e. rainfall) flood events (**Figure 7.5**). The 1 in 100-year fluvial flood zone incorporates notable land area surrounding the Owenbeg River to the west and northwest of the proposed development site.

There is no 1 in 100-year fluvial flood zones mapped within the site or surrounding area, particularly in relation to the Knockardagur stream. Therefore, it is concluded that, based on the available flood mapping, the proposed development site is located in Flood Zone C (Low Risk).

There is no identifiable map text on local available historical 6" or 25" mapping for the study area that identify lands that are "prone to flooding".

There are no areas within the proposed development site or downstream of it mapped as "Benefiting Lands". Benefiting lands are defined as a dataset prepared by the OPW identifying land(s) that might benefit from the implementation of Arterial (Major) Drainage Schemes (under the Arterial Drainage Act 1945) and indicating areas of land subject to flooding or poor drainage.

A walkover of the proposed development site was undertaken on 20 March 2020 during which it was surveyed for any signs or anecdotal evidence of flooding. No such signs were noted. Local landowners were also consulted in relation to historical flooding on their lands and no flood events were identified.

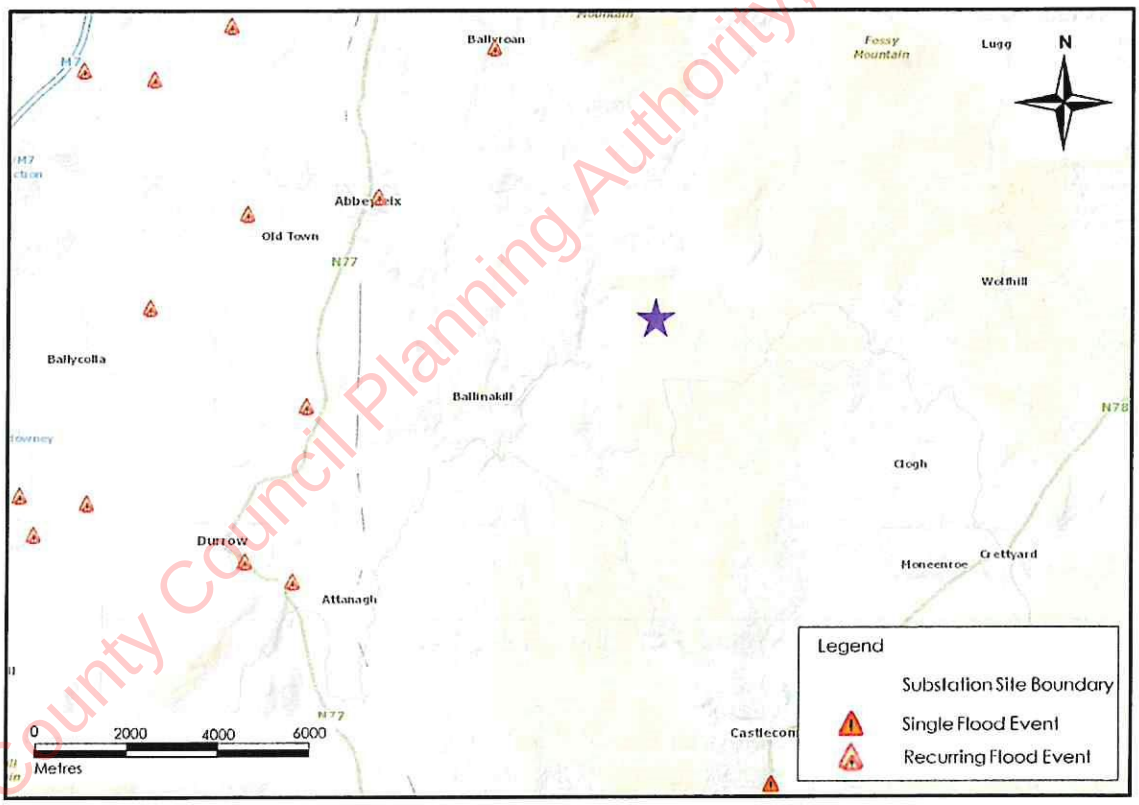


Figure 7.4: OPW Flood Hazard Mapping

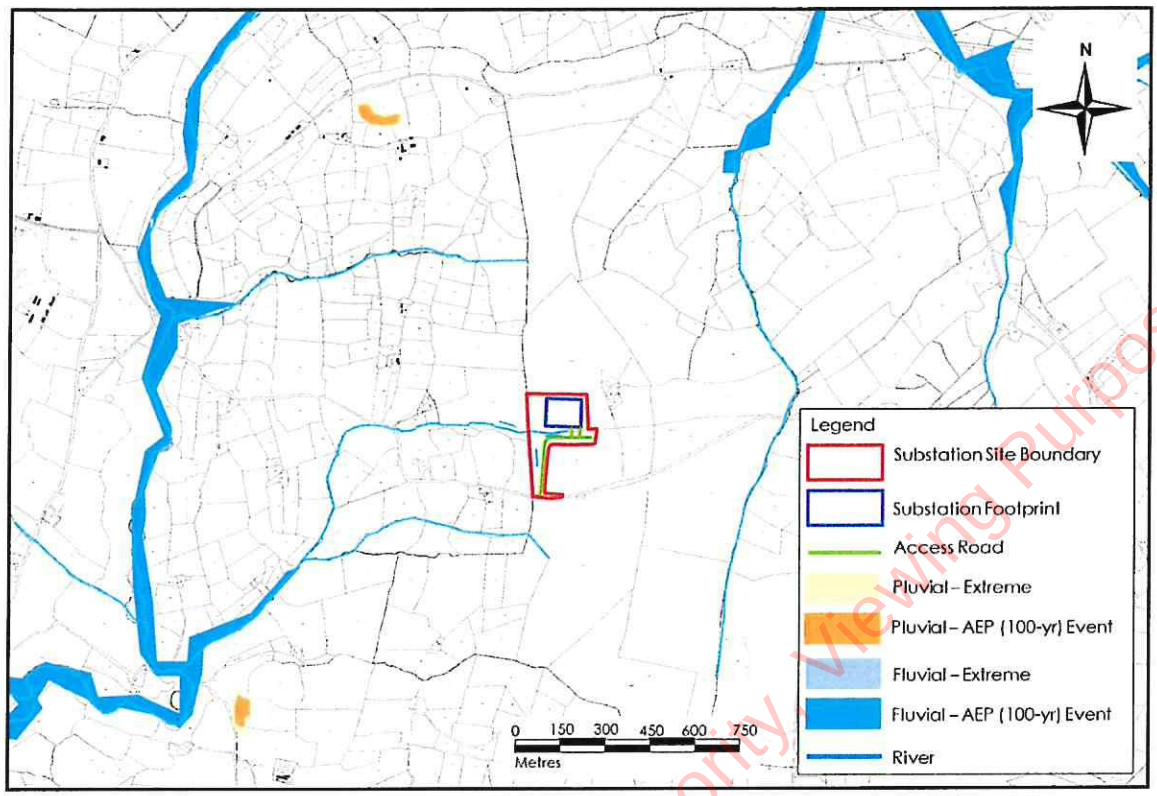


Figure 7.5: PFRA Flood Zone Mapping

7.3.6 Surface Water Hydrochemistry

Q-rating data for EPA monitoring points are available on the Owenbeg River in the area of the proposed development. The most recently available data indicates that the Owenbeg River has a Q4 rating (Good Status) both upstream and downstream of the proposed development site. There is no Q-rating data for the Knockardagur stream which provides the only hydrological connection between the proposed development site and the Owenbeg River.

Surface water samples were taken from 2 no. locations along the Knockardagur stream, both of which are downstream of the proposed development site. Sampling was undertaken on the 20th March 2020 during a relatively dry spell of weather. Field hydrochemistry measurements of unstable parameters, electrical conductivity (µS/cm), pH (pH units) and temperature (°C) were taken at each location and the results are listed in **Table 7.9** below. Refer to **Figure 7.3** above for sample locations.

Electrical conductivity (EC) values for surface waters at sampling locations SW1 and SW2 ranged between 139 and 147µS/cm which would be typical for the local mapped geology (*i.e.* sandstone; see **Chapter 6**).

The pH values, which ranged between 7.2 and 7.3 at each sampling location, were generally near neutral and would be typical of catchments with mineral soil coverage.

Location	EC (µS/cm)	pH	Temperature
SW1	147	7.3	8.3
SW2	139	7.3	8.4

Table 7.9: Summary of Surface Water Chemistry Measurements

The results of analyses carried out on the water samples are shown alongside relevant water quality regulations in **Table 7.10** below. In addition, Environmental Objectives Surface Water Regulations (S.I. 272 of 2009) are shown in **Table 7.11** below. Laboratory reports are provided at **Annex 7.1.**

Parameter	EC DIRECTIVES			Sample ID	
	2006/44/EC		EC DW Regs 2007	SW1	SW2
	Salmonid	Cyprinid			
Total Suspended Solids (mg/L)	≤ 25 (O)	≤ 25 (O)	-	<5	<5
Ammonia N (mg/L)	≤0.04	≤0.02	0.3	0.03	0.11
Nitrite NO_2 (mg/L)	≤ 0.01	≤ 0.03	0.5	<0.05	<0.05
Ortho-Phosphate – P (mg/L)	-	-	-	<0.02	0.02
Nitrate - NO_3 (mg/L)	-	-	50	9	7.5
Nitrogen (mg/L)	-	-	-	2.1	1.8
Phosphorus (mg/L)	-	-	-	<0.1	<0.1
Chloride (mg/L)	-	-	250	11.4	10.2
BOD	≤ 3	≤ 6	-	<2	2

Table 7.10: Analytical Results of Surface Water Sampling

Parameter	Threshold Values (mg/L)
BOD	High status ≤ 1.3 (mean)
	Good status ≤ 1.5 mean
Ammonia-N	High status ≤ 0.04 (mean)
	Good status ≤0.065 (mean)
Ortho-phosphate	High status ≤0.025 (mean)
	Good status ≤0.035 (mean)

Table 7.11: Chemical Conditions Supporting Biological Elements*

** Environmental Objectives Surface Water Regulations (S.I. 272 of 2009)*

Total suspended solids was reported at <5mg/L in both samples which is below the Freshwater Fish Directive (2006/44/EC) MAC of 25mg/L.

Nitrite was below the laboratory detection limit of 0.05 mg/L in both samples. Nitrate ranged between 7.5 and 9mg/L and was slightly higher in the SW1 which are both substantially below the threshold level of 50mg/L.

Ortho-phosphate ranged between <0.02 to 0.02mg/L. In comparison to the Environmental Objectives Surface Water Regulations (S.I. 272 of 2009), all results for ortho-phosphate exceeded the "High Status" threshold.

In relation to Ammonia N, which ranged between 0.03 and 0.11mg/L, there was a notable increase in the downstream sample (SW2) which is likely to be reflective of agricultural activities in the local area. SW2 exceeded both the "Good Status" and "High Status" while SW1 was below the "High Status" threshold.

BOD ranged between <2 and 2mg/L, which exceeds both the "Good status" and "High status" threshold limits.

7.3.7 Hydrogeology

The Namurian sandstones, which underlie the subject site and parts of the permitted Pinewoods Wind Farm site, are classified by the Geological Survey of Ireland (GSI) (www.gsi.ie) as a Poor Aquifer, having bedrock which is generally unproductive except for local zones (Pl/Pu). Bedrock aquifer mapping is shown as **Figure 7.6** below.

The shales and sandstones that underlie the site generally have an absence of inter-granular permeability, and most groundwater flow is expected to be in the uppermost part of the aquifer comprising a broken and weathered zone typically less than 3m thick, a zone of interconnected fissuring 10m thick, and a zone of isolated poorly connected fissuring typically less than 150m (GSI, 2004).

Groundwater levels in this bedrock type, elsewhere, have been measured mainly 0-5m below ground level. However, the presence of a spring close to the south of the proposed substation footprint suggests that groundwater levels are close to the surface locally as a result of the low permeability nature of the bedrock.

During the trial pit investigation (refer to **Figure 6.2** of **Chapter 6**), no significant groundwater inflows were noted within the proposed development footprint area (location were deepest excavations will occur). However, an approximate static groundwater level of 2.3m was noted in trial pit TP7.

Groundwater flowpaths are likely to be short (30-300m), with groundwater discharging to nearby streams and small springs. Water strikes deeper than the estimated interconnected fissure zones suggest a component of deep groundwater flow, however shallow groundwater flow is considered to be dominant. Groundwater flow directions are anticipated to follow topography; and, therefore, groundwater directions within the site are expected to be towards the primary streams within the valleys of the site (GSI, 2004).

Baseflow contribution to streams tends to be low, particularly in summer as the groundwater regime cannot sustain summer baseflows due to low storativity within the aquifer. In winter, low permeabilities will lead to a high water table and possible water logging of soils. Local groundwater flow directions will mimic topography, whereby flowpaths will be from topographic high points to lower elevated discharge areas at local streams (GSI, 2004). The groundwater direction in the area of the substation site is expected to the downslope to the west.

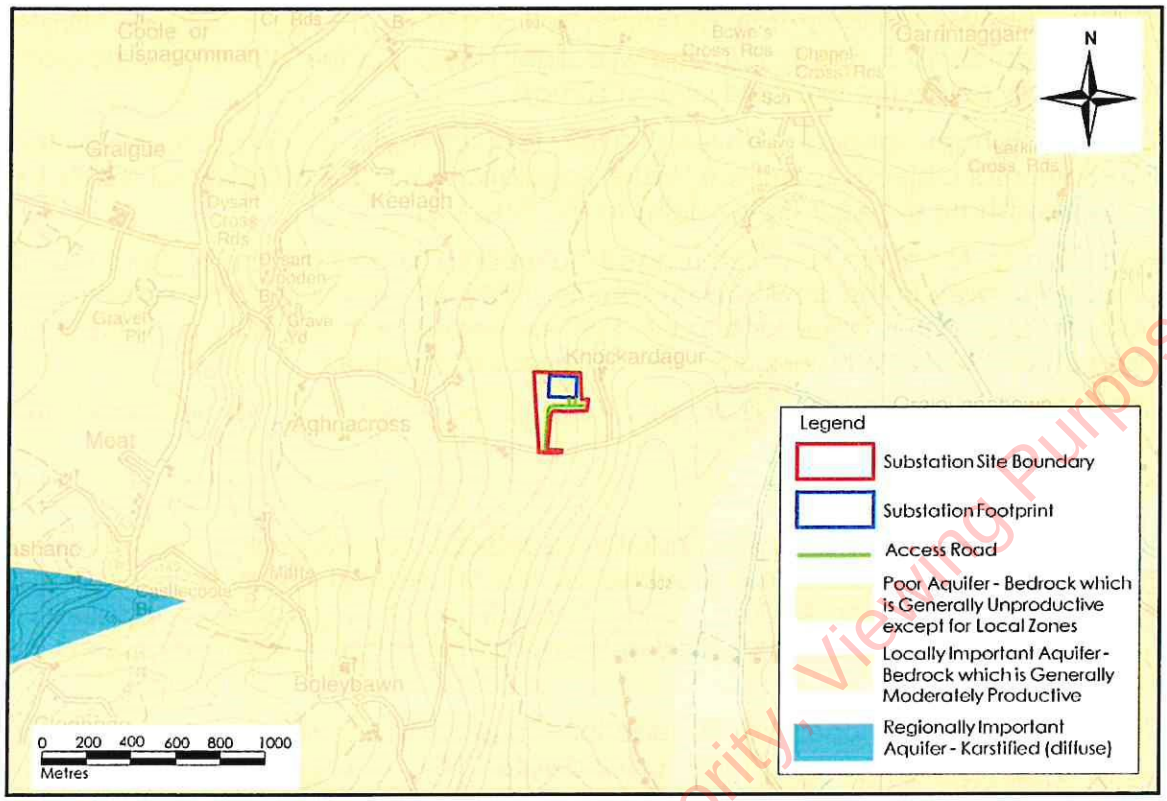


Figure 7.6: Bedrock Aquifer Mapping

7.3.8 Groundwater Vulnerability

The vulnerability rating of the aquifer at the proposed development site, as classified by the GSI, (west to east) ranges between Extreme (E) to Extreme (X) which is reflective of the varying depth of local subsoils. An Extreme (X) vulnerability rating is given where bedrock is at or close to the surface. An Extreme (E) vulnerability rating is given where subsoils are present with a maximum thickness of 3 metres.

Based on the site investigations completed at the proposed development site, which encountered bedrock at depths ranging from 1.3m to 6.6m (see **Chapter 6**), the actual mapped vulnerability mainly ranges from Extreme (X) to High (3-5m) with more localised Moderate vulnerability (5-10m).

However, due to the relatively low permeability of the shales and sandstones underlying the site, groundwater flowpaths are likely to be short (30–300m), with recharge emerging close by at seeps and surface streams. As a result, there is a low likelihood of groundwater dispersion and movement within the aquifer and, therefore, surface water bodies such as local drains and streams are more vulnerable than groundwater at this site.

7.3.9 Groundwater Hydrochemistry

There are no groundwater quality data for the proposed development site and groundwater sampling would generally not be undertaken for this type of development as groundwater quality effects would not be anticipated. However, the surface water sample taken immediately downstream of the site (SW1) is considered to be particularly representative of local groundwater conditions due to the proximity of the spring upslope.

Based on data from GSI publication *Calcareous/Non calcareous classification of bedrock in the Republic of Ireland* (WFD,2004), alkalinity for these non-calcareous bedrock type generally ranges from 14 – 400mg/L while electrical conductivity and hardness are reported to have mean values of 446µS/cm and 200mg/L respectively.

7.3.10 Groundwater Body Status

Local Groundwater Body (GWB) status information is available from **www.catchments.ie**.

Local Groundwater Body (GWB) and Surface Water Body (SWB) status reports are available for download from **www.wfdireland.ie**.

The Ballingarry GWB (IE_SE_G_009) underlies the proposed development site and is assigned 'Good Status', which is defined based on the quantitative status and chemical status of the GWB.

7.3.11 Surface Water Body Status

River/Surface Water Body status information is also available from **www.catchments.ie**. River/Surface Water Body status information is available for sub-catchments within the Owenbeg River in the area of the proposed development. The Owenbeg (Owveg(Nore)) is assigned "Good Status" both upstream and downstream of the site.

7.3.12 Designated Sites & Habitats

Due to the presence of the Knockardagur stream within the proposed development site, notwithstanding the fact that it is predominately dry and only on occasions will contain flow, a number of European and nationally designated sites are hydrologically connected to the subject site. Nationally designated sites include National Heritage Areas (NHAs) and proposed National Heritage Areas (pNHAs); while European sites designated for nature conservation include Special Areas of Conservation (SACs), candidate Special Areas of Conservation (cSAC) and Special Protection Areas (SPAs).

The proposed development site is not located within any designated conservation site. Designated sites in the wider vicinity of the proposed development site are show in **Figure 7.7**.

The proposed development site drains to the Owenbeg River, via the Knockardagur stream, which forms part of the River Barrow and River Nore SAC. The River Nore, downstream of the proposed development site, also comprises an SPA (designated due to the presence of Kingfisher) and a pNHA (River Nore and Abbeyleix Woods Complex).

The following key aquatic species and habitats of the River Barrow and River Nore SAC were identified as being at risk from a deterioration in water quality:-

- Water courses and vegetation;
- White-clawed Crayfish;
- Sea Lamprey;
- Brook Lamprey;
- River Lamprey;
- Twaite Shad;
- Salmon; and
- Nore Pearl Mussel.

The River Barrow and River Nore SAC is, therefore, considered to be very sensitive to the effects of water quality deterioration.

Designated sites that are not hydrologically connected to the development site but are located in the wider vicinity of the subject site include Lisbigney Bog SAC and pNHA (5.9km to the southwest of the site). These designated sites are not hydrologically connected to the proposed development site and, therefore, there is no likelihood of any interaction with these sites.

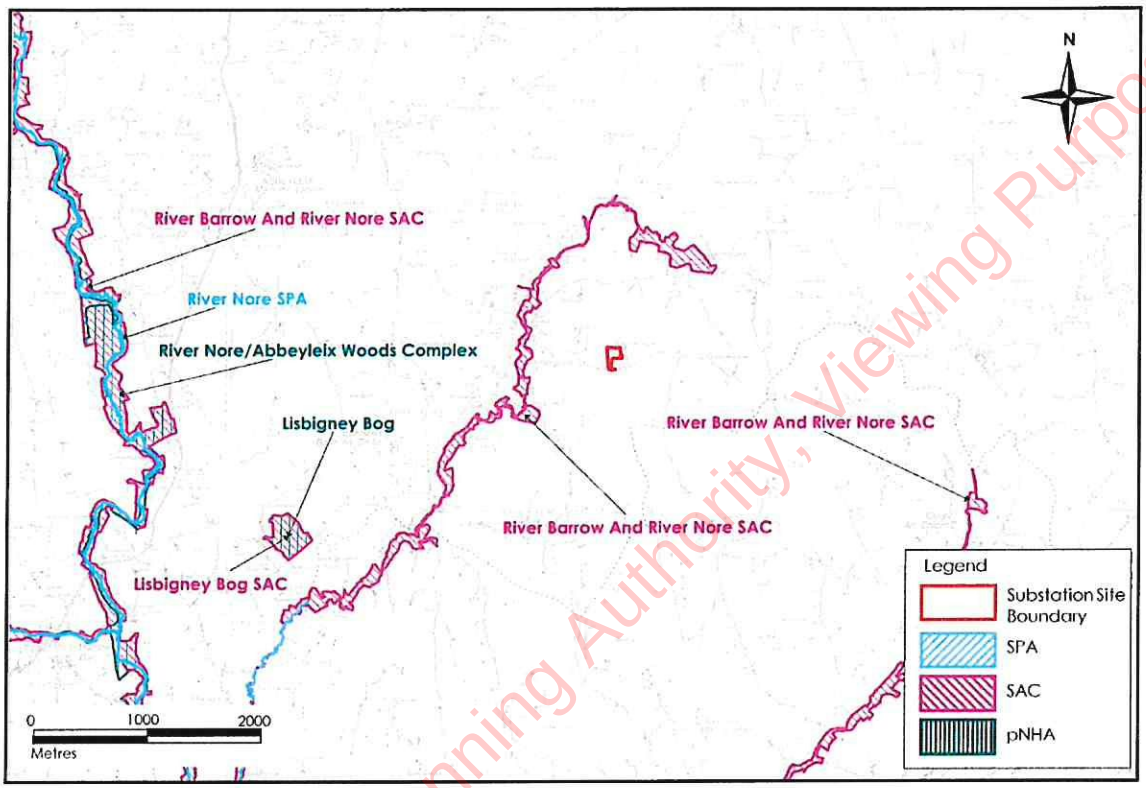


Figure 7.7: Designated Sites

7.3.13 Water Resources

There are no mapped groundwater source protection areas for public water supplies in the immediate vicinity of the proposed development.

There are a number of group water scheme (GWS) boreholes in the wider area including Ironmills GWS, Graiguenahoun GWS, Garrintaggert No. 2 and No. 3 GWS and Moyadd No. 1 GWS. Each of the GWS boreholes listed above are, at least, 2km from the proposed development and the proposed development site is not located inside the groundwater zone of contributions (ZOC) of these sources.

A search of private well locations (wells with a mapped accuracy of 1–50m were only considered) in the GSI well database (www.gsi.ie) was also undertaken. No private wells with a mapped accuracy of 1–50m are present within 1km of the proposed development site.

As the GSI well database is not exhaustive, in terms of all well locations being identified, it has been assumed that every private dwelling within 500m of the proposed development site has a well supply and this impact assessment

approach is described further below. This is an extremely conservative approach[1] as it is unlikely that every private dwelling will have its own supply well.

The private well assessment undertaken below also assumes that groundwater flow patterns and direction in the aquifer underlying the site mimics the topography of the site, whereby flowpaths will be from topographic high points to lower elevated discharge areas at streams and rivers. Using this conceptual model of groundwater flow, dwellings which are possibly located down-gradient of the proposed development site are identified and an impact assessment for these potential well locations is undertaken in the impact assessment section below.

The locations of private dwellings within 500m of the proposed development site are illustrated at **Figure 7.8**. **Figure 7.8** also illustrates, based on topography/slope that there are no private dwellings located directly down-gradient of the proposed substation footprint excavation area. Impacts on the groundwater levels of local wells from the site entrance and access road construction are not likely due to the shallow nature of the required excavations. Measures are provided at **Section 7.4** below with regard groundwater quality protection for the overall site.

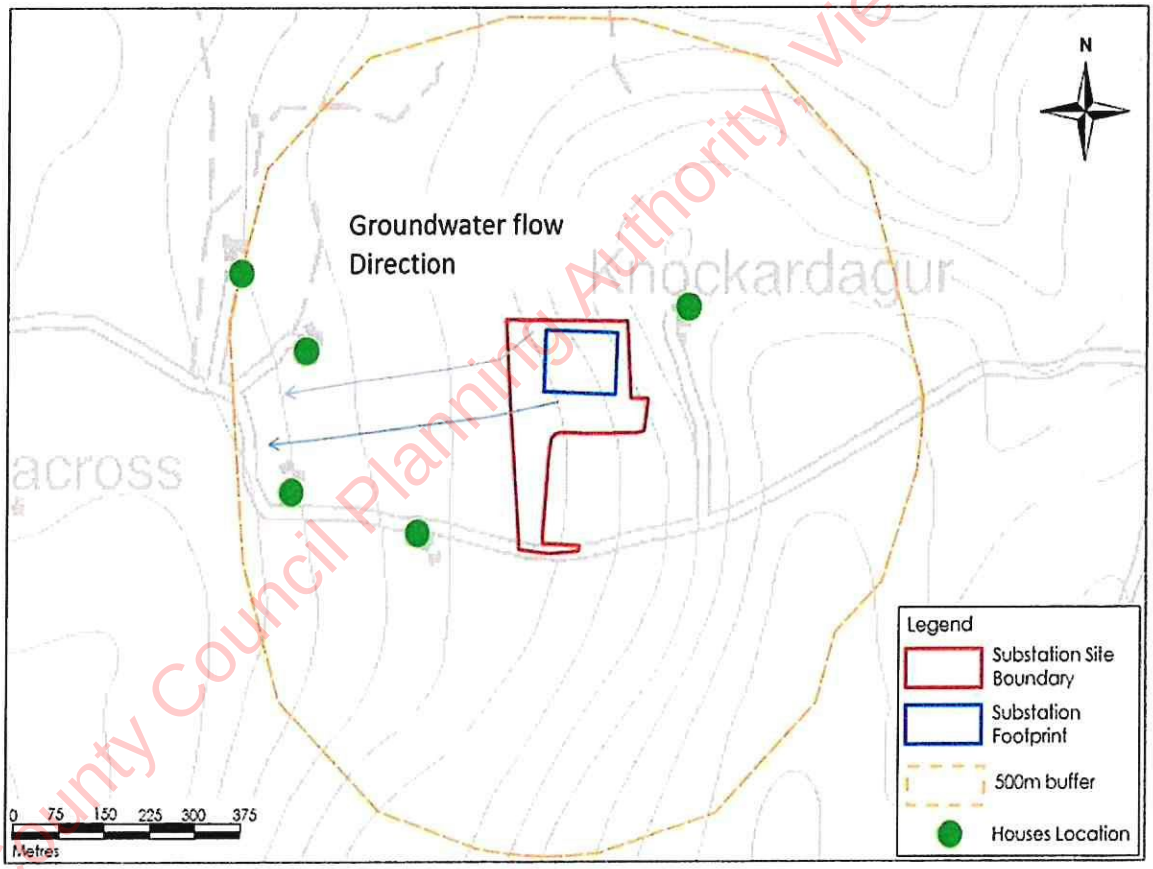


Figure 7.8: Private Dwelling Locations

[1] Please note that while wells may or may not exist at each property, the precautionary approach employed assumes that a well exists at each downgradient property and an assessment is therefore completed for each downstream dwelling.

7.3.14 Receptor Sensitivity

Due to the nature of the proposed development, being near surface construction activity, effects on groundwater are generally negligible. The primary risk to groundwater at the proposed development site would be from cementitious materials, hydrocarbon spillage and leakages. These are common possible effects on all construction sites (such as road works and industrial sites). All contamination sources are to be carefully managed at the site during the construction and operational phases of the development and mitigation measures are proposed below to avoid and manage any likelihood of effects.

Based on criteria set out at **Table 7.1** above, the Poor Aquifers (i.e. Namurian sandstones) at the site can be classed as Not Sensitive to pollution.

The majority of the proposed development site is also covered in poorly draining soil which acts as a protective cover to the underlying aquifer. Any contaminants which may be accidently released on-site are more likely to affect local surface water features, via runoff, than infiltrate groundwaters.

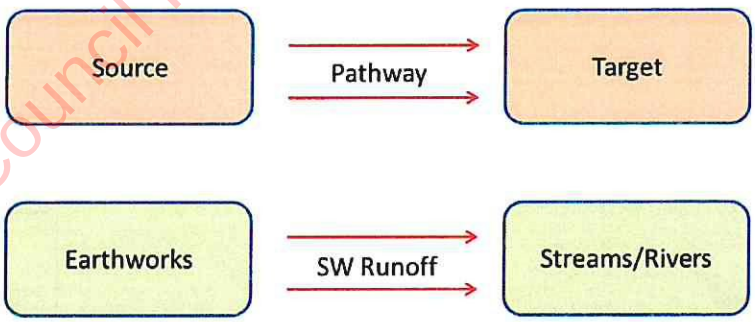
Surface water is evaluated to be the main sensitive receptor particularly given the presence of the Knockardagur stream within the proposed development site and the hydrological connectivity between the proposed development site and the Owenbeg (Owveg) River which forms part of the River Barrow and River Nore SAC. The SAC is considered to be very sensitive to adverse effects on water quality.

7.4 Description of Likely Effects

The likely effects of the proposed development are set out below, with mitigation measures that will be put in place to eliminate or reduce them provided in following sections.

7.4.1 Overview of Impact Assessment Process

The conventional source-pathway-target model (see below, top) was applied to assess likely effects on downstream environmental receptors (see below, bottom as an example) as a result of the proposed development.



Where likely effects are identified, the classification of effects in the assessment follows the descriptors provided in the glossary of impacts contained in the following guidance documents produced by the Environmental Protection Agency (EPA):-

- Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, 2017);
- Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003); and,

- Guidelines on the Information to be contained in Environmental Impact Statements (EPA, 2002).

The description process clearly and consistently identifies the key aspects of any likely impact source; namely its character, magnitude, duration, likelihood and whether it is of a direct or indirect nature.

In order to provide an understanding of the stepwise impact assessment process applied below (**Sections 7.4.3 and 7.4.4**), we have firstly presented below a summary guide that defines the steps (1 to 7) taken in each element of the impact assessment process (see **Table 7.12**). The guide also provides definitions and descriptions of the assessment process and shows how the source-pathway-target model and the EPA impact descriptors are combined.

Using this defined approach, this impact assessment process is then applied to all construction and operation activities, associated with the proposed development, which have the potential to generate significant adverse effects on the hydrological and/or hydrogeological (including water quality) environments.

Step 1	Identification and Description of Impact Source This section presents and describes the activity that brings about the likely impact or the source of pollution. The significance of effects is briefly described.	
Step 2	Pathway/ Mechanism:	The route by which a source of impact can transfer or migrate to an identified receptor. In terms of this type of development, surface water and groundwater flows are the primary pathways, or for example, excavation or soil erosion are physical mechanisms by which a likely impact is generated.
Step 3	Receptor:	A receptor is a part of the natural environment which could be impacted upon, e.g. human health, plant / animal species, aquatic habitats, soils/geology, water resources, water sources. The impact can only arise as a result of a source and pathway being present.
Step 4	Pre-mitigation Impact:	Impact descriptors which describe the magnitude, likelihood, duration and direct or indirect nature of the impact before mitigation is put in place.
Step 5	Proposed Mitigation Measures:	Control measures that will be put in place to prevent or reduce all identified significant adverse impacts. In relation to this type of development, these measures are generally provided in two types: (1) mitigation by avoidance, and (2) mitigation by engineering design.
Step 6	Post Mitigation Residual Impact:	Impact descriptors which describe the magnitude, likelihood, duration and direct or indirect nature of the impacts after mitigation is put in place.
Step 7	Significance of Effects:	Describes the likely significant post mitigation effects of the identified impact source on the receiving environment.

Table 7.12: Impact Assessment Approach

7.4.2 Do Nothing Scenario

In the do nothing scenario, there would be no alteration to the hydrological

environment. The hydrological regime, including runoff rates, would remain unchanged and current land use practices would continue. Existing land drainage arrangements would continue to function in their current manner.

7.4.3 Construction Phase

7.4.3.1 Earthworks (Removal of Vegetation Cover, Excavations and Stock Piling) Resulting in Suspended Solids Entrainment in Surface Water)

Construction phase activities including access track and substation construction will require earthworks resulting in removal of vegetation cover and excavation of soil and mineral subsoil where present.

These activities could result in the release of suspended solids to surface watercourses and could result in an increase in the suspended sediment load, resulting in increased turbidity which in turn could affect the water quality and fish stocks of downstream water bodies (receiving waters).

Attribute	Description
Receptor	Down-gradient streams, rivers and dependant ecosystems
Pathway/Mechanism	Drainage and surface water discharge routes
Pre-Mitigation Effect	Indirect, negative, significant, temporary, likely effect

Table 7.13: Earthworks

7.4.3.2 Excavation Dewatering and Likely Effects on Surface Water Quality

Some minor surface water/shallow groundwater seepages and direct rainfall input will likely occur in excavations which will create additional volumes of water to be treated by the runoff/surface water management system. Inflows will require management and treatment to reduce suspended sediments. No contaminated land was noted at the site and therefore pollution issues are not assessed as likely to occur.

Attribute	Description
Receptor	Down-gradient surface water bodies
Pathway/Mechanism	Overland flow and site drainage network
Pre-Mitigation Effect	Indirect, negative, moderate, temporary, unlikely effect on surface water quality

Table 7.14: Excavation Dewatering

7.4.3.3 Release of Hydrocarbons during Construction and Storage

Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a significant pollution risk to groundwater, surface water and associated ecosystems, and to terrestrial ecology. The accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk. Hydrocarbon has a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. It is also a nutrient supply for adapted micro-organisms, which can rapidly deplete dissolved oxygen in waters, resulting in death of aquatic organisms.

Attribute	Description
Receptor	Groundwater and surface water
Pathway/Mechanism	Groundwater flowpaths and site drainage network
Pre-Mitigation Effect	Indirect, negative, slight, short term, unlikely effect on local groundwater quality. Given the nature of the groundwater environment, discussed at **Sections 7.3.7**, **7.3.8**, **7.3.9** and **7.3.10** above, adverse effects on groundwater quality are assessed to be unlikely. Indirect, negative, significant, short term, likely effect to surface water quality

Table 7.15: Release of Hydrocarbons

7.4.3.4 Groundwater and Surface Water Contamination from Wastewater

Release of effluent from site welfare treatment systems may impact on groundwater and surface waters.

Attribute	Description
Receptor	Groundwater quality and surface water quality
Pathway/Mechanism	Groundwater flowpaths and site drainage network
Pre-Mitigation Effect	Indirect, negative, significant, temporary, unlikely effect on surface water quality. Indirect, negative, slight, temporary, unlikely effect on local groundwater.

Table 7.16: Contamination from Wastewater

7.4.3.5 Release of Cement-Based Products

Concrete and other cement-based products are highly alkaline and corrosive and can have significant adverse effects on water quality. They generate very fine, highly alkaline silt (pH 11.5) that can physically damage fish by burning their skin and blocking their gills. A pH range of ≥6 to ≤ 9 is set in S.I. No. 293 of 1988 Quality of Salmonid Water Regulations, with artificial variations not in excess of ± 0.5 of a pH unit. Entry of cement based products into the site drainage system, into surface water runoff, and hence to surface watercourses or directly into watercourses represents a risk to the aquatic environment. Freshwater ecosystems are dependent on stable near neutral pH hydrochemistry. They are extremely sensitive to the introduction of high pH alkaline waters into the system. The batching of wet concrete on site and washing out of transport and placement machinery are the activities most likely to generate a risk of cement based pollution.

Attribute	Description
Receptor	Surface water hydrochemistry and ecosystems
Pathway/Mechanism	Site drainage network
Pre-Mitigation Effect	Indirect, negative, moderate, brief, likely effect on surface water

Table 7.17: Release of Cement-Based Products

7.4.3.6 Hydrological Effects on Designated Sites

The proposed development site drains to the Owenbeg (Owveg) River which forms part of the River Barrow and River Nore SAC. The River Nore downstream of the site is also a designated pNHA (i.e. River Nore and Abbeyleix Woods Complex). Effects include a deterioration in water quality which could result in significant effects on the habitats and species of the designated sites in the absence of mitigation.

Attribute	Description
Receptor	Down-gradient water quality and designated sites
Pathway/Mechanism	Surface water flowpaths
Pre-Mitigation Effect	Indirect, negative, imperceptible, short term, likely effect

Table 7.18: Release of Cement-Based Products

7.4.4 Operational Phase

The increase in hardstanding area and roofing could result in increased runoff and erosion in the nearby stream. Pre-mitigation effects on surface water flows from site runoff are likely to result in a probable, indirect, negative, long term, reversible, slight effect.

The primary risk to surface water and groundwater quality during the operational phase will be from hydrocarbon/chemical spillage. Pre-mitigation effects are likely to result in a near certain, indirect, negative, short term, reversible, imperceptible effect.

It is proposed that all wastewater effluent, associated with welfare facilities in the Eirgrid building and IPP building (see **Chapter 3**), will be stored on-site in a sealed tank, and will be removed by tanker on a regular basis by a licensed waste management company to a licensed wastewater facility for treatment and disposal. There will be no discharges of wastewater on-site.

7.4.5 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, decommissioning phase effects will not occur.

7.4.6 'Worst-Case' Scenario

The 'worst-case' for hydrological effects is assessed to comprise the contamination of surface water features in the vicinity of the proposed development site during the construction and operational phases, which, in turn, could adversely affect the ecology and quality of the downstream surface water bodies. Furthermore, it is assessed that localised groundwater contamination from spillages or hydrocarbons and other pollutants could occur; however, based on the nature of the existing groundwater environment, any effects are not likely to be significant.

Based on the likelihood of adverse effects on the hydrological environment resulting from the construction and operation of the proposed development, it is assessed that a comprehensive suite of best practice construction methodologies and dedicated mitigation measures will be required to be implemented to prevent this 'worst-case' scenario from arising. Moreover, in addition to the prevention of the worst-case scenario, these construction methodologies and mitigation measures will ensure the avoidance of any likely significant effects on the hydrological

environment.

7.4.7 Cumulative Effects

The main likelihood for cumulative effects is assessed to be hydrological (surface water quality) rather than hydrogeological (groundwater). Due to the hydrogeological setting of the site (i.e. clay overlying a poor bedrock aquifer) and the near surface nature of construction activities, cumulative effects with regard groundwater quality or quantity arising from the proposed development are not assessed as likely.

With regards surface water quality cumulative effects, is it evaluated that the only development which is likely to act in-combination with the proposed development is the Pinewoods Wind Farm. The construction, operation and decommissioning of the Pinewoods Wind Farm, which was previously subject to Environmental Impact Assessment (EIA) and Appropriate Assessment (AA), provides for an extensive suite of detailed surface water protection measures (detailed at **Annex 3.4, Volume II**) to ensure that all surface water runoff from the that development area will be treated to an extremely high standard prior to discharge.

The mitigation measures proposed in respect of the subject proposed development, detailed at **Section 7.5** below, will also ensure that all water discharged from the proposed development site has been subject to substantial treatment to remove all presence of silt, sediment and other pollutants. Therefore, and in consideration of the relatively small footprint of the proposed development and the localised nature of the works, there is no likelihood for the proposed development to act in combination with other existing, permitted or proposed developments, including the permitted Pinewoods Wind Farm, to contribute to or result in significant hydrological/water quality effects.

7.5 Mitigation & Monitoring Measures

The overarching objective of the proposed mitigation measures is to ensure that all surface water runoff is comprehensively attenuated such that no silt or sediment laden waters or deleterious material is discharged into the local drainage system. A Surface Water Management Plan (SWMP), incorporating the surface water drainage design has been prepared, see **Annex 3.5 (Volume II)**, and incorporates the principles of Sustainable Drainage Systems (SuDS) through an arrangement of surface water drainage infrastructure. The SWMP has had regard to greenfield runoff rates and has been designed to mimic same and is sufficient to accommodate a 1-in-100 year rainfall event.

While the SuDS, overall, is an amalgamation of a suite of drainage infrastructure; the overall philosophy is straightforward. In summary:-

- All surface water runoff will be directed to specially constructed swales surrounding all areas of ground proposed to be disturbed (including areas for the temporary storage of material);
- The swales will direct runoff into settlement ponds and, subsequently, lagoon-type sediment ponds where silt/sediment will be allowed to settle; and
- Following the settlement of silt/sediment, clean water will be discharged to the local drainage network via buffered outfalls thus ensuring that no scouring occurs.

The suite of surface water drainage infrastructure will include *inter alia* infiltration interception drains, swales, sedimats, flow attenuation and filtration check dams,

settlement ponds, lagoon-type sediment ponds and buffered outfalls. A detailed description of each of these individual elements, their specific purpose and effectiveness and their technical implementation is provided at **Annex 3.5**.

The design criteria implemented as part of the SuDS are as follows:-

- To minimise alterations to the ambient site hydrology and hydrogeology;
- To provide settlement and treatment controls as close to the site footprint as possible and to replicate, where possible, the existing hydrological environment of the site;
- To minimise sediment loads resulting from the development run-off during the construction phase;
- To preserve greenfield runoff rates and volumes;
- To strictly control all surface water runoff such that no silt or other pollutants shall enter watercourses and that no artificially elevated levels of downstream siltation or no plumes of silt arise when substratum is disturbed;
- To provide settlement ponds to encourage sedimentation and storm water runoff settlement;
- To provide lagoon-type sediment traps which adhere to the design principles outlined by Altmuller and Dettmer (2006). It is not proposed to adopt, in full, the recommendations of Altmuller and Dettmer but to adapt the overall principles as applicable to the proposed development site. These lagoon-type ponds will absorb the fine particles, which may not settle in the primary settlement ponds;
- To reduce stormwater runoff velocities throughout the site to prevent scouring and encourage settlement of sediment locally;
- To manage erosion and allow for the effective revegetation of bare surfaces; and
- To manage and control water within the site and allow for the discharge of runoff from the site within the limits prescribed in the Freshwater Pearl Mussel and Salmonid Regulations.

It should be noted that the measures set out below refer to the overall mitigation framework within which the SWMP has been prepared; while further measures are also proposed.

7.5.1 Construction Phase

7.5.1.1 Earthworks (Removal of Vegetation Cover, Excavations and Stock Piling) Resulting in Suspended Solids Entrainment in Surface Water)

The management of surface water runoff and subsequent treatment prior to release off-site will be undertaken during construction work as follows:-

- Prior to the commencement of construction activities, silt fencing will be placed along the western boundary of the proposed development site and up-gradient of the Knockardagur stream. It is important to note that no construction activities will commence until all necessary preliminary water quality protection measures have been implemented to the satisfaction of the Ecological Clerk of Works (ECoW) and Environmental Manager (EM);
- All necessary preventative measures, set out in this chapter and the Surface Water Management Plan (see **Annex 3.5**) will be implemented to ensure no entrained sediment, or deleterious matter, will enter the Knockardagur stream or other watercourse/existing drain;
- Disturbed Sediment Entrainment Mats - SEDIMATS (see http://www.hy-tex.co.uk/ht_bio_sed.html) will also be used in the Knockardagur stream. These

will be installed according to the manufacturer's instructions at suitable locations on the stream;

- The silt fences will be embedded into the local soils to ensure all site water is captured and directed to the surface water drainage system;
- As construction works progress through the site towards the substation footprint, water protection measures will be implemented.;
- Discharge to ground will be via a buffered outfall arrangement e.g. silt bag which will filter any remaining sediment from the pumped water;
- No pumped construction water will be discharged directly into local streams and all surface water runoff will be fully treated prior to discharge;
- Installation of upslope interceptor drainage to keep clean surface water runoff away from works areas;
- Daily monitoring of the excavation/earthworks, the water treatment and pumping system and the discharge area will be completed by the EM throughout the construction phase;
- If high levels of silt or other contamination is noted in the water treatment systems, all construction works will be immediately stopped. No works will recommence until the issue is resolved, to the satisfaction of the EM, and the cause of the elevated source is fully remedied;
- Earth works will be scheduled to take place during periods of low rainfall to reduce run-off and possible siltation of watercourses; and
- The Construction Industry Research and Information Association (CIRIA) provide guidance on the control and management of water pollution from construction sites ('Control of Water Pollution from Construction Sites, guidance for consultants and contractors', CIRIA, 2001). The guidance contained within this document will be strictly implemented and enforced on-site which will ensure that surface water arising during the course of construction activities will contain minimum sediment.

Pre-emptive Site Drainage Management

The works programme for the construction stage of the development will also take account of weather forecasts and predicted rainfall in particular. Large excavations and movements of soil/subsoil or vegetation stripping will be suspended or scaled back if prolonged or intense rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

The following forecasting systems are available and will be used on a daily basis at the site to direct proposed construction activities:-

- General Forecasts: Available on a national, regional and county level from the Met Eireann website (www.met.ie/forecasts). These provide general information on weather patterns including rainfall, wind speed and direction but do not provide any quantitative rainfall estimates;
- Meteo Alarm: Alerts to the possible occurrence of severe weather for the next 2 days. Less useful than general forecasts as only available on a provincial scale;
- 3 hour Rainfall Maps: Forecast quantitative rainfall amounts for the next 3 hours but does not account for possible heavy localised events;
- Rainfall Radar Images: Images covering the entire country are freely available from the Met Eireann website (www.met.ie/latest/rainfall_radar.asp). The images are a composite of radar data from Shannon and Dublin airports and give a picture of current rainfall extent and intensity. Images show a

quantitative measure of recent rainfall. A 3 hour record is given and is updated every 15 minutes. Radar images are not predictive; and,
- Consultancy Service: Met Eireann provide a 24 hour telephone consultancy service. The forecaster will provide interpretation of weather data and give the best available forecast for the area of interest.

The use of safe threshold rainfall values will allow work to be safely controlled (from a water quality perspective) in the event of an impending high rainfall intensity event.

Works will be suspended if forecasting suggests either of the following is likely to occur:-

- >10 mm/hr (i.e. high intensity local rainfall events);
- >25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
- >half monthly average rainfall in any 7 days.

Prior to works being suspended, the following control measures should be completed:-

- Secure all open excavations;
- Provide temporary or emergency drainage to prevent back-up of surface runoff; and,
- Avoid working during heavy rainfall and for up to 24 hours after heavy events to ensure drainage systems are not overloaded.

7.5.1.2 Excavation Dewatering and Effects on Surface Water Quality

The management of excavation dewatering (pumping) and subsequent treatment prior to discharge into the drainage network will be undertaken as follows:-

- Appropriate interceptor drainage, to prevent upslope surface runoff from entering excavations, will be put in place;
- The interceptor drainage will be discharged to the site constructed drainage system and not directly to surface waters to ensure that Greenfield runoff rates are mimicked;
- If required, pumping of excavation inflows will prevent build up of water in the excavation;
- All pumped water will be directed to the surface water drainage system for treatment prior to discharge;
- There will be no direct discharge to surface watercourses, and therefore no risk of hydraulic loading or contamination will occur;
- Daily monitoring of site excavations by the EM will occur during the construction phase. If high levels of seepage inflow occur, excavation work at this location will cease immediately and a geotechnical assessment undertaken; and,
- A mobile 'Siltbuster' or similar equivalent specialist treatment system will be available on-site for emergencies. Siltbusters are mobile silt traps that can remove fine particles from water using a proven technology and hydraulic design in a rugged unit. The mobile units are specifically designed for use on construction-sites. They will be used as final line of defence if needed.

7.5.1.3 Release of Hydrocarbons during Construction and Storage

Mitigation measures proposed to avoid release of hydrocarbons at the site are as follows:-

- The volume of fuels or oils stored on site will be minimised. All fuel and oil will be stored in an appropriately bunded area within the temporary construction compound at the Pinewoods Wind Farm site and will be transported to the proposed development site as required. Only an appropriate volume of fuel will be stored at any given time. The bunded area will be roofed to avoid the ingress of rainfall and will be fitted with a storm drainage system and an appropriate oil interceptor;
- All bunded areas will have 110% capacity of the volume to be stored;
- On site re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer, will be re-filled at the temporary compound and will be towed around the site by a 4x4 jeep to where plant and machinery is located. The 4x4 jeep will also be fully stocked with fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations to avoid any accidental leakages;
- All plant and machinery used during construction will be regularly inspected for leaks and fitness for purpose;
- Spill kits will be readily available to deal with and accidental spillage;
- All waste tar material arising from road cuttings (as may be required in the construction of the site entrance) will be removed off-site and taken to a licensed waste facility. Due to the possibility of contamination of soils and subsoils, it is not proposed to utilise this material for any reinstatement works; and
- An outline emergency plan for the construction phase to deal with accidental spillages is contained within the preliminary CEMP (**Annex 3.4**). This emergency plan will be further developed prior to the commencement of development, and will be agreed with the Planning Authority as part of the detailed CEMP.

7.5.1.4 Groundwater and Surface Water Contamination from Wastewater Disposal

Measures to avoid contamination of ground and surface waters by wastewaters will comprise:-

- Self contained port-a-loos (chemical toilets) with an integrated waste holding tank will be installed at the Pinewoods Wind Farm temporary construction compound, maintained by the providing contractor, and removed from site on completion of the construction works;
- Water supply for the site office and other sanitation will be brought to site and removed after use to be discharged at a suitable off-site treatment location; and,
- No water will be sourced on the site, nor will any wastewater be discharged to the site.

7.5.1.5 Release of Cement-Based Products

The following mitigation measures are proposed to ensure that the release of cement-based products is avoided:-

- No batching of wet-cement products will occur on site. Ready-mixed concrete will be brought to site as required and, where possible, emplacement of pre-cast products, will take utilised;

- Where concrete is delivered on site, only the chute will be cleaned, using the smallest volume of water practicable. Chute cleaning will be undertaken at lined cement washout ponds within the Pinewoods Wind Farm temporary construction compound with waters being tankered off site and disposed of at an approved licensed facility. There will be no discharge of cement contaminated waters to the construction drainage system or to any drain or watercourse;
- Weather forecasting will be used to ensure that prolonged or intense rainfall is not predicted during concrete pouring activities; and,
- The pour site will be kept free of standing water and plastic covers will be ready in case of sudden rainfall event.

7.5.1.6 Hydrological Effects on Designated Sites

The proposed mitigation measures for protection of surface water quality, discussed above and further detailed at **Annex 3.5**, will ensure that the quality of runoff from proposed development areas will be very high and that no deleterious material is discharged to watercourses.

As stated in **Section 7.4.3.1** above, in the absence of mitigation, there could be an "imperceptible, temporary, low probability effect" on local streams and rivers which, if occurring, would be extremely localised and of a very short duration (i.e. hours). Given the wide ranging and comprehensive set of mitigation measures outlined above and further detailed in the SWMP, it is concluded that there is no likelihood of significant hydrological or water quality effects on any downstream designated site including the River Barrow and River Nore SAC, River Nore SPA and River Nore & Abbeyleix Woods Complex pNHA.

7.5.2 Operational Phase

7.5.2.1 Progressive Replacement of Natural Surface with Lower Permeability Surfaces

Stormwater Runoff

Stormwater control measures are as follows:-

- During the operational phase, stormwater from the proposed development site will be discharged to ground via soakaways following attenuation;
- Stormwater discharge from the proposed development site will be limited to greenfield runoff rates, therefore there will be no increase in storm water runoff rates entering the local environment;
- Runoff from the transformer and car park areas will be also be passed through an oil interceptor to prevent any discharge of hydrocarbons; and,
- It is likely that minor volumes of groundwater seepage will arise from the cut slopes. This water will be directed into the surface water management system for appropriate treatment prior to discharge.

Hydrocarbons and Chemicals

Proposed mitigation measures for storage of fuel and chemicals are outlined as follows:-

- All storage containers will be labelled appropriately, including hazardous markings;

- All holding tanks will be constructed of material appropriate for fuel/chemical storage and will be bunded to at least 110% of the maximum tank volume or 25% of the total capacity of all the tanks within the bund, whichever is greatest;
- All bulk tanks will be located within an impervious bund;
- Bunds will be to standard specified in CIRIA Report 163 'Construction of bunds for oil storage tanks' and CIRIA Report C535 'Above-ground proprietary prefabricated oil storage tank systems;
- Barrels and bunded containers will be stored upright and internally where appropriate and always on drip trays or sump pallets;
- Appropriate spill kits will be available at all storage locations;
- All fuel/chemical storage facilities will be subject to weekly inspection; and,
- Leaking or empty drums will be removed from the site immediately and disposed of via a registered waste disposal contractor.

7.5.3 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, no decommissioning phase mitigation measures are required.

7.6 Residual Effects

7.6.1 Construction Phase

7.6.1.1 Earthworks (Removal of Vegetation Cover, Excavations and Stock Piling) Resulting in Suspended Solids Entrainment in Surface Water

Following the implementation of appropriate mitigation measures, as outlined above, the residual effect is assessed to be a negative, indirect, imperceptible, short term, likely effect. Significant adverse effects on water quality are not assessed as likely.

7.6.1.2 Excavation Dewatering and Likely Effects on Surface Water Quality

Residual effects, following the implementation of mitigation measures, are assessed to be indirect, imperceptible, short term and are not assessed as likely to be significant.

7.6.1.3 Likely Release of Hydrocarbons during Construction and Storage

Following the implementation of appropriate mitigation measures, as outlined above, the residual effect is assessed to be indirect, negative, imperceptible, short term and unlikely.

No significant effects on surface water or groundwater quality are assessed as likely.

7.6.1.4 Groundwater and Surface Water Contamination from Wastewater Disposal

No significant residual effects are assessed as likely to occur.

7.6.1.5 Release of Cement-Based Products

Residual effects, following the implementation of mitigation measures, are assessed to be negative, indirect, imperceptible, short term and unlikely.

No significant effects on surface water quality are assessed as likely to occur.

7.6.1.6 Likely Hydrological Effects on Designated Sites

No significant residual effects are assessed as likely to occur.

7.6.2 Operational Phase

7.6.2.1 Replacement of Natural Surface with Lower Permeability Surfaces

Following the implementation of appropriate mitigation measures, as outlined above, the residual effect is assessed to be direct, neutral, long term and likely; however, significant effects on surface water features are not likely.

7.6.3 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, residual decommissioning phase effects will not occur.

7.7 Monitoring

Ongoing monitoring of the surface water drainage system will be the responsibility of the EM. Prior to the commencement of development, a detailed Water Quality Inspection & Monitoring Plan (WQIMP) will be agreed with the Planning Authority. The monitoring programme will comprise field testing and laboratory analysis of a range of agreed parameters. Surface water monitoring will be undertaken along the Knockardagur stream and will include sampling locations SW1 and SW2.

The civil works contractor, who will be responsible for the construction of the site drainage system, and EM will undertake regular inspections of the drainage system to ensure that all measures are functioning effectively. Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended.

Any excess build-up of silt levels at any drainage features that may decrease the effectiveness of the drainage feature will be removed and disposed of at a licensed waste management facility.

7.8 Summary

During each phase of the proposed development (construction and operation), a number of activities will take place on the site of the proposed development which will have the potential to adversely affect the hydrological regime or water quality at the site or its vicinity. These likely effects generally arise from sediment input from runoff and other pollutants such as hydrocarbons and cement based compounds, with the former having the most likelihood for effect.

Surface water drainage measures, pollution control and other preventative measures have been incorporated into the project design to minimise any likely adverse effects on water quality and downstream designated sites.

The management of surface water is the principal means of significantly reducing sediment runoff arising from construction activities and to control runoff rates. The key surface water control measure is that there will be no direct discharge of site runoff into local watercourses.

Preventative measures also include fuel and concrete management and the preparation of a final SWMP which will be incorporated into the detailed CEMP to be prepared prior to the commencement of development.

Overall, the proposed development presents no likelihood for significant effects on surface or groundwater quality following the implementation of the proposed mitigation measures. Additionally, this assessment has determined that there is no

likelihood for significant cumulative effects to arise as a result of the construction, operation or decommissioning of the proposed development.

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Pinewoods Wind Farm Substation & Grid Connection

Chapter 8:
Air Quality & Climate

Pinewood Wind Ltd

Galetech Energy Services
Clondargan, Stradone, Co. Cavan Ireland
Telephone +353 49 555 5050
www.galetechenergy.com

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8.1 Introduction

8.1.1 Background

This chapter comprises an assessment of the likely effect on air quality and climate associated with the proposed development. This report provides a baseline assessment of the setting of the proposed development in terms of air quality and climate, and discusses the likely and significant effects that the construction, operation and decommissioning of the proposed development will have on them. Where required, appropriate mitigation measures to limit any identified likely significant adverse effects to air quality and climate are recommended.

8.1.2 Description of the Proposed Development

In summary, the proposed development comprises the following main components:-

- 1 no. 110kV 'loop in-loop out' air-insulated switchroom (AIS) substation including control buildings, transformers and all ancillary electrical equipment; and
- All associated site development, access and reinstatement works.

The entirety of the proposed development is located within the administrative area of County Laois; while the overall Pinewoods Wind Farm project is partly located within County Laois and County Kilkenny. Additionally, candidate quarries which may supply construction materials are also located within County Kilkenny and Carlow.

A full description of the proposed development is presented in **Chapter 3**.

8.1.3 Statement of Authority

The assessment of likely effects on air quality and climate, and preparation of this EIAR chapter, has been undertaken by various members of the Galetech Energy Services (GES) Environment & Planning Team. GES has substantial experience in preparing EIARs and having prepared and reviewed Air Quality & Climate EIAR chapters for numerous wind farm developments.

8.2 Standards & Guidance

8.2.1 Ambient Air Quality Standards

In order to reduce the risk to health from poor air quality, national and European statutory bodies have set limit values in ambient air quality for a range of air pollutants. These limit values or "Air Quality Standards" are health or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set, see **Table 8.1** below.

Air quality significance criteria are assessed on the basis of compliance with the appropriate standards or limit values. The applicable standards in Ireland include the Air Quality Standards Regulations 2011, which incorporate EU Directive 2008/50/EC and combines the previous air quality framework and subsequent daughter directives (see **Table 8.1**). Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions (see **Annex 8.1**, **Volume II**).

The focus from a health perspective is on particles of dust which are less than 10 microns. EU ambient air quality standards (Council Directive 2008/50/EC transposed into Irish law as S.I. 180 of 2011) centres on PM_{10} (particles less than 10 microns) as it is

these particles which may be inhaled into the lungs and possibly cause adverse health effects. The Directive also sets an ambient standard for $PM_{2.5}$ (particles less than 2.5 microns and form part of PM_{10}) which came into force in 2015 (see **Table 8.1**).

8.2.1.1 Gothenburg Protocol

In 1999, Ireland signed the Gothenburg Protocol to the 1979 UN Convention on Long Range Transboundary Air Pollution. The initial objective of the Protocol was to control and reduce emissions of Sulphur Dioxide (SO_2), Nitrogen Oxides (NO_X), Volatile Organic Compounds (VOCs) and Ammonia (NH_3). To achieve the initial targets, Ireland was obliged, by 2010, to meet national emission ceilings of 42kt for SO_2 (67% below 2001 levels), 65kt for NO_X (52% reduction), 55kt for VOCs (37% reduction) and 116kt for NH_3 (6% reduction). In 2012, the Gothenburg Protocol was revised to include national emission reduction commitments for the main air pollutants to be achieved in 2020 and beyond and to include emission reduction commitments for $PM_{2.5}$. In relation to Ireland, 2020 emission targets are 25kt for SO_2 (65% below 2005 levels), 65kt for NO_X (49% reduction), 43kt for VOCs (25% reduction), 108kt for NH_3 (1% reduction) and 10kt for $PM_{2.5}$ (18% reduction). COM (2013) 917 Final is the "Proposal for a Council Decision for the acceptance of the Amendment to the 1999 Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution to Abate Acidification, Eutrophication and Ground-level Ozone".

European Commission Directive 2001/81/EC and the National Emissions Ceiling Directive (NECD), prescribes the same emission limits as the 1999 Gothenburg Protocol. A National Programme for the progressive reduction of emissions of these four transboundary pollutants has been in place since April 2005. Directive (EU) 2016/2284 "On the Reduction of National Emissions of Certain Atmospheric Pollutants and Amending Directive 2003/35/EC and Repealing Directive 2001/81/EC" was published in December 2016. The Directive will apply the 2010 NECD limits until 2020 and establish new national emission reduction commitments which will be applicable from 2020 and 2030 for SO_2, NO_X, NMVOC, NH_3 and $PM_{2.5}$. In relation to Ireland, 2020-29 emission targets are for SO_2 (65% below 2005 levels), for NO_X (49% reduction), for VOCs (25% reduction), for NH_3 (1% reduction) and for $PM_{2.5}$ (18% reduction). In relation to 2030, Ireland's emission targets are for SO_2 (85% below 2005 levels), for NO_X (69% reduction), for VOCs (32% reduction), for NH_3 (5% reduction) and for $PM_{2.5}$ (41% reduction). The data available from the EPA in 2020 (EPA 2020a) show that Ireland exceeded its emission ceiling for NH_3, NOx and NMVOC) in 2018. For 2030, NMVOC and NH_3 are projected to be in non-compliance with emission ceilings

Pollutant	Regulation	Limit Type	Margin of Tolerance	Value
Nitrogen Dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	None	200 µg/m³ NO_2
		Annual limit for protection of human health	None	40 µg/m³ NO_2
		Annual limit for protection of vegetation	None	30 µg/m³ $NO + NO_2$
Particulate Matter (as PM_{10})	2008/50/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50%	50 µg/m³ PM_{10}
		Annual limit for protection of human health	20%	40 µg/m³ PM_{10}
$PM_{2.5}$	2008/50/EC	Annual limit for protection of human health	None	25 µg/m³ $PM_{2.5}$

Table 8.1: Air Quality Standards Regulations 2011 (Based on Directive 2008/50/EC and S.I. 180 of 2011)

8.2.2 Climate Agreements

Ireland ratified the United Nations Framework Convention on Climate Change (UNFCCC) in April 1994 and the Kyoto Protocol in principle in 1997 and formally in May 2002 (Framework Convention on Climate Change, 1999 and Framework Convention on Climate Change, 1997). For the purposes of the EU burden sharing agreement under Article 4 of the Doha Amendment to the Kyoto Protocol, in December 2012, Ireland agreed to limit the net growth of the six Greenhouse Gases (GHGs) under the Kyoto Protocol to 20% below the 2005 level over the period 2013 to 2020 (UNFCCC 2012).

The UNFCCC is continuing detailed negotiations in relation to GHG reductions and in relation to technical issues such as Emission Trading and burden sharing. The most recent Conference of the Parties to the Convention (COP24) took place in Katowice, Poland in December 2018 and focussed on advancing the implementation of the Paris Agreement. The Paris Agreement was established at COP21 in Paris in 2015 and is an important milestone in terms of international climate change agreements. The Paris Agreement, agreed by over 200 nations, has a stated aim of limiting global temperature increases to no more than 2°C above pre-industrial levels with efforts to limit this rise to 1.5°C. The aim is to limit global GHG emissions to 40 gigatonnes as soon as possible whilst acknowledging that peaking of GHG emissions will take longer for developing countries. Contributions to greenhouse gas emissions will be based on Intended Nationally Determined Contributions (INDCs) which will form the foundation for climate action post 2020. Significant progress was also made on elevating adaption onto the same level as action to cut and curb emissions.

The EU, on the 23 & 24 October 2014, agreed the '2030 Climate and Energy Policy Framework' (EU, 2014). The European Council endorsed a binding EU target of at least a 40% domestic reduction in greenhouse gas emissions by 2030 compared to

1990. The target will be delivered collectively by the EU in the most cost-effective manner possible, with the reductions in the ETS (Emissions Trading Scheme) and non-ETS sectors amounting to 43% and 30% by 2030 compared to 2005, respectively. Secondly, it was agreed that all Member States will participate in this effort, balancing considerations of fairness and solidarity. The policy also outlines, under "Renewables and Energy Efficiency", an EU binding target of at least 32% for the share of renewable energy consumed in the EU in 2030.

The EPA 2019 GHG Emissions Projections Report (EPA 2019a) notes that there is a long-term projected decrease in greenhouse gas emissions as a result of inclusion of new climate mitigation policies and measures that formed part of the National Development Plan (NDP) which was published in 2018. Implementation of these policies and measures are classed as a "*With Additional Measures scenario*" for future scenarios. A change from generating electricity using coal and peat to wind power and diesel vehicle engines to electric vehicle engines are envisaged under this scenario. While emissions are projected to decrease in these areas, emissions from agriculture are projected to grow steadily due to an increase in animal numbers. However, over the period 2013-2020 Ireland is projected to cumulatively exceed its compliance obligations with the EU's Effort Sharing Decision (Decision No. 406/2009/EC) 2020 targets by approximately 10 Mt CO_2 equivalent under the "*Without Existing Measures scenario*" and 9 Mt CO_2 equivalent under the "*With Additional Measures scenario*". The most recent EPA (EPA 2020b) projections show that full implementation of the 2019 Climate Action Plan will result in a reduction in Ireland's total greenhouse gas emissions by up to 23% by 2030 compared to the 2019 greenhouse gas inventory levels.

8.3 Methodology

The methodology employed as part of this assessment comprised a desktop appraisal and evaluation of existing environmental conditions; the likely effects which may arise during the construction, operational and decommissioning phases; and identification of measures to off-set or reduce likely adverse effects. The following sections set out the methodology utilised to assess air quality and climate in respect of the construction and operational phases.

8.3.1 Construction Phase

8.3.1.1 Air Quality

The assessment of air quality has been carried out using a phased approach as recommended by the Department for Environment, Food and Rural Affairs in the United Kingdom [UK DEFRA 2016]. The phased approach recommends that the complexity of an air quality assessment be consistent with the risk of failing to achieve the air quality standards.

The current assessment thus focused firstly on identifying the existing baseline levels of NO_2 and PM_{10} in the region of the proposed development by an assessment of EPA monitoring data. Thereafter, the effect of the development during the construction phase of the project on air quality at the neighbouring sensitive receptors was determined by an assessment of the dust generating construction activities associated with the proposed development. The effect of dust from the construction phase will be short-term in nature and is assessed in **Section 8.5.2.1**.

Material handling activities, including excavation and backfill, on site may typically emit dust. Dust is characterised as encompassing particulate matter with a particle size of between 1 and 75 microns (1- 75 µm). Deposition typically occurs in close

proximity to each site and effects generally occur within 500 metres of the dust generating activity as dust particles fall out of suspension in the air. Larger particles deposit closer to the generating source and deposition rates will decrease with distance from the source. Sensitivity to dust depends on the duration of the dust deposition, the dust generating activity and the nature of the deposit. Therefore, a higher tolerance of dust deposition is likely to be shown if only short periods of dust deposition are expected and the dust generating activity is either expected to stop or move on.

The likelihood of dust emissions will depend on the type of activity being carried out in conjunction with environmental factors including levels of rainfall, wind speed and wind direction. Activities associated with the proposed development such as excavation and backfill are likely to generate dust.

As indicated, dust generation rates depend on the site activity, particle size (in particular the silt content, defined as particles smaller than 75 microns in size), the moisture content of the material and weather conditions. Dust emissions are dramatically reduced where rainfall has occurred due to the cohesion created between dust particles and water and the removal of suspended dust from the air. It is typical to assume that no dust is generated under "wet day" conditions where rainfall greater than 0.2 mm has fallen. Information collected at the Kilkenny Meteorological Station (Met Eireann 2019, 30-year averages) identified that 193 days per annum are typically classed as "wet". Thus, almost 53% of the time no significant dust generation will be likely due to meteorological conditions.

Large particle sizes (greater than 75 microns) fall rapidly out of atmospheric suspension and are subsequently deposited in close proximity to the source. Particle sizes of less than 75 microns are of interest as they can remain airborne for greater distances and can give rise to dust nuisance at the sensitive receptors. This size range would broadly be described as silt. Emission rates are normally predicted on a site-specific particle size distribution for each dust emission source. The nearest sensitive residential receptor is at a distance of approximately 100m from the proposed development; however there are residential receptors in closer proximity to the construction traffic haul route.

Research carried out in the United States has shown that haul trucks generate the majority of dust emissions from surface mining sites, accounting for an estimated 78 - 97% of total dust emissions (UK ODPM 2000). The Institute of Air Quality Management Construction Dust Guidance (IAQM 2014) states that 'track out' (the spreading of dust onto roads from the wheels of vehicles leaving construction sites) related construction dust impact increases with respect to the number of movements of HGV's per day, length of unpaved road, distance to receptors and the sensitivity of local receptors. While the dust emission magnitude can be high, due to the short length of on-site unpaved access track, the paved nature of proposed haul route (public roads), the distance to receptors and low ambient background PM_{10} concentrations, the risk of effects with respect to health effects and dust soiling is initially considered as likely to be low; however, this will be further assessed below.

8.3.1.2 Climate – Construction Traffic and Materials

Under the EU Commission's Climate and Energy Package, Ireland is required to deliver a 20% reduction in non-ETS greenhouse gas emissions by 2020 (relative to 2005 levels). In addition, Ireland also has binding annual emission limits for the period 2013 - 2020 to ensure a gradual move towards the 2020 target. In 2014, the EU agreed the "2030 Climate and Energy Policy Framework" (EU, 2014). The European

Council endorsed a binding EU target of at least a 40% domestic reduction in greenhouse gas emissions by 2030 compared to 1990. In terms of 2030 reduction targets the, EU Effort Sharing Regulation (Regulation (EU) 2018/842) requires that Ireland reduce its non-ETS emissions by 30% on 2005 levels by 2030.

The non-ETS sectors cover those that are outside the EU ETS and include the agriculture, transport, residential, commercial, waste and non-energy intensive industries. In order to assess the effect on GHG concentrations of the combined total of embodied energy from construction materials, forestry loss and peat extraction; the three are summed. This value is then compared to Ireland's 2017 total national GHG emissions and the targets which Ireland must achieve. No set guidance is available on significance of the increase in GHG emissions and therefore professional judgement must be used when reviewing this effect.

Climate change is a result of increased levels of carbon dioxide and other GHGs in the atmosphere causing the heat trapping capacity of the atmosphere to increase. GHGs can be emitted from vehicles and embodied energy associated with materials used in the construction of a development. Embodied energy refers to the sum of the energy needed to produce a good or service. It incorporates the energy needed in the mining or processing of raw materials, the manufacturing of products and the delivery of these products to site. A number of embodied GHGs could be emitted during the construction phase of the development. For example, construction vehicles, generators etc., may give rise to CO_2 and N_2O emissions as well as the large quantities of material such as stone, concrete and steel that will be required for the project. The Institute of Air Quality Management Guidance on the Assessment of Dust from Demolition and Construction (IAQM 2014) states that site traffic and plant is unlikely to make a significant effect on climate.

8.3.1.3 Climate – Forestry and Peat Removal

Trees are a natural carbon sink and absorb CO_2 from the atmosphere helping in the reduction of climate change; any felling of forestry results in a loss of this carbon sink thus, increasing the levels of CO_2 in the atmosphere. However, increased planting of trees on suitable lands will, over time, help to increase the carbon sink capacity of the land and benefit climate. The "Best Practice Guidelines for the Irish Wind Energy Industry" (IWEA 2012) is used for calculating the GHG sinks due to the loss of forestry.

The GHG emissions associated with peat excavation has been assessed using the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories, Volume 4: Agriculture, Forestry and Other Land Use, Chapter 7 Wetlands (IPCC 2006).

8.3.2 Operational Phase

8.3.2.1 Air Quality

An assessment of baseline air quality in the region has been conducted to determine whether current levels of key pollutants are significantly lower than their limit values.

8.3.2.2 Climate

There will be no greenhouse gas emissions from the operation of the proposed development. However, the operation of the proposed development will facilitate export of renewably generated electricity to the national grid from the permitted

Pinewoods Wind Farm and will displace approximately 110 GWh[1] (annually) of electricity which, otherwise, would have been produced from fossil fuels; thus resulting in a net benefit in terms of greenhouse gas emissions by off-setting c. 50,000 tonnes of CO_2 equivalent per annum.

Vehicular traffic is often a dominant source of greenhouse gas emissions as a result of developments; however, operational phase vehicular movements will be negligible.

8.3.3 Decommissioning Phase

The methodologies for assessing construction phase effects will also be used to assess the likelihood of effects during the decommissioning phase.

8.4 Description of the Existing Environment

8.4.1 Meteorological Data

A key factor in assessing temporal and spatial variations in air quality is the prevailing meteorological conditions. Depending on wind speed and direction, individual receptors may experience very significant variations in pollutant levels under the same source strength (i.e. traffic levels) (WHO 2006). Wind is of key importance in dispersing air pollutants and for ground level sources, such as traffic emissions, pollutant concentrations are generally inversely related to wind speed. Thus, concentrations of pollutants derived from traffic sources will generally be greatest under very calm conditions and low wind speeds when the movement of air is restricted. In relation to PM_{10}, the situation is more complex due to the range of sources of this pollutant. Smaller particles (less than $PM_{2.5}$) from traffic sources will be dispersed more rapidly at higher wind speeds. However, fugitive emissions of coarse particles ($PM_{2.5}$ – PM_{10}) will actually increase at higher wind speeds. Thus, measured levels of PM_{10} will be a non-linear function of wind speed.

The nearest representative weather station collating detailed weather records is Carlow Oakpark, which is located approximately 23 km east of the proposed development site. However, due to the availability of long term average meteorological data from the Kilkenny weather station, data from this station has been utilised in this assessment. Kilkenny meteorological data has been examined to identify the prevailing wind direction and average wind speeds over the long-term data set from 1981-2007. The average wind speed over the period 1981–2007 is approximately 3.5 m/s at ground level. Although the wind data gives an indication of the prevailing wind direction, this data is not used in the air quality and climate assessment of the proposed development.

In addition, and as set out above, 30-year average data, for Kilkenny weather station, indicates that 193 days per annum are typically classed as "wet" which would significantly curtail the likelihood of significant emissions of dust.

8.4.2 Available Background Data

8.4.2.1 Air Quality

Air quality monitoring programmes have been undertaken in recent years by the EPA and Local Authorities. The most recent annual report on air quality "*Air Quality Monitoring Report 2018*" (EPA 2019a), details the range and scope of monitoring undertaken throughout Ireland. As part of the implementation of the Air Quality

[1] See Section 7.3.2.1, Chapter 7, Volume I of the Pinewoods Wind Farm EIAR/EIS

Standards Regulations 2002 (S.I. No. 271 of 2002), four air quality zones have been defined in Ireland for air quality management and assessment purposes (EPA, 2019b). Zone A is defined as Dublin and its environs, Zone B is defined as Cork City, Zone C is defined as urban areas with a population greater than 15,000 and Zone D is defined as the remainder of the country. The rural area within which the proposed development is located is classed as Zone D.

NO_2 monitoring was carried out at two rural Zone D locations in 2018, Emo Court (County Laois) and Kilkitt (County Monaghan) and the urban site of Castlebar (County Mayo) (EPA 2019a). The NO_2 annual average in 2018 for both rural sites was 3µg/m³ with a result of 8µg/m³ for the urban site. Hence, long-term average concentrations measured at all locations were significantly lower than the annual average limit value of 40µg/m³. Based on the above information, a conservative estimate of the background NO_2 concentration at the proposed development site and its environs, given its rural setting, is 4µg/m³.

PM_{10} monitoring was carried out at the Zone D locations of Castlebar, Cobh, Claremorris, Kilkitt, and Roscommon Town in 2018 (EPA 2019a). The average annual mean concentration measured in 2018 is 11.8µg/m³ (EPA 2019a). Therefore, average PM_{10} concentrations measured at these locations were significantly lower than the annual average limit value of 40µg/m³. Given the rural location of the proposed development site, it is considered that PM_{10} levels are likely to be similar to those at Kilkitt which, in 2018, recorded an average of 9µg/m³.

The results of $PM_{2.5}$ monitoring at Claremorris (Zone D) in 2018 (EPA 2019a) indicated an average $PM_{2.5}/PM_{10}$ ratio of 0.5. Based on this information, a ratio of 0.5 was used to generate a rural background $PM_{2.5}$ concentration of 6µg/m³. Again, long-term average $PM_{2.5}$ concentrations measured at this location were significantly lower than the annual average limit value of 25 µg/m³.

In summary, existing baseline levels of NO_2, PM_{10} and $PM_{2.5}$ are substantially below ambient air quality limit values for Zone D, which encompasses the proposed development site. It is also noteworthy that the given the similarly rural location of the proposed development site and the Kilkitt monitoring station, the data gathered at Kilkitt is considered to be particularly representative of conditions at the proposed development site.

8.4.2.2 Climate

Anthropogenic emissions of greenhouse gases in Ireland included in the EU 2020 strategy are outlined in the most recent review by the EPA which details emissions up to 2017 (EPA, 2019c). Agriculture was the largest contributor in 2017 at 33.3% of the total, with the transport sector accounting for 19.8% of emissions of CO_2 (EPA, 2019c).

2017 is the fifth year where compliance with the European Union's Effort Sharing Decision "EU 2020 Strategy" (Decision 406/2009/EC) was assessed. Ireland had total GHG emissions of 60.74 Mt CO_2eq in 2017. This is 2.94 Mt CO_2eq higher than Ireland's annual target for emissions in 2017 (EPA, 2019c). Emissions are predicted to continue to exceed the targets in future years and, therefore, reduction measures are required in all sectors.

The EPA 2020 GHG Emissions Projections Report for 2019–2040 (EPA 2020b) notes that there is a long-term projected decrease in greenhouse gas emissions as a result of inclusion of new climate mitigation policies and measures that form part of the National Development Plan (NDP) which was published in 2018. Implementation of the "With Additional Measures" scenario" (including the impact of the 2019 Climate

Action Plan) is projected to save 79 Mt CO2 eq over the period 2021-2030 compared to the "With Existing Measures" scenario. This represents an average annual reduction of 2.9% over the period. Ireland is projected to meet non-ETS EU targets over the period 2021 to 2030. This assumes full implementation of the 2019 Climate Action Plan and the use of flexibilities in relation to land use, land use change and forestry. However, Ireland's non-ETS emissions are projected to be only 2-4% below 2005 levels in 2020, compared to the EU target of 20%.

8.5 Description of Likely Effects

8.5.1 Characteristics of the Proposal

From an air quality perspective, the construction phase for the proposed development will be the key aspect in relation to the generation of dust and other fugitive emissions from construction activities. Additionally, the construction phase will involve the operation of plant and machinery throughout which will result in exhaust emissions. The operational phase, although requiring some vehicular movements resulting in exhaust emissions, is not anticipated to result in significant effects.

From a climate perspective, the operational phase of the project is expected to lead to a beneficial effect on climate by displacing fossil-fuel derived electricity from the national electricity network in favour of renewable electricity generated at the Pinewoods Wind Farm.

8.5.2 Construction Phase

8.5.2.1 Construction Dust

Whilst construction activities are likely to produce some level of dust during excavation and earth moving phases of the project, these activities are likely be confined to particles of dust greater than 10 microns which may be considered a nuisance but are not likely to result in significant health effects. For instance, bulldozing and compacting operations release 84% of particles which are greater than PM_{10} with only 16% of particles being less than 10 microns (IAQM 2014).

In terms of receptor sensitivity to dust soiling, there are 4 no. highly sensitivity receptors (i.e. residential dwellings) within 400m (all dwellings located between 100m and 400m) of groundworks or construction activities which could give rise to dust the proposed development. While there is an increased number of dwellings within 400m of the proposed construction material haul route (see **Chapter 3**), it is assessed that there is limited opportunity for effects to arise due to the absence of groundworks and the paved and well maintained nature of the road network involved. As a result, the sensitivity rating of dust soiling effects on sensitive receptors is Low according to the IAQM guidance in **Table 8.2** (IAQM, 2014).

Receptor Sensitivity	Number of Receptors	Distance from source (m)			
		<20	<50	<100	<400
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table 8.2: Sensitivity of the Area to Dust Soiling Effects on People and Property (IAQM, 2014)

In addition, the IAQM guidelines also outline the criteria for assessing the human health effect from PM_{10} emissions arising from construction activities. This assessment is based on the current annual mean PM_{10} concentration, receptor sensitivity and the number of receptors affected. In accordance with **Section 8.4.2.1** above, current PM_{10} concentration at the proposed development site is estimated to be 9µg/m3. As shown in **Table 8.3**, the sensitivity to human health effects from PM_{10} (high sensitivity, distance of between 100m and 400m to groundworks and with receptor numbers of between 1 no. and 10 no.) is considered to be Low.

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance from source (m)			
			<20	<50	<100	<400
High	<24µg/m³	>100	Medium	Low	Low	Low
		10-100	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Medium	<24µg/m³	>10	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Low	<24µg/m³	>1	Low	Low	Low	Low

Table 8.3: Sensitivity of the Area to Human Health Effects (IAQM, 2014)

Dust deposition effects on ecology can occur due to chemical or physical effects. This can include a reduction in photosynthesis due to smothering as a result of the settling of dust on plants and chemical changes such as acidity to soils. Often, effects will be reversible once the works are completed, and dust deposition ceases. The proposed development is not located within sufficient proximity to result in significant effects on highly sensitive ecological areas and these have, therefore, been screened from further assessment.

Demolition

The construction of the proposed development does not involve the demolition of any existing buildings or structures.

Earthworks

Earthworks will primarily involve excavation, haulage, tipping, landscaping and stockpiling. The dust emission magnitude from earthworks can be classified as small, medium or large and are described as follows:-

- **Large**: Total site area >10,000m², potentially dusty soil type (e.g. clay which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds > 8m in height, total material moved >100,000 tonnes;
- **Medium**: Total site area 2,500m²–10,000m², moderately dusty soil type (e.g. silt), 5 - 10 heavy earth moving vehicles active at any one time, formation of bunds 4 – 8m in height, total material moved 20,000 – 100,000 tonnes; and
- **Small**: Total site area <2,500m², soil type with large grain size (e.g. sand), < 5 heavy earth moving vehicles active at any one time, formation of bunds < 4m in height, total material moved <20,000 tonnes, earthworks during wetter months.

The dust emission magnitude for the proposed earthwork activities can be classified as Large due to the proposed development site area. Combining this classification with the previously established sensitivity of the area to dust soiling and human health effects (low sensitivity respectively), an overall Low risk of temporary dust soiling impacts and Low risk of temporary human health effects is reached, per **Table 8.4**.

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 8.4: Risk of Dust Impacts - Earthworks

Construction of Buildings

Dust emission magnitudes from the construction of buildings can be classified as small, medium or large and are described as follows:-

- **Large**: Total building volume >100,000m³, on-site concrete batching, sandblasting;
- **Medium**: Total building volume 25,000m³–100,000m³, potentially dusty construction material (e.g. concrete), on-site concrete batching; and
- **Small**: Total building volume <25,000m³, construction material with low likelihood of dust release (e.g. metal cladding or timber).

The dust emission magnitude for the proposed construction activities can be classified as Small. As set out at **Chapter 3**, the proposed development will involve the construction of an IPP control building (c. 600m3) and Eirgrid control building (c. 2,050m3). Therefore, due to the limited scale and volume of the proposed buildings and the overall Low risk of temporary dust soiling impacts and Low risk of temporary human health effects, there is an overall Negligible risk of temporary human health effects as a result of the proposed construction activities, as outlined in **Table 8.5**.

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 8.5: Risk of Dust Impacts - Construction

Trackout

Trackout refers to the movement of dust and dirt from a construction/demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network. The factors which determine the magnitude of dust emissions are vehicle size, vehicle speed, vehicle numbers, geology and duration. Dust emission magnitudes from trackout can be classified as small, medium or large and are described as follows:-

- **Large**: >50 HGV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100m;
- **Medium**: 10 - 50 HGV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50-100m; and
- **Small:** <10 HGV (> 3.5t) outward movements in any one day, surface material with low likelihood of dust release, unpaved road length <50m.

The trackout activities associated with the proposed development are classified as Medium i.e. 10-50 HGV outward movements per day (see **Chapter 13**). This results in an overall Low risk of temporary dust soiling impacts and an overall Low risk of temporary human health effects as a result of trackout effects, as outlined in **Table 8.7**.

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 8.6: Risk of Dust Impacts – Trackout

Summary of Construction Dust Emission Risk

The proposed development is not assessed as likely to result in any significant dust soiling or human health effects as a result of fugitive construction phase dust emissions. As set out at **Table 8.7**, the magnitude of effects range from Medium to Negligible. While these magnitude ranking are on the lower end of the significance spectrum, a suite of mitigation measures have been proposed at **Section 8.6** to further reduce any effects. The overall effects of construction phase dust emissions are direct, short-term and low.

Impact	Dust Emission Magnitude			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	N/A	Low	Low	Low
Human Health	N/A	Low	Negligible	Low

Table 8.7: Summary of Construction Dust Impact Magnitudes

8.5.2.2 Climate – Construction Traffic and Materials

Construction traffic is expected to be the dominant source of greenhouse gas emissions as a result of the proposed development as construction vehicles will give rise to greenhouse gas emissions during trips to/from the site and during construction activities within the site. Due to the presence of suitable construction materials on-site (see **Chapter 3** and **Chapter 6**), it is assessed that the volume of traffic required to import aggregates to the proposed development site will be substantially reduced. The geological composition of this material means that there will be no requirement for significant processing of materials on site. On-site sorting of materials may occur to ensure that material is appropriately utilised.

The worst-case (i.e. furthest distance) candidate quarry (see **Chapter 13**) for the supply of aggregates, Kilcarrig Quarries Limited, is located approximately 45km from the proposed development site. The construction phase will also require the importation of concrete for the construction of substation buildings and plinths for the installation of electrical apparatus. The worst-case candidate quarry for the supply of concrete is, again, Kilcarrig Quarries Limited.

Due to the presence of a quantity of suitable material for the construction of access tracks and the substation compound, this material will be used where relevant within the proposed development site. Should excess aggregate material be present, it is proposed that this material will be used to construct access tracks or areas of hardstanding within the permitted Pinewoods Wind Farm thus reducing the volume of aggregates to be imported to that development site. Soil and subsoil encountered will be temporarily stockpiled on-site and used for reinstatement and landscaping and may, where appropriate to do so and where material is available, be transported to the Pinewoods Wind Farm for use in reinstatement and landscaping activities within that development site.

Emissions which could possibly cause climate change will arise from embodied carbon dioxide in site materials, as well as the kilometres travelled by vehicles delivering/removing this material to and from the construction site. Due to the relatively small volume of construction traffic associated with the proposed development; this effect is assessed as likely to be a direct, short-term, imperceptible effect.

8.5.2.3 Climate – Forest Loss

As discussed in the "*Best Practice Guidelines for the Irish Wind Energy Industry (2012)*, forest loss can be a contributor to carbon losses. The Guidance states that "*the carbon impact of proposed tree felling i.e. loss of carbon sink should be included in any carbon calculations*" (IWEA 2014).

The proposed development does not require the felling or loss of forestry and, therefore, there will be no carbon losses due to forestry loss.

8.5.2.4 Climate – Peat Extraction

As discussed in the "*Best Practice Guidelines for the Irish Wind Energy Industry (2012)* (IWEA 2014), the excavation of peat can be a contributor to carbon losses The Guidance states "*it is good practice to undertake a calculation of the carbon costs of the construction and operation of a wind farm. The carbon release associated with the excavation and oxidization of peat soils can be relatively significant and should be included in any carbon calculation*" (IWEA 2014).

Although the proposed development does not comprise a wind farm, it is an ancillary element of the adjoining permitted Pinewoods Wind Farm. The geological environment at the proposed development site does not comprise peat and, therefore, the effect associated with peat loss is assessed to be neutral.

8.5.3 Operational Phase

8.5.3.1 Air Quality

The assessment of baseline air quality in the region of the proposed development has shown that current levels of key pollutants are significantly lower than their limit values. There is no likelihood of the proposed development resulting in any significant emissions during the operational phase. It is likely that the operational development will be visited 1-2 times per week by a van or light goods vehicle (LGV); however, such trips will result in a negligible effect on air quality.

The generation of electricity from the permitted Pinewoods Wind Farm and exported to the national electricity grid via the proposed development will lead to a net savings in terms of GHG emissions. The wind farm is anticipated to generate approximately 110 GWh of electricity per annum.

The supply of c.110 GWh of renewable electricity to the national grid will lead to a net saving in terms of GHG emissions which would otherwise have been emitted from fossil fuels to produce electricity.

8.5.3.2 Climate

Vehicular traffic is expected to be the only source of GHG emissions resulting from the operation of the proposed development. Vehicles, associated with the maintenance of the site, will give rise to CO_2 and N_2O emissions en route to the proposed development. However, due to the very small number and the displacement of 110 GWh of electricity which otherwise would have been produced from fossil fuels, there will be a substantial net benefit in terms of greenhouse gas emissions. The export of this renewable electricity to the national grid will off-set approximately 50,000 tonnes (annually) of CO_2 equivalent which would have been emitted by generating this electricity from fossil fuels.

8.5.4 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, decommissioning phase effects will not occur.

8.6 Cumulative Effects

During the construction phase, it is possible that cumulative effects may arise in relation to dust. This effect is only likely to arise should the construction phase of the proposed development run concurrently with the construction of another project. Given the relationship between the proposed development and the permitted Pinewoods Wind Farm, it is highly likely that the developments will be constructed concurrently as a single project.

Chapter 7 (Volume III) of the Pinewoods Wind Farm EIAR/EIS concluded that significant air quality and climate effects were not assessed as likely to occur. Similarly, this EIAR has determined that there is no likelihood of significant effects to arise even in the absence of mitigation and, following the implementation of the measures set out at **Section 8.7**, significant dust emissions from the proposed development are unlikely and are similarly unlikely, in combination with construction activities of other developments, to adversely affect sensitive receptors.

During the operational phase, it is assessed that there is no likelihood of significant adverse cumulative effects. The proposed development will, in combination with the Pinewoods Wind Farm, result in a long-term beneficial effect on both air quality and climate.

Other existing, permitted and proposed developments, including those described at **Chapter 1**, are not assessed as likely to result in significant cumulative adverse effects on air quality or climate.

8.7 Mitigation and Monitoring

The preceding sections have determined that the proposed development is not assessed as likely to result in any significant adverse effects on air quality and climate. Notwithstanding this, and in order to sufficiently ameliorate effects which are likely to arise, a schedule of air quality control measures has been formulated for both the construction, operational and decommissioning phases of the proposed development.

Specific mitigation measures, additional to best practice methods, are not proposed in relation to climate as the proposed development will result in a net benefit in the abatement of GHG emissions.

8.7.1 Construction Phase

8.7.1.1 Air Quality

The greatest likelihood of effects on air quality during the construction phase is from construction dust emissions and nuisance dust. In order to minimise dust emissions during construction, a series of mitigation measures have been prepared in the form of an outline Dust Minimisation Plan (see **Annex 8.2, Volume II**).

A detailed Dust Minimisation Plan will be formulated prior to the construction phase of the project. Measures to be included within the detailed Dust Minimisation Plan include:-

- Access tracks and public roads in the vicinity of the site shall be regularly cleaned to remove mud, aggregates and debris and maintained as appropriate. All road sweepers shall be water assisted;
- Any access track that may give rise to fugitive dust shall be regularly watered, as appropriate, during dry and/or windy conditions;
- Vehicles delivering materials, which could give rise to dust, shall be enclosed or covered with tarpaulin at all times to restrict the escape of dust;
- In the event of dust nuisance occurring outside the site boundary, movement of materials will be immediately terminated and satisfactory procedures implemented to rectify the problem before the resumption of operations;
- Public roads in the vicinity of the site shall be regularly inspected for cleanliness and cleaned as necessary;

- If issues persist and the above measures are not satisfactorily control dust emissions, a wheel washing system with rumble grids to dislodge accumulated dust and mud prior to leaving the site should be installed; and
- The dust minimisation plan shall be reviewed at regular intervals during the construction phase to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures.

8.7.1.2 Climate

Construction related plant, machinery and vehicles will give rise to CO_2 and N_2O emissions. However, due to the short-term and temporary nature of these works, the effect on climate will not be significant. Best practice construction methods including just in time delivery methods to prevent material waste, reuse of on-site materials (where possible) and the minimisation of fuel use will reduce construction related climate emissions.

8.7.2 Operational Phase

8.7.2.1 Air Quality

The proposed development will not result in any significant adverse air quality effects during the operational phase and no mitigation measures are proposed.

8.7.2.2 Climate

The proposed development will have a positive and beneficial effect on climate through the reduction of GHG emissions associated with energy generation and will make a significant contribution to Ireland's GHG abatement commitments. Thus, no mitigation measures are necessary in terms of the operational phase of the proposed development.

8.7.3 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, no decommissioning phase mitigation measures are required.

8.8 Residual Effects

8.8.1 Construction Phase

With effective implementation of the Dust Minimisation Plan and other mitigation measures outlined above, the proposed development is likely to have a short-term negligible effect on air quality and climate.

8.8.2 Operational Phase

The likely effect on air quality during the operational phase will be imperceptible as, essentially, there will be no change in traffic volumes as a result of the scheme. As discussed above, the operational development will be visited, on average, 1-2 times per week.

The likely effect of climate will be beneficial by facilitating the export of c. 110 GWh of renewable electricity per annum to the national grid thus leading to a reduction in CO_2 equivalent emissions.

8.8.3 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, residual decommissioning phase effects will not occur.

8.9 Summary

An assessment of the likely air quality and climate effect associated with the proposed development has been undertaken. The assessment of baseline air quality in the region has shown that current levels of key pollutants are significantly lower than their limit values.

This assessment has concluded that any likely adverse construction phase effects on air quality and climate are assessed as ranging from Low to Negligible and thus no likely significant adverse effect on the environment. During the operational phase, the development will result in a long term positive effect on both air quality and climate.

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