Orsted Onshore Ireland Midco Limited

5: MEMORANDUM RESPONSE TO SUBMISSIONS RECEIVED

HYDROLOGY & HYDROGEOLOGY

Proposed Oatfield Wind Farm Project, Co. Clare: ABP Case No. ABP-318782-24

June 2024

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1 HYDROLOGY AND HYDROGEOLOGY

1.1 Introduction

The following memorandum has been prepared to address submissions received during the observations and submissions period associated with the Oatfield Wind Farm Planning Application. The planning application for the aforementioned Proposed Development was submitted to An Bord Pleanála on 22nd December 2023 (ABP Case Number: ABP-318782-24). The period for submissions and observations was 22nd December 2023 to 19th February 2024.

This is memorandum number 5 in the Oatfield Wind Farm submission response documentation, which addresses common themes identified within the discipline of Hydrology and Hydrogeology (corresponding to Chapter 9 of the EIAR, submitted as part of the planning application made to An Bord Pleanála).

Reference is made to submission response on Land, Soils and Geology (memorandum no. 6 of the submission response documentation, hereafter referred to as **memorandum no. 6**).

Responses to submissions received from regulatory & prescribed bodies are presented in Section 2 and responses to common themes in submissions received from the general public are presented in Section 3.

1.2 Statement of authority

RSK (Ireland) Ltd. (RSK), part of RSK Group, is a consultancy providing environmental services in the hydrological, hydrogeological, geological and other environmental disciplines. The company and group provide consultancy to clients in both the public & private sectors. More information can be found at www.rskgroup.com. The principal members of the RSK EIA team involved in this assessment include the following persons;

- Project Manager & Lead Author: Sven Klinkenbergh – B.Sc. (Environmental Science), P.G.Dip. (Environmental Protection). Current Role: Principal Environmental Consultant. Sven has c. 10 years industry experience in the preparation of hydrological and hydrogeological reports.
- Dr. Jayne Stephens - B.Sc. (Environmental Science), PhD (Environmental and Infection Microbiology). Jayne is an Environmental consultant with c. 5 years' experience.

2 REGULATORY & PRESCRIBED BODIES

2.1 Clare County Council

The section of the Clare County Council Response relating to hydrology also includes soils which are considered in the Land, Soils and Geology submission response (see **memorandum no. 6**).

The concerns by the council relating to hydrology and hydrogeology include:

- The upland nature of the site and the soil type which includes peat;
- The high density of drainage channels throughout the site and the upgrade works required for same which will require careful oversight and detailed mitigation measures;
- The timing of construction works outside of the breeding season for birds coinciding with wetter periods (see 'timing of works' in Section 8.5.3 of **EIAR Chapter 8 Ornithology**);
- The nature and extent of the construction works, hardstanding areas, cable connection works, road upgrades and potential alterations to the hydrological regime of the site;
- The hydrological connectivity of the watercourses to the Lower River Shannon SAC.
- The impact on drinking water and private wells.

2.1.1 The upland nature of the site and the soil type which includes peat

As noted within Section 9.3.13 of **EIAR Chapter 9 Hydrology & Hydrogeology** (hereafter referred to as **EIAR Chapter 9**), *"Peat depth across the Site is generally very shallow to moderately deep with some isolated pockets of deep peat (EIAR Volume III Appendix 10.1 – App A and App B). There was 1 no. sampling point of deep peat recorded in the surround area of T11."*

Mitigation measures as outlined in **EIAR Chapter 9**, Section 9.5.1.8, Section 9.5.2.6, Section 9.5.2.16 and Section 9.5.3.1 state the following measures to reduce any erosion of peat and potential runoff from site to downstream receptors:

- *"In peatland areas, one of the main objectives of Nature Based Solutions and SuDS is to create an array of runoff stilling areas / standing water and promote diffuse discharge and recharge of runoff on peatland. Generally, and as is the case on the subject site, peatlands have been subject to peat cutting and draining of peatland bogs. Lowering bog water levels leads to increased erosion, release of carbon to atmosphere and the receiving surface water network and reduces the productivity and general health of the bog, potentially leading to chronic degradation and decline. The objective of nature-based solutions in peatlands will be to reverse this impact where there is the opportunity and where it is appropriate through surveying and risk assessment."*
- A Peat and Spoil Management Plan has been prepared in **EIAR Appendix 2.1**. *"Excavated peat will be deposited with a view to restore infilled excavation areas*

associated with the Site e.g., adjacent to Turbine Hardstand areas and spoil storage areas. The peat layers Acrotelm and Catothelm will be stored separately until reinstatement and then the Acrotelm layer will be placed on top. The deposition of peat, particularly in cutover peat areas, once successfully restored / revegetated will promote the recovery and development of blanket peat habitats."

- "*The only exception to limiting vehicular movements to the footprint of the Proposed Development will be for peat cutting. Peat cutting is in line with baseline conditions / Do Nothing impact, will be carried out in line with peat cutting operations best practice guidance*."
- **"***The principles of the mitigation measures described under* ***EIAR Chapter 9****, Section 9.5 (check dams, stilling ponds, attenuation lagoons etc.) are based on the control and management of runoff discharge rates, which ensure the regulating the speed of runoff within the drainage network, buffering the discharge from the drainage network where possible, and maintaining the natural hydrological regime.*"
- "*Monitoring of potential hydrological impact of the Development, particularly during the operational phase will be inherently linked to the ecological health of the blanket peat (as a functioning ecosystem) and therefore both hydrology and ecology will be considered and monitored in tandem. For example, effects to the hydrological regime at the Site can potentially impact on the ecological health or characterisation of the Site, and vice versa. Ecological indicators can potentially provide useful data in relation to the long-term impact of changes to the hydrological regime at the Site*."

Section 9.5.1.8 of **EIAR Chapter 9** outlines the promotion of peatland habitats and states "*Improvements to the hydrological regime as a function of the Proposed Development will promote the recovery and development of blanket peat habitats, particularly in significantly impacted areas, such as existing cutover peat areas and areas adjacent to the Development. This is worth noting in the context of the impact/s posed by the Proposed Development on blanket peat habitats i.e., range from temporarily adverse to beneficial.*"

2.1.2 Drainage channels

All drainage channels have been mapped and assessed in terms of connectivity and flow on site. Buffer zones of 15 metres have been applied to all these receptors. Where instream works are required such as watercourse crossings, potential effects were assessed separately in Section 9.4.3.17 of **EIAR Chapter 9**, and mitigation measures outlined in Section 9.5.2.11 of **EIAR Chapter 9**. This includes the following:

- The use of a clear span bridge over the Snaty_25 river,
- Detailed design of these culverts to "*facilitate peak, or storm discharge rates so as to avoid localised flooding and associated issues during storm events",*
- *Extending the existing closed culvert will minimise construction activities required*

- *Considering the width of all waterbodies associated with crossings discussed here (<2m width) in stream supports will not be required for the construction of single span structures.*
- *The design minimises the potential for localised bank and bed erosion, refer to Planning Drawing No. 20959-NOD-XX-XX-DR-C-08301_S4_P01, 20959-NOD-XX-XX-DR-C-08050.*

All relevant guidance documents (see **EIAR Chapter 9**, Section 9.2.2) have been consulted and applicable mitigation measures have been incorporated into the design of the culverts and construction methodology of same. These will be adhered to with a view to mitigating and reducing any potential impact on the receiving watercourse.

2.1.3 Felling of trees and clearance works

Felling of commercial forestry is in line with baseline conditions and is likely to happen with or without the Proposed Development, that is; part of Do Nothing Impact (**EIAR Chapter 9**, Section 9.4.2).

Furthermore, Section 9.4.3.2 of **EIAR Chapter 9** states that "*the overall potential effects here are considered to be of moderate significance, permanent but reversible, and adverse, though this is of a minor scale in comparison to the normal forestry activities taking place at the Site (i.e., small-scale felling proposed).*" With reference to Section 9.5.2.3 of **EIAR Chapter 9**, the proposed mitigation measures will ensure that potential effects from this work are reduced to slight significance.

2.1.4 Timing of construction works outside of the breeding season for birds

The timing of construction works may fall in this 'wetter' period (*late September to early February*), however, the mitigation measures in Section 9.6.2 of **EIAR Chapter 9** will be applied. The aim is to utilise dry weather in this 'wetter' period to reduce runoff and the release of suspended solids, nutrients etc. associated with earthworks, and to cease works on site in response to incoming extreme weather alerts. Although monthly rainfall averages would indicate seasonally dry periods, it is also true that the most intense storm rainfall events frequently occur in seasonally dry periods including summer months. Therefore, monitoring for and mitigating during times of intense rainfall is considered relevant throughout the year.

As outlined in Section 9.5.2.1 of **EIAR Chapter 9**, "*earthworks will be limited to seasonally dry periods and will not occur during sustained or intense rainfall events. An emergency response system has been developed for the construction phase of the Proposed Development (see **EIAR Appendix 2.1,** Section 5.10 and Environmental Response Plan), particularly during the early excavation phase. This involves 24-hour advance meteorological forecasting (downloadable from Met Éireann) linked to a trigger-response system. When a pre-determined rainfall trigger levels is exceeded (e.g., sustained rainfall (any foreseen rainfall event longer than 4-hour duration) and/or any yellow or greater rainfall warning (>25mm/hour) issued by Met Éireann, planned responses will be undertaken. These responses will include:*

Cessation of all construction works during and until such storm events (yellow warning, Met Éireann), including storm runoff passing over. Before construction works recommence, the Site construction areas and infrastructure will be inspected by an

Environmental Clerk of Works to confirm no additional escalation of response is required."

The following works will be subject to these works ceasing and recommencing:

- "*Earthworks will be limited to meteorologically dry periods, for example watercourse crossings, the installation of drainage infrastructure, pouring of concrete*."
- *"Felling and extraction of timber are to be undertaken in dry weather conditions. Harvesting operations are scheduled according to the nature of the soil with sites being categorised into winter and summer sites depending on ground conditions."*
- GCR portions located within a probable flood zone – "*To mitigate against any potential for onsite flood risk and consequences, it will be a strict requirement to carry out works at this location during seasonally dry conditions.*"

2.1.5 Nature and extent of construction works and potential alterations to hydrology

Mitigation by avoidance and by design are the first steps in reducing the extent of construction works on site outlined in Sections 9.5.1.9, 9.5.2.1, 9.5.2.4, 9.5.2.5, 9.5.2.6, 9.5.2.11 and 9.5.2.13 of **EIAR Chapter 9**. These avoid receptors using buffer zones where possible. Examples of reduction of construction work extents by design are outlined below.

- *Vehicular movements will be restricted to the Development footprint and advancing ahead of any constructed hardstand will be minimised in so far as practical.*
- *For the Grid Connection route, before starting construction, the area around the edge of each joint bay which will be used by heavy vehicles will be surfaced with a terram cover (if required) and stone aggregate to minimise ground damage.*
- "*Erosion control will be incorporated into the design (**EIAR Appendix 9.5– Tile 2**), this requires minimising the area of exposed soil in existing and newly established channels. This will include a combination of the use of coarse aggregate / crushed rock (non-friable / non-weak), engineered solutions and/or revegetation."*
- *"Management of excavations, that is areas of soil / subsoils to be excavated will be drained ahead of excavation works by sumps, in a stepped / phased approach whenever necessary, with the aim of temporarily lowering groundwater levels to allow excavation to be carried out in dry and stable conditions. For example, saturated areas of peat, thus reducing the volumes of water encountered during excavation works."*

Attenuation features outlined in **EIAR Chapter 9**, Section 9.5.1 ensures that any changes to the hydrological regime will be beneficial as it will ensure runoff from site is reduced from baseline levels.

EIAR Chapter 9, Section 9.5.2.16 also outlined water quality monitoring to ensure changes to the hydrological regime of the site are detected and states that "*Changes to the management of runoff and in turn the hydrological regime at the Site will lead to a positive impact overall when compared to the baseline conditions associated with the*

Site e.g. introduction of intermittent buffered outfalls along the length of the drainage network is in contrast to baseline, this will promote a more even distribution runoff, attenuate runoff and reduce the hydrological response to rainfall, enhanced potential for recharge to ground, and in turn raising bog water levels resulting in wetting of blanket peat at the Site."

2.1.6 Hydrological connectivity of the watercourses to the Lower River Shannon SAC

"*Surface waters, under the scope of the objectives of the WFD are considered attributes with the 'Very High' sensitivity and importance and will be protected in their own right. Although potential contamination incidents will be temporary in terms of the waters themselves, it is important to consider the potentially long lasting or potentially permanent impact/s of contaminants on the ecological attributes dependent on the surface water bodies associated with designated areas.*" The Lower River Shannon SAC (EPA Site Code: 002165) which is located 13.2 km south of site, (15.8km downstream of the Western Development Area (WDA), 16.1km downstream of the Eastern Development Area (ED, 14.6km downstream of the GCR, 10.3km from the IPP route) was identified in **EIAR Chapter 9**, Section 9.3.15 and assessed in terms of hydrological connectivity in **EIAR Chapter 9**, Section 9.4.3.10.

The potential effects were considered given the high sensitivity of this receptor. "*Any accidental release of potential contaminants to the environment as a result of the Development will likely be intercepted by the drainage and surface water network at the Site. Therefore, any contaminants potentially released will subsequently impact on a designated site. The potential of the Development to introduce contaminants to surface waters and in turn impact on the designated areas downstream is considered to be a likely, indirect, localised (potentially regional), adverse, moderate to profound, temporary to long-term effect of the Development which conforms to Baseline (e.g., cumulative upstream impacts), while being small to moderate in scale."*

Following the Natural Impact Statement (NIS) statement, it was determined that "*The Proposed Development will not compromise the ability of waterbodies affected to maintain good status or achieve any improved status or on any European site and that it has been concluded in the NIS, there will be no adverse effect on the integrity of any European site in view of their conservation objectives.*"

Mitigation measures as outlined in **EIAR Chapter 9**, Section 9.5 will ensure that all potential contaminants released will remain on site and be processed correctly so that minimal suspended solids, construction water, and no cementitious materials, hydrocarbons, wastewater etc will flow downstream to highly sensitive receptors.

2.1.7 Impact on drinking water and private wells

As addressed in Section 3.2 under Theme 2, the potential effects on drinking water and private wells utilised a worst case scenario approach that all dwellings nearby had private wells. A list of the closest dwellings is outlined in Table 3.1.

EIAR Chapter 9, Section 9.5.2.4 also states that "*A combination of the underlying bedrock geology, the associated aquifer potential, low permeability soils/peat and low recharge rates has resulted in the risk posed to groundwater quality by the Development being considered as low risk."* Despite the low risk, the mitigation measures will be

implemented on site to ensure any potential contamination of drinking water or private wells will be reduced to a neutral or slight effect as a result of the Proposed Development. Mitigation measures have been split into hydrocarbon specific, as they pose the greatest risk to groundwater receptors and non-hydrocarbon contaminants.

Mitigation measures for contamination by hydrocarbons are outlined in Section 9.6.2.3 and Section 9.6.2.4 of **EIAR Chapter 9**.

Mitigation measures for non-hydrocarbon contaminants are outlined in Section 9.6.2.2, Section 9.6.2.5 and Section 9.6.2.6 of **EIAR Chapter 9**.

3 GENERAL PUBLIC

3.1 Theme 1: Surface water quality / contamination

3.1.1 Surface water quality

Submissions raised concerns of potential pollution on local water network/systems and under SDG6 upland areas need "to be protected and not damaged through the development of large industrial construction projects such as the Proposed Development".

Response

All downstream hydrologically linked surface waters (mapped rivers, lakes, transitional waters and coastal waters) have been identified and outlined in Section 9.3.5 and Section 9.3.15 of **EIAR Chapter 9**. These are also presented in Figure 9.3 of **EIAR Chapter 9** which has been appended to this response document (**Appendix 1**). These receptors range from less than 1km Oatfield_25 & Snaty_25 river water bodies up to 93.5km to the nearest coastal waterbodies downstream [Mouth of the Shannon].

Duin loch is located in the river subbasin Owengarney_030 and is a 4.33km downstream receptor. Castle Lake is located in the Owenogarney_040 river subbasin and is a 13.32km downstream receptor due to the topography in the area (Figure 3.1). Doon lake is located upstream of Duin Lake and is not a downstream receptor.

It should be noted that on another southern branch of the Gourna_010 is a spring fed lake; Coolmeen which is underlain by a locally important aquifer - Bedrock which is Moderately Productive only in Local Zones. This is not hydrologically connected to the site as it is located upstream on the river network branch which can be seen in Figure 9.2b of **EIAR Chapter 9**.

The Clare County Development Plan 2023 – 2029 and the Climate Action Plan 2024 - 2029, recognise surface waters as highly important, sensitive receptors. This was outlined also in Section 9.2.1.2 and Section 9.2.5.1 of **EIAR Chapter 9**. CCDP also recognised the Broadford catchment as an 'Area for Action' (AFA).

River subbasins that the works take place in are presented in Figure 3.1. In the WDA, there are three river subbasins, outlined below with the level of works taking place in these areas.

- The Blackwater (Clare)_010; containing five (5 no.) turbines and the substation
- Gourna_010; containing one (1 no.) turbine
- Owenogarney_010; containing one (1 no.) turbine

In the EDA, there are two river subbasins which are outlined below with the level of works taking place in these areas.

- Mountrice_010; containing three (3 no.) turbines
- Broadford_010; containing one (1 no.) turbine

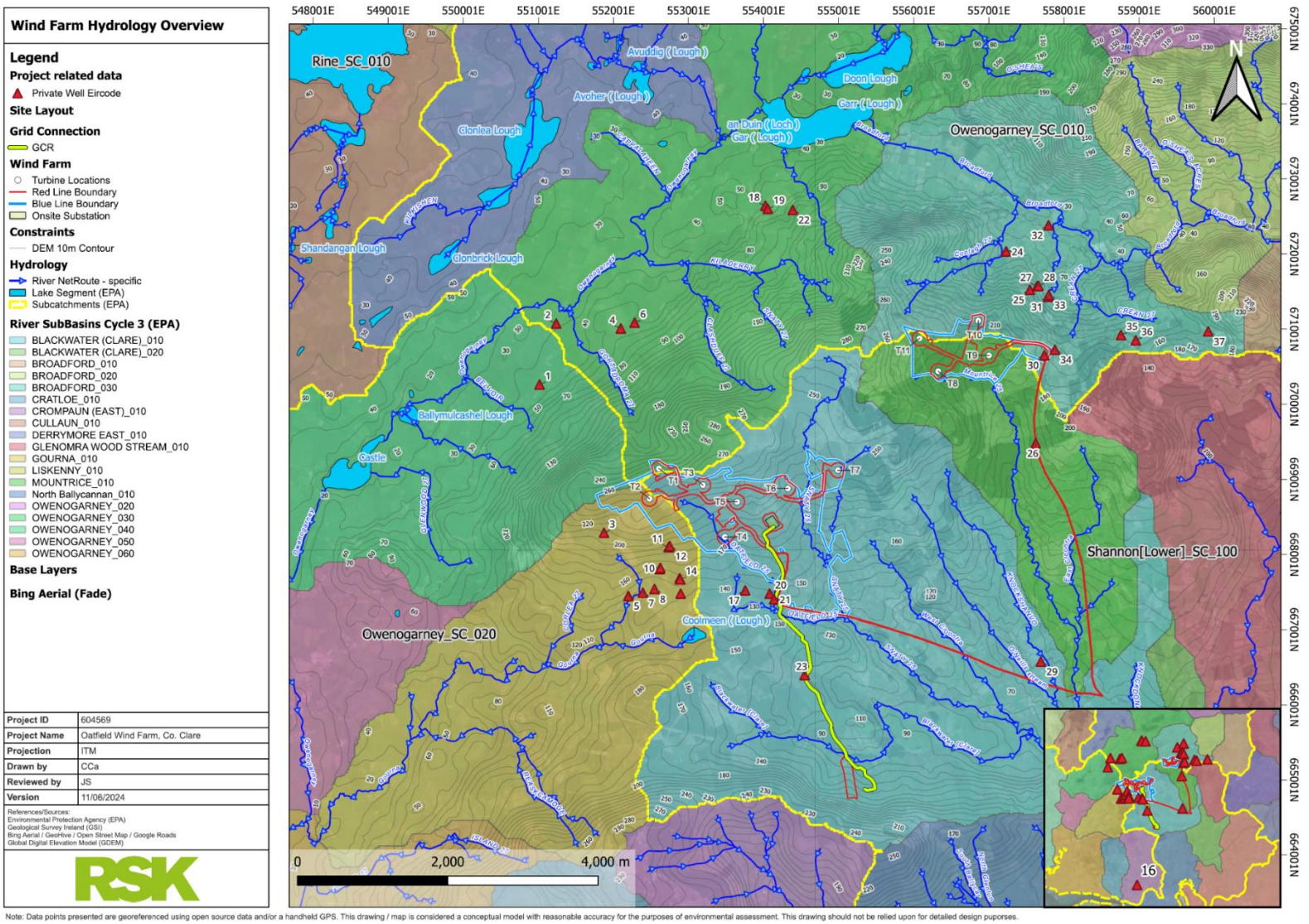


Figure 3.1: Wind farm hydrology

EIAR Chapter 9, Section 9.2.1.2 states *"The EIAR will align with the objectives of the Water Framework Directive (WFD) whereby the objective for surface waters is, member states must achieve or maintain at least 'Good' status in all water bodies. This approach equates to qualifying all surface water features as very important and sensitive receptors and that any adverse impact will be viewed as potentially jeopardising the objectives of the WFD."*

Potential effects on hydrology and hydrogeology arising from the development includes increase in runoff and the release of suspended solids, construction water, dewatering activities, release of hydrocarbons, release of cementitious materials and HDD fluids, the release of wastewater sanitation contaminants. These were discussed and assessed in terms of a source pathway receptor model in Sections 9.5.3.1 to 9.5.3.7 of **EIAR Chapter 9**. Section 9.5.2.8 outlines mitigation measures for the release of HDD fluids.

These effects are due to activities that will take place in the construction phase of the development, such as hydraulic loading/vehicular movements, clear felling of forestry, dewatering, excavations, foundation installations, updating tracks, instream works, watercourse crossing installation or upgrading, construction and diversion of drainage on site.

Section 9.5.2.1 to 9.5.2.3 of **EIAR Chapter 9** sets out the mitigation measures that will be implemented to reduce increased runoff and the release of suspended solids on the wind farm site during the construction phase and the activity of clear felling trees. Instream works such as watercourse crossings and culverts will be isolated as well as similar mitigation measures implemented for runoff etc, to avoid damage to these waterbodies. **EIAR Chapter 5 Project Description** and **EIAR Chapter 13 Noise and Vibration** have included the mitigation measure of a wheelwash to reduce dust on site. **EIAR Chapter 5 Project Description** noted areas of tree felling, and mitigation measures for the effects of tree felling are outlined in **EIAR Chapter 9**, Section 9.5.2.3. **EIAR Chapter 9** also identified areas for the storage of excavated soils and the management of these spoils. This is contained in the spoil management plan (as part of **EIAR Volume III CEMP Appendix 5.1**).

The development is at planning stage and includes reasonably detailed layout and design details for the purpose of conducting an Environmental Impact Assessment, however a detailed engineered design phase will be done post consent and prior to the commencement of construction. An Environmental Impact Assessment Report is not intended or required to include detailed engineering design, it is intended to include preliminary design of a Proposed Development, an assessment of the likely significant effects (only), to include conceptual principals of mitigation and how it will be applied, and in a manner that is not overly complex. Proposals for management of the excavated soils and materials on the site have been defined in detail relative to the development stage, including estimated volumes of particular materials, temporary storage locations, and methodologies for the sustainable reuse of the material as fill and or to remove any residual excess off site for reuse as a bi-product or as a waste. The material used for fill will be deposited in line with baseline conditions i.e. similar soil horizons and will be reinstated including promotion and reestablishment of surface vegetation and ecology.

If the Proposed Development application is granted, a detailed design phase will include geotechnical ground investigation to inform the detailed design of infrastructure – including turbine foundations in line with manufacturer's requirements, and refinement of

excavation arising volumes and programme of movements. Contractors, who are still to be appointed, will also have a role in detailing the design in terms of construction programming and ground movements as part of preparing method statements. These aspects are described in detail in **EIAR Chapter 10 Land, Soils and Geology**. However, in terms of Hydrology & Hydrogeology these items are related to the excavation and movement of arisings, including the potential for adverse effects to runoff, surface water and groundwater quality. These have been considered, assessed and mitigation applied. The drainage, attenuation and other surface water runoff management systems will be installed concurrent with the main construction activities to control increased runoff and associated suspended solids loads in runoff during intensive construction activities e.g., excavation of Turbine Foundation. As outlined in **EIAR Chapter 9**, Section 9.5.2.4 "*In all instances where construction water, or runoff has the potential to entrain solids during excavation and other construction activities, runoff will be contained by means of temporary berms (lined geotextile of similar), bunds (lined) and sumps. This will be referred to as Dewatering. Construction water (contaminated) will be pumped to the Treatment Train (EIAR Volume III Appendix 9.5 Tiles 13-15).*" Storm runoff will be intercepted and attenuated and treated on site to mimic greenfield runoff rates (low flow conditions). High flow rates are a potential factor for such items as horizontal drilling along the GCR. Along the GCR, rivers encountered are not the extreme headwaters.

High volumes of water and high flow rates during dewatering of excavations is not anticipated, namely due to the site topography, elevation etc. Construction waters will be managed on site, and direct discharges to the extreme headwaters of rivers is not envisaged. Application of discharge licence will be sought where required for practical reasons, either way mitigation addresses the potential for significant effects to surface water quality.

EIAR Chapter 9, Section 9.5.2.5 sets out the mitigation measures that will be implemented to control and minimise the release of suspended solids on the wind farm site during the construction phase. "*Buffer zones, constructed drainage, check dams, two-stage stilling ponds design for attenuation, buffered outfalls are referred to as The Treatment Train, whereby the runoff will continuously be treated from source (construction area) to receptor (site exit, outfall of attenuation lagoon). Where necessary (>25mg/l suspended solids) the treatment train will be augmented through the use of anionic polymer gel blocks. These measures will reduce the suspended sediment and associated nutrient loading to surface water courses and mitigates potential effects to water quality and on plant and animal ecologies downstream of the Site.*"

All of the above mitigation measures are implemented with a view to having minimal adverse effects (neutral to slight temporary) on water quality.

EIAR Chapter 9, Section 9.5.2.6 states that " *Vehicular movements will be restricted to the footprint of the Proposed Development and advancing ahead of any constructed hardstand will be minimised in so far as practical.* any localised unforeseen impacts will trigger escalation of response ensuring locations are restored and any potential pathways to receptors are isolated."

Water quality management protocols have been developed and are outlined in the water quality management plan (WQMP). Both the surface water management plan (SWMP) and WQMP are appended to the **EIAR Volume III, Appendix 5.1 CEMP,** which are live

documents that contractors will have on site to ensure that best practices are followed, to maintain the water quality of surface waters on site and downstream of site. The WQMP will be updated regularly by the contractors on site as the need arises.

In the **EIAR Volume III, Appendix 5.1,** Section 3 of the WQMP, Table 2 discusses general surface water monitoring requirements while Table 3 in the WQMP outlines specific surface water monitoring requirements. "*Monitoring at downstream baseline Surface Water (SW) monitoring locations (Figure 2), will be undertaken by the Environmental Clerk of Works in accordance with this WQMP. If any the thresholds are exceeded at these locations this will trigger emergency response and escalation of measures including immediate full site inspection to ascertain to the potential unknown source (bearing in mind that the quality of managed runoff at the site will be known by means of live telemetry and handheld meters*."

Monitoring was also included under mitigation measures outlined in Section 9.5.2.3 and Section 9.5.2.4 of **EIAR Chapter 9**. Section 9.5.2.16 of **EIAR Chapter 9**, states **"***During the construction phase, daily inspection of silt traps, buffered outfalls and drainage channels, and daily measurement of total suspended solids, electrical conductivity, and pH at selected water monitoring locations on the Site.*

Monitoring during times when excavations are being dewatered (likely high in solids) will be done in real time. In this regard, physiochemical properties will be monitored in real time by means of alarmed telemetry e.g., telemetric monitoring at baseline sampling locations and alarm thresholds established in line with water quality reference concentrations/limits which will be set using relevant instruments for example, Surface Water Quality Regulations, <25mg/l Total Suspended Solids (TSS)."

Achieving this will ensure that there is no significant effect or contribution to exceeding Environmental Quality Standards (EQSs) (e.g. Surface Water regulations threshold of 25mg/l Total Suspended Solids) in water receptors downstream of the development. However, as discussed previously the development will be subject to detailed design post consent and prior to the commencement of the construction phase. The detailed design phase, as well as including detailed geotechnical design, will include detailed design and engineering specification of all works including proposed sustainable drainage systems.

Provided these mitigation measures are followed the residual effects of increase in runoff, dewatering, treatment & discharge of trade effluent (construction water management), release of suspended solids, release of hydrocarbons, release of HDD fluids, release of wastewater sanitation contaminants and the release of construction and cementitious materials on surface waterbodies are neutral to slight adverse temporary effects and in some cases slight adverse to beneficial.

3.1.2 Surface water - drinking water quality

Drinking water resources were outlined in **EIAR Chapter 9**, Section 9.3.16 and identifies mapped drinking water rivers and lakes.

"*Drinking water rivers designated in accordance with European Communities (Drinking Water) (No. 2) Regulations 2007 (SI no. 278/2007) which are protected for the purposes of drinking water abstraction are presented in* ***EIAR Chapter 9****, Figure 9.8a - b, however*

none are located within the River Subbasin or Sub Catchment associated with the Proposed Development."

Castle lake (IE_SH_27_74), located 13.32km downstream of the site is mains water reservoir for Ennis town and East Clare. This was presented in Figure 9.14 of **EIAR Chapter 9** as a sensitive receptor.

Due to the location where this lake is downstream and the associated river subbasin and given residual water quality effects, there is no likely significant effect on water resource. The risk associated with potential effects outlined above would have to travel a distance of 13.32 km through various waterbodies before reaching this sensitive receptor.

Provided the mitigation measures above are followed, the residual effects on surface waterbodies for drinking identified in Section 3.1.1 are neutral to slight and temporary.

3.2 Theme 2: Groundwater drinking water quality and private wells

Concerns were raised regarding contaminants and hazardous materials, such as hydrocarbons, entering pathways to groundwater (for example; gravity fed system from spring water) and private drinking water wells. Concern was also raised around the potential for *contaminating the local water ways which could eventually leech into drinking water supplies*. Groundwater vulnerability was raised as a concern beneath these private wells and potential effects on the water table.

Response

The risk to groundwater associated with the site are low. Groundwater protection is a priority for this development. The groundwater body underlain on the west of the site is Tulla – Newmarket-on-Fergus and is of 'Good status' and 'Not at Risk'. The groundwater body Lough Graney is on the east of the site, is of 'Good' status and 'Not as Risk'.

Drinking water resources were outlined in Section 9.3.16 of **EIAR Chapter 9** and identifies mapped drinking water sources. National Federation of Group Water Schemes (NFGWS) and public source of protection areas were screened, and it was determined that the nearest NFGWS to the site is *"c.10.6km from the EDA but is not hydrologically connected*".

Section 9.3.10 of **EIAR Chapter 9** screened for mapped wells in the area and determined "*There are no mapped wells (GSI, 2022) within the Site, however there are numerous wells, springs and boreholes located surrounding the Proposed Development."*

However, it was outlined that *"Given the incomplete nature of the GSI well database and the rural location, it has been assumed on a worst-case scenario that all dwellings in the vicinity of the Site are utilising a private groundwater well and that groundwater flow direction in the underlying aquifer mimics the local topography.*"

EIAR Chapter 9, Section 9.4.3.12 identifies that "*Utilising this conceptual model of groundwater flow, dwellings that are located down gradient of the Proposed Development can be identified as potential receptors. The groundwater flow direction in the area of the Proposed Development is expected to be predominantly in a north to south direction. There are no dwellings located within the Redline Boundary, although numerous*

dwellings are located within 2km of the Site." These have been mapped, using Eircodes of individuals confirming ownership of a private well (using the submissions received). See Figure 3.2, with the exception of ten (no.10) submissions that did not include Eircodes. This map also shows the river subbasin which these dwellings are in and the level of infrastructure (potential effects by works) that falls into those catchments. Private wells are numbered from west to east. All wells; private and GSI mapped have been allocated a buffer of 250m.

"*A combination of low permeability soils (i.e., peat), the temporary nature of the construction works, and moderate recharge rates at the Proposed Development is expected to result in a likely, neutral to adverse, slight to moderate significance, localised effect of the Development on private and drinking water reserves which conforms to Baseline (peat cutting drains). With appropriate mitigation measures in place, the potential effects on groundwater can be managed and reduced to Imperceptible to Slight. Mitigation measures are outlined in* ***EIAR Chapter 10 Soils and Geology.****"*

EIAR Chapter 9, Section 9.4.3.13, states "*It has been assumed on a worst-case scenario that all dwellings in the vicinity of the Site are utilising a private groundwater well and that groundwater flow direction in the underlying aquifer mimics the local topography*."

All works taking place in a subbasin will drain into the rivers in that subbasin and then take the river flow direction downstream.

River subbasins that the works take place in are as follows:

WDA

- The Blackwater (Clare)_010; containing five (no. 5) turbines and the substation
- Gourna_010; containing one (no. 1) turbine
- Owenogarney_010; containing one (no. 1) turbine

EDA

- Mountrice_010; containing three (no. 3) turbines
- Broadford_010; containing one (no. 1) turbine

The nearest dwellings were outlined in **EIAR Chapter 9**, Section 9.4.3.13 and are also summarised below in Table 3.1 and presented in Figure 3.2. This table has now been updated to outline all confirmed dwellings with wells. The associated river subbasin is outlined below and the nearest turbine in that river subbasin identified. The level of potential contamination is based on the magnitude of works in that subbasin.

Table 3.1: Dwelling database

Dwelling number	Eircode	River Subbasin	Distance to nearest Turbine	Nearest Turbine in same subbasin	Groundwater Vulnerability	Bedrock Aquifer
Dwelling	-	Gourna_010	0.73km	**T2**	Moderate	Locally important
Dwelling	-	Blackwater (Clare)_010	0.72km	**T6**	High	Locally important
Dwelling	-	Blackwater (Clare)_010	0.74km	**T7**	Rock	Locally important
Dwelling	-	Broadford_030	0.74km	**T9**	Extreme	Locally important
Dwelling	-	Blackwater (Clare)_010	0.75km	**T4**	Moderate	Locally important
Dwelling	-	Broadford_030	0.77km	**T10**	Extreme	Poor Aquifer
Dwelling	-	Broadford_030	0.87km	**T11**	Extreme	Poor Aquifer
1	V95NYT3	OwenoGarney_040	1.94km	**T1 (in different subbasin)**	High	Poor Aquifer
2	V95N2T4	Owenogarney_030	2.36km	**T1**	High	Locally important
3	V95N827	Gourna_010	0.76km	**T2**	Extreme	Locally important
4	V95RR77	Owenogarney_030	1.95km	**T1**	Extreme	Locally important
5	V95RY74	Gourna_010	1.33km	**T2**	Low	Locally important
6	V95CYK0	Owenogarney_030	1.95km	**T1**	Extreme	Locally important
7	V95X003	Gourna_010	1.25km	**T2**	Low	Locally important
8	V95TX64	Gourna_010	1.21km	**T2**	Low	Locally important
9	V95F4E6	Gourna_010	0.93km	**T2**	Moderate	Locally important
10	V95F4E6	Gourna_010	0.93km	**T2**	Moderate	Locally important
11	V95TP62	Gourna_010	0.69km	**T2**	High	Poor Aquifer

Dwelling number	Eircode	River Subbasin	Distance to nearest Turbine	Nearest Turbine in same subbasin	Groundwater Vulnerability	Bedrock Aquifer
12	V95TP62	Gourna_010	0.68km	**T2**	High	Poor Aquifer
13	V95Y312	Gourna_010	1.12km	**T2**	Low	Locally important
14	V95Y312	Gourna_010	1.15km	**T2**	Low	Locally important
15	V95R821	Gourna_010	1.33km	**T2**	Low	Locally important
16	V94W8PR	Cropaun (East)_010	8.51km	**T4 (in different subbasin)**	High	Locally important
17	V95XW68	Blackwater (Clare)_010	0.85km	**T4**	Moderate	Locally important
18	V94H61V	Owenogarney_030	3.77km	**T1**	Moderate	Locally important
19	V94PCF9	Owenogarney_030	3.74km	**T1**	High	Locally important
20	V95E5Y3	Blackwater (Clare)_010	1km	**T4**	Moderate	Locally important
21	V95K2W2	Blackwater (Clare)_010	1.07km	**T4**	Moderate	Locally important
22	V94V60W	Owenogarney_030	3.87km	**T1**	High	Poor Aquifer
23	V95K2K6	Blackwater (Clare)_010	2.13km	**T4**	Low	Locally important
24	V9466X9	Broadford_030	0.99km	**T10**	High	Poor Aquifer
25	V94PX8X	Broadford_030	0.78km	**T10**	Rock	Poor Aquifer
26	V9467X9	Mountrice_010	1.32km	**T9**	Rock	Poor Aquifer
27	V94RDK5	Broadford_030	0.90km	**T10**	Rock	Poor Aquifer
28	V94RDK5	Broadford_030	0.93km	**T10**	Rock	Poor Aquifer
29	V95XY94	Blackwater (Clare)_010	3.70km	**T7**	Low	Locally important
30	V94YH3F	Broadford_030	1km	**T10**	Rock	Locally important
31	V94KND4	Broadford_030	0.98km	**T10**	Extreme	Poor Aquifer

Dwelling number	Eircode	River Subbasin	Distance to nearest Turbine	Nearest Turbine in same subbasin	Groundwater Vulnerability	Bedrock Aquifer
32	V94XHN6	Broadford_030	1.57km	**T10**	Moderate	Poor Aquifer
33	V94KND4	Broadford_030	0.99km	**T10**	Extreme	Poor Aquifer
34	V94R28P	Broadford_030	1.1km	**T10**	Extreme	Locally important
35	V94832D	Broadford_030	1.93km	**T10**	Rock	Locally important
36	V94YE6X	Broadford_030	2.11km	**T10**	Rock	Locally important
37	V949K29	Broadford_030	3.05km	**T10**	Extreme	Poor Aquifer

To protect groundwater, the construction on greenfield areas are outside buffers placed on wells, the aquifers underlying these wells are designated as LI and PI (see Figure 3.2). Groundwater vulnerability classed as X indicates rock at the surface. The risks to groundwater associated with the site are low.

EIAR Chapter 9, Section 9.3.11 of EIAR states that "*the Wind Farm Site is underlain by areas classified predominantly mapped as 'Extreme (E)' vulnerability rating, with some areas mapped as 'Rock at or Near Surface (X)' vulnerability rating. The proposed location of T1, T3, T6, T10 and T11 have been mapped as areas with 'Rock near surface (X)' vulnerability rating. The proposed locations of T2, T4, T5, T7, T8 and T9 are in areas of 'Extreme (E)' vulnerability. (Figure 9.10a – Groundwater Vulnerability).*" This is presented in Figure 3.4 below.

As outlined in **EIAR Chapter 9**, Section 9.3.13, "*Due to the absence of any recorded groundwater quality data within or proximal to the study area, no published data on groundwater quality for the Site is available. However, the 2016-2021 WFD Groundwater status for groundwater units underlying the Site is 'Good' (Groundwater units: Lough Graney and Tulla-Newmarket on Fergus) and is considered not at risk.*

*Peat depth across the site is generally very shallow to moderately deep with some isolated pockets of deep peat (**EIAR Appendix 10.1 – App A and App B**). There was 1 no. sampling point of deep peat recorded in the surround area of T11."*

There is the potential to affect groundwater levels locally during excavation works, particularly for turbine foundations, however considering the scale of the excavation i.e. relatively shallow, and duration i.e. temporary, the potential effects to groundwater levels are slight and temporary. Furthermore, relevant guidance stipulating groundwater buffer distances allows the assessment to screen for potential receptors. In the few occurrences where receptors fall within buffers, the connectivity will likely be poor (poor aquifer), and the potential slight localised effects of excavations are highly unlikely to have any significant adverse effect on receptors, namely groundwater wells in the area. A detailed groundwater level and flow direction assessment is not required to refine these conclusions.

Mitigation measures for groundwater receptors have been recommended in relation to hydrocarbon contamination and non-hydrocarbon potential contamination of groundwater. Mitigation measures for all hydrocarbon contamination outlined in **EIAR Chapter 9**, Section 9.6.2.3 and Section 9.6.2.4.

Mitigation measures for non-hydrocarbon contaminants are outlined in Section 9.6.2.2, Section 9.6.2.5 and Section 9.6.2.6 of **EIAR Chapter 9**.

Mitigation measures for the protection of groundwater are as follows:

- All mitigation measures used for surface waters;
- Hydrocarbons and chemicals on site will be bunded;
- Spill kits and mats will issued and utilised on site;
- Construction water will go into an active treatment management systems, overall protecting the groundwater systems;
- The reduction of recharge to groundwater will be minimised and mitigated through redressing of semi impermeable surfaces; and,

- Earthworks and excavation concerns are addressed in **memorandum no. 6**. Prior to construction geotechnical ground investigations will be done including drilling, this will include installation of boreholes and obtaining groundwater level data which will inform construction methodologies.

Drilling will take place as part of the geotechnical ground investigations. The other unavoidable potential contamination risk to groundwater is the use of concrete which is a temporary effect. The submission response document for land, soils and geology (see **memorandum no. 6**) states that "*the use of concrete on groundwater recharge and the potential for flooding is a negligible to small adverse effect*."

Contamination by metals from rust is considered unlikely due to the distance to receptors. **EIAR Chapter 9**, Section 9.4.3.12 states that "*Considering the baseline data and Proposed Development characteristics, the risk of lowering groundwater levels to a significant extent is considered unlikely."* Section 9.4.3.13 surmises that "*Considering the quality of the groundwater underlying the Site, and the 'Medium to High' sensitivity and importance associated with groundwaters nationally, any introduction of contaminants is considered an unlikely, direct and indirect, adverse, slight, temporary effect of the Development which conforms to Baseline (e.g., other shallow excavations*).

With the implementation of appropriate mitigation measures and environmental engineering controls, these potential risks can be significantly reduced". These are outlined in the design phase and discussed in Sections 9.5.1.1, 9.5.1.8. and 9.5.2.14 of **EIAR Chapter 9**.

EIAR Chapter 9, Section 9.5.2.14 states "*A combination of the underlying bedrock geology, the associated aquifer potential, low permeability soils/peat and low recharge rates has resulted in the risk posed to groundwater quality by the Proposed Development being considered as low risk."* The mitigation measures proposed, and the residual effect falls in line with the Clare County Development plan 2023 - 2029 (CDPB.218), objective which is "*to protect groundwater resources in accordance with the statutory requirements and specific measures as set out in the relevant River Basin Management Plan*". Figure 3.3 shows the associated aquifers under each of the private mapped wells and the GSI wells.

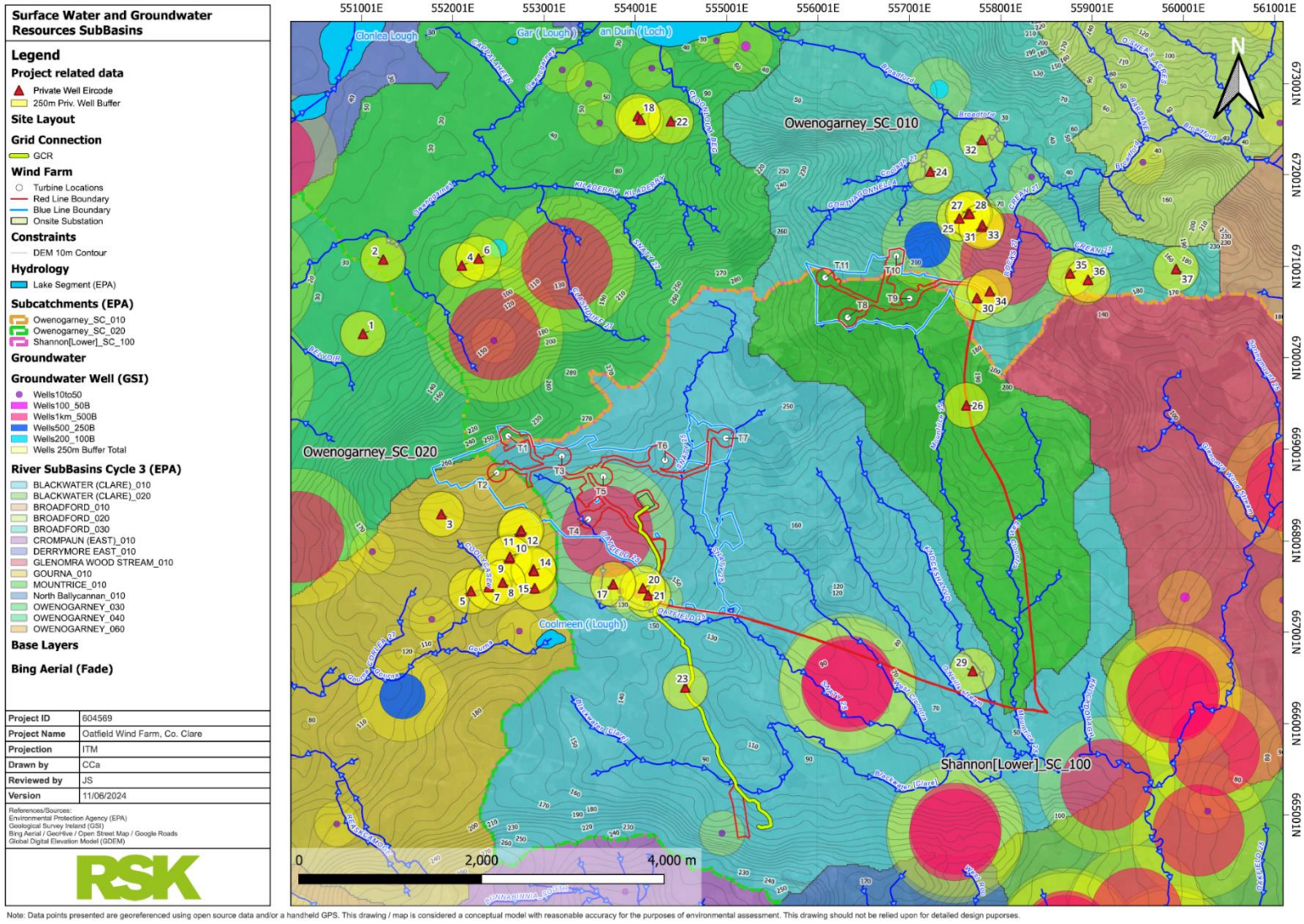


Figure 3.2: Private mapped wells and GSI mapped wells in the vicinity of the site

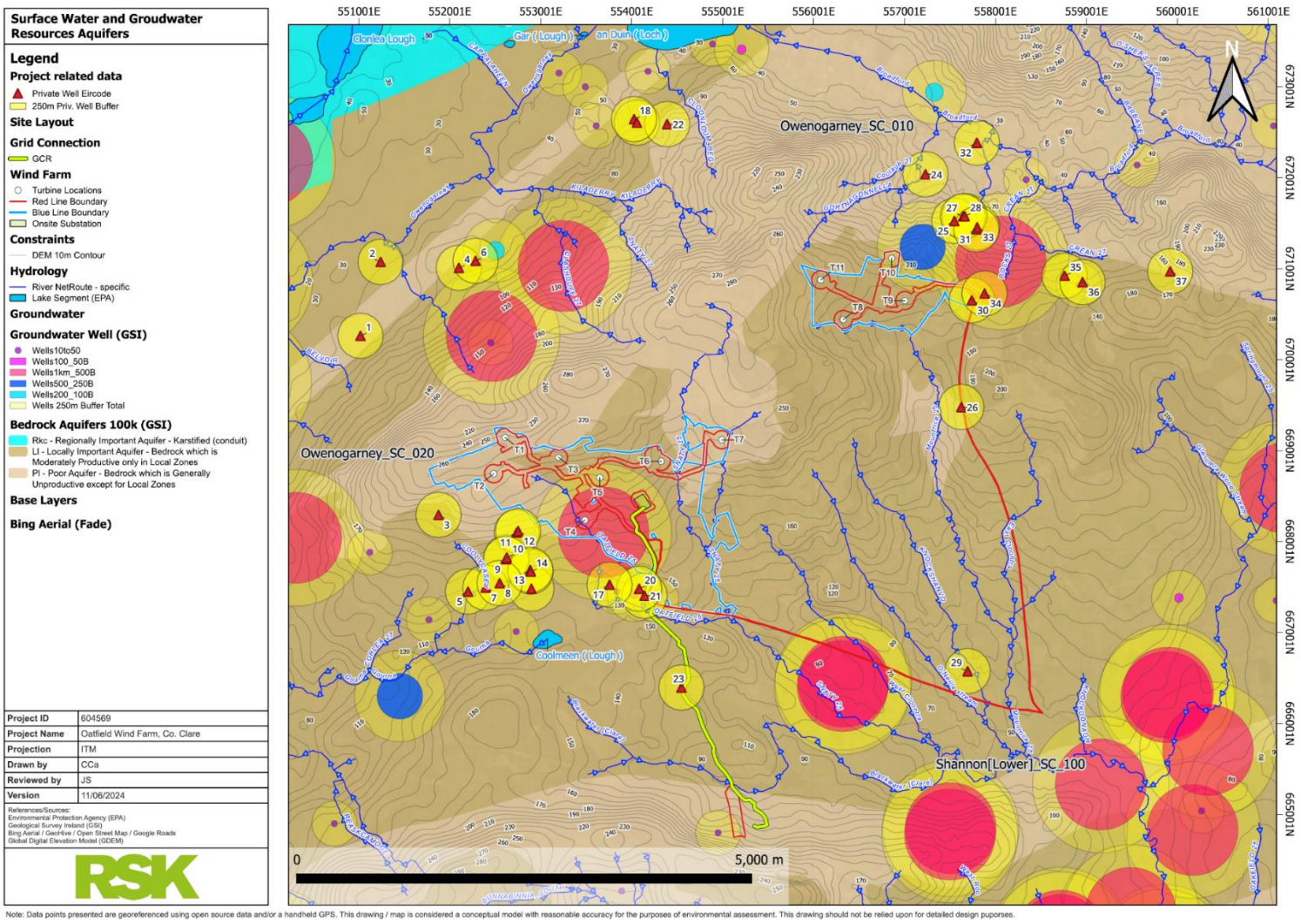


Figure 3.3: Mapped private wells and their associated bedrock aquifer

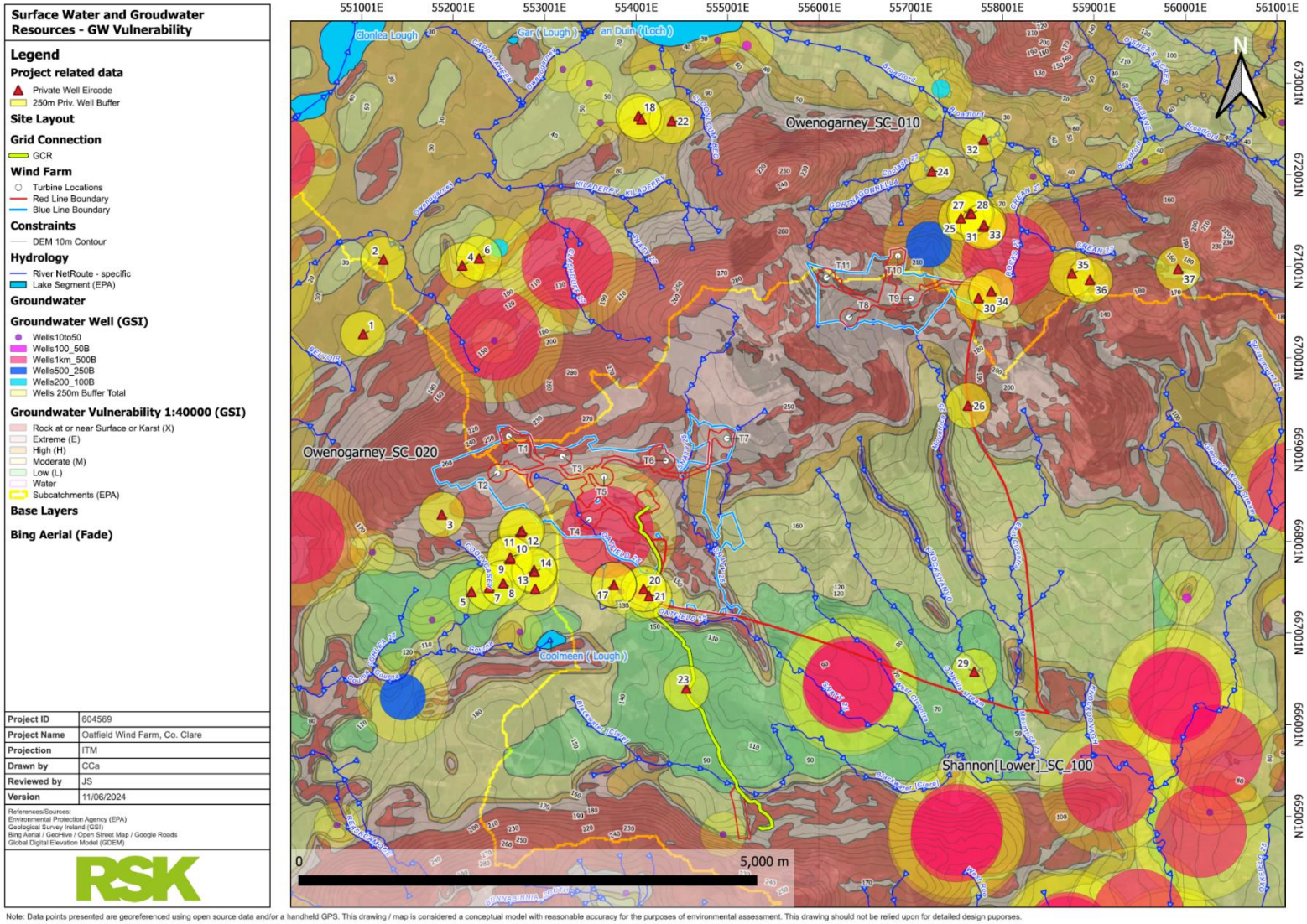


Figure 3.4: Groundwater vulnerability

3.3 Theme 3: Flooding

There were concerns raised regarding flooding downstream, homes being at risk of flooding, local flooding of streams being exacerbated, road flooding in wet weather periods being exacerbated, and the removal of peat which stores water.

Response

Historic maps were assessed for the site, these included GeoHive MapGenie 6 Inch and 25 Inch.

The GeoHive website states "*Historic Map Services: Digital versions of some of our historic maps are available as MapGenie services. MapGenie users can access 1st edition six inch maps. Surveyed between 1829 and 1842, these maps represent the first ever large-scale survey of an entire country. Also available to MapGenie users is a set of larger scale 25 inch maps which were surveyed and published at the start of the 20th century and an updated set of six inch maps dating from the mid-20th century.*" Nearest past flooding events on the OPW mapped were searched for the in Flood Risk Assessment. These included:

- Broadford Road Jan 2005 (ID-4480) - Flood Source: Low lying land. West of the site.
- Ahaclare River Woodfield Br Recurring (ID-4699) – Flood Source: Lake. North west of site.
- R465 at Kyleglass 2005 (ID-4697) - Flood Source: Low lying land. East of the site.

In the Broadford river subbasin reoccurring floods have taken place.

- Glenomra River R466 Cloonyconry More Recurring (ID-4695) – Flood Source: River.
- R466 at Fahy More Recurring (ID-4696) – Flood Source: Low lying land.
- Flooding at Clonlara on 10/12/2015 (ID-13435) – Flood Source: River. South east of the site downstream.
- R463 and L7040 at Monaskeha Aug 2004 (ID-4698) – Flood Source: River. South east of the site downstream.
- Geological Survey Ireland (GSI) Winter 2015/2016 Surface Water Flooding was also documented in the River Shannon downstream of site.

All these past flood events were considered and in mitigating for future scenarios runoff calculations added 20% to account for climate change.

Mitigation measures will be implemented to ensure runoff is reduced and attenuated onsite. This will reduce the amount of water that would be on roads and in streams, having a beneficial effect on the hydrological regime of the area. Clare County Development Plan 2023 – 2029 states that "*Flooding can be exacerbated by development through removal of flood plain and therefore flood storage, by altering watercourses and increasing surface water run-off. Flooding can also pose a threat of water contamination*

due to inundation of wastewater treatment systems, agricultural runoff, and surface water run-off from developments.

Catchment Flood Risk Assessment and Management (CFRAM) Studies have been undertaken and Flood Risk Management Plans (FRMPs) have been prepared in line with the European Directive 2007/60/EC (Floods Directive). It requires member states to carry out preliminary flood assessments to identify areas of potentially significant flood risk, or Areas for Further Assessment (AFA)."

EIAR Chapter 9, Section 9.3.7 summarised the results of the Flood Risk Assessment (FRA) which can be found in **EIAR Volume III**, **Appendix 9.1**. *"The southwestern Catchment Flood Risk Assessment and Management (CFRAM) programme did not indicate any flood extents within the proposed site boundaries or in the surrounding areas of the Grid Connection Route."*

In the concluding remarks of the submitted FRA Stage 1 Section 4.3.1 & 4.3.4; "*The site is not within a probable flood zone, nor has it experienced any historical flooding. The Proposed Development is considered an 'appropriate' development for Flood Zone C."*

Stage 2 of the FRA outlines a water balance assessment for a *"1 in 100-year storm event scenario results in a net increase of surface water runoff associated with the development, calculated to be c. 0.754m^3/second, or 0.19% relative to the approximate site area (blueline boundary- 381m²)*". In **EIAR Chapter 9**, Section 9.3.7 the net increase *"is considered an adverse but slight impact of the development and minor in terms of effect but considering the significant cumulative effect of runoff on flood risk it is important to mitigate any potential adverse effects."*

"The Proposed Development will use the latest best practices guidance document(s) to ensure that flood risk within or downstream of the site is not increased as a function of the development, i.e., a neutral impact at a minimum. As a result of the mitigation measures being followed there will be no impacts on hydrology offsite.

Considering the Proposed Development does not acutely or significantly impact on a probable flood risk area, FRA Stage 3 including advanced flood modelling is not required. However, it is recommended to include drainage modelling during the detailed design phase of the development.

A SWMP will be prepared prior to the construction phase commencing, with a view to ensuring that the surface water runoff at the site is managed effectively and does not exacerbate flood risk to the surrounding areas downstream. It is recommended that this is done in consultation with relevant stakeholders".

Given the locations of dwellings and national indicative fluvial flooding maps, the nearest fluvial flooding is located two (2 nos.) river subbasins downstream of works. Any potential flooding associated with the site will therefore be pluvial. Assuming all mitigation measures will be followed to decrease runoff rates and attenuate surface waters on site this will not affect downstream receptors.

As outlined in Section 4.3.1 & 4.3.4 of the FRA; *"the associated drainage - some of which is permeant for the lifetime of the development, will be attenuated for greenfield run-off, the Proposed Development will not increase the risk of flooding elsewhere in the catchment. Based on this information, the Proposed Development complies with the appropriate policy guidelines for the area and is at no risk of flooding."*

3.4 Theme 4: Buffers and drainage

3.4.1 Buffers

Concerns were raised that Proposed Development will fall within the buffer zones applied. Concerns also included how the design phase was achieved in the timeline, taking into account the constraints (buffers) determining the locations of infrastructure.

Response

Clare County Development Plan 2023 – 2029 recognises buffers are riparian zones. "*The riparian zone is an integral part of any watercourse system serving ecological as well as practical functions, for example, the vegetation provides bank stability during flood conditions and filters pollutants out of surface water before it reaches a river or lake.*"

As outlined in **EIAR Volume III, Appendix 5.1 CEMP**, Section 4 of the SWMP and **EIAR Chapter 9**, Section 9.5.1.15, buffers fall under the constraints package in the design phase of the Proposed Development. These buffer zones then influence the design of the Proposed Development layout. During the design phase turbines and infrastructure was moved to minimise encroachment on these areas. A key example in this case was the placement of turbine number 4 (T4) in a water buffer zone, the track to this turbine was then reduced to pull the infrastructure out of this buffer zone, therefore using mitigation by avoidance to reduce the potential effect on the waterbody.

"The available guidance from EPA, Catchments programme and Scottish EPA documents stipulates varying surface water buffer widths depending on type of activity, receptor type and sensitivity, and riparian zone characteristics including topography (steepness). Recommended surface water buffer widths range from 5m to 50m depending on site specific and activity specific characteristics."

A conservative approach buffer zone of 50m is recommended for mapped rivers, however a minimum requirement of 25m must be maintained. All watercourse crossings do take place within the buffer zones of the waterbody, but this work is done taking care to minimise the amount of disturbance to the river/drain beds, by installing bottomless culverts/ clear span bridges etc.

However, there are some instances where surface water buffers cannot be avoided, including for example; watercourse crossings. As outlined in **EIAR Chapter 9**, Section 9.5.1.9, "*Some portions of the Development footprint fall within assigned buffer areas".* Other portions of a development which fall into buffer zones are likely doing so due to the sum of influences and constraints associated with multiple environmental disciplines.

Where this was not possible, additional mitigation measures such as "*clean water collector drains will intercept clean runoff (upgradient of construction areas) and will direct runoff around construction areas. The runoff will be attenuated by means of check dams and intermittent buffered outfalls (Appendix 9.5 – Tile 3, 13 and 14, 19)."*

As outlined in **EIAR Chapter 9**, Section 9.5.2.16 "*Telemetric continuous Monitoring will be carried out as part of Active Management of construction water management and treatment for the duration of the construction phase of the Development* ***(****Appendix 9.5). These monitoring systems will travel with the active construction areas / remain with the Active Management infrastructure. The purpose of this is to recycle water if quality is unfavourable and adjust the dewatering and treatment train accordingly until discharge*

quality is observed to be acceptable." Heightened monitoring takes place within these buffer zones "*If discharging within sensitive areas or buffer zones, the quality of discharge from the Active Management train will be in line with prescribed reference limits (e.g., 25mg/l TSS)*".

3.4.2 Drainage

Concerns were raised about the disruption to the natural drainage in the area, and the lack of requirement on discharge licensing.

Response

All drainage on site was mapped extensively and outlined in **EIAR Chapter 9**, Section 9.3.6. These on site surveys are presented in Figure 9.6a and 9.6b of **EIAR Chapter 9** and in Figure 3.5 below.

"*Drainage channels are mapped using five categories of significance;*

- *Minor Drainage (non-mapped Drainage - Confirmed)*
- *Historically Mapped SW Features (Not mapped by EPA/WFD) (Confirmed)*
- *Inferred Drainage (non-mapped Drainage)*
- *Obsolete (Historically Mapped SW Features (Gone/ Not Observed)*
- *Forestry Drainage (light blue dashed polygons)*

Note: Aerial lidar survey data (topographical elevation data, accuracy 1m) and recent aerial photography, as well as historical maps were interrogated, and some additional drains were identified. These are discussed in the constraints EIAR Chapter 9 Section 9.5.1.9."

The drainage, attenuation and other surface water runoff management systems will be installed concurrent with the main construction activities to control increased runoff and associated suspended solids loads in runoff during intensive construction activities e.g., excavation of Turbine Foundation. As outlined in **EIAR Volume III, Appendix 5.1 CEMP.** Section 5 of the SWMP; the drainage system includes the following:

- A 50m buffer from watercourses except at water crossings. These will be marked out prior to works beginning on site.
- Drainage will be installed in parallel with road construction.
- Check dams will be mainly used for road drainage. All road sections will drain to settlement-attenuation ponds.
- Silt fencing will be utilised during water crossings and around stockpiles.
- Settlement-attenuation ponds will be used at every major excavation.

The existing drainage regime at the site has been assessed and mapped in high detail. Mitigation measures include identifying drainage features and isolating and diverting drainage where necessary so as to isolate the construction area. That is, the clean water runoff regime at the site will be maintained, and the constructed drainage will intercept runoff from the construction area and development footprint. Working with drainage as 'in stream works' and the use of over pumping (isolating working area) and other mitigation measures will ensure disturbance and mobilisation of contaminants / solids is minimised. The constructed drainage will also include sustainable drainage system

(SuDS) which will provide attenuation / retention of runoff and passive treatment (settlement / filtration of solids) before releasing runoff in a buffered and intermittent nature to vegetated areas before being intercepted by the existing receiving network, thus maintaining the baseline hydrological regime.

With the exception of the potential for slight temporary effects in terms of the release of suspended solids during the construction phase (discussed in previous responses), the development will provide beneficial effects in terms of the site hydrological regime, that is; reducing hydrological response to rainfall (mitigating downstream flood risk), providing passive treatment for water quality (SuDS), and the potential for enhanced biodiversity.

The water pollution act states under Section 4 *"—(1) (a) Subject to subsection (2), a person shall not, after such date as may be fixed for the purpose of this subsection by order made by the Minister, discharge or cause or permit the discharge of any trade effluent or sewage effluent to any waters*". **EIAR Chapter 9**, Section 9.5.2.4 states "*No extracted or pumped water will be discharged directly to the drainage or surface water network associated with the Site (This is in accordance with the Local Government (Water Pollution) Act, 1977 as amended)*". Water will be pumped to constructed drainage only which possesses a passive treatment train (development constructed drainage, check dams, stilling ponds) and with buffered outfalls to vegetated areas. Where works are situated within buffers, or when conditions dictate, construction water will be pumped to active treatment trains (temporary stilling pond, treatment / settlement tank, silt bags, etc) in controlled areas, which will release acceptable quality waters to vegetated areas within the red line boundary.

This process will be monitored continuously, and where necessary, emergency intervention will be escalated to assess, review and modify the process. The necessity of intervening will be dictated by monitoring and observations on site in relation to; water and runoff quality including any exceedance of reference thresholds (<25mg/l suspended solids), indications of erosion, etc. Intervention measures will include; diverting construction water to the active treatment train and controlled release area, temporary drain blocking, temporary silt screening, temporary installation of floc blocs or other similar mitigation measures.

It is also worth noting that the guidance for applications for discharge licences state that applications for discharging of trade effluent in the extreme headwaters of rivers is not looked on favourably. Therefore, the proposed methodology includes anticipating, intercepting, manging and treating as necessary the impacted site runoff or construction waters within the confines of the development area and to ensure that water quality is acceptable before releasing to vegetated areas within the red line boundary. Overland flow of waters intercepted by the receiving drainage and surface water network thereafter do not pose a likely significant effect on surface water quality.

There are some instances where due to constraints e.g. available working space along the GCR, the appointed contractor will potentially require a direct discharge to water, that is; where there is insufficient space to incorporate the methodologies outlined above and manage construction waters passively on site. In such instances, an application for a discharge licence will be viewed more favourably (lower elevations, not in extreme headwaters). Through similar active treatment, and with prescribed licence conditions and associated discharge limits, residual effects on surface water quality are not likely to

be significant. During the operational phase of the Development there is no likely significant effect on surface water quality.

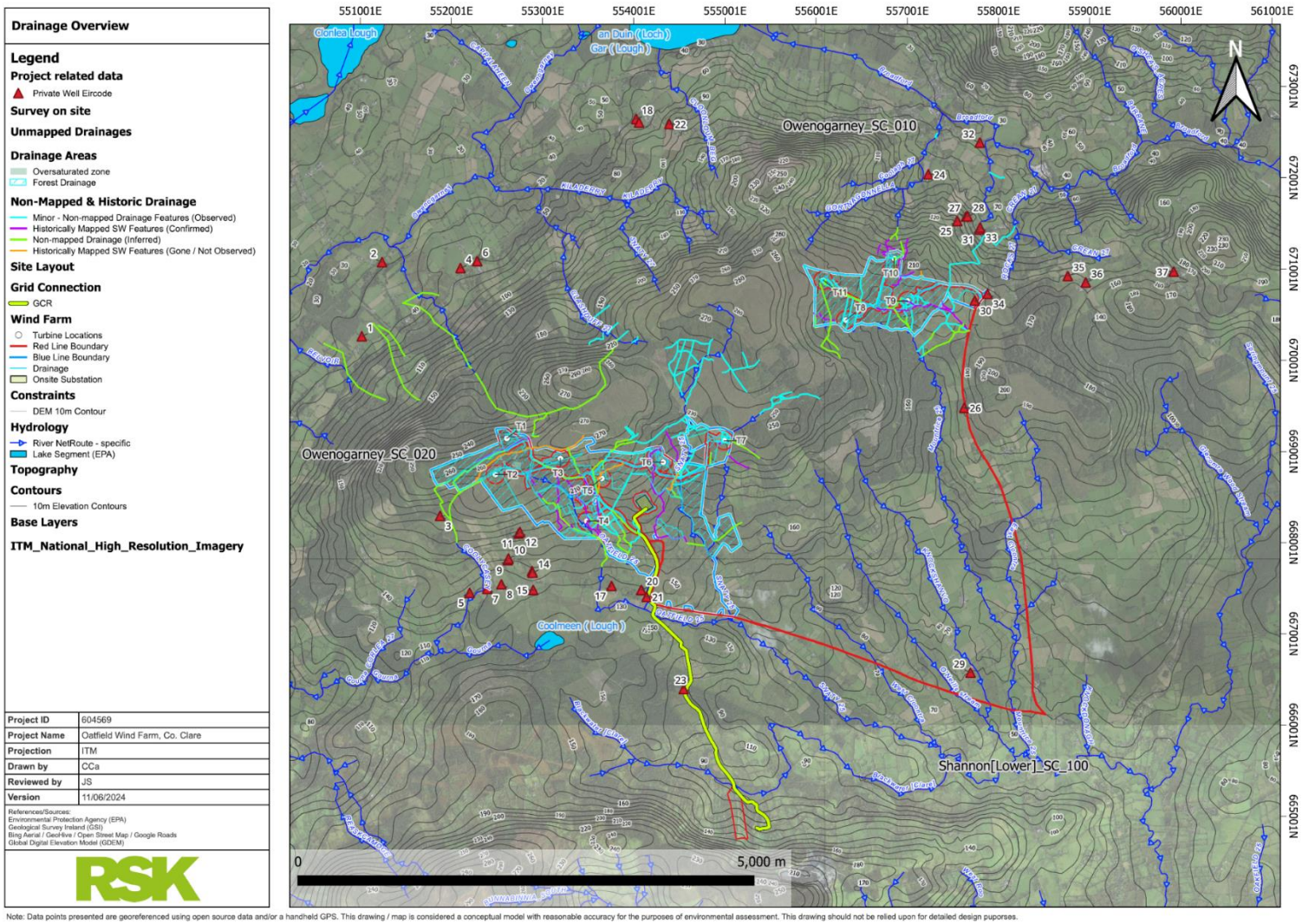


Figure 3.5: Drainage overview

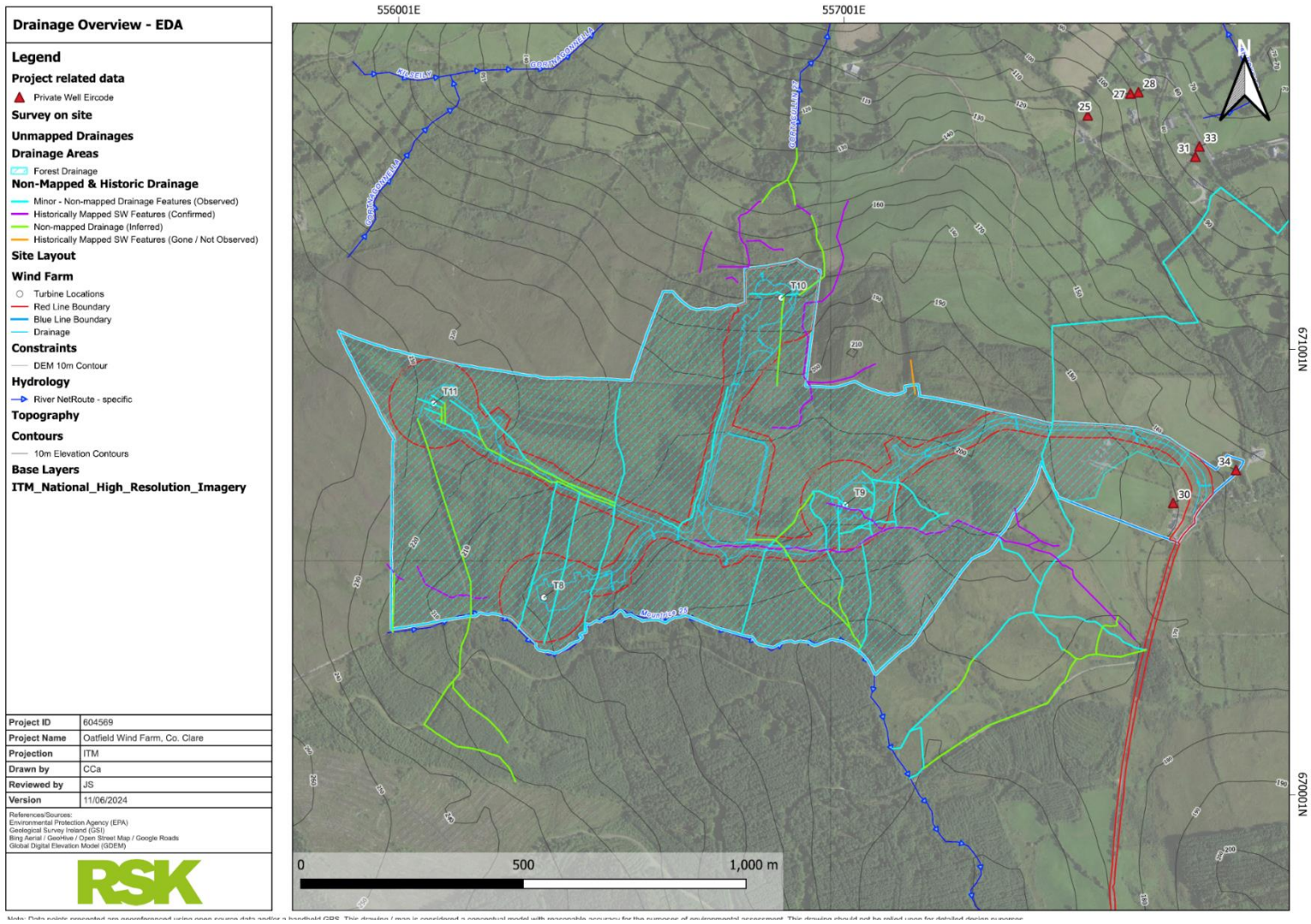
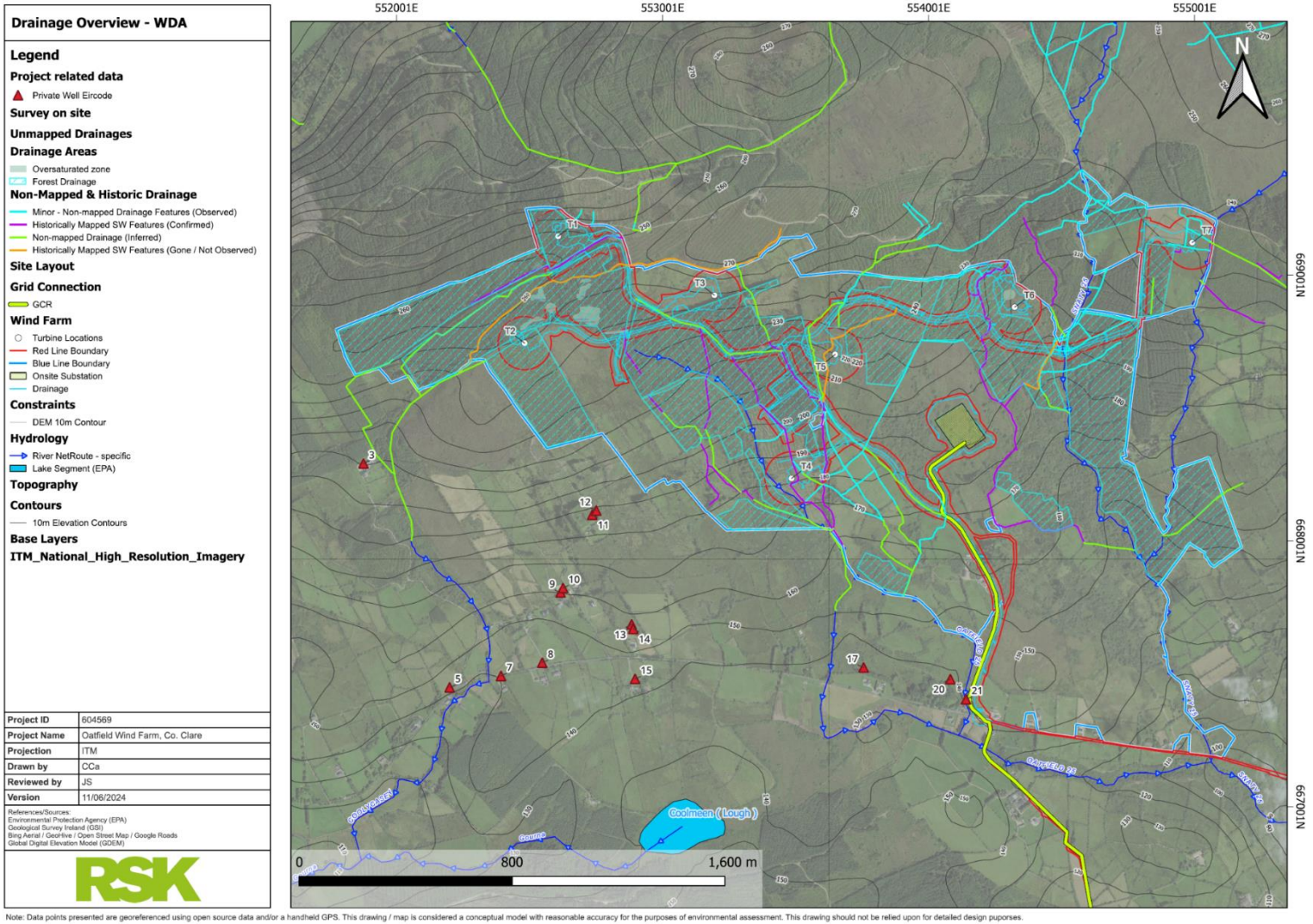


Figure 3.6: EDA site drainage



Note: Data points presented are georeferenced using open source data and/or a handheld GPS. This drawing / map is considered a conceptual model with reasonable accuracy for the purposes of environmental assessment. This drawing should not be relied upon for detailed design puporses.

Figure 3.7: WDA site drainage

3.5 Theme 5: Designated areas - downstream areas

Concerns were raised regarding the proximity of Gortacullin Bog NHA and that the Mountrice_010 is one of the hydraulic controls of the Gortacullin Bog NHA. In addition, there were concerns regarding potential pollutants entering the Poulnalecka SAC via the Owenogarney_030, pollutants entering the Doon Lough NHA and surrounding hinterland which contains Danes Hole, Poulnalecka SAC.

Response

As outlined in **EIAR Chapter 9**, Section 9.3.15**,** ‘’*the Oatfield Wind Farm Site is situated ca. 0.1km from Gortacullin Bog* Natural Heritage Areas (*NHA) and ca. 4km from Poulnalecka SAC. Designated and Protected Areas associated with the Development are detailed in* EIAR *Chapter 9 Figure 9.3 and presented in EIAR Chapter 9 Figure 9.12a’’.*

The nearest downstream designated areas include the following as outlined in Figure 9.4 and Figure 9.12a of **EIAR Chapter 9**.

- *Gortacullin Bog NHA (EPA Site Code: 002401) 0.1km to the north of the EDA*
- *Danes Hole, Poulnalecka SAC (EPA Site Code: 002401) 4km to the west of the EDA*
- *Doon Lough NHA (EPA Site Code: 000337) 3.81km to the northwest of the EDA*
- *Ratty Cave SAC (EPA Site Code: 002316) 6.29km to the west of the WDA*
- *Lower River Shannon SAC (EPA Site Code: 002165) 13.2 km south of site.*
- *River Shannon and River Fergus Estuaries SPA (EPA Site Code: 004077) 13.2 km south of site*

As with all potential effects, it is important to recognise the level of works taking place in the same river subbasin as well as the contours on site to fully understand the direction of flow to these sensitive receptors. Gortacullin Bog NHA is located in the Broadford_010 River subbasin which is an “*Area for Action*” under Clare County Development Plan 2023 - 2029. Although the NHA borders the Blue line boundary of the Proposed Development, contours indicate that the drainage mapped on site in this area (minor and forestry drains) flows away from the NHA, therefore having a minimal effect on the hydrological regime of this protected designated site. Refer to Figure 3.8 for the mapped drainage and construction drainage with flow directions at T11 and the nearest Designated Site to the Proposed Development. *Danes Hole, Poulnalecka SAC* is located in the Owenogarney_030 river subbasin and the proposed works located in this area is T1.

EIAR Chapter 9, Section 9.4.3.10 recognises that the potential of the Proposed Development to introduce contaminants to surface waters and in turn impact on the designated areas downstream is considered to be a likely, indirect, localised (potentially regional), adverse, moderate to profound, temporary to long-term effect of the Proposed Development which conforms to Baseline (e.g., cumulative upstream impacts), while being small to moderate in scale.

However, with the implementation of appropriate mitigation measures and environmental engineering controls, discussed in **EIAR Chapter 9**, Section 9.5.2**,** these potential risks can be significantly reduced and are considered not likely to be significant.

Furthermore, construction phase interceptor drains will ensure that any potential contaminants will not drain into river subbasins where possible, for example Owenogarney_030, which is in line with objective CDP14.2A of the Clare County Development Plan 2017-2023 i.e. "*To afford the highest level of protection to all designated European sites*".

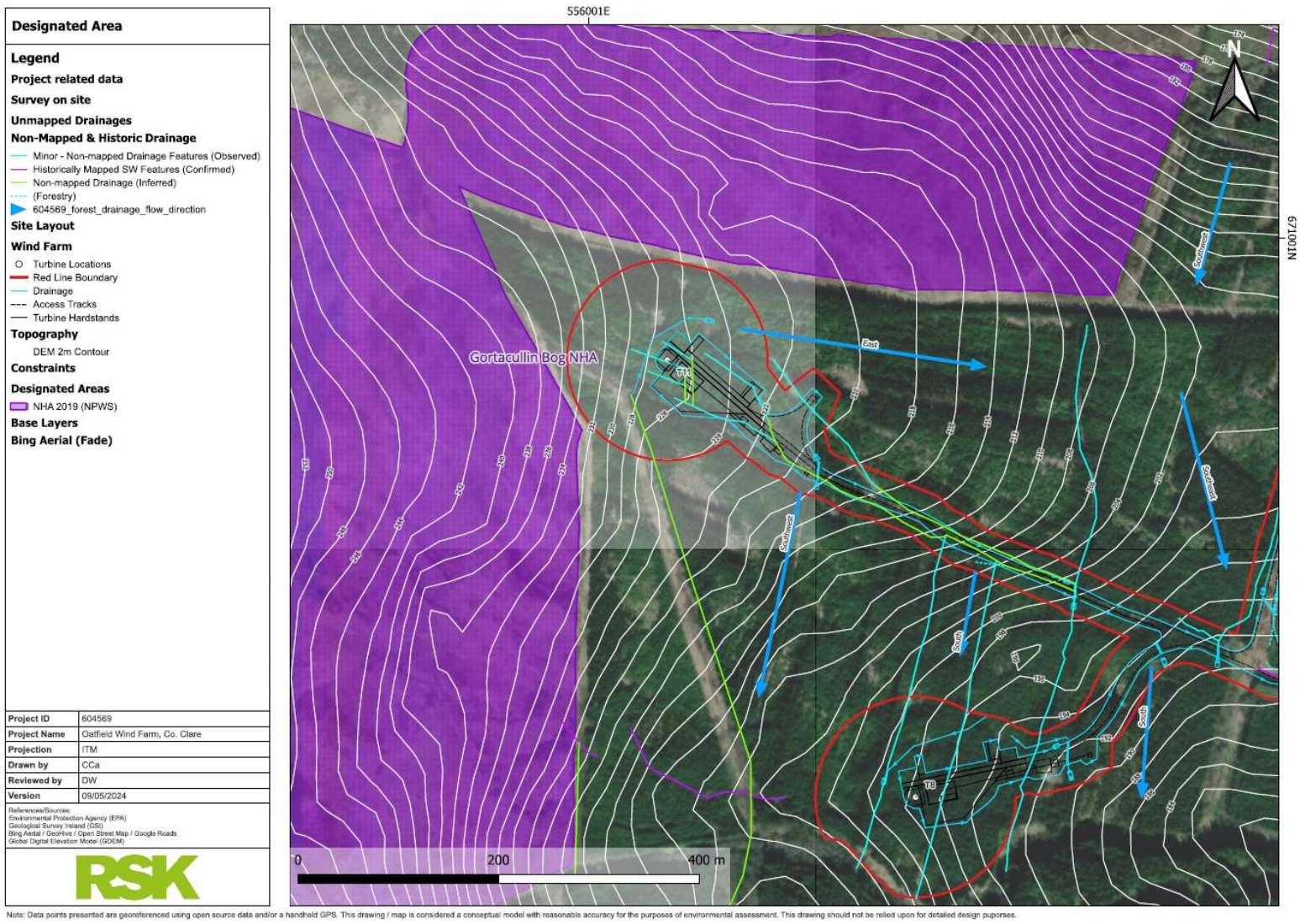


Figure 3.8: Drainage with flow directions, at T11 and nearest designated site to the wind farm

3.6 Theme 6: Competency of authors

Concerns were raised regarding the competency of authors of the Hydrology and Hydrogeology Chapter.

Sven Klinkenbergh is an Environmental Scientist with 11 years' experience working on hydrological, hydrogeological and geological projects. Specifically in relation to hydrogeology, experience including inter alia; borehole drilling scope and supervision, well design and installation, well pump testing, borehole rehabilitation and airlifting, borehole camera surveys, piezometer installation and bog water monitoring, groundwater sampling and analytical hydrochemistry, groundwater level monitoring (manual dip, water level loggers, impress sensors / telemetry), groundwater flow direction assessment, groundwater quality assessment, surface karst assessment and mapping, dewatering construction sites including in line treatment and discharge (settlement, filtration, pH adjustment (acid dosing), flocculant dosing, hydrocarbon removal and polishing (GAC vessels)), ground gas monitoring, and peat stability risk assessments. Sven is RSK Ireland EIA Hydrology, Hydrogeology and Geology team lead and was involved in the assessment for Hydrology & Hydrogeology, and Land, Soils and Geology chapters throughout the process and conducted a quality and technical reviews of the content of the assessment.

Jayne Stephens has a doctorate in water microbiology with 8 published scientific papers in that realm. She has studied extensively for 5 years the movement of biological contaminants and hydrochemistry assessments in the river water columns as well as the marine water environments. In the one year of experienced gained at RSK, she has been involved in several similar wind farm projects.

The locations of turbines were based on an in depth design phase with all relevant experts to ensure that they have minimal impact on watercourses, drainage, deep peat, invasive species, endangered species etc. As outlined in **EIAR Chapter 9**, Section 9.3.6**,** drainage surveys identified a relatively extensive network of artificial drainage channels and some non-mapped natural drains. Peat probing was conducted extensively across the site to ensure all areas of deep peat and over saturated zones mapped were identified, discussed and avoided. In addition, **EIAR Chapter 9**, Section 9.3.13 states that "*peat depth across the Site is generally very shallow to moderately deep with some isolated pockets of deep peat (EIAR Volume III Appendix 10.1 – App A and App B). The risks to groundwater associated with the site are low*." "*Peat and slope stability investigations at the Proposed Development indicate that the area has a generally low risk probability with respect to peat slippage and slope failure under the footprint of the Proposed Development*."

3.7 Theme 7: Inadequate methodologies, site surveys and water test results

Concerns were raised that the methodologies implemented, and site surveys completed were inadequate as they were carried out solely in September and October and that the use of results of a few water samples was considered not enough for a hydrogeological impact assessment.

The purpose of an EIAR is to identify and assess likely significant effects, prescribe mitigation measures - in a conceptual nature, and to assess likely residual effects.

The site and receiving environment have been characterised, assessed, and surveyed. This process has identified and qualified receptors and constraints which have informed the design phase of the Development. Qualification of receptors includes assessing in terms of both importance and sensitivity. A detailed assessment with high resolution data will not significantly influence the qualification of significant receptors, such as surface water or groundwater as these are very important sensitive receptors – irrespective of whether they have good or poor status currently.

The Proposed Development layout is optimised to minimise effects while considering multidisciplinary receptors and constraints. The Proposed Development has also been characterised and assessed, which informs the assessment of potential effects on the receiving environment. Considering the nature of the receiving environment and the Proposed Development, likely impacts, pathways to and effects on receptors are identified, qualified, and assessed.

Mitigation measures prescribed in the EIAR will minimise likely effects to acceptable levels. Where residual effects are identified, monitoring and ongoing intervention as necessary to ensure mitigation objectives are met have been considered.

The submissions call for additional site detail but do not indicate how additional site detail will inform the EIAR, or how additional detail might render differing assessment results and conclusions, or whether mitigation measures will be insufficient.

The site was assessed in detail through desk based assessments, site surveys, and monitoring events, which is reflected in the baseline data and associated maps presented. This included a review of historic drainage maps, drainage visible in aerial and lidar data, site walkover surveys, and surface water sampling. The resulting data presents a comprehensive understanding of the hydrological regime, particularly in relation to identifying pathways and receptors for potential effects and informing the development design and application of prescribed mitigation measures.

Initial site walkovers were scoped in and conducted on the basis of a preliminary design which was provided by the client and based on previous feasibility and high level constraint assessments. That work then informed refinement of the design and two subsequent investigations were conducted following layout revisions. This enabled the layout to change based on findings from desk assessment and site observations.

Due to time constraints surface water monitoring was limited. However, data obtained from surface water sampling locations was useful in qualifying existing baseline effects on the receiving waters, which in combination with the WFD status, WFD risk, and the objectives of the WFD itself (achieve and maintain good water quality status), and other downstream designations or ecological receptors, all receiving surface waters are considered important sensitive receptors.

Rainfall data from nearby weather stations was used for the assessment. River discharge rates, particularly in the extreme headwaters of the receiving rivers will naturally be extremely flashy, and monitoring accurate river discharge rates would be very difficult from a practical point of view. For any reliable assessment of the changes in river discharge as a product of the development, it would require an expansive data set

spanning years. This is not required as the likely effect on runoff volumes will be neutral, to beneficial.

Low flow conditions do indicate baseline values in the water columns as during the 'wetter' months but biological indicators and chemical indicators can increase with huge variability during storm events. However, a baseline wet weather event was sampled for where there had been three days of rain before the day of sampling.

Sampling occurred in both wet and dry conditions in the short time frame given to best capture seasonality. Monitoring at these sampling locations will continue throughout the construction phase and any potential changes will trigger an emergency response protocol, outlined in the CEMP.

Section 9.4.3.12 and Section 9.4.3.13 of **EIAR Chapter 9** assesses the potential effect on local groundwater supplies and bog waters, and surmises that "*the site is characterised by moderately deep and shallow peat or peaty soil with isolated minor areas of moderately deep saturated peat (EIAR Chapter 10: Soils and Geology). Therefore, the scale of such impact is likely limited to the extent of those isolated pockets, if impacted. Furthermore, the Site is generally characterised as having extensive existing drainage features, and therefore impacts arising from drainage can be in line with baseline conditions*." This section goes on to identify that "*Considering the baseline data and Proposed Development characteristics, the risk of lowering groundwater levels to a significant extent is considered unlikely."*

The baseline assessment and EIA undertaken for the Proposed Development is considered detailed and robust. The necessity for more detailed site surveys must consider the magnitude of hazards and significance of potential effects.

The development has the potential to adversely impact on water quality, but this will be mitigated in such a way that impacts to water quality are not permitted. More detail in the baseline will not influence the qualification of receptors or require alteration of mitigation.

The development has the potential to contribute a net increase in runoff, potential downstream flood risk areas are assumed in all instances and mitigation includes sustainable drainage systems which will provide a neutral to beneficial effect. There is no requirement here to advance to a detailed Stage 3 flood risk assessment.

3.8 Theme 8: Cumulative effects

The cumulative impact or effect associated with the Proposed Development is considered and assessed in **EIAR Chapter 9**, Section 9.6.5. The industry standard is to approach cumulative effects based on the combined effects of similar developments in the area. However, the assessment of cumulative effects under Hydrology and Hydrogeology must consider some other variables, such as; the connectivity between similar developments or placement within hydrological catchments, the diffuse cumulative effect on the receptor in the catchment (surface water / groundwater), the sensitivity and importance of the receptor in terms of hydro chemical and ecological status, the aims and objectives of policy and legislation, namely the Water Framework Directive (WFD) and the objective to maintain or achieve at least 'good' water quality in all water bodies. These factors are brought into the assessment from the outset whereby;

- Qualifying the importance and sensitivity of receptors includes the fact that surface water groundwater bodies are highly important and sensitive receptors in their own right and that how any adverse effect is considered potentially significant when considering the ongoing cumulative effects on those bodies and the ongoing deterioration of water quality on a national scale;
- Qualifying the significance of effects includes for cumulative effects for potential downstream receptors, for example; the net increase in runoff is 'on the face of it' a very small effect, however this must be considered under the scope of cumulative effects and catchment scale mitigation for flood risk, and therefore considered significant and mitigated for;
- The scoping and objective of mitigation measures, as discussed above, sets out to ensure potential adverse effects to water quality are minimised, and that residual effects are likely to be neutral to slight temporary during the construction phase, and neutral to beneficial during the operational phase;
- The expected residual effects to water quality following successful implementation of mitigation with zero accidental releases is neutral, in the event a minor accidental release occurs these instances will be observed through monitoring and resolved in good time through the escalation of emergency intervention resulting in a temporary slight effect. Therefore, on this basis the Proposed Development is not likely to significantly contribute to cumulative effects on water quality downstream.

Taking into consideration the cumulative effects of the proposed wind farm developments; **EIAR Chapter 9**, Section 9.7.1 states that "*There are no significant cumulative effects anticipated from other projects during the construction phase of the Proposed Development. When considering cumulative effects of pressures on the surface water networks it is advised to look at this by catchment areas. The Development is not considered likely to significantly contribute to cumulative effects in terms of water quality nor flood risk, however if another Wind farm was to be in a construction phase in the same catchment at the same period this will likely raise the cumulative effect to slight on surface water networks and groundwater systems. It is assumed that the residual effects from other construction projects would be similar to this development i.e., would lead to slight residual effects on the hydrology and hydrogeological environment with the protection of waterbodies such as buffer zones, silt screens and active management treatment rains*".

This assumes that with "*similar developments, construction activities and potential adverse effects in the area, there is the potential for such incidents to have a cumulative effect on water quality to some degree if such incidents occur on multiple sites in a short period of time and within the same hydrological catchments."*

APPENDIX 1 – SURFACE WATER FLOWCHART

Figure 9.3 - Surface Water & Designated Area Flow Chart for Wind Farm and GCR

File Ref. 604659-00 Fixed and Variable Data - Surface Water Flow Chart. JS 27/10/2023

FLOW

UPSTREAM

DOWN STREAM

Associated Turbines	Eastern Portion	Western Portion	Western Portion	Eastern Portion
	T8, T9, T11	T2, T3, T4, T5, T6, T7, GCR	T1	T10

SENSITIVE / PROTECTED AREAS	Catchment = Lower Shannon ID_25D. Area_km2 =1041.26			Catchment = Shanno Estuary North ID_27. Area_km2 =1651.27
	Sub- Catchment = Shannon[Lower]_SC_100			Sub- Catchment = Owenogarney_SC_010
	River Sub Basin = Mountrice_010	River Sub Basin = Blackwater [Clare]_010	River Sub Basin = Owenogarney_030	River Sub Basin = Broadford_030
NHA: Gortacullin Bog NHA				Broadford_030 WFD Moderate 2016-2021 At Risk
NHA: Doon Lough NHA				Duin CE WFD Moderate 2016-2021 Under Review
NHA: Gortacullin Bog NHA, S.A.C Danes Hole, Poulnalecka SAC			Owenogarney_030 WFD Good 2016-2021 Not At Risk	
			Owenogarney_040 WFD Good 2016-2021 Not At Risk	
			Castle CE WFD Moderate 2016-2021 At Risk	Western Portion T2 River Sub Basin = Gourna_010
			Owenogarney_050 WFD Good 2016-2021 Not At Risk	
NHA: Gortacullin Bog NHA	Mountrice_010 WFD Good 2016-2021 At Risk		Gourna_010 WFD Moderate 2016-2021 At Risk	
NHA: Gortacullin Bog NHA	Blackwater (Clare)_010 WFD Good 2016-2021 At Risk		Owenogarney_060 WFD Good 2016-2021 Under Review	
SAC: Lower River Shannon SAC SPA: River Shannon and River Fergus Estuaries SPA		Blackwater (Clare)_020 WFD Moderate 2016-2021 At Risk	Upper Shannon Estuary WFD Poor 2016-2021 At Risk	
SAC: Lower River Shannon SAC SPA: River Shannon and River Fergus Estuaries SPA		Lower Shannon Estuary WFD Good 2016-2021 Not At Risk		
SAC: Lower River Shannon SAC SPA: River Shannon and River Fergus Estuaries SPA		Mouth of the Shannon WFD Good 2016-2021 Not At Risk		
		South Western Atlantic Seaboard WFD High 2016-2021 Not At Risk		

NOTES:

* Denotes infrastructure is situated on the boarder to two River Basins

LEGEND:

- River or Stream
- Lake or similar surface water body
- Transitional or oceanic surface water feature