Virginie LAVEAU
Maughanaclea
Kealkill
Co Cork
P75AX81

An Coimisiún Pleanála
64 Marlborough Street
D01V902
DUBLIN

House on EIAR: H077

ACP: 324165

Location: Ardrah, Maughanaclea, Ballynamought, Gortloughra, Cousane, Coomclogh, Derragh, Glanycarney, Keenrath, Derrynacaheragh, Shiplough, Coolsnaghtig and other townlands Co. Cork

Attached is my submission + our hydrologist's report by Dr. Pamela Bartley of Hydro-G. I ask that you refer to the details in the Hydro-G Report addressing the EIAR, lack of Consideration of Alternatives, the High Status Rivers and the lacunae in the Water and Land, Soils & Geology Chapters of the EIAR.

My name is Virginie Laveau. I bought this property in July 2022 without any knowledge of this wind farm project or I would have never bought it. I am restoring this 1850 traditional Irish stone cottage on my own these past 3.5 years. This wind farm would be divided into northern and southern clusters. See map below, my house is HO77 so it would be situated at the center of this two part wind farm.

I can already see Grousemount wind farm ahead of my house at nighttime on the northern side (approx 13km away) and I do not enjoy looking at red lights in the distance.

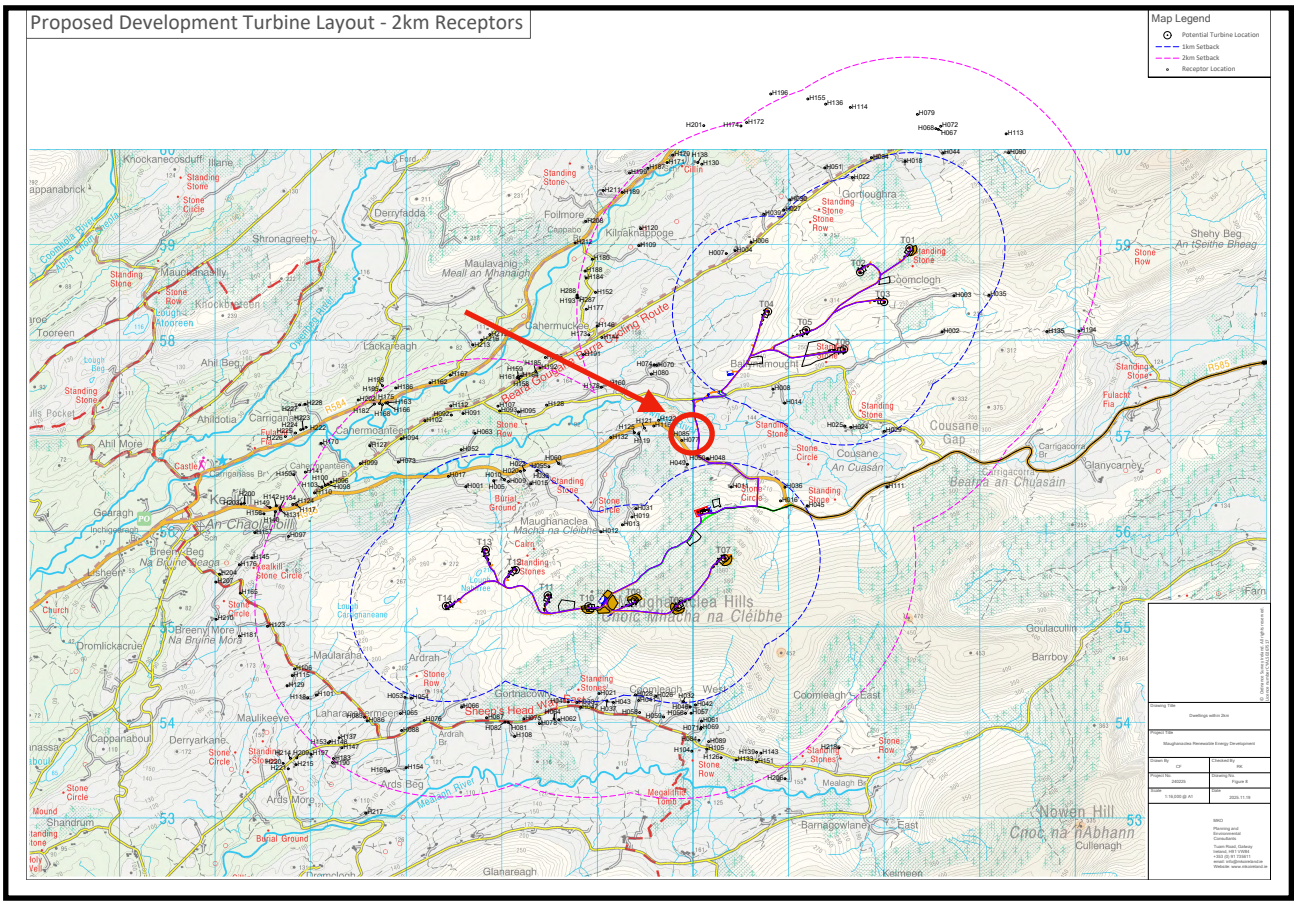
I put a 120cm round window on my northern side last year, and it was that week that I discovered where the wind farm was planned: the hill straight across my round window if you look towards the right, I would be looking at T01, T02, T03, T04, T05, T06. On the south side, my kitchen window is 3 meters wide and I would be looking at turbines T07, T08, T09, T10 and a bit of T11. Makes me laugh when I read in the EIAR that locals wouldn't feel surrounded, what adjective would they use then?

So the Maugnanaclea wind farm project would be visible on both sides of my house as it is in two parts: - one side 6 turbines visible (NE to E see mockup picture below) and at least 5 visible on the other side SE to SW. My night sky would be gone as I'd have bright red lights all around me. I did not move to West Cork to be surrounded by an industrial installation of any kind. Even all my years living in Cork city, my night sky wasn't that polluted compared to what they propose here.

So every single of my windows would be looking onto several turbines less than 2km, both sides downhill. I would be totally surrounded

I also very very serious concerns about the new road they wanna build right next to my house (about 150 meters away) off the R585 to access T06 to T07. My well is between my house and this new road and I am really worried about my water being contaminated.

Last but not least, the land where this wind farm is planned is of a horse shoe shape. Everything resonates across our valley. You can hear people chatting when cycling from top of valley down, I can hear the geese of my neighbour far down in the distance. The sound travels a lot. So between the proximity of the turbines and the cumulation of so many in such a small space, this is causing us all a lot of concern.



Kitchen window south side, would be looking at 5 turbines

New round window, facing north but looking N to NE, would be looking at T01 to T06

Once my restoration project is completed, I will run creative workshops and **offer respite for autistic adults** taking them over for short stay and emergency stays. I have worked with people on the spectrum since 2007. I used to work for the Cork Association for Autism for two years as a horticulture therapist and I was also the director of Surf2HEAL nationwide and the Garretstown coordinator for Surf2Heal both for 9 years - Ireland first surf camp for children on the autism spectrum. So being right next to and in the middle of such installation is not an option for my service users. **I am also self employed and work full time from home**. I am a ceramicist and a fashion designer. I cannot imagine working for two years listening to rock breaking all day long from early to late and spending the rest of my life less than 2km from 14 turbines that are 169 m tall. Not being able to sleep with an open window anymore in spring/summer months and endure hours of light flicker on clear days in the winter and autumn / winter evenings.

My house is fully off grid, my power comes from solar panels with battery storage andI have my own well. I grow my own vegetables. Here we live in harmony with nature. I am seriously concerned about the consequences of such industrial project uphill from me and my neighbours and the terrible effect this would have on our water and in turn our livelihood.

1. Cumulative Effects and Direct Breaches of the Cork County Development Plan CCDP

The proposed Maughanaclea Wind Farm, particularly when combined with other nearby wind farms, will cause unacceptable harm to our community. The developer, Maughanaclea Ltd has provided thousands of pages of reports. However, when you strip away the technical jargon, their own assessments admit that this project directly violates key protections set out in the CCDP.

Failure to Protect Residents (Breach of Objective ET 13-7) The site for this wind farm is located in an area zoned as "Open to Consideration" for wind energy. However, the CCDP is very clear under Objective ET 13-7: developers are only allowed to build in these areas if they can "avoid adverse impacts on residential amenity particularly in respect of noise, shadow flicker and visual impact". My house would be SURROUNDED. Rooms are across my house, no running away from the sight of turbines, I am in the middle (see HO77), clusters on each side of my house.

The developer's own reports prove they have failed to avoid these impacts:

- Severe Visual Impact on Homes: out of the viewpoints assessed, MKO openly admits that the wind farm will cause a "Significant" visual impact for local people. They highlight "Substantial" changes and "Significant" negative effects for residents in Gortloughra (Viewpoint 6) and Maughanaclea (Viewpoint 16).

- Shadow Flicker: The developer's models show that 30 homes are theoretically predicted to experience shadow flicker that exceeds the recommended daily or annual limits. Even after

applying a "sunshine average factor," multiple homes not involved in the project will still be pushed over the 30-hour annual limit before they attempt to step in with mitigation controls.

You cannot meet a planning objective that requires you to "avoid adverse impacts" when your own report admits to causing "Significant" visual harm to local homes and exceeding shadow flicker limits.

Then the Ddgradation of scenic routes (Breach of Policies GI 14-13 and GI 14-14) The CCDP designates - scenic routes - to protect Cork's natural beauty. Under Objective GI 14-14, any developer building near a scenic route must prove there will be "no adverse obstruction or degradation of the views".

The developer fails this test completely. The R585 Regional Road is designated as Scenic Route C-SR29. MKO's own landscape assessment admits that the massive 169-metre turbines will cause a "Significant" visual effect on this exact scenic route at Viewpoints 11 and 12 in the Maughanaclea Valley. It is impossible to claim "no adverse degradation" while simultaneously classifying the visual damage to the route as "Significant."

This would be na overwhelming cumulative industrialisation. The CCDP explicitly states that planners must consider the "cumulative impacts" of wind farms in the area. Maughanaclea is not an isolated project; it is being squeezed into an area that is already saturated with turbines. Within just 5km of the proposed turbines, there is the existing Shehy More Wind Farm, as well as three other proposed wind farms: Gortloughra, Curraglass and Dereenacreenig West. The combined burden on this community is entirely unacceptable:

- Surrounded by turbines: the developer's own visual assessments admit that people on local roads, recreational routes and at historical sites like the Kealkill Stone Circle, will experience "in combination cumulative visual effects". People will be looking at the Maughanaclea turbines in one direction, and the Gortloughra, Shehy More, or Curraglass turbines in the other.

- Cumulative Shadow Flicker: The developer admits that the shadow flicker zone for Maughanaclea overlaps with the proposed Gortloughra Wind Farm, meaning at least one local home has the potential to suffer from shadow flicker from both projects combined.

The R585 (C-SR29) is a scenic road and the gateway to West Cork. I will always remember driving over the top of Cousane and stopping to take it all in - the first time I have reached it and pretty much every time I pass it. This view never tires me. I highly recommend the walk up the forestry to he left as you reach the top tp admire this incredible view or to realise the dramatic effect such industrial installation would have. We have created a link online to see where the turbines would be, see: https://www.google.com/maps/d/edit?mid=1dRvvl86ereFUtgxUMl_RiZ9PzUXG58s&usp=sharing

The visual impact of this wind farm will not stop when the sun goes down. Because these 14 turbines are massively tall at 169 metres, they will be required to be fitted with aviation warning lights. Because my home (H077) sits in the valley directly between the northern and southern clusters, my night-time sky will be entirely surrounded by flashing or glowing red industrial lights. I did not move to rural West Cork to live in the middle of an illuminated industrial estate, and the developer has failed to adequately assess the severe psychological intrusion of this night-time light pollution on residents trapped in the valley.

Conclusion: the developer is trying to use promises of "mitigation" to push through a project that is fundamentally unsuited for this specific landscape. The Cork County Development Plan does not say developers can cause significant harm as long as they try to mitigate it later; it says they must avoid adverse impacts on residents and scenic routes. Because ENERCO/MKO's own EIAR admits to causing "Significant" visual effects on local homes, "Significant" effects on a designated

scenic route, and overwhelming cumulative impacts, this project violates the core rules of the County Development Plan and must be refused

2.The Real Noise Impact on our Community (Based on Independent Expert Review)

The developer claims that the noise from this massive wind farm will be "Not Significant". To challenge these claims, we hired an independent acoustic expert, Dick Bowdler, to review their noise models. His findings prove that the developer's noise assessment is fundamentally flawed, uses incorrect data, and completely ignores the severe, real-world impact this alien industrial noise will have on our quiet rural community.

The Developer is underestimating the turbine noise to predict how loud the wind farm will be, the developer used a "candidate turbine" (the Nordex N133) and claimed its maximum noise output (sound power level) is 104.5 decibels.
However, our acoustic expert checked the actual manufacturer's data sheet for this exact turbine. The true maximum noise output for this model is actually between 106 and 107.5 decibels. Because the developer used artificially low numbers in their computer models, the actual noise hitting our homes will be up to 3 decibels louder than they are telling the planning authority. Their entire noise model is based on an underestimation.

Hiding behind outdated 2006 guidelines, the developer argues that the noise impact is "not significant" simply because it scrapes by the government's 2006 Wind Energy Development Guidelines (WEDG 2006). Our expert clearly explains that meeting a 20-year-old policy guideline does not mean there is no impact on people's lives.

The developer also claims their assessment is based on the UK standard, ETSU-R-97. This is highly misleading. The Irish 2006 guidelines allow for significantly higher daytime noise limits (45 decibels or 5 decibels above background) than the UK standard they claim to follow (which recommends 35 to 40 decibels in low-noise environments). Our expert's analysis proves that while this wind farm might technically scrape by the outdated Irish 2006 rules, it would completely fail the UK ETSU-R-97 standards because the noise levels are far too high.

Ignoring World Health Organisation (WHO) warnings in 2018, the World Health Organisation set strict guidelines to protect people from the adverse health effects of wind turbine noise. They recommend keeping noise below 45 dB Lden, which our acoustic expert translates to a downwind noise level of roughly 37 decibels (LA90) on the ground. Noise above this level is proven to cause people to become "highly annoyed" and suffer adverse health impacts.

The developer's own (underestimated) models show that at least 25 properties in our community will experience turbine noise of 37 decibels or more. For example, at property H013, the noise will reach nearly 40 decibels. The developer is willingly subjecting dozens of families to noise levels that the WHO explicitly states will cause adverse health effects.

Introducing "Alien Industrial Noise" to a quiet rural area, the developer is trying to drop a massive industrial power plant into a very quiet rural area. To measure the true impact of introducing an industrial noise source like this, acoustic experts use the BS 4142 standard. Under this standard, if the new industrial noise is 8 decibels louder than the existing quiet background noise, it causes a "significant adverse impact".

Our expert's analysis of the developer's own data reveals a shocking reality:

- At property H013, the turbine noise at night will be up to 12.2 decibels louder than the peaceful background noise they currently enjoy.

- There are approximately 60 properties around this wind farm where the turbine noise will exceed the background noise by 8 decibels or more.
PRECEDENT: With reference to this court case https://ww2.courts.ie/acc/alfresco/7a91a5ce-89bb-45b4-97ff-2bc2562c2403/2025_IEHC_330.pdf/pdf#view=fitH

This recent High Court ruling (Byrne and Moorhead v. ABO Energy) completely dismantles the developer's argument that merely ticking the boxes of outdated planning guidelines will protect our community. In that case, the developers claimed their wind farm operated within its planning limits, yet the court found that the constant "whoomphing" and low-frequency tonal droning from the turbines caused an extreme, unrelenting nuisance that destroyed a local family's sleep, concentration, and ability to enjoy their home and garden. The judge ultimately ordered a permanent shutdown of the offending turbines, ruling that the broad public interest in renewable energy does not entitle a developer to ruin a neighbour's life with a serious, ongoing nuisance. My home, H077, is situated just 1,313 metres from the nearest proposed turbine (T07), which is incredibly similar to the 1,050-metre distance that caused such devastation to the family in the ABO case.

The massive difference in turbine size and source noise in the court case, the turbines were 125 metres tall with a rotor diameter of 90 metres. The proposed Maughanaclea turbines are 169 metres tall with a massive 133 metre rotor diameter.

Because the Maughanaclea blades are so much larger, they sweep through a vastly greater area of air. Independent acoustic expert Dick Bowdler notes that the specific turbines proposed for Maughanaclea (Nordex N133) have a maximum sound power output of up to 107.5 decibels at the source. You are dealing with a much larger, louder, and more powerful industrial machine to begin with, which easily eats up the benefit of that extra 263 metres of distance.

Low-frequency noise and "Thumping" travel long distances. The High Court judge in the ABO case made it clear that the nuisance wasn't just about the raw loudness of the turbines, but the character of the noise—specifically the "whoomphing" (amplitude modulation) and the low-frequency mechanical humming.

The court experts proved that while high-pitched "swishing" noises fade over distance and are blocked by the walls of your house, low-frequency droning noises are not. When you go indoors, the natural masking noises of the countryside (like birdsong or leaves rustling) are blocked out, making the low-frequency turbine drone even more prominent and intrusive inside your home.

Being 1,313 metres away will not stop low-frequency noise from penetrating my walls.

The topography trap (valleys and turbulence)
One of the most crucial findings in the court case was how the local landscape made the noise infinitely worse. The experts explained that when wind hits steep hills and passes over forests, it becomes "turbulent" and "unsteady". When this turbulent air hits the massive spinning blades, it creates high aerodynamic loads that cause severe "thumping" and forces the turbine gearboxes to emit a loud, low-frequency tone.

Maughanaclea is situated in exactly this type of complex, mountainous valley terrain. The exact same topographical turbulence that caused the extreme nuisance in the court case is highly likely to occur on the ridges above your home.

Our valley has such resonance of sound. You can hear people talking while walking and chatting across the valley, so I cannot imagine how their study says that there would be no major impact on local lives

Conclusion: The developer's conclusion that the noise impact will be "not significant" is a complete distortion of the truth. They are introducing a totally alien, industrial noise into our homes. They have used artificially low turbine noise data, hidden behind outdated 2006 rules that allow much higher noise than international standards and ignored the fact that 60 local homes will suffer a "significant adverse impact" from the loud thumping over our quiet background noise. You cannot simply look at a map and say "I am 1,313 metres away, so I am safe." The High Court case proved that the continuous, unpredictable "thumping" and low-frequency droning of turbines ruins lives. Because the Maughanaclea developer is using turbines that are 44 metres taller, significantly louder at the source, and placed in a similar mountainous landscape that generates turbulent winds, the impact on our life at H077 could easily be just as severe as the family who won the court case. If this project is approved based on the developer's same basic, inadequate

noise models, my home and us living here will inevitably be subjected to the exact same detrimental impacts—constant indoor thumping, sleep deprivation, and the total loss of our peace and quiet—proving that this wind farm will create an unlawful nuisance and therefore must be refused.

3.Unacceptable Shadow Flicker Impacts and Failure to Protect Property H077

Shadow flicker is a highly intrusive indoor nuisance caused by rotating turbine blades casting moving, strobe-like shadows through the windows of a home. While the developer admits my home will be heavily impacted by this phenomenon, they have explicitly chosen not to implement any protective measures for myself and anyone living with me, directly contradicting local planning objectives.

The developer's own admission of harm to H077 according to the developer's own shadow flicker modelling in Table 5-8 of the EIAR, my home (H077) is located 1,313 metres from the nearest proposed turbine (T07), up on a hill, SOUTH of my house.

The developer's models predict that my home will be subjected to 25 minutes of shadow flicker in a single day, and over 18 hours of flicker annually (reduced to roughly 6 hours when average sunshine is factored in).

Exploiting outdated 2006 Guidelines to avoid mitigation despite admitting that my home will suffer through 25 minutes of moving shadows flickering across the rooms in a single day, the developer explicitly states in their EIAR table that "No" mitigation strategy is required for my property.

They justify ignoring the impact on my home by hiding behind the government's Wind Energy Development guidelines published back in 2006. These outdated rules state that shadow flicker should not exceed 30 minutes per day. Because my home is predicted to experience 25 minutes a day—just 5 minutes shy of their maximum limit—the developer classifies this severe daily disruption as acceptable and refuses to protect my home.

The technology exists, but they refuse to use it for my home. The developer is fully aware that the 2006 guidelines are obsolete. They acknowledge the government's 2019 Draft Revised Wind Energy Development Guidelines, which explicitly state the modern standard: "no existing dwelling or other affected property will experience shadow flicker as a result of the wind energy development".

The developer boasts in their EIAR that modern turbines can be fitted with a Supervisory Control and Data Acquisition (SCADA) system. This technology can be pre-programmed to automatically shut down the turbine blades on the specific days and times when shadow flicker is predicted to hit a house. The developer has promised to use this shut-off technology for other homes in the area that exceed the 30-minute threshold.

However, because I fall just 5 minutes under the outdated 2006 loophole, they are actively choosing not to program the SCADA system to protect my home. They have the technology to eliminate the 25 minutes of daily flicker hitting my windows, but they are making a conscious choice to subject my family to it anyway.

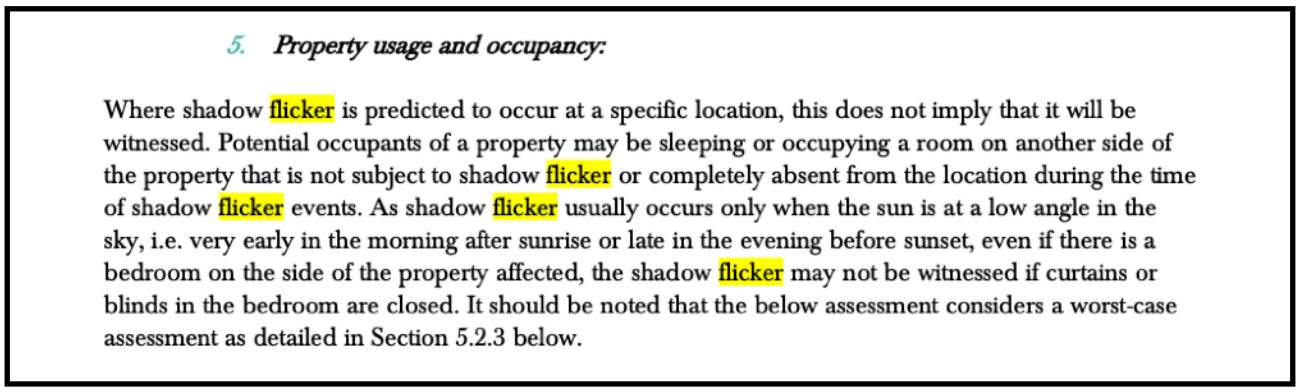
Direct Conflict with the Cork County Development Plan (CCDP): The site of this proposed wind farm is zoned as "Open to Consideration". However, Cork County Development Plan Objective ET 13-7 dictates that commercial wind energy is only open to consideration where proposals can "avoid adverse impacts on residential amenity particularly in respect of noise, shadow flicker and visual impact".

Subjecting a family to 25 minutes of strobe-like shadows in their home on a daily basis is a severe adverse impact on residential amenity. Because the developer has explicitly stated they will

provide "No" mitigation, they are utterly failing to avoid this adverse impact as strictly required by Objective ET 13-7.

Conclusion The developer has the technology to achieve zero shadow flicker at my home (H077) but has explicitly refused to use it, choosing instead to exploit a 20-year-old loophole to maximize their turbine operation times. This blatant disregard for my family's quality of life violates the core conditions of the Cork County Development Plan, and on these grounds, this planning application must be refused.

Below screenshot is taken from EIAR Chap 5.2.3.1 Background
Even a standup comedian wouldn't have come up with this one
Also, the rooms in my house are across the width of my house (like most people around here) so there would be no running away from shadow flicker with windows on all sides



5. Property usage and occupancy:

Where shadow flicker is predicted to occur at a specific location, this does not imply that it will be witnessed. Potential occupants of a property may be sleeping or occupying a room on another side of the property that is not subject to shadow flicker or completely absent from the location during the time of shadow flicker events. As shadow flicker usually occurs only when the sun is at a low angle in the sky, i.e. very early in the morning after sunrise or late in the evening before sunset, even if there is a bedroom on the side of the property affected, the shadow flicker may not be witnessed if curtains or blinds in the bedroom are closed. It should be noted that the below assessment considers a worst-case assessment as detailed in Section 5.2.3 below.

4. Threats to Our Drinking Water and Private Wells (Property H077)

This section outlines the severe threat the proposed Maughanaclea Wind Farm poses to our only source of drinking water. Like most of my neighbours, my home (iH077) relies completely on my private well. The developer tries to brush off the risk to our water. However, based on the review by independent water expert Dr. Pamela Bartley, the developer's claims are unscientific, their testing is completely inadequate, and they are hiding the true danger this massive construction project poses to our water supply.

Treating our drinking water as "Not Sensitive", my home is located 1,313 metres from the nearest proposed turbine (T07). The developer openly states in their report that because of this distance, there will be "no impact on private wells".

Shockingly, to justify pushing this project through, the developer has officially classified local family wells as being "Not Sensitive to impact". Labelling our only source of clean drinking water as "not sensitive" shows a complete disregard for our basic health and safety.
It is common sense, we are all downhill from this project so we will be affected from all the land movements uphill.

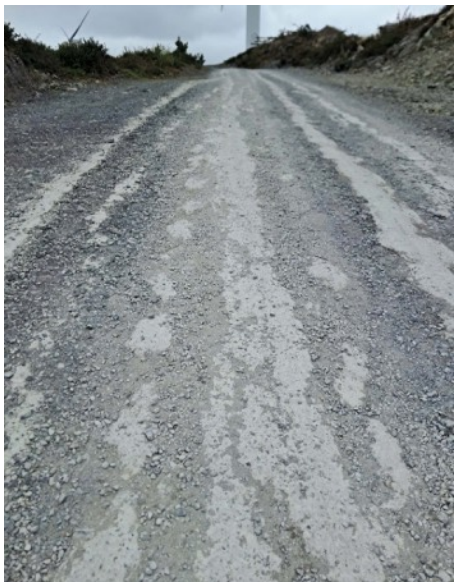
Destroying the "Sponge" that feeds our wells, the developer tries to argue that wind farms only involve "near surface" digging, so the impacts on the deep groundwater that feeds our wells are "negligible".

Dr. Bartley points out that this is a dangerous myth. The ground acts like a giant sponge, soaking up rainwater to refill the underground aquifer. You cannot strip away the natural vegetation, compact the earth with massive cranes and heavy machinery and pour 14 giant concrete foundations without destroying that sponge. By failing to measure exactly how much less rainwater will be able to soak into the ground to feed our wells, the developer's assessment is completely flawed.

Hiding massive quarries as "borrow pits" to get the rock they need, the developer plans to blast four deep holes into the hills using explosives. Throughout their reports, they innocently call these "borrow pits".

Dr. Bartley warns that this term is highly deceptive—these are actually massive, deep rock quarries. By calling them "borrow pits," the developer is trying to dodge the strict environmental rules and water discharge licenses that normal quarries are legally required to get. Blasting explosives into the rock that holds our drinking water, without treating the site like a proper quarry, is a massive and unassessed risk to our water quality.

Useless tests and meaningless 50 metre buffers to claim the site is safe, the developer mostly dug shallow "trial pits" using a digger. Dr. Bartley notes that this is an outdated, cheap method of testing that doesn't even reach the actual depths where the giant foundations will be built. They are making promises about our groundwater without actually drilling deep enough to know what is down there.
Furthermore, the developer promises to protect water quality by leaving a "50 metre buffer" around local streams. Dr. Bartley points out that on a steep mountain slope, a 50 metre distance means absolutely nothing. Gravity will simply pull the mud, cement runoff, and chemical spills straight down the hills and into the water system. Speaking about cement run off, I have visited the nearby Carrigdangan wind farm in the last few weeks where they are extending with 3 new turbines. They were after pouring the bases and the cement run-offs are outrageous. See below:



Unrealistic peat and spoil management the project proposes extreme landscape excavation, including four borrow pits (quarries), extensive new road networks, deep turbine bases, and the removal of 44 hectares of forestry. The developer claims they can effectively manage, store, and reuse all of this excavated peat, spoil, and rock on-site. However, in upland, mountainous terrain, the volume of excavated material routinely exceeds a developer's ability to safely store it without causing landslides or severe runoff into local rivers. The planning authority must strictly scrutinise the developer's Peat & Spoil Management Plan against their actual excavation volumes, as the risk of catastrophic peat failure or illegal dumping of excess spoil is a highly known vulnerability for wind farms of this massive scale.

Two lakes would be under threat from this Maughanaclea wind farm: lough Naibree (See Sioned Jones' submission for a deep dive on it) and hortough.

Conclusion: developers always promise "no impact" on paper, but as Dr. Bartley highlights, these promises routinely fail in the real world. Similar wind farm projects in Ireland recently caused the devastating Meenbog landslide and polluted the drinking water in Kerry (Kilgarvan and Brosna) leading to carcinogenic chemical alerts and “BOIL WATER" notices.
My daily life and health depends entirely on the water from my well at H077. The developer has failed to do the proper deep testing, failed to measure how they will affect rainwater soaking into our aquifer, and failed to properly assess the massive rock quarries they plan to blast into the hills. Because they cannot guarantee the safety of our drinking water, this project must be refused.

5. The Threat to Our Local Birds

Introduction: I am writing this section to object to the wind farm because of the massive threat it poses to our local bird populations. Throughout their reports, the developer repeatedly tries to claim that their massive project will have "no significant effect" on our wildlife. However, when you actually read their own bird surveys, they admit that they are planning to build giant turbines, an electrical substation, and rock quarries right on top of the breeding grounds of rare and highly protected birds. This place is a heaven for birds for us who witness them every day.

Building right on top of rare birds **the red grouse** and **snipe** are both "Red-Listed" species, meaning they are in severe decline and need strict protection. The developer’s own surveys admit that both of these birds are actively breeding right where they want to build. They found a **red grouse** breeding territory just 90 metres away from a proposed turbine location.They found a **snipe** breeding territory just 230 metres from a proposed turbine. The **chough** is nesting near the wind farm (old cottage less than one km from wind farm). In their report they say “calling and foraging. Of these records, eight were within the Proposed Wind Farm site”

To make matters worse, the developer’s own report quotes scientific studies proving that these specific birds will abandon their habitats and flee from turbines at distances of up to 400 metres. You cannot claim to be environmentally friendly while knowingly dropping giant industrial turbines hundred of metres away from the nests of endangered birds.

Then the **hen harrier,** one of the most strictly protected birds of prey in Ireland. The developer’s surveys confirm that **hen harriers** actively use this exact site for hunting.

In fact, the developer officially classifies the **hen harriers** using our area as a population of "National Importance”.

Even though they admit our landscape is nationally important for this sensitive bird, they are pushing ahead anyway. They know the harriers will likely abandon the site once the turbines are built, but their attitude is simply that the birds will just have to go find somewhere else to hunt in the "wider surrounds". Will it leave or will it be killed by blades?

Blasting quarries in breeding territories, it is not just the spinning blades that will destroy our local wildlife; it is the massive construction project required to build them. The developer admits that buzzards and **hen harriers** are breeding in the exact areas where they plan to do the heaviest construction.

For example, they plan to build new roads, a high-voltage electrical substation, and a borrow pit directly inside a buzzard breeding territory. They also plan to put a temporary construction compound, more roads, and another borrow pit right where **sparrowhawks** are breeding.
Let's be clear: a borrow pit is an unregulated rock quarry that will be dug out using rock breakers and explosives. It defies common sense for the developer to claim there will be "no significant effect" while they plan to blast open rock quarries directly inside the breeding territories of our resident birds of prey.

We also have w**hite-tailed sea eagles** in this area. MKO says that The White-tailed Eagle was spotted exactly two times during the surveys, both of which occurred in the wider surroundings rather than directly on the proposed wind farm site.

- First observation (August 2022): A single bird was spotted soaring at a height of over 200 metres, approximately 3.2 kilometres away from the proposed site.

- Second observation (February 2023): A single immature bird was spotted being mobbed by a raven, approximately 750 metres away from the proposed site

During the consultation process, an expert specifically warned the developer about a major danger: building turbines on these ridges creates rising air currents or updrafts - that eagles use to fly. The expert warned that this could pull the eagles directly into the spinning blades.

The expert specifically asked the developer to use a recommended scientific model to test this exact danger. The developer completely ignored this request and failed to do the modelling, instead just guessing that the risk to the eagles is "negligible". **We have observed one of the white tail eagle fly over us and where the turbines are going**. I never managed to take a picture but one of my close neighbour Sean Worboys did, see his submission.

We also spot **skylarks** on our walks at https://maps.app.goo.gl/pn8mXxeYmMyrswwo7?g_st=aw and https://maps.app.goo.gl/kqf9SFoxFfvpEDQX9?g_st=aw while facing North at T6

Please note that we observed MKO onsite observing wildlife on those dates:
27/06/25
16/07/25
Not just the wettest days but amongst my top worst days in Ireland in 27 years.
How can you do a proper survey when it is pouring rain with very strong winds.
Surveys in such conditions should not be allowed.
When my neighbour asked them why they came in such weather, they said because they were too busy doing observations. Again, it shouldn't be allowed. When you give millions bribing locals at 80000 euro per turbine per year, you could employ more people to do surveys in the correct weather conditions.

Conclusion: the developer's own reports prove that our area is a rich, biodiverse habitat full of rare, breeding, and nationally important birds. Instead of respecting that, they have drawn up a plan that drops turbines 90 metres from r**ed grouse** nests and blasts rock quarries inside the territories of local birds of prey. Why reintroducing the white tail sea eagle, tracking it and allowing wind farms to go through its path. This shows a complete disregard for our local environment. And I know plenty locals will be submitting their sighting in their submissions too. This site is entirely unsuited for heavy industry, this wind farm must be refused.

6. Destruction of Biodiversity and Breach of Nature Restoration Laws

The developer attempts to paint this wind farm as a "green" project that will help the environment. However, when you look at the reality of their proposal—which involves clear-felling 44 hectares of forestry, blasting rock quarries, and pouring massive concrete foundations into peatland—it is an act of ecological vandalism. This project directly contradicts the biodiversity protections set out in the Cork County Development Plan (CCDP) and blatantly ignores the strict new legal duties placed on planning authorities under national and European law.

A new legal duty: The EU Nature Restoration Law and the Wildlife Act 2023 - The legal landscape for planning has completely changed, and the developer's Environmental Impact Assessment Report (EIAR) fails to grasp this.

- The EU Nature Restoration Law (2024) makes it a strict legal requirement to actively restore degraded ecosystems by 2030, not just "mitigate" further damage.

- The Wildlife (Amendment) Act 2023 places a mandatory "public sector duty" on all public bodies, including Cork County Council. Planners are now legally obliged to ensure their decisions align with Ireland's 4th National Biodiversity Action Plan, which demands transformative changes to protect and restore nature.

You cannot restore a habitat while simultaneously allowing heavy industry to rip it apart. As experts have rightly noted regarding similar developments, building massive turbines in delicate habitats directly worsens the biodiversity crisis. A strategy of restoration, rather than construction, is the only legally defensible approach. The council cannot legally grant permission for a development that actively destroys biodiversity while they have a statutory duty to restore it.

The Myth of "Green" Peatland Destruction (Breach of Objective BE 15-2) The proposed site is dominated by wet heath and upland blanket bog. The developer's own reports admit that the construction will result in the permanent loss of upland blanket bog habitat, leaving a "residual negative effect".

Cork County Development Plan Objective BE 15-2(c) explicitly states the Council must "Protect and where possible enhance... peatland and other wetland habitats". The developer's plan to dig massive holes into the bog to pour concrete turbine foundations completely violates this objective. As expert hydrologists and environmental scientists have warned: "Beyond all scientific doubt, building turbines in peat will negatively affect biodiversity and increase carbon loss... The case that wind farms in peatlands are 'green' or 'sustainable' is a myth". Destroying a natural carbon sink to build a wind farm defeats the entire purpose of climate action.

Evicting the highly protected Kerry slug which is rare and in internationally protected species. The developer's own surveys confirm that the Kerry slug is currently living on the proposed wind farm site. To get around the fact that they want to build heavy industry on top of a protected species' habitat, the developer applied for a "derogation licence" to simply remove and relocate the slugs out of the way of the construction. Capturing and evicting a highly protected native species from its natural habitat so you can bulldoze the area is not environmental protection; it is industrial clearance. The council should not facilitate the displacement of protected wildlife for commercial gain.

Clear-felling 44 Hectares in a freshwater pearl mussel catchment, the site is located within the highly sensitive "Margaritifera" (Freshwater Pearl Mussel) catchment. These mussels are critically endangered and rely entirely on pristine, unpolluted river water to survive.

Despite this extreme sensitivity, the developer plans to clear-fell 44 hectares of forestry, excavate 4 rock quarries (borrow pits), and undertake massive earthworks right above the Owngar, Owvane, and Mealagh rivers.

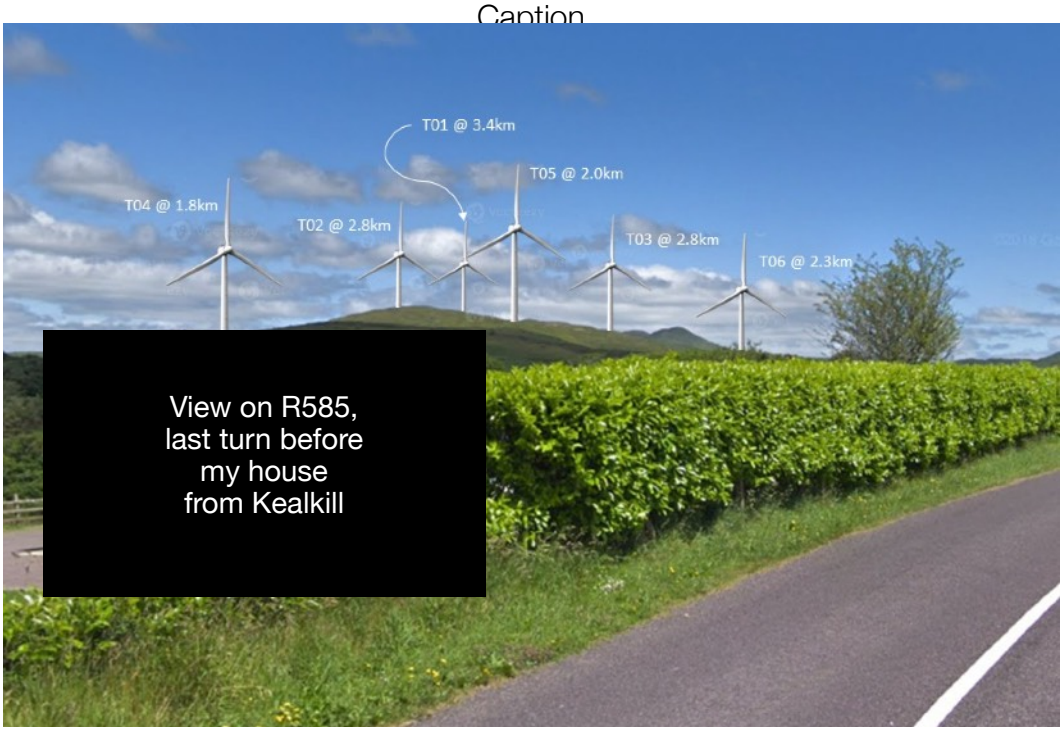
While the developer promises to use 50-metre buffers to protect the water, it defies basic common sense to believe you can rip up 44 hectares of trees and blast quarries on steep mountain slopes without gravity pulling severe levels of mud, silt, and chemical runoff directly into the rivers below. Smothering these rivers in silt will devastate the local aquatic biodiversity and destroy the exact conditions the freshwater pearl mussel needs to survive.

Conclusion: the planner is legally bound by the Wildlife (Amendment) Act 2023 and the EU Nature Restoration Law to protect and restore our natural habitats. The Cork County Development Plan strictly requires the protection of peatlands and endangered species. Because this project proposes to permanently destroy upland blanket bog, evict protected species like the Kerry slug, and risk catastrophic silt pollution in a Freshwater Pearl Mussel catchment through the clear-felling of 44 hectares of land, it completely fails to respect these fundamental environmental laws. On these grounds, the planner has no choice but to refuse this application.

7. Extremely misleading viewpoints

The viewpoints are extremely misleading. None of the R595 are representative of the visual impact this will truly have. The ones we created for our campaign are the ones who really woke up people to what this project would really mean, how it would change our valley forever.
Below are the mockups done by one of our community member:

Caption

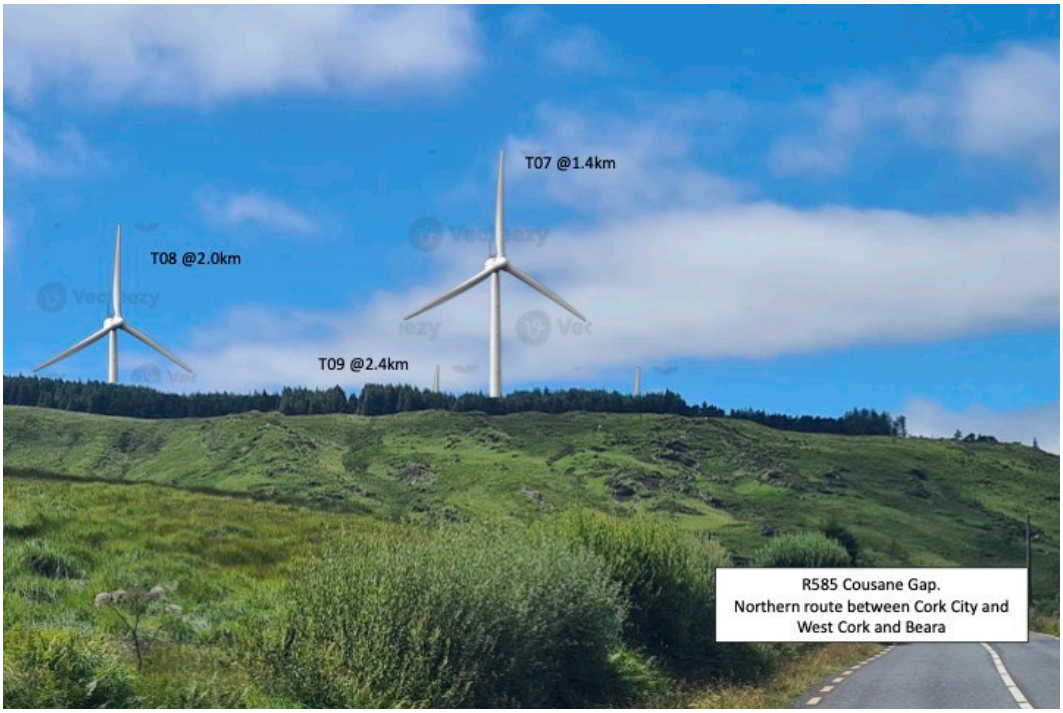


View from H122

View from R585,

Caption

My house H077 and T01 to T06 (closest turbine is on other side)



Arriving at the top of cousane

8. The Threat to Local Tourism, Artisan Businesses, and the West Cork "Brand"

The developer's Environmental Impact Assessment Report (EIAR) attempts to completely dismiss the importance of tourism in our area. In Chapter 5, they boldly claim that our community is of "low tourism significance" simply because we do not have massive, ticketed visitor attractions. This shows a fundamental misunderstanding of how the tourism economy in West Cork actually works. Tourism here is not built on theme parks; it is built on the unspoilt, rugged landscape, the Wild Atlantic Way, and the vibrant ecosystem of local markets, festivals, and artisan businesses in towns like Bantry and Skibbereen.

I am a self-employed artisan who designs and makes ceramic earrings and clothing, which I sell at local markets in Bantry, Skibbereen and local festivals, mainly to tourists.

The company is using flowed survey to justify building this massive wind farm in a scenic area. It relies heavily on Fáilte Ireland surveys from 2007 and 2012, claiming that tourists generally do not mind wind farms.

A surveys that was created 12 and 17 years so this is entirely misleading. In 2007, wind turbines were a fraction of the size they are today. The developer is proposing 14 monstrous 169 metre turbines—structures taller than the Spire of Dublin. You cannot use outdated surveys about much smaller turbines to claim that modern, towering industrial power plants will not deter the hikers, cyclists, and eco-tourists who specifically travel to West Cork for its natural beauty.

Degrading the tourism assets we do have even though the developer claims our area lacks tourism significance, their own reports admit that the proposed turbines will be visible from major regional tourism assets. The turbines will be seen from the Kealkill Stone Circle, the Beara-

Gougane Barra Cycling Route, St Finbar's Pilgrim Way, Hungry Hill (Beara Peninsula), Shehy Highland Park Trails (near Cousane Gap), Maughanaclea Hills Loop, Knockboy Summit (Highest point of the Shehy Mountains), various points along the Sheep's Head Way, and even Discovery points along the Wild Atlantic Way.

The developer's argument is that these trails and sites are not heavily crowded, it doesn't matter if we ruin the view. This completely contradicts the Cork County Development Plan.

Cork County Development Plan (CCDP) Under Objective TO 10-5, states that the Council is strictly required to: "Protect and conserve those natural, built, and cultural heritage features that form the resources on which the County's tourist industry is based".

Furthermore, the CCDP states that "Underpinning the new tourism agenda is the concept of Sustainable Tourism, which provides a high-quality product, based on, and in harmony with, a high-quality natural environment".

You cannot claim to be in harmony with a high-quality natural environment when you are erecting an industrial skyline that will dominate the valleys and ridges above Bantry and Kealkill. The local artisan economy, the market towns of Bantry and Skibbereen, and my own livelihood depend on the council upholding its duty to protect the natural landscape. Because this project threatens to permanently scar the landscape that forms the backbone of West Cork's tourism and artisan economy, it must be refused.

9. Archeological impact

I enjoy hiking for the past 27 years in Ireland and discovering new ancient sites along my walks. I find those sites transcendent and it amazes me that after all these years we still cannot comprehend fully the interconnection and need our ancestors had to create such sites. How they were able to align them with celestial events. But common sense is fighting with the idea that a 30m buffer zone ONLY from sites is considered ok. We have destroyed many sites already and it would be a shame to destroy more before we even understand why they are here.

One of my favorite stone circle is the Kealkil stone circle + the two giant stone and the gorgeous cairn.

I'd like to refer you to our local expert's submission David Myler who wrote several archeological books after his research and finds in the area.

Kealkil stone circles below:

10. Crippling Construction Traffic and the Threat to Local Artisan Markets

My livelihood as an independent artisan the survival of the vibrant weekly markets in towns like Bantry and Skibbereen, relies entirely on the smooth, uninterrupted flow of tourists into West Cork. The developer's Environmental Impact Assessment Report (EIAR) attempts to brush off the impact of their construction traffic, claiming it will be "temporary" and "not significant." However, a closer look at their own traffic data reveals that for up to two years, the main gateway roads into West Cork will be choked by heavy industrial machinery, concrete trucks, and continuous roadworks, creating a nightmare for the tourists and deliveries our local economy depends on.

The true scale scale of the traffic disruption: the developer admits that construction will take between 18 to 24 months. During this time, the peaceful rural roads leading into West Cork (specifically the N22 and the R585) will be transformed into an industrial haulage route.
The developer's own figures show the massive scale of this disruption:

- For 205 days of general construction, there will be an extra 250 vehicle movements a day travelling to and from the site.

- On the days they are pouring the massive concrete foundations, they admit there will be an extra 584 vehicle movements locally, causing a massive 10.3% spike in traffic on the R585 at Crookstown, and a 9.2% spike through Gloun.

Tourists coming to West Cork to relax do not want to spend their holidays stuck behind convoys of heavy goods vehicles, dump trucks, and mobile cranes. If the main gateways to Bantry and Skibbereen become known as congested, stressful construction zones, tourists will simply stop coming, causing immediate financial harm to market traders and local festivals.

The 20-Kilometre "Rolling Roadblock" (Grid Connection) Perhaps the most damaging element to local tourism is the developer's plan for the underground electrical grid connection. They plan to dig a trench directly through the public road network for 20.5 kilometres, tearing up the R585, R587, and R586 regional roads all the way to Dunmanway.

The developer admits this grid connection work will take 9 to 12 months to complete, digging up 100 metres of the road every single day. This means almost a full year of stop-and-go traffic, temporary traffic lights, single-lane closures, and diversions on the exact regional roads tourists use to navigate between West Cork towns.

Telling Tourists to "Go Another Way", the developer's attitude towards this massive disruption is highly arrogant and shows a total lack of understanding of the local economy. In their report, they explicitly state that during the 9 to 12 months of grid connection roadworks, "tourists seeking to travel to various attractions in the wider landscape... can utilise other routes".
Artisan markets, cafes, and local shops in Bantry and Skibbereen rely on passing trade and tourists exploring the regional road network. If developers are actively planning to divert tourists away from these routes to hide their 20-kilometre construction trench, they are actively diverting income away from my business and my community.

Conclusion The developer cannot guarantee the protection of the local tourism economy. Choking the R585 and surrounding regional roads with up to 584 extra heavy vehicle movements a day, and tearing up 20.5 kilometres of the road network for up to a year, will create an intolerable environment for visitors. The developer's official solution—that tourists should simply bypass our area and find "other routes"—proves that this project is fundamentally incompatible with the survival of the local artisan and tourism economy. On these grounds, the project must be refused.

11. Unable to move away if…

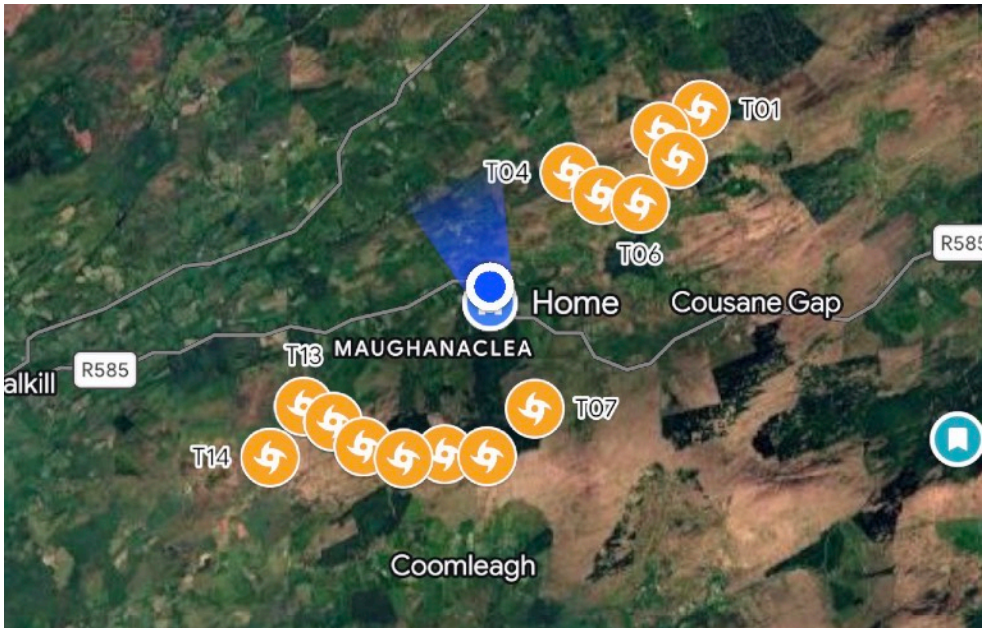
Between my mortgage, the location of my house in the middle of this wind farm, the proximity (1st turbine on one side at 1.4 km and 1.3 on the other side and all 14 less than 2km), let's be realistic, I'd be left with nothing if I found someone crazy enough to buy my house and move somewhere else.

I fell in love with this house the first time I saw it:12 years ago. I worked so hard to make my dream come true. It took me 8 years. I bought it to be my forever home.

No one can live in those conditions. Moree and more studies on ultra sound are coming out. See Ken Mattsson's work.

14 turbines, no matter how small or how tall, so close, is not liveable. Precedents show this.

See below, the blue dot is my house, all 14 turbines less than 2km from my house. Again let's be realistic, even a blind and deaf buyer wouldn't buy due to the vibrations, no one would want to live here if this was built.



12. GRID CONSTRAINTS

Grid constraints lead to wind energy curtailment—often referred to as "dispatching down"—because the electrical network cannot safely absorb and distribute all the power being generated at a given time. When this happens, wind farms are forced to reduce or halt their energy production specifically to match the needs and capacity limits of the grid.
In Ireland, this occurs for several key reasons based on the expert engineering reports and court documents provided:

- The Grid is a bottleneck: Ireland's electrical infrastructure was historically built as a low-level network and currently operates very close to its capacity limit. It lacks the high-voltage infrastructure required to easily divert power around the country as demand shifts. Because there is no existing spare capacity to distribute power, the grid acts as a bottleneck for new energy generation.

- System stability issues: adding large amounts of variable, non-synchronous power from wind and solar creates stability problems for the power supply. Traditional fossil fuel plants help stabilize the grid by providing "network inertia" through the sheer physical mass of their heavy spinning turbines. Wind power provides little to no inertia.

- Lack of Energy Storage: Currently, there is limited grid-level battery or long-term energy storage available in Ireland. Because electricity must generally be used the moment it is created in a supply-and-demand model, any excess wind energy that cannot be immediately used or safely transmitted must be curtailed.

Because of these infrastructure limits and stability challenges, even if the wind is blowing and turbines are capable of generating renewable energy, the wind farm must dispatch down its output whenever the grid simply cannot handle the extra load.

13. PEAT LOSS / CARBON RELEASE

Based on the developer's (MKO) own Environmental Impact Assessment Report, the construction of this project will require the massive excavation of approximately 173,420 cubic metres of peat, contributing to a total of 368,400 cubic metres of peat and spoil that must be dug up and relocated. This extreme level of industrial excavation directly contradicts the Cork County Development Plan's explicit objective (BE 15-2) to protect and enhance peatland habitats. The environmental cost of this destruction is severe because intact peatlands are naturally waterlogged ecosystems that safely store vast amounts of carbon. When peatlands are drained and excavated to install deep turbine foundations and access roads, the peat dries out and is exposed to oxygen. This oxygen exposure triggers a process called peat oxidation, which causes the stored organic matter to rapidly decompose and release its deeply trapped carbon directly into the atmosphere as carbon dioxide (CO_2). MKO's own calculations admit that this project will result in the loss of 149,464 tonnes of carbon dioxide equivalent. Independent experts have repeatedly warned that installing wind turbines on peatlands causes significant carbon loss and irreversibly damages the bog's natural ability to store carbon. Far from helping the climate, this releases large quantities of greenhouse gases and undermines — or even reverses — the emissions reductions the wind farm claims to achieve

CLOSING ARGUMENT:

I am part of the Stop The Spin campaign. After we met the first time, we created a questionnaire that we distributed to our local community to see how people felt about this project. I was very surprised by the amount of local people who wanted to object but wouldn't because they knew

some of the land owners where the turbines would be going and were afraid of what those land owners would say to them if they saw their objection. The land owners should be he ones ashamed to destroy the valley forever. Not the other way around. About 25 people would benefit directly financially from this installation and 500 would suffer the consequences. If you ask me, there is no amount of money, gold or diamonds that would make me accept to live next to such installation, life is too precious.

People don't realise what this would mean, once they are up, it would too late to object. This would destroy the local community forever, the livelihood of people, our mental health, etc.

When a grid isn't equipped for so much power and the government, our taxes, pay developers to stop their turbines, to avoid a burnout of the grid, it all sounds so crazy. But this id what is going on.

Destroying the peat, greenhouse gases release undermines the emissions reductions the wind farm claims to achieve

Due to the proximity (1st turbine on one side at 1.4 km and 1.3 on the other side and all 14 less than 2km), no one would want to live at my house, there are precedents (see Byrne and Moorhead v. ABO Energy case). Why trying reproduce the same scenario when you already know it will have repercussions on the well being of local people and their children.

And make it make sense, start using all existing roof surfaces, private, commercial, car park roofs, factory roofs, etc… with solar panels.

Maughanaclea hills dominate over the Bantry bay, the Mealagh Valley, Ardrah, Ballynamought, Gortloughra, Cousane, Coomclogh, Derragh, Glanycarney, Keenrath, Derrynacaheragh, Shiplough, Coolsnaghtig, and thise areas should be preserved before it's too late.

I hope with all my heart that this project will be refused. Again, **I ask that you refer to the details in the accompanying Hydro-G Report addressing the EIAR, lack of Consideration of Alternatives, the High Status Rivers and the lacunae in the Water and Land, Soils & Geology Chapters of the EIAR.**

Virginie LAVEAU

Mauganaclea 25/05/26

Hydro-G

An Coimisiún Pleanála - Case reference: PAX04.324165

Maughanaclea Renewable Energy Development

Applicant: Enerco Energy Ltd

Agents: MKO

Independent Expert Opinion for Virginie Laveau & An Coimisiún Pleanála

in the context of

European Union Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.

Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (EIA Directive).

European Communities Environmental Objectives (Surface Water) Regulations, S.I. No. 272 of 2009 as amended.

European Communities (Birds and Natural Habitats) Regulations, 2011. S.I. No. 477 of 2011, as amended 2021. SI No. SI No. 293 of 2021.

Prepared by

Dr. Pamela Bartley, Consultant

Hydro-G

for

Virginie Laveau

Maughanaclea, Kealkill, Co. Cork, P75 AX81

May 2026

Hydro-G

50 Henry St.
Galway
H91 FA4X

pamela@hydro-g.com

Project No.: 2026_Virginie (Resident inside the Proposed Construction Development Area)

Report Status: **Issue**

Report Title: **Independent Expert Opinion for Virginie Laveau & An Coimisiún Pleanála: Maughanaclea Renewable Energy Development, Co. Cork. Applicant: Enerco Energy Ltd. Agents: MKO.**

Legislation of Particular Note:

- European Union Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.
- European Communities Environmental Objectives (Surface Water) Regulations, S.I. No. 272 of 2009 as amended.
- European Communities (Birds and Natural Habitats) Regulations, 2011. S.I. No. 477 of 2011.
- European Communities (Birds and Natural Habitats) (AMENDMENT) Regulations, 2021. S.I. No. S.I. No. 293 of 2021.

Date: 24th May 2026

Prepared by: Pamela Bartley

Dr. Pamela Bartley B.Eng, M.SC., Ph.D.

Contents

Statement of Expertise Pamela Bartley B.Eng., MSc., Ph.D

This report has been prepared by Dr. Pamela Bartley. She is a water focussed civil engineer and is considered an Expert Service Provider (ESP) in the matter of construction impacts on hydrology and hydrogeology. Pamela is a team member in Environmental Impact Assessments and the preparation of Environmental Impact Assessment Reports (EIARs) for the extractive industry in Ireland.

Pamela is engaged as an independent consultant to Uisce Eireann, Group Water Schemes supplying potable water to the public, regionally important quarries. She has over 25 years of field based practice in borehole drilling, groundwater monitoring and abstraction point management and the assessment of rivers for the purposes of Section 4 Discharge and Water Pollution Act evaluations. Her Ph.D was a field based Impact Assessment tying actions at the land surface to responses in water by application of the Source Pathway Receptor (SPR) Risk Assessment model. Pamela is qualified and IOSH certified to act as PSDP (Project Supervisor Design Phase) & PSCS (Project Supervisor Construction Stage) as defined by the Construction Regulations. She has a wealth of experience in working at large scale construction sites involving earth movement and placement of rock, such as would occur in the construction of pads for Turbine erection. She is co-owner of Hydro-G and this Ltd. company is a registered Irish Water Supplier (no. 1855). Pamela Bartley is HSQE approved within Irish Water and is one of their Hydrogeologist Framework service providers. Upon completion of a Diploma in Water and Wastewater Technology at Sligo RTC, she completed a degree in Civil Engineering at Queens University, Belfast and then completed a Master of Science in Environmental Engineering followed by a hydrogeological focussed Ph.D. on Karst Groundwater Impact: both postgraduate degrees were completed within the school of Civil Engineering at Trinity College, Dublin.

Her key work areas are groundwater impact and groundwater use. Pamela has successfully completed post doctorate formal course training in the areas of:

- PSDP & PSCS (IOSH certified, 2016)
- Karst Hydrogeology (GSI, 2013)
- Planning & Development Act (IE, 2010) & Expert Witness (IE, 2011)
- On Site Wastewater & Water Services Amendment Act 2012 (IE, 2012 & Dublin 2012)
- Zero Discharge Willow Wastewater Systems Design Courses (Denmark 2008 & 2011 & Ireland 2012)
- Surface Water Regulations 2009 & Assessment of Licensing (DoE, 2010 & 2011)
- Sustainable Drainage (Wallingford/CIRIA, 2005 & 2008)
- Source Protection Zone Delineation (IGI/GSI, 2007)
- Groundwater & Contaminant Microbiology (IGI/GSI, 2006)
- Site Suitability Assessment (FETAC, 2002) & Applied Groundwater Modelling (ESI, UK, 2000)

As a result of work in evaluating planning appeals, Pamela has become specialist in planning evaluations in the context of enacted Irish Regulation and EU Directives concerning the water environment such as the Groundwater Regulations (S.I. No. 9 of 2010 & Amendment Regulations S.I. No. 366/2016), Surface Water Regulations (S.I. No. 272 of 2009 & Amendment Regulations S.I. No. 386 of 2015), Water Framework and Habitats' Directives. She has been an invited guest speaker at An Bord Pleanála, The Irish Concrete Federation, The Health Service Executive, Environmental Health Officers National Conference, The Irish Planning Institute's National Conference, The International Association of Hydrogeologist's National Conference (Irish Branch) and has delivered hydrogeological lectures to the public during Science Week. In the past, she has held full time lecturing positions in third level institutions (WIT & CIT, 1996 – 1999), delivered practical laboratory instruction in the assessment of subsoils for the FETAC Site Assessor programme and also demonstrated hydraulics laboratory and practical field survey tutorial modules at Trinity College Dublin (1996). Pamela is a qualified and certified 'Site Assessor' and has been an interviewer of examination candidates in respect of eligibility for the Site Suitability FETAC Qualification.

Pamela Bartley's company is Bartley Hydrogeology ltd., registered to trade as Hydro-G. The company holds the industry requisite professional indemnity insurance and employers, public and products liability insurances.

Independent assessment of the proposed west Cork Maughanaclea Wind Turbine Agglomeration, substation and underground cabling in the context of the EIA Directive, Water & LSG information. Report supporting the Objection by Virginie Laveau

1) This report was commissioned by people who live in homes and farms that Enerco Ireland ltd. have eyeballed for profiteering from the Irish Governments return on investment payouts on 'throw down' payouts from generated wind that the grid cannot accept.

2) The development description provided on An Coimisiún Pleanála web portal for Case reference: PAX04.324165 is as follows:

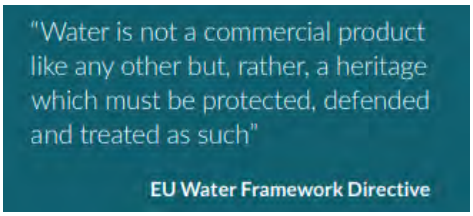
"10 year planning permission for Maughanaclea Wind Farm consisting of 14 no. wind turbines, a 110kV substation and 110kV underground cabling connection and associated works"
located in Ardrah, Maughanaclea, Ballynamought, Gortloughra, Cousane, Coomclogh, Derragh, Glanycarney, Keenrath, Derrynacaheragh, Shiplough, Coolsnaghtig and other townlands, Co. Cork.

3) This report has been prepared by Dr. Pamela Bartley for the benefit of the river systems in which Enerco Ireland ltd. and their agents MKO propose large scale habitat destruction over a number of years of construction activity all for the purposes of providing energy for data centres and substantial financial gain to MKO and the shareholders of the private capital company Enerco. Fourteen large scale construction pads are proposed with many Kms of access roads across 100's of acres of upland landscape with pristine river systems.

4) This report will assist the many homeowners and residents of the High Status river system and the upland area of outstanding beauty and peace. However, this report has been specifically prepared to accompany the Objection of one local resident named Virginie Laveau with an address that is in the same townland as Enerco Energy's power plant proposal: Virginie lives in Maughanaclea, Kealkill, Co. Cork. The rivers surrounding her home are a rare type of high quality waters that are not common in Ireland. The Objectives of the Water Framework Directive are to achieve 'at least Good Status'. The rivers that flow and live in the lands that Enerco Energy wish to turn into large scale construction sites are better than Good Status. The rivers that flow on the lands that Enerco Energy wish to send large articulated trucks and earth moving excavators to as High Status Rivers and are mapped by the Irish Environmental Protection Agency as High Status Objective Rivers.

5) It is interesting to note that the EIAR company MKO has a significant number of Geographical Information System (GIS) specialists in full time employment. However, similar to the Irish Government, either they have not applied their GIS skills for their client OR they have ignored the results of the GIS evaluation OR they have failed to apply the High Status Objective layer as a constraint in their advice to their client that the area is not suitable. The proposes development area is NOT SUITABLE. The reasons that the proposed development area is not suitable is because (1) the EIA Directive requires 'Consideration of Alternatives'; (2) there is an 'alternative in County Cork – names the offshore Wind Potential and (3) Ireland's river systems are in crisis. The proliferation of Poor and Moderate Status rivers necessitates that High Status Rivers should be protected when there are 'alternative' locations. As stated, there is no reason to propose large scale Risk in High Status river catchments when there is abundant Off Shore capability within a very short distance of the proposed development area. The reason that renewable energy is being pursued is because a reduction in fossil fuel use is perceived as a societal action that will assist in the Biodiversity Crisis. Water is a Biodiversity critical component. To propose large scale construction in pristine High Status Waters and EPA mapped High Status Objective Waters is something that is nonsensical.

6) The EPA's mapping for the High Status rivers of the area is presented as **Plate A**. Ireland's Water Action Plan 2024 opens with a quote from the Water Framework Directive, as follows:



Water is a HERITAGE that must be protected, defended and treated as such.

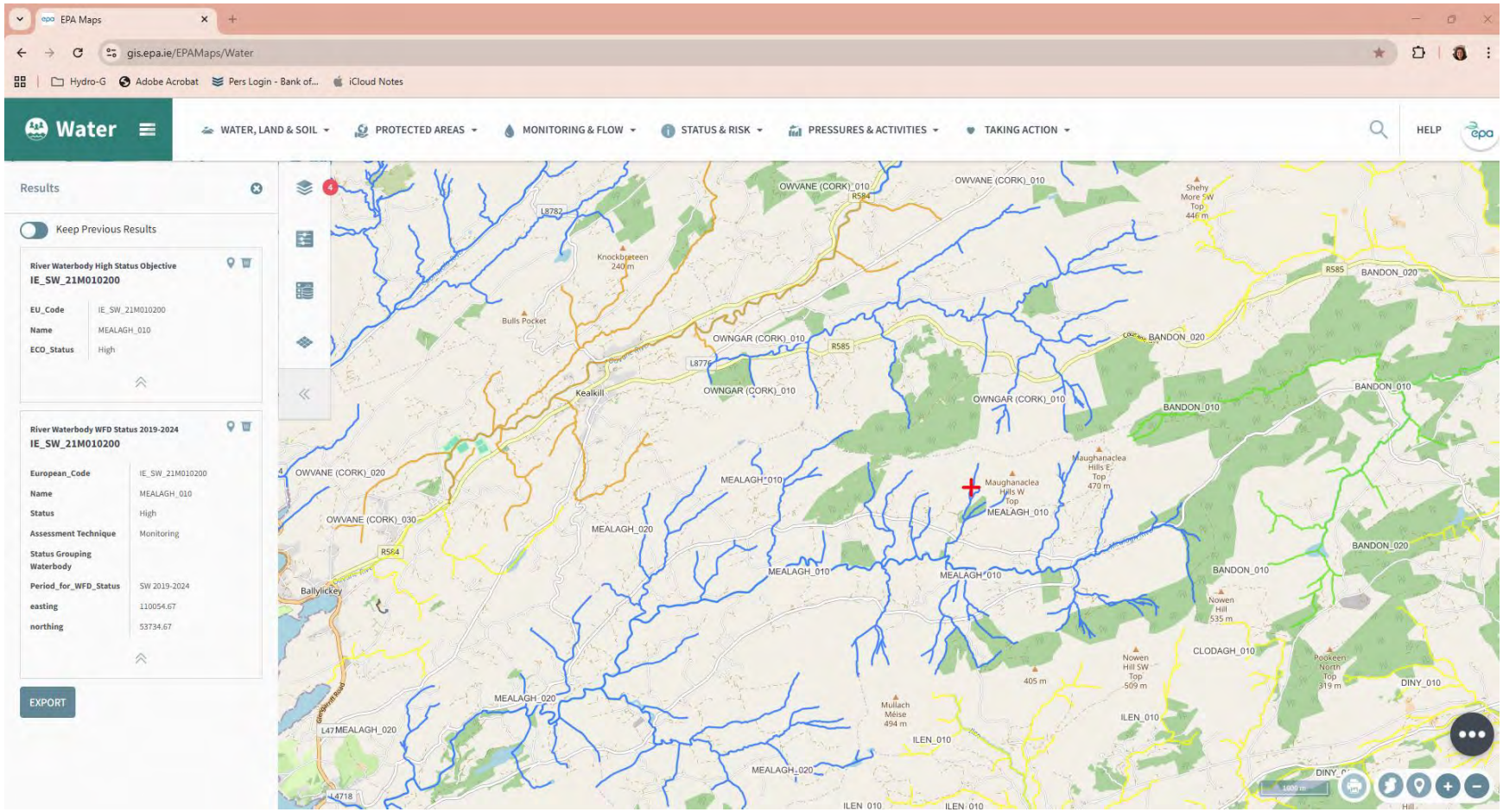


Plate A Proposed Wind farm & EPA High Status Rivers and High Status Objective Mapping.

7) The agent for the applicant states, in the opening para of page 63 of the Water Chapter 9, that "*Our understanding of the objectives of the WFD is that surface waters, regardless of whether they have 'Poor' or 'High' status, should be treated the same in terms of the level of protection and mitigation measures employed, i.e. there should be no negative change in status at all. This is reflected in the strict mitigation measures in relation to maintaining a high quality of surface water from the Proposed Project will ensure that the status of surface waterbodies in the vicinity of the Proposed Project will be at least maintained regardless of their existing status.*" Dr. Pamela Bartley hereby advises An Coimisiún Pleanála that the agents "understanding" is scientifically flawed. The facts of the matter are that the construction companies rarely get the memo that this is a High-Status pristine water environment and therefore the construction sites, and access to them, must be managed to within an inch of their life. The disconnect between planners instructed to implement government policy, the economics of construction procurement (lowest price/biggest profit for investors) and the complete lack of enforcement resources at county level = a RISK that cannot be adequately reduced to the level required by High Status & High Status Objective environments that no amount of "Mitigation" on paper can counter. MKO and their subcontracted assessors of the Water Environment (Chapter 9) are the same combination responsible for the environmental disaster that is Meenbog.

8) There is even a full manual, published by Ireland's EU funded project 'Waters for Life', dedicated presenting a 'Framework of Best Practice Measures and Guidelines for the Protection and Restoration of High Status River Water Bodies' (RPS & Daly (2023). The Waters of Life Project report is available to all on the internet at the link https://www.watersoflife.ie/app/uploads/2023/08/Measures_Framework.pdf. The applicant has not presented any reference or acknowledgement of the published and publically available Framework of Best Practice Measures and Guidelines for the Protection and Restoration of High Status River Water Bodies' (RPS & Daly (2023).

9) With specific reference to High Status Objective Rivers, there is the publically available EU cofounded Waters of LIFE website available @ https://www.watersoflife.ie/ and in which a specific information page is hereby made known to An Coimisiún Pleanála Inspector @ https://www.watersoflife.ie/high-status-objective-water-bodies/. "The Waters of LIFE is an EU LIFE Integrated Project (IP) which aims to help reverse the deterioration of Ireland's most pristine waters".

10) The Waters of Life website https://www.watersoflife.ie/high-status-objective-water-bodies/ states that "High status surface water bodies are the rivers, lakes, estuarine and coastal waters with the best quality water. These waters are home to lots of species that are sensitive to pollution and would not survive in lower quality waters. High status waters have a natural physical form that has not been changed by human activities e.g. humans have not straightened the river channel or built hard structures to support the river banks. These waters have excellent water quality with little or no excess nutrients and healthy river beds, free of excess siltation."

11) The Waters of Life website https://www.watersoflife.ie/high-status-objective-water-bodies/ continues in presenting that "High Status Objective or "blue dot "waters bodies are water bodies which are either currently at high status or have been at high status in the recent past and for which a target of restoring them to high status has been set in the River Basin Management Plan for Ireland 2022 to 2027. The map viewer shows the location of all high status objective water bodies and sites in Ireland. It also indicates which of those are currently failing to meet the requirements for high status".

12) The Waters of Life website https://www.watersoflife.ie/high-status-objective-water-bodies/ continues in presenting that "High status waters reflect largely undisturbed catchment conditions and status that is close to natural or pristine. They indicate the reference status that catchment management should strive to achieve. They may also be centres of high biodiversity or may contain rare and threatened habitats some of which are essential to survival of species with very particular ecological requirements such as the endangered fresh water pearl mussel. The presence of high status sites can contribute significantly to species diversity and these sites act as refuges for species that are a source for re-colonisation of river stretches that are recovering from pollution. High status sites and their catchments are also important providers of ecosystem goods and services and are areas of high natural capital value."

13) The Waters of Life website https://www.watersoflife.ie/high-status-objective-water-bodies/ continues in presenting in relation to HSO Decline, that "Unfortunately many sites previously at high status have lost their status over recent decades. In its most recent Water Quality Indicators Report Ireland's EPA reported

a decline in the number of high status sites from almost one third (31%) of sites monitored in the 1980s to just under one fifth (17%) in 2017, and only 30 of these remaining high status sites are considered pristine. The EPA conclude that the ongoing loss of our most pristine rivers is a very significant concern. A large effort is required to protect the few remaining high status river sites and, where possible, return impacted ones to high status.

Ireland's Decline in High Status Sites from 1980, through to 2017 and 2022: Only 30 remain.
Source: https://www.watersoflife.ie/high-status-objective-water-bodies/

14) It is hereby requested that An Coimisiún Pleanála evaluate the proposal's proposed construction area in the context of Ireland's DoHLGH (2024) River Basin Management Plan 2022 – 2027; Water Action Plan and the associated Programme of Measures.

15) What is missing from the applicant's presented case is the fact that Ireland's Wind Energy Strategy is technically and logistically infeasible and unattainable. In response to Mr. John McGuiness' PQ 103 question in the Oireachtas on the 5th of November 2024, Mr. Eamon Ryan admitted that Ireland's onshore Wind Targets were not tested using geospatial techniques (Wind Energy Generation – Tuesday, 5 Nov 2024 – Parliamentary Questions (33rd Dáil) – Houses of the Oireachtas & https://www.oireachtas.ie/en/debates/question/2024-11-05/103/#pq_103). The fact that Mr. Eamon Ryan admitted that they did not use geospatial techniques means that the government has not proven that their targets are logistically feasible given the biodiversity value, water quality, nature of housing development and the land area available in Ireland. Instead, wind energy targets were chosen by the then government based on modelling emissions and power systems. Therefore, Mr. Ryan's team decided that they wanted a certain emission reduction and set their target to that desire, regardless of any consideration of constraints posed by threats to Ireland's rivers, aquifers, water supply water to rural communities, Conservation Objective Natura 2000 sites and their endangered or protected species and habitats, nor were Housing Density nor Human Health implications considered in the selection of the onshore wind targets. It is for that reason that the results of the Strategic Environmental Assessment on Renewable targets cannot be published or defended by the Government. It would seem that the RTE reported current achievement of 5,000MW in wind energy provision (https://www.rte.ie/news/business/2025/0110/1489988-wind-power-ireland/) is the limit of what is feasible on the basis of land use and Conservation Objective Natura 2000 sites. An Coimisiún Pleanála is hereby asked and supported to make their planning determination using a combination of geospatial and risk-based factors, which the Irish Government has failed to do. Might a question be asked as to whether Ireland's housing crisis has not been helped at all because of the consequences of Mr. Eamon Ryan and WEI's efforts to push an indefensible and unhealthy Wind Energy target upon Rural Ireland? It would seem that so many SID Wind Farms and their associated grid connections are proposed in indefensible locations and this lack of professional judgement and overwhelming lodgement of SID Wind Farm applications to An Coimisiún Pleanála has resulted in valuable Planning resources and time lost in providing much needed alternatives to fossil fuels. The agents and investors in 'renewables' are avoiding offshore because of the poorer return on investments. It is only a matter of time before an Irish citizen brings a class action against the Irish Government or its Civil Servants in the context of the amount of time being wasted in the evaluation of incorrectly sited developments.

16) Maladaptation refers to actions or strategies that, while intended to address the challenges posed by climate change, inadvertently exacerbate the problem, or create new vulnerabilities. This can occur when

adaptation measures are poorly planned, misaligned with the local conditions, or fail to account for long-term consequences. The Ireland National Adaptation Framework – National Adaptation Plan 2025 (NAP 2025) published by United Nations Framework Convention on Climate Change (UNFCCC) requires, as follows:

- p.42, "Avoiding Maladaptation: Ensure that adaptation actions do not inadvertently create new vulnerabilities or exacerbate existing ones."
- "Consideration of Climate Mitigation: Ensure that climate mitigation outcomes are considered alongside adaptation planning where appropriate."
- p. 47, As part of its annual review, the CCAC also considers developments made in terms of supporting a just transition in terms of both mitigation and adaptation – noting in its 2023 review the need to accelerate the integration of the just transition principles across all mitigation and adaptation policy development and implementation".

17) It is stated in the 'Statement of Authority' that the authors of the Lands, Soils and Geology Chapter and the Hydrology and Hydrogeology Chapter have worked on 60 to 100 Wind Farm applications. Whilst that is true, the sites that they list as some of the 100's of example sites do not include the most high profile Wind Farm case combination of MKO's and HES's assessments named Meenbog Wind Farm in which the EIAR's conclusion of No Potential for Impact was proven incorrect when the land did slide in November 2020 and there was both water impact and habitat destruction requiring Donegal County Council to secure an order prohibiting further works at Meenbog wind farm (Irish Times, April 2024; Donegal Daily, 12th April, 2024). Photographs of the scale of the real risk again presented here for this Maughanaclea area. There are comparative areas of peat, forestry and Conservation Objective Site's impact potential.

Plate B Proposed Wind farm EIAR author's MKO & HES's previous 'Not Potential for Impact' Meenbog Wind Farm site, which failed in in 2020. (Photo credit Donegal Daily 12th April 2024).

Plate C Proposed Wind farm EIAR author's MKO & HES's previous 'Not Potential for Impact' Meenbog Wind Farm site, which failed in in 2020. (photo credit Donegal Live 4th January 2024).

With specific reference to the evidence of peat failure and watercourse impact shown in Plate B and Plate C, the assessments completed and reported for that Meenbog Wind Farm by the same agents for Maughanaclea and the proposed substation, MKO and HES, are available for review at https://www.pleanala.ie/en-ie/case/300460 and comparison with the information before them now. In 2018 the Board accepted a conclusion by HES (2017) in the Lands, Soils and Geology Chapter that ***"No significant impacts on the soil and geology of the site of proposed development will occur."*** **and qualifications that "*A peat stability assessment undertaken for the site shows that the risk of peat failure is designated trivial and tolerable and that the site has an acceptable margin of safety.".*** Yet, there was a failure. In the Board's 'Reasons and Considerations' supporting a Grant of Permission for Meenbog Windfarm the opening statement is that "*Having regard to: (a) the national targets for renewable energy contribution of 40% gross electricity consumption by 2020….".*

However, Mr. Justice Holland is reported by the Irish Times (11th April, 2024) as ruling that "*the integrity of the planning and environmental law systems "weighs heaviest" in this case of all the factors in paly and favour granting the injunction. He did not see that the "undoubted public interest in wind energy" weighs "much at all" in favour of exercising his discretion against making the order.* [Hydro-G provides clarification that Mr. Justice Holland has restrained the developers from finishing their "largely complete" 19-turbine project.] Mr Justice Holland said the developers submitted a report of a civil and environmental engineering expert to the EPA estimating that in the November 2020 incident about 86,240m³ of peat slid, of which about 65,740m³ entered a river and ended up on nearby European-protected sites, "causing significant environmental damage".

> **Hydro-G** offers that the Meenbog Windfarm slide of 86,240m³ of peat equates to destroying a carbon sequestration asset equivalent to 14.8 million kgs of CO2 emissions. [Source: National Trust for Scotland, 2024, provides that 172 kg of CO2eq is contained in each m3 of peat].
>
> **Hydro-G** offers that with respect to the information presented by HES for the proposed Maughanaclea Windfarm, the number of trial pits is very small (1 pit at each of the proposed Turbine Locations) and the real risk of slides and impact on High Status Rivers is BY THE stockpiles of peat or bedrock extracted from the mini quarries proposed (name 'borrow pits by the agents for applicant). No Site Investigation has been presented for the actual High Risk locations of proposed stockpiles and crane hardstanding areas required to lift the >80m length of each turbine blade.

With respect to the 'Statement of Authority' of both the Lands, Soils and Geology Chapter and the Hydrology and Hydrogeology Chapter that the authors of the Chapters have *"substantial experience in geological characterisation, peatland morphology, and surface water drainage design and SUDs design and surface water/groundwater interactions*". However, An Bord Pleanála do not currently seem to be convinced by designs by the authors for this Windfarm, MKO and HES. The HES Drainage Designs and Impact Assessment in Case File Reference 309770 resulted

in a recent Board Direction (BD-015822-24), dated the 13th March 2024, explicitly stating that there were unacceptable uncertainties in the nature of the windfarm's proposed drainage and uncertainties with the effectiveness of mitigation measures in dealing with the combined issues of construction works. Hydro-G offers that the HES (2023) response to the Board is publically available information, retrievable by google Search, and are provided here as Appendix A for convenience. Yet, in 2024 the Board determined in File Reference 309770 that the Drainage design was not enough to rule out risks. Hydro-G offers that the Board is now learning from experience and taking account of previous mistakes? Can An Coimisiún Pleanála adopt the same principles: that the risk is too great.

Hydro-G offers that the applicant's reliance on point methods for Site Investigation is outdated and has led to many failures and precedent that should preclude evaluation of those methods of Site Investigation. An Coimisiún Pleanála are advised to refer to the detail presented as Appendix B in which the current Best practice of Site Investigations using methods that are not point (Probes, Trial Pits and soil sampling for Particle Size Distribution based). The Geotechnical Assessment Industry has moved on. However, those 'well placed' for the Renewable Business sector have not.

18) It is usual for the EIARs for Wind Turbine plantations to state that IF the project is constructed and operated in accordance with the design, best practice and mitigation that is described within the application's documents, then significant individual or cumulative effects on ecology are not anticipated at the international, national, county, or local scales or on any of the identified Key Environmental Receptors. **Hydro-G** offers that that Conclusion is at odds with recent experiences in Meenbog and also contrary to the most recent Case Law in Ireland stating that one cannot rely on Best Construction Practices and mitigation to protect Conservation Sites.

19) An Coimisiún Pleanála is requested to refuse permission to the proposed development on many grounds, some detailed by other experts for the local residents and some presented by people who live inside the proposed development area. With specific reference to Water and Lands, Soils & Geology, Reasons for Refusal are outlined as follows

    a. Refusal is warranted on the basis that there is too much understatement of Risk with respect to the Impact Assessment and that previous understatement of Risk by the same agents and authors of EIAR Chapters resulted in real environmental damage: namely at Meenbog Windfarm, Co. Donegal. In 2026 Irish rivers cannot sustain any more damage, even if not intentioned. Avoidance of High Status Rivers is a critical design factor omitted from the applicant's agents GIS system's screening process.

    b. Refusal is warranted on the grounds that the applicant has not correctly applied the principles of the requisite 'Consideration of Alternatives' requirement of the EIA Directive. There is abundant wind power available off the shores of Cork where the High Status Rivers of the proposed development area can be avoided and thereby protected. Again, no amount of 'mitigation' text can outweigh the concept of 'avoidance of risk' which is a key tenet of the Construction Regulations.

    c. There are unacceptable uncertainties with respect to residual risks and land stability, risks of failure and the potential for the proposed substation site and the Wind Farm's proposed enabling works to interfere with numerous water dependent Designated Sites with Conservation Objectives.

Pamela Bartley

Signed: _____ Date: 25th May 2026

Dr. Pamela Bartley BEng, MSc, PhD

References & Bibliography

An Bord Pleanála (2018) Inspectors Report and Board Direction Case File PA05E.300460. Meenbog (ED Goland), Croaghonagh and Cashelnavean, Co Donegal. Donegal County Council.

An Bord Pleanála (2024) Inspectors Report and Board Direction Case File ABP- 309770-21. Coole Wind Farm.

Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (EIA Directive).

DoHLGH (2024) River Basin Management Plan 2022 – 2027. Department of Housing, Local Government and Heritage. https://www.gov.ie/en/policy-information/8da54-river-basin-management-plan-2022-2027/

DoHLGH (2024) Water Action Plan 2024. Department of Housing, Local Government and Heritage. https://www.gov.ie/en/policy-information/8da54-river-basin-management-plan-2022-2027/

EPA (1999) WWT systems for small communities and businesses.

EPA (2009) Code of Practice WW treatment for single houses.

EPA (2011) Guidance on the Authorisation of Discharges to Groundwater. Version 1 - December 2011.

EPA (2022) Guidelines on the information to be contained in Environmental Impact Statements. ISBN 978-1-80009-005-7. May 2022

EPA Online Water Quality Mapping. (https://gis.epa.ie/EPAMaps/)

EPA, 2006 Environmental Management Guidelines for the Extractive Industry (Non-Scheduled Minerals).

European Communities (Birds and Natural Habitats) (AMENDMENT) Regulations, 2021. S.I. No. S.I. No. 293 of 2021.

European Communities (Birds and Natural Habitats) Regulations, 2011. S.I. No. 477 of 2011.

European Communities (Quality of Salmonid Waters) Regulations, 1988. S.I. No. 293/1988

European Communities Environmental Objectives (Groundwater) (Amendment) Regulations, 2011, S.I. No. 389 of 2011.

European Communities Environmental Objectives (Groundwater) (Amendment) Regulations, 2012, S.I. No. 149 of 2012.

European Communities Environmental Objectives (Groundwater) (Amendment) Regulations, 2016. S.I. No. 366 of 2016.

European Communities Environmental Objectives (Groundwater) Regulations, 2010. S.I. No. 9 of 2010.

European Communities Environmental Objectives (Groundwater) Regulations, 2010. Statutory Instruments. S.I. No. 9 Of 2010.

European Communities Environmental Objectives (Surface Water) Regulations, 2009. S.I. No. 272 of 2009.

European Communities Environmental Objectives (Surface Waters) (Amendment) Regulations, 2012. S.I. No. 327 of 2012.

European Union Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.

European Union Environmental Objectives (Surface Waters) (Amendment) Regulations, 2015. S.I. No. 386 of 2015.

European Union Environmental Objectives (Surface Waters) (Amendment) Regulations, 2019. S.I. No. 77 of 2019.

European Union (Drinking Water) Regulations 2023 (S.I. No. 99 of 2023).

GSI Bedrock Geology Sheets 1:100,000 Map Series. Geological Survey of Ireland.

GSI On-line Groundwater database. Aquifer Classification, Aquifer Vulnerability, Teagasc Soil Classification, Subsoils, Karst features, groundwater recharge.

Guidelines for the Preparation of Soils, Geology & Hydrogeology Chapters of Environmental Impact Statements, 2013.

Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes, NRA Document.

HES (2017) Meenbog Wind Farm - Environmental Impact Assessment Report 160502 – EIAR – 2017.11.22 – F.

HES (2023) Re: Hydrological & Hydrogeological Responses to An Bord Pleanála Further Information Request and Third-Party Submission in relation to the proposed Coole Wind Farm, Co. Westmeath (ABP Ref: 309770-21). Letter dated 27th October 2022 issued by HES, addressed to MKO, outlining their "STATEMENT OF EXPERIENCE – WIND FARM DRAINAGE" and response to 3rd Party Submissions and An Bord Pleanála. Case refused by An Bord Pleanála.

https://windsystemsmag.com/laying-the-foundation-for-wind-turbines-now-and-in-the-future/#:~:text=In%20this%20example%2C%20a%201.5,pedestal%20nearly%20double%0the%20height.

IGI (2002) Geology in Environmental Impact Statements a Guide.

National Parks and Wildlife Service (NPWS). Database of Special Areas of Conservation, National Heritage Areas, National Parks, Special Protection Areas including site synopsis reports.

National Trust for Scotland (2024) https://www.nts.org.uk/stories/conserving-natural-capital-the-trusts-peatlands

NRA (2008) Environmental Impact Assessment of National Road Schemes – A Practical Guide & National Roads Authority (2008) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.

Ordnance Survey, Ireland Map Series 1:50,000 Sheets.

RPS & Daly, D. (2023) Framework of Best Practice Measures and Guidelines for the Protection and Restoration of High Status River Water Bodies. Waters of Life Project. Ireland. Available to all at https://www.watersoflife.ie/app/uploads/2023/08/Measures_Framework.pdf

SNH (2018) Scottish National Heritage A handbook on environmental impact assessment: Guidance for Competent Authorities, Consultees and others involved in the Environmental Impact Assessment Process in Scotland, Scottish Natural Heritage, 5th Edition, 2018. Section C8.

Uisce Eireann (2023) NWRP Preferred Approach.

WFD Working Group (2004) Guidance document no. GW3: THE CALCAREOUS/ NON-CALCAREOUS ("SILICEOUS") CLASSIFICATION OF BEDROCK AQUIFERS IN THE REPUBLIC OF IRELAND.

Appendix A

Publically Available HES (2023) Drainage Design Response to 3rd party Observations, An Bord Pleanála Further Information Case File ABP- 309770-21. Coole Wind Farm.

& RESULTANT Direction REFUSAL BY An Bord Pleanála (2024) File ABP- 309770-21. Coole Wind Farm.

HYDRO ENVIRONMENTAL SERVICES

22 Lower Main St
Dungarvan
Co.Waterford
Ireland

tel: +353 (0)58 44122
fax: +353 (0)58 44244
email: info@hydroenvironmental.ie
web: www.hydroenvironmental.ie

Date: 27th October 2022
Our Ref: P1320-2-0010

MKO Ireland
Planning & Environmental Consultants
Tuam Road,
Galway.
H91 VW84.

Attn: Ms. Meabhann Crowe

Dear Meabhann,

Re: Hydrological & Hydrogeological Responses to An Bord Pleanála Further Information Request and Third-Party Submission in relation to the proposed Coole Wind Farm, Co. Westmeath (ABP Ref: 309770-21)

Hydro-Environmental Services (HES) were requested by MKO Ireland (MKO) to respond to a further information request from An Bord Pleanála (ABP) with respect to geological, hydrological, and hydrogeological matters raised in relation to the proposed Coole Wind Farm SID application, Co. Westmeath.

1 STATEMENT OF EXPERIENCE – WIND FARM DRAINAGE

Hydro-Environmental Services (HES) has extensive wind farm drainage and hydrogeological experience relevant to this project. Wind farm environmental impact assessment in respect of geology, hydrology, and hydrogeology has and is a core business area for HES presently and also over the past 18 years. Wind farm drainage design/management requires experience both as a civil/drainage engineer, a hydrologist, and as a hydrogeological specialist. HES have these combined experiences and expertise. HES has worked on over 100 wind farm projects in Ireland and Northern Ireland. Many of these required assessments of existing drainage features and streams and water quality data. HES work at all stages of wind farm developments including feasibility stage, layout design & preliminary drainage design/planning stage, and also at construction management stage.

HES's experience also covers the key area of water quality and drainage controls and mitigation during the construction phase of wind farm developments. HES work at EIAR/planning stage to assist with the development of the optimal site layout which involves the development of hydrological constraints maps and interaction with geotechnical and ecological specialists and with site designers. HES also provide a follow-on consultancy service (if planning is granted and the development proceeds to construction) of detailed drainage design and construction management for drainage during wind farm development/construction stage. This practical on-site experience is invaluable as it has led to development of improved preliminary and detailed drainage layouts and also many improvements/optimisations to standard peatland drainage mitigation measures.

HES specialises in wetland and peatland eco-hydrology. We also complete flood risk assessments for all types of developments across the country.

All these experiences are particularly relevant to this project, and they have been applied through the project development phase, the constraints mapping phase, and EIAR preparation work, including the cumulative impact assessment.

This response submission has been prepared by Adam Keegan and Michael Gill. Adam and Michael prepared the Land Soil and Geology and Water Chapters of the submitted EIAR, and their qualifications, competencies, and experience are already presented in the EIAR.

2 RESPONSE TO ABP ITEM 4 "SOILS AND GEOLOGY AND INTERACTIONS WITH PEAT HARVESTING"

Further peat depth probing and investigations have been completed by MWP in the area of T12. As a result of those investigations, which are outlined in the report entitled "Response to RFI Item 4.1, Coole Wind Farm" (MWP, September 2022), the upper end of peat depths referenced in the EIAR should now be 8.7m. As such peat thicknesses from peat probing, window sampling, and drilling ranged from 0 to 8.7m.

2.1 "Soils & Geology interaction with Peat Harvesting" Item 4.2

Item 4.2 is divided into 7 bullet points (for ease of reference we have numbered those as a) to g)). HES is responding below to items pertinent to the EIAR (Land, Soils & Geology and Water Chapters), namely items (**b**) and (**c**). Item 4.2 is written as follows:

> *"The comments of the Department of Housing, Local Government and Heritage on nature conservation raise a number of issues including the following which are considered of particular relevance to soil and geology and hydrology.*
>
> *b) The potential for impacts on Gariskil Bog and Scragh Bog as a result of the effects of drainage works.*
>
> *c) The need to identify the location of all mitigation measures involved in the construction phase drainage management.*

2.1.1 HES Response to Item 4.2 (b)

As outlined in Section 9.4.1.9 of the EIAR, the potential effects of the proposed development on the Gariskil Bog SAC and Scragh Bog SAC have been carefully considered.

These designated sites are >5km from the Coole Wind Farm, thus the proposed drainage measures incorporated into the Wind Farm design will not impact on them. However, the SAC's are located near the associated grid route.

As set out in Section 9.4.19 of the EIAR, and on Cross-Section X1 and Cross-Section X2 (refer to EIAR Appendix 9.4), Gariskil Bog SAC is situated ~60m from the Grid Connection Route along the L1826. The road (and Grid Connection Route) is ~ 2.5m lower than the raised bog that forms the SAC. The River Inny exists between the edge of the bog and the public road and acts as a hydraulic boundary to groundwater flow. A small stream (a tributary of the River Inny) exists, ~ 230m south of the bridge to the north of the SAC boundary. This stream is culverted under the L1826. The stream flows east, while drainage from the bog will flow west towards the River Inny.

In summary, the potential for hydrological impacts from the Grid Connection Route to Gariskil Bog SAC are limited by:

- The River Inny acting as a hydraulic boundary between the Gariskil Bog;
- The separation distance between the Grid Connection Route and the SAC;
- Local drainage patterns are towards the River Inny and away from the grid connection trench;
- The grid route ducting (and cable) will be installed in a shallow temporary trench;
- No groundwater dewatering will be required to install the grid connection trench; and,
- The base of the temporary trench is above the invert of the River Inny which is located between the SAC and the Grid Connection Route.

As set out in Section 9.4.1.9 of the EIAR, Scragh Bog SAC/pNHA is situated ~320m from the Grid Connection Route at its closest point. Land-use between the Grid Connection Route and the

Scragh bog is typically agricultural with some residential dwellings along the N4 road. There is a considerable amount of grass verge/shrubbery along the N4 roadside. Given the distance relative to the ~1.2m deep trench and the intervening land use, there is no direct or indirect hydrological pathway to the Scragh Bog SAC/pNHA, any excess surface water would infiltrate to ground within several metres of the road, based on permeability/groundwater recharge values mapped by the GSI.

In summary, the potential for hydrological impacts from the Grid Connection Route to Scragh Bog SAC/pNHA are limited by:

- The separation distance between the Grid Connection Route and the SAC;
- There are no direct/indirect hydrological pathways between the Grid Connection Route and Scragh Bog SAC/pNHA;
- The grid route ducting (and cable) will be installed in a shallow temporary trench;
- No groundwater dewatering will be required to install the grid connection trench; and,
- The shallow nature of the temporary trench along Grid Connection Route.

The proposed mitigation measures to eliminate any potential impacts on these SAC's are given in Section 9.4.1.9, and are summarised briefly as follows:

- Drainage control measures will be put in place during the excavation and construction of the grid route;
- Sediment control measures used during the construction such as silt bags, the covering of exposed soils and the avoidance of works during heavy rainfall;
- Mitigation measures related to spills/chemical releases, *i.e* petroleum products will be put in place during the construction;
- No groundwater dewatering is required during grid route construction;
- All trenching works are proposed at or very near existing ground levels with minimal ground disturbance proposed; and,
- No deep foundations are proposed near the SAC's or along the grid route in general.

Section 9.4.1.9 of the EIAR concludes, and we, HES, continue to assert, that with the implementation of the mitigation measures (as outlined in the EIAR and as summarised above), no significant hydrological or hydrogeological impacts on designated sites are anticipated from the proposed development.

In addition to the above, and in response to paragraph 1.3.5 of the Departments (DAU) submission, the type of drainage impact encountered by Regan et al (2019)[1] at Clara Bog SAC cannot occur at Gariskil Bog SAC nor at Scragh Bog SAC/pNHA, as in this instance the proposed grid connection trench will be 1.2m deep, it will be a transient and temporary excavation, and it will not intercept or drain the local groundwater system.

2.1.2 HES Response to Item 4.2 (c)

The locations of proposed mitigation measures to be implemented within the Coole Wind Farm site during the construction phase including check dams, attenuation ponds, settlement ponds, silt fences, and collector and interceptor drains are shown in Drawings D101 to D107 (EIAR Appendix 4.9).

The implementation of these mitigation measures is listed in detail in Section 9.4.1.1 of the EIAR. The concluding paragraph of Section 9.4.1.1 states:

[1] *Regan, S., Flynn, R., Gill, L., Naughton, O., & Johnston, P. (2019). Impacts of groundwater drainage on peatland subsidence and its ecological implications on an Atlantic raised bog. Water Resources Research.*

"The potential for the release of suspended solids to watercourse receptors is a risk to water quality and the aquatic quality of the receptor. Proven and effective measures to mitigate the risk of releases of sediment have been proposed above and will break the pathway between the potential sources and the receptor. The residual effect is considered to be - Negative, indirect, imperceptible, temporary, low probability impact on the water environment within the Wind Farm Site, along the Grid Connection Route and near other ancillary works (River Inny, Glore River, River Deel, Monkstown stream, Lough Derravaragh).

For the reasons outlined above, no significant effects on the surface water quality are anticipated."

Mitigation measures proposed along the grid route are also described in the EIAR (Section 9.4.1), and include the temporary use of appropriate interceptor drainage, which will be continuously implemented along the grid route during construction, as the route progresses. The mitigation measures implemented will be specific to the ground conditions/slope and related to the antecedent weather (*i.e* during periods of low/no rainfall, management of surface water will not be required). The EIAR includes the following requirements:

- The majority of the Grid Connection Route is >50m from any nearby watercourse, apart from a section of the N4 alongside Lough Owel and at bridges along the Grid Connection Route. It is proposed to limit any works in any areas located within 50m of any watercourse/waterbody including the stockpiling of excavated soils and subsoils
- A constraint/buffer zone will be maintained for all crossing locations where possible, whereby all watercourses will be fenced off.
- Source controls such as silt bags, silt fences, filter fabrics and interceptor drains will be installed where required.
- No batching of wet-cement products will occur along the grid route works or near other ancillary construction activities. Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place;
- Where possible pre-cast elements for culverts and concrete works will be used;
- No washing out of any plant used in concrete transport or concreting operations will be allowed on-site;
- Refuelling or maintenance of machinery will not occur within 100m of a watercourse;
- Fuels stored on site (along grid route) will be minimised;
- Any diesel or fuel oils stored at the temporary site compound will be bunded.
- Mitigation measures relating to the use of biodegradable drilling fluids such as Clear Bore are included in Section 9.4.1.10 if directional drilling is deemed necessary.
- The hydrological regime locally will not be affected by the proposed works and so the regime of the SACs, SPAs, NHA and pNHAs will not be affected.
- No groundwater dewatering is proposed during grid route construction. Any rainwater removal will be temporary and at a very shallow depth above the groundwater table.
- All building and trenching works are proposed at or very near existing ground levels with minimal ground disturbance proposed.
- No deep foundations are required or are proposed. As such there will be no interruption or blocking of shallow or deep groundwater pathways below the site (grid route).

The potential for the release of suspended solids to watercourse receptors is a risk to water quality and the aquatic quality of the receptor. Proven and effective measures to mitigate the risk of releases of sediment have been proposed above and will break the pathway between the potential sources and the receptor. These mitigation measures are included in the submitted CEMP, and during the construction phase works will be supervised and overseen by an ECoW. The residual effect is considered to be - Negative, indirect, imperceptible, temporary, low probability impact on the water environment within the Wind Farm Site, along the Grid Connection Route.

2.2 "Soils & Geology interaction with Peat Harvesting" Item 4.4

Item 4.4 is written as follows:

> *"It is considered that more detailed information should be provided relating to water quality monitoring proposals specified in Section 9.4.1.1 of the EIAR. In particular, a suite of parameters to be monitored and the limits to be met should be specified."*

2.2.1 HES Response to Item 4.4

The paragraphs relating to water quality monitoring in Section 9.4.1.1 of the EIAR states:

> *"During the construction phase, field testing and laboratory analysis of a range of parameters with relevant regulatory limits and EQSs should be undertaken for each primary watercourse, and specifically following heavy rainfall events (i.e. weekly, monthly, and event based)."*

To supplement this, the following suite of parameters will be monitored:

Parameter	EQS	Event	Methodology
Visual Inspection	No abnormal change	Daily	Field Inspection and photographic record.
pH	4.5<pH>9.0	Weekly	Field Measurement (Handheld probe)
Dissolved Oxygen	No abnormal change	Weekly	Field Measurement (Handheld probe)
Conductivity	No abnormal change	Weekly	Field Measurement (Handheld probe)
Temperature	No abnormal change	Weekly	Field Measurement (Handheld probe)
Ammonia	High Status ≤0.04mg/L Good Status ≤0.065mg/L	Monthly	Accredited Laboratory Analysis
Nitrate	-	Monthly	Accredited Laboratory Analysis
BOD	High Status ≤1.3 mg/L Good Status ≤1.5 mg/L	Monthly	Accredited Laboratory Analysis
Total Petroleum Hydrocarbons	Below Detection Limit	Monthly/ Following potential hydrocarbon spill	Accredited Laboratory Analysis
Orthophosphate	High Status ≤0.025 Good Status ≤0.035		
Alkalinity	No abnormal change	Monthly/ Following potential cement leaching	

The inspections, monitoring, and sampling will be undertaken at the locations WF_SW1 – WF_SW5 show in Figure 9-9 of the EIAR. These sampling points are located along both the Glore River and River Inny.

2.3 Soils & Geology interaction with Peat Harvesting" Item 4.5

Item 4.5 is written as follows:

> *"You are requested to clarify the layout and management arrangements for the operational drainage structure."*

2.3.1 HES Response to Item 4.5

The drainage system as outlined in drawings D101-D107 (Refer to Appendix 4-9 and 9-3 of the EIAR) will be utilised and maintained during the operational phase of the proposed Wind Farm. The maintenance and management of the drainage system will be included within the overall maintenance regime of the Wind Farm.

Coole Wind Farm Ltd will have the responsibility for maintaining the drainage system at the operational wind farm. The maintenance of the wind farm will incorporate the activities associated with keeping the drainage system operating effectively.

The drainage maintenance regime will include:

- The inspection and maintenance of swales and settlement ponds;
- Inspecting cross-drains for any blockages, and removal of any blockages identified;
- Inspecting and maintaining outfalls to existing field drains;
- Inspecting the existing roadside drains for any obstructions, and removal of any obstructions identified;
- Inspecting the progress of the re-establishment of vegetation and where required testing the water quality at the outfalls periodically; and,
- Inspection and regular cleaning of drainage channels and settlement ponds. Drainage inspections and maintenance will be in completed accordance with CIRIA C697 SuDS and Maintenance Manual.

Note, weekly inspections will be required during the construction period. Monthly inspections will be completed for one year following construction, and then on a quarterly basis thereafter during the operational lifetime of the Wind Farm.

2.4 Soils & Geology interaction with Peat Harvesting" Item 4.6

Item 4.6 is written as follows:

> *"It is noted that the heading of Section 8.5.1.2 of the EIAR includes reference to the alteration of peat/soil geochemistry. Please clarify how this topic is assessed under that heading or if it is addressed elsewhere in the submitted documentation"*

2.4.1 HES Response to Item 4.6

The alteration of peat/soil geochemistry is included under Section 8.5.1.2 as "Contamination of soil by leakages and spillages and alteration of Peat/Soil Geochemistry".

It is understood that this may have been misinterpreted as being separate items and should be renamed "Contamination of soil by leakages and spillages and ***resulting*** alteration of Peat/Soil Geochemistry".

This section considers the possibility of hydrocarbon spills from the use of on-site fuel/oil and the potential impact on the Peat/Soil geochemistry as a receptor. A potential fuel/oil spill could alter the peat/soil geochemistry by lowering or raising the pH (depending on the specific type of hydrocarbon), by potentially reducing dissolved oxygen via the creation of an oil film and in a more general sense from introducing a range of hydrocarbon molecules which would not otherwise be present.

With the implementation of the mitigation measures outlined in the EIAR (Section 8.5.1.2), the assessed impact of this potential source is "*Negative, imperceptible, direct, short-term, low probability effect on peat and subsoils and bedrock*".

3 RESPONSE TO 3RD PARTY SUBMISSIONS

3.1 DAU Submission Point 2.3

T1, T3 and T4 are close to the River Gore and Inny and associated features including Lough Bane pNHA. The Department is concerned about the potential impacts from the siting of a turbine with regard to the drainage impacts on this pNHA.

3.1.1 HES Response to DAU Submission Point 2.3

Potential impacts on Lough Bane pNHA have been assessed within Section 9.4.1.9 of the EIAR. Lough Bane pNHA is upgradient of the wind farm site therefore it is hydraulically disconnected from the Wind Farm site in terms of surface water. There is also a high bank and a number of deep drains separating the Wind Farm Site from the pNHA and the groundwater gradient at the Wind Farm Site is not in the direction of Lough Bane.

Please note Lough Bane was specifically targeted for investigation and monitoring during the EIAR process. Piezometers were installed to the south and southeast of the Lough, and seasonal monitoring was undertaken (refer to Sections 9.3.7.1 and 9.4.1.9). Hydrochemical monitoring was also completed in Lough Bane.

Impact assessment with respect to T2 was also undertaken at Section 9.4.1.9 of the EIAR. This concluded:

> *"The hydrological regime locally will not be affected by the proposed works and so the regime of the SACs, SPAs, NHA and pNHAs will not be affected as:*
>
> - *No groundwater dewatering is proposed during construction. Any rainwater/surface water removal will be temporary and at a very shallow depth.*
> - *All building and trenching works are proposed at or very near existing ground levels with minimal ground disturbance proposed.*
> - *No deep foundations are required or are proposed. As such there will be no interruption or blocking of shallow or deep groundwater pathways below the site."*

Therefore there will be no hydrological or hydrogeological impacts on designated sites.

3.2 Other 3rd Party Submissions

A total of 41 no. 3rd party submissions were received in relation to ABP Ref: 309770-21. Of these, 10 no. submissions contained comments relating to Soils & Geology or Hydrology/Hydrogeology.

The main hydrological/hydrogeological issues raised in those 10. no. submissions can be distilled down to the following themes:

1) Due to the emplacement of the turbine hardstands, a large volume of groundwater will be displaced, which will create a rise in the groundwater level, which will in turn flow to the River Glore/Inny and could cause flooding.
2) All surface water from the site flows towards the Inny/Glore River, which are headwaters of Lough Derravaragh. The proposed works will have a negative impact on water quality in these rivers, and thus the downstream lake.
3) The proposed development will have a negative effect on the hydrology/hydrogeology of Lough Bane, Gariskil Bog, Scragh Bog, and other designated sites.

3.2.1 HES Response to 3rd Party theme 1) issue:

- The installation of the turbine hardstands and its potential impacts on the water environment has been assessed in Section 9.4.1.1 (Construction) and 9.4.2.1 (Operation).
- The primary mechanisms for alteration of the water environment is considered to be excavation during the construction phase which has been carefully assessed in Section 9.4.1.1 and the emplacement of relatively impermeable concrete hardstands which has been carefully assessed within Section 9.4.2.1.
- The emplacement of the turbine hardstands will not displace a large volume of water, in the context of the overall bog basins. Any displacement of water caused by turbine installation will be a singular, localised occurrence, before the groundwater table recedes back to its static level, controlled by the surrounding drainage channels.
- The emplacement of a 600m3 turbine hardstand will displace ~450 m3 of water.

- Over a 523 hectare site, assuming each of the 15 no. turbines require the same approximate volume of concrete/lean mix, this will displace a volume of water leading to an average initial rise of 0.0012m, just over 1 millimetre.
- The groundwater will then recede back to its initial conditions with no further change in groundwater levels.
- For context, there is a ~ 20cm annual range in groundwater levels across the bogs.

On this basis, it is considered that implying the hardstands will displace a volume of water which could have any potential impacts on downstream hydrology/hydrogeology is shown to have a negligible impact on groundwater levels. This issue will not create or generate a potential significant impact.

3.2.2 HES Response to 3rd Party theme 2) issue:

- The potential effects on downstream receptors such as the River Inny, River Glore and Lough Derravaragh has been assessed in detail in Sections 9.4.1.1 to 9.4.1.10 of the EIAR. Robust and effective mitigation measures have been included within the EIAR which will break the pathway between source and receptor. These mitigation measures are outlined briefly in Section **Error! Reference source not found.** above.
- Through the implementation of these mitigation measures. there will be no significant effects on surface water quality as a result of the proposed development, including the River Inny, River Glore, and Lough Derravaragh.

3.2.3 HES Response to 3rd Party theme 3):

- Refer to Section **Error! Reference source not found.** above, i.e. response to Item 4.2 (b)

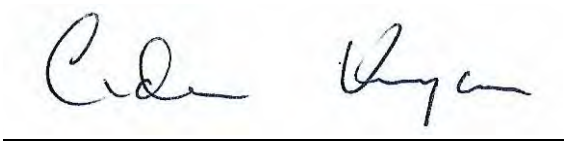
4 RESPONSE SUBMISSION SUMMARY:

- A robust and detailed EIAR for the proposed wind farm development was submitted with the SID application.
- A detailed drainage plan outlining the location of drainage mitigation measures has been submitted (Appendix 4-9 and 9-3 of EIAR).
- We have comprehensively responded to and addressed all matters raised by the Board, and by Statutory and non-statutory submissions.
- There is significant water related mitigation outlined in the EIAR to ensure that water quality protection is upheld.
- All (water-related) mitigation as outlined in the EIAR will be included in the CEMP and implemented on-site.
- We have comprehensively addressed the matters raised in the DAU submission relating to Lough Bane; and,
- The submitted EIAR concludes, and HES continue to assert, that through the implementation of the proposed groundwater and surface water protection related mitigation measures, this proposed development will not have significant impacts on the hydrology/hydrogeology of the Wind Farm Site, nor the Grid Connection Route, nor any downstream receptors such as the River Inny, River Glore and all nearby designated sites.

5 CLOSURE

We trust the above response meets your requirements. Please contact the undersigned if you have any questions regarding the above.

Yours sincerely,



Adam Keegan
Hydrogeologist
B.Sc., MSc.

22 Lower Main Street, Dungarvan, Co. Waterford, X35 HK11
T: +353-(0)58-441 22 **F:** +353-(0)58-442 44 **E:** info@hydroenvironmental.ie

www.hydroenvironmental.ie

An Bord Pleanála

Board Direction
BD-015822-24
ABP-309770-21

The submissions on this file, the internal Ecologist Report prepared following the submission of further information
and the Inspector's report were considered at a Board meeting held on 13/03/2024.

The Board decided to refuse permission, generally in accordance with the Inspector's recommendation, for the following reasons and considerations.

Reasons and Considerations

Having regard to

(a) the nature of the proposed wind farm drainage, which utilises the existing peatlands drainage system within and outside of the site boundary, which has not been authorised by a grant of permission

(b) the continuance of peat harvesting as the baseline scenario for the EIAR, including bird collision risk assessment and the assumed continuance of this land use

(c) the uncertainty as to the effectiveness of the proposed mitigation measures in dealing with the combined issues of construction works on exposed peat and the wider exploited peat basins

(d) if, hand peat harvesting is to cease permanently, there has been no assessment of the implications of a peatland rehabilitation plan on the local biodiversity as part of the EIA or in the NIS

(e) the uncertainty relating to future land use at the 'optioned lands'

(f) the absence of evidence of sufficient legal control to support the management proposals for the 'optioned lands'

(g) the information presented in relation to peat depth

The Board considered that there is significant uncertainty relating to the effect on soils, water and ecology which precludes assessment of the full environmental effects in accordance with the provisions of EU Directive 2014/52/EU amending Directive 2011/92/EU. The proposed development is, therefore, premature.

Furthermore, on the basis of the information provided by the applicant in relation to site drainage proposals and collision risk modelling for birds, and in the absence of an assessment of the future land use together with the proposed development, the Board cannot be satisfied that the proposed development individually, or in combination with other plans or projects would not be likely to have a significant effect on European Site Lough Derravaragh Special Protection Area (Site Code: 004043), or any other European Site, in view of the site's Conservation Objectives.

Having regard to the above, the Board was not satisfied that the proposed development would not adversely affect the integrity of the above-mentioned European Site in view of the site's conversation objectives.

In such circumstances the Board is precluded from granting permission.

Schedule of Costs

In accordance with the provisions of section 37H(2)(c) of the Planning and Development Act 2000, as amended, the amount due to be recouped from the applicant is €19,883.

Board Member Peter Mullan **Date:** 13/03/2024

Peter Mullan

Appendix B

Current Best Practice Example Paper for the Assessment of Geological Environments

Applied in Ireland for Study of Spatial Areas

Groundwater & Planning

INTERNATIONAL ASSOCIATION OF HYDROGEOLOGISTS - Irish Group

Proceedings of the 43rd Annual Groundwater Conference

Tullamore Court Hotel, 18th and 19th April 2023

PEAT STABILITY ON UPLAND SITES: THE ROLE OF HYDROGEOLOGY

Eileen McCarthy, *University College Cork*

IN SITU CHARACTERISATION OF PEATLANDS USING GEOPHYSICAL TECHNIQUES

Andy Trafford, iCRAG & UCD, Dublin

INTRODUCTION

Engineering on peatlands has always given engineers certain specific problems to overcome, with access, ground stability, sampling, and site classification all posing distinctive challenges. These challenges have been brought further to the forefront due to the acknowledgement that these unique environments are hugely important from and ecological viewpoint with high habitat value, and extensive carbon and water storage properties. Along with the need to develop certain infrastructure projects, there is an increasing pressure to maintain, protect and restore peatlands with the assessment of their characteristic properties become much more relevant in order to reduce the risk in terms of peat slides.

In this paper we show how using light weight portable equipment developed specifically for peat soil assessment we can assess the in situ properties of peat for input into slope stability analysis.

INVESTIGATION METHODOLOGY

By combining the outputs from Ground Penetrating Radar and Vertical Shear Wave Profiling it is possible to determine both the electromagnetic and mechanical response of the peat soil providing the required input parameters for a comprehensive geotechnical assessment to be carried out.

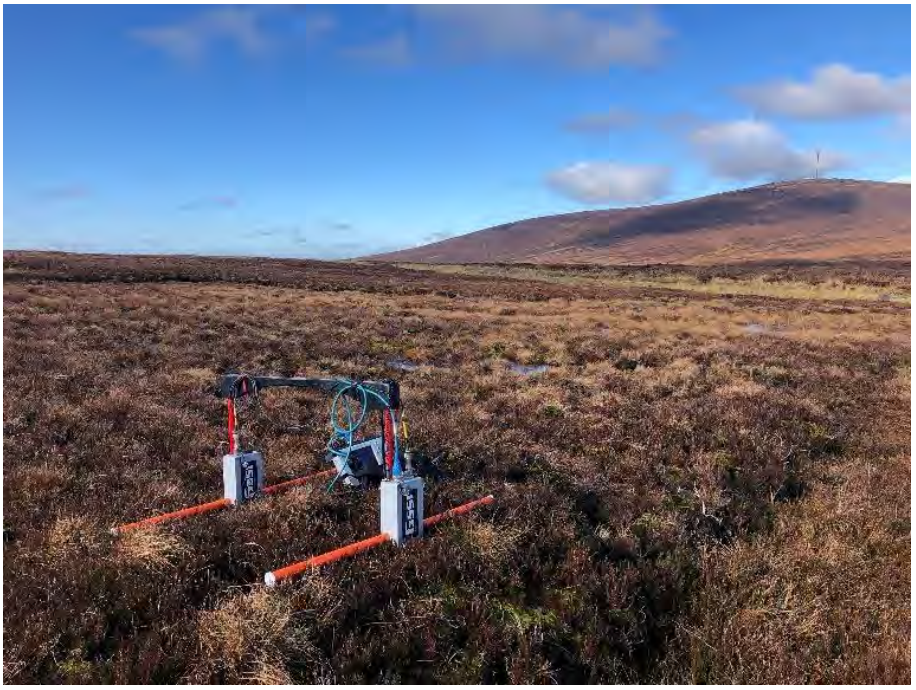


Figure 1: *80MHz GPR antenna operated from GSSI SIR 3000 system. Liffey Head Bog*

Ground Penetrating Radar (GPR) is accepted as being the most effective method for accurately and comprehensively assessing the peat thickness and distribution across a site. This method involves the transmission of high frequency radio waves into the subsurface and recording the reflected waveforms. The method involves the collection of data along survey transects to build up a 2D cross section through the peat (*Figure 1*). By linking the output from the GPR system to accurate elevation data it is possible to generate accurate sub peat elevation maps for use in slope stability assessments.

The shear strength of peat is one of the key parameters in engineering design when dealing with foundation and slope stability issues. Its determination has previously been particularly difficult due to factors such as the fibre content, degree of humification, drainage, water content, organic matter, and also from sample disturbance where laboratory methods are employed (Kazemian et al. 2011; O'Kelly 2017).

A Russian auger (Jowsey 1966) was used to obtain a 45 mm diameter “half core” of the peat over the full depth profile. The peat was logged on site using the extended version (Hobbs 1986) of the von Post and Granlund peat classification scheme (von Post and Granlund 1926). Samples of the peat were taken at 0.1 m intervals for water content measurements. These water content measurements would later be used in conjunction with the field shear wave velocity measurements which were taken at the same depth intervals and frequency and down the same borehole as that used for logging the peat.

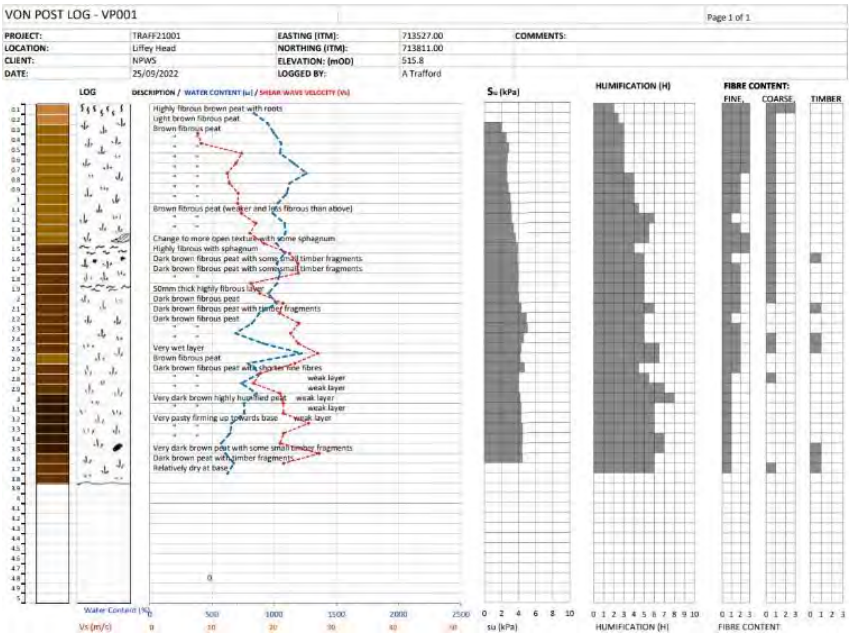


Figure 2: *Typical output from VSWP and peat logging including undrained shear strength and Von Post classification***.**

By using Vertical Shear Wave Profiling (VSWP) along with water content analysis it is possible to determine the required undrained shear strength (s_u) parameter (*Figure 2*). By measuring V_s in situ it is possible to take into account the stress history and the current stress state of the peat (*Figure 3*).

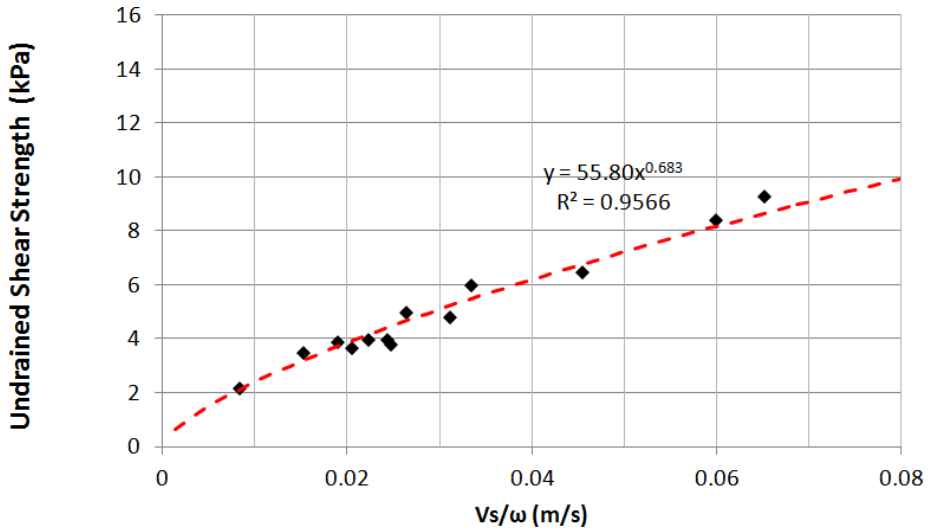


***Figure 3**: Relationship between su, Vs and w for saturated fibrous peat.*

This relationship can be written as:

$$s_u = C\left(\frac{V_s}{w}\right)^n$$

where: C and n constants
(55.8 and 0.683 respectively, for saturated fibrous peat)

The remaining topographical parameters are determined by integration of the GPR data with either traditional survey data or more recently the use of lidar surface mapping (*Figure 4*).

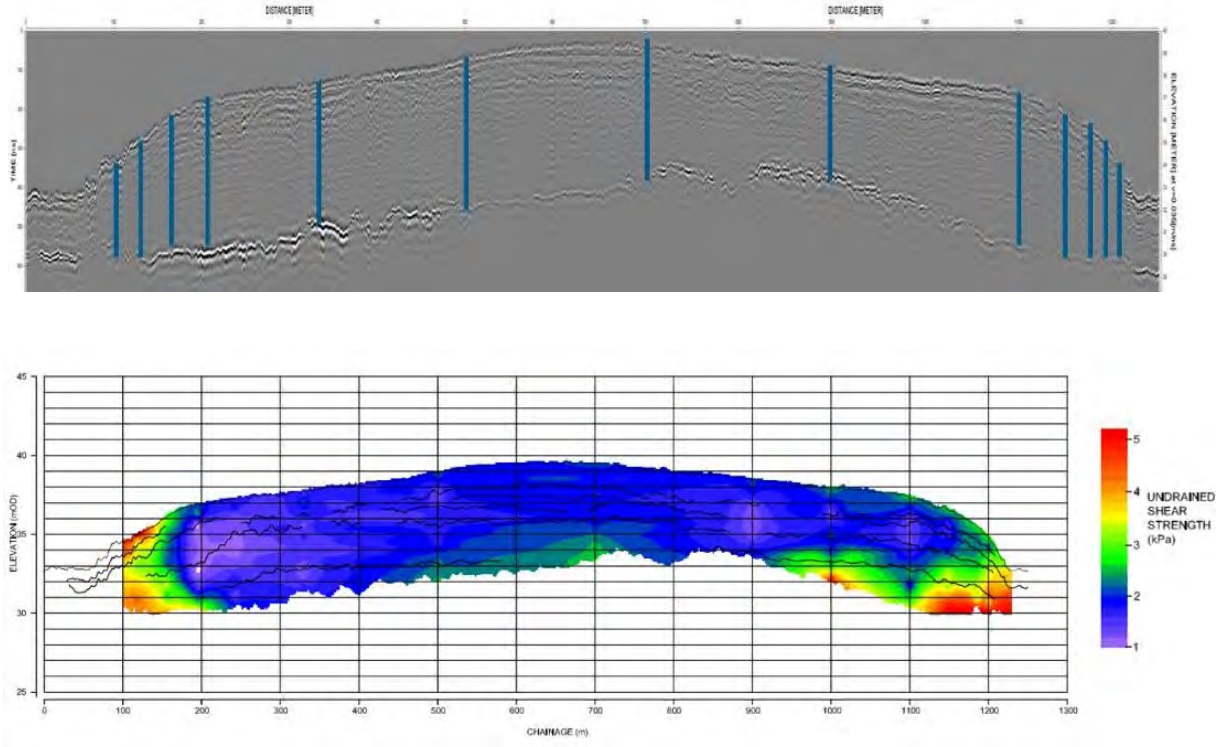


***Figure 4:** Topographically corrected GPR profile (a) with interpolated Undrained Shear Strength profile (b). Moanvenlagh Bog, Co. Kerry.*

SLOPE STABILITY ASSESSMENTS

In order to carry out a quantitative assessment of the risk posed by peat stability an infinite slope analysis to calculate the factor of safety (FoS) is used. The inputs to this analysis include assessing the peat thickness, topography as well as the undrained shear strength of the peat across the site and using the formula:

$$FOS = \frac{c_{u,d}}{\gamma_{sat,d} h (sin\beta)(cos\beta)}$$

$c_{u,d}$	Undrained shear strength
$\gamma_{sat,d}$	Saturated unit weight
h	peat depth
β	basal peat slope

The FoS gives an assessment of the instability of a peat slope with a FoS of < 1.0 indicating an unstable slope liable to fail. Typically a FoS of 1.3 is used to represent a stable slope with low risk of failure. Using this approach it is also possible to model the effect of loading of the peat by applying a surcharge to represent the effect of different construction practices. *Figure 5 (d)* shows a surcharge designed to represent the effect of loading of a typical c. 1.5psi ground bearing machine proposed to carry out the restoration works.

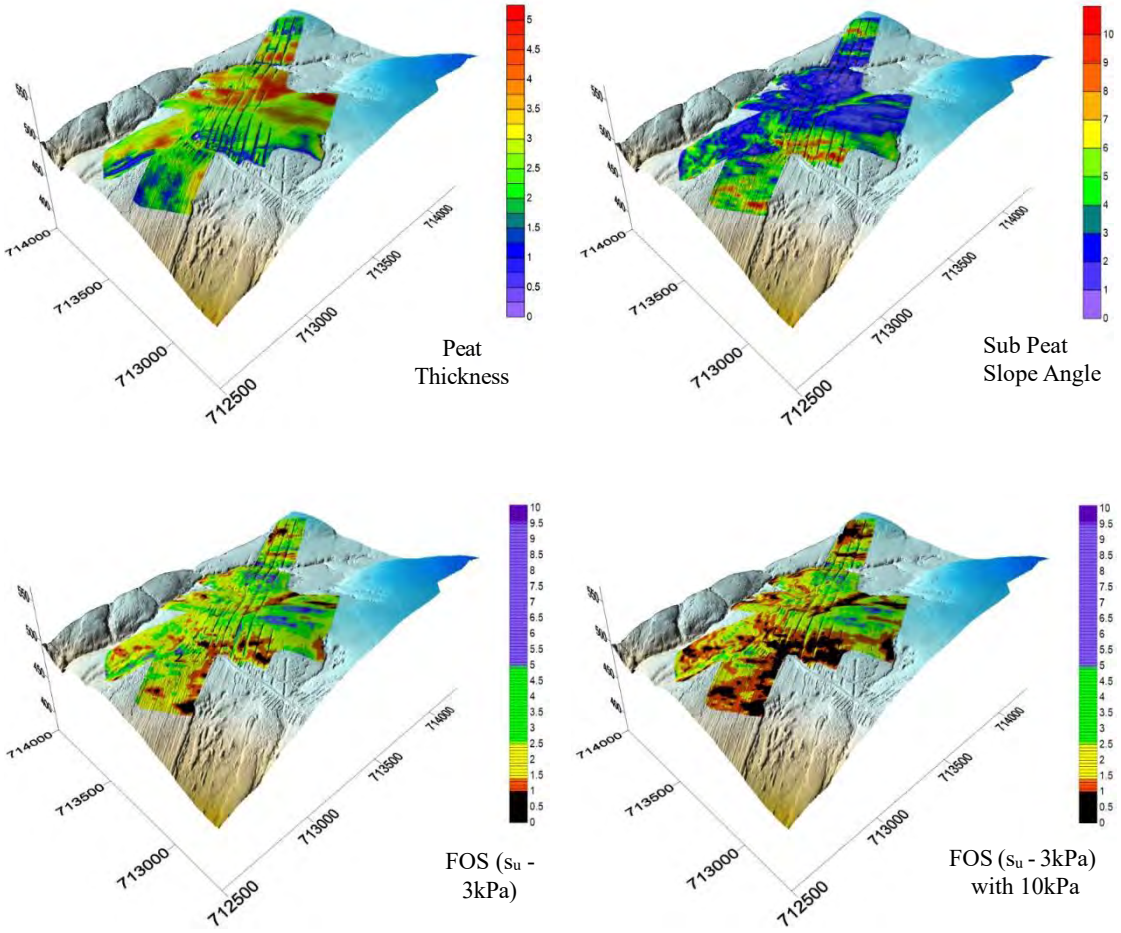


Figure 5: *Topographically corrected plots showing sequence of slope stability analysis. (a) peat thickness, (b) sub peat slope angle, (c) FOS using determined s_u, (d) FOS using determined s_u and 10kPa surcharge.*

REFERENCES

Hobbs, N. B. (1986). "Mire morphology and the properties and behaviour of some British and foreign peats." *Quarterly Journal of Engineering Geology and Hydrogeology*, 19, 7- 80.

Jowsey, P. C. (1966). "An improved peat sampler." *New Phytologist*, 65, 245-248. Kazemian, S., Huat, B., Prasad, A., and Barghchi, M. (2011). "A state of art review of peat, geotechnical engineering perspective." *International Journal Physical Science*, 6(8).

Long, M., and Boylan, N. (2012). "In situ testing of peat – a review and update on recent developments." *Geotechnical Engineering Journal of the SEAGS & AGSSEA*, 43(No. 4, December), 41 - 55.

O'Kelly, B. (2017). "Measurement, interpretation and recommended use of laboratory strength properties of fibrous peat." *Institution of Civil Enginers Journal of Geotechnical Research, Thomas Telford Ltd*, 4(3), 136 - 171.

Trafford, A. (2017). "In situ measurement of shear wave velocity and its use in the determination of undrained shear strength of peat, MEngSc thesis, University College Dublin, May."

Vaughan, P. R., Maccarini, M., and Mokhtar, M. B. S. M. (1988). "Indexing the engineering properties of residual soils." *Quarterly Journal of Engineering Geology*, 21, 69 - 84.

von Post, L., and Granlund, E. (1926). "Peat resources in southern Sweden." *Sveriges geologiska undersökning, Yearbook*, 335(19.2 Series C), 1 – 127.