Foel Fach Wind Farm Limited.

Foel Fach Wind Farm - Environmental Statement Volume II

Main Written Statement – Chapter 7

Project Reference: 664094

This chapter is summarised within the Non-Technical Summary of this Environmental Statement.

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7 LAND, SOILS AND WATER

7.1 Introduction

7.1.1 This chapter presents an assessment of likely significant effects arising from the construction, operation and decommissioning of the Proposed Development upon land, soils and water.

7.1.2 This chapter is supported by the following appendices presented in Environmental Statement **(ES) Volume III**:

- Appendix 7.1: Flood Consequences Assessment
- Appendix 7.2: Watercourse Crossing Schedule
- Appendix 7.3: Water Framework Directive Assessment
- Appendix 7.4: Outline Peat Management Plan
- Appendix 7.5: Peat Slide Risk Assessment
- Appendix 7.6: Borrow Pit Assessment
- Appendix 7.7: Groundwater-Dependent Terrestrial Ecosystem Assessment
- Appendix 7.8: Private Water Supply Risk Assessment
- Appendix 7.9: Outline Soil Management Plan
- Appendix 7:10: Outline Drainage Strategy

7.1.3 This chapter is supported by the following figures presented in **ES Volume IV**:

- Figure 7.1: Study Areas
- Figure 7.2: Bedrock Geology
- Figure 7.3: Superficial Geology
- Figure 7.4: Soils and Peat Soils
- Figure 7.5: Peat Soil Depth
- Figure 7.6: Hydrological Catchments and Watercourses
- Figure 7.7: Private Water Supplies
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- Figure 7.10: Water Quality Monitoring Locations

7.2 Consultation and Scope

Scoping Direction

7.2.1 The scope of this assessment has been established through an ongoing scoping process. This has involved the production of an Environmental Impact Assessment (EIA) Scoping Report (provided in **ES Volume III, Appendix 1.1: EIA Scoping Report**), which was submitted to Planning and Environment Decisions Wales (PEDW) in July 2024. Further information on the scoping process can be found in **ES Volume II, Chapter 4: Approach to the EIA**.

7.2.2 The Scoping Direction, a copy of which is included in **ES Volume III, Appendix 1.2: EIA Scoping Direction and Addendum**, was received on the 5 December 2024 and 18 December 2024. **Table 7.1** summarises the key Scoping Direction comments related to this assessment, and sets out how these have been addressed by the Applicant.

Table 7.1 Summary of Scoping Direction Comments Relevant to the Land, Soil and Water Assessment

ID no.	Issue	Summary of comment raised	Applicant response
ID.40	Consultees	Natural Resources Wales (NRW) advises Land Quality Advice Service (LQAS) is also consulted and PEDW concurs.	LQAS has been consulted; details are provided in **Table 7.2** below.
ID.41	Surveys-Land and Soil	NRW highlight that a Phase 1 peat survey may not pick up peat soils and shallow peats occurring at scales smaller than the 100 m grid used and recommend Phase 2 surveys.	Phase 2 peat depth surveys have been undertaken, with results provided in **ES Volume III, Appendix 7.4: Outline Peat Management Plan.**
ID.41	Surveys-Land and Soil	NRW also advises undertaking mapping of Section 7 habitats as part of the Phase 2 survey to ensure irreplaceable peatland habitats are avoided, as well as National Vegetation Classification (NVC) survey.	This is covered in the **ES Volume II, Chapter 5: Terrestrial Ecology**.
ID.41	Surveys-Land and Soil	NRW highlights it does not regard hand-held probing as a reliable assessment methodology for peat if not supported by confirmatory coring.	Peat coring and in situ Von Post Classification have been undertaken in addition to hand-held probing, with further details on the methodology and results provided in **Appendix 7.4**.
ID.42	Surveys-Peat survey report	NRW notes that the maps should include areas of 10-20 cm peat and 20-30 cm peat as these are important if they connect areas of deeper peat and support hydrological connectivity. NRW also notes that Table 3 [of the EIA Scoping Report] states that penetration of 0-30 cm indicates no peat is present. They however advise that anything over 10 cm should be considered shallow peat. NRW further advises that 10 peat core locations are insufficient and that further peat cores are required to confirm the probing is reliable. They also	ES Volume IV, Figure 7.5: Peat Soil Depth shows interpolated peat soil maps with areas of 10-20 cm and 20-30 cm soil depths. 105 peat cores were taken across the application boundary. The variance between core and probe depth is often related the presence of clay, as evidenced in the peat core analysis.

ID no.	Issue	Summary of comment raised	Applicant response
		highlight that the stated variance of 10 cm is not considered acceptable. NRW also query that there is no mention of any boulder clay underneath, which they would have expected. LQAS states that on Figure 1, detail of soil type for probe locations less than 0.3 m of peat should be provided and all probe and coring points should be indicated on the mapping. PEDW recommends the applicant liaises directly with NRW and LQAS regarding these concerns and ensures that these matters are clearly addressed in the ES.	Further details on the methodology and results provided in **Appendix 7.4**. During site surveys, clay was found to be present at numerous locations. This is discussed fully in **Appendix 7.4**. Details of soil types can be found in **ES Volume IV, Figure 7.5**.
ID.43	Surveys-Water	The applicant's attention is drawn to comments from NRW regarding the hydrological and geological walkover survey, advising site investigation including monitoring is carried out to inform the proposed infrastructure, the nature of hydraulic linkages between infrastructure locations and Groundwater-Dependent Terrestrial Ecosystems (GWDTE), Private Water Supply (PWS) and watercourses, notably crossings for access tracks and cabling. NRW adds that useful ground characterisation and monitoring locations include GWDTEs near wind farm infrastructure or wind turbine foundations.	A hydrological and geological walkover survey was undertaken; details of this survey are provided in **ES Volume III, Appendix 7.2: Watercourse Crossing Descriptions**. A water quality monitoring programme is provided in **Table 7.21**. The nature of hydrological linkages between infrastructure locations and GWDTE, PWS and watercourses are discussed in **ES Volume III 7.2, ES Volume III 7.7: Groundwater-Dependent Terrestrial Ecosystem Assessment** and **ES Volume III 7.9: Private Water Supply Risk Assessment**. Groundwater monitoring locations are recommended post-consent to avoid unnecessary disturbance to peat soils.

ID no.	Issue	Summary of comment raised	Applicant response
ID.44	Baseline conditions- Land and Soil	The applicant's attention is drawn to NRW's comments regarding Soils and Peat, seeking clarification on the statement in the SR about evidence scores and correcting the reference for the work. PEDW recommends the applicant liaises directly with NRW to provide the required clarification and ensures this is appropriately addressed in the ES. The applicant's attention is also drawn to comments from LQAS stating a robust baseline is required, informing options for all infrastructure siting and working area, to ensure that peatland and impacts to hydrological functions can be adequately assessed. LQAS adds that location and extent of mineral, organo-mineral and shallow peat (where not integral to the functioning of a peat body) soils on site and their physical characteristics is also required to assess potential impacts and inform decisions on all infrastructure locations including the restoration and beneficial after use.	Evidence score is based upon the Welsh Government's appraisal; the corrected reference of (Welsh Government, 2022) is provided in paragraph **7.4.23**. Aside from the evidence score, the peat soil assessment in this chapter is primarily based on data from the Phase 1 and 2 peat soil surveys as well as the peat coring conducted throughout the Site. A robust baseline has been attained through Phase 1 and 2 probing and peat coring throughout the Site. A detailed assessment of peat soils and its reuse is provided in **Appendix 7.4**.
ID.45	Baseline conditions- Water	The applicant's attention is drawn to comments from NRW regarding baseline conditions and monitoring. NRW asks for confirmation of when baseline monitoring will commence and for how long before construction takes place. NRW advises a draft monitoring plan is prepared and provided to NRW and other stakeholders for comment. They also seek confirmation of when the results of ground characterisation and monitoring will be shared with NRW. PEDW recommends the applicant liaises directly with NRW to discuss the draft monitoring plan and provide the requested clarification, ensuring these matters are clearly outlined in the ES.	A hydrological walkover survey has been undertaken to establish baseline water conditions. Hydrological monitoring locations are recommended post-consent to avoid unnecessary disturbance to peat soils. A water quality monitoring programme would be established at key locations around the Proposed Development. Monitoring would begin prior to any construction works, to provide a pre-construction baseline to enable future comparison. Details and location of water quality monitoring and draft monitoring plans are found in **Table 7.21**. A detailed

ID no.	Issue	Summary of comment raised	Applicant response
			monitoring plan is also provided in the **ES Volume III, Appendix 2.1: Outline Construction Environmental Management Plan.**
ID.46	Groundwater conditions	The applicant's attention is drawn to NRW's comments highlighting insufficient information has been provided in the Peat Depth Survey Report and the NVC habitat map on groundwater conditions within the peat deposits or at the proposed turbine locations. They add this would inform dewatering requirements and impacts, including potential impacts on local peatland and areas of GWDTE. NRW highlights that it currently is unclear how areas of peatland, GWDTE, groundwater and proposed turbine locations are linked. They add that it is not possible to determine if the wider wind farm infrastructure including turbine locations, haul roads, sub-surface cabling trenches and drainage, will negatively interact with and impact upon the shallow groundwater system that supports areas of peatland and GWDTEs. PEDW recommends the applicant liaises directly with NRW on the information and detail required, ensuring this is included in the ES.	An updated Peat Depth Survey Report and peat soil deposits can be found in **Appendix 7.4**. An updated NVC habitat map and GWDTE maps can be found in **ES Volume III, Appendix 7.7: Groundwater-Dependent Terrestrial Ecosystem Assessment**. The impact of the Proposed Development on GWDTEs is addressed in **Appendix 7.7**. NRW was consulted, with details of the liaison found in **Table 7.2**. Ground investigations would take place pre-construction, owing to the complexity of gaining access at this stage of the process.
ID.47	Maps	The applicant's attention is drawn to comments from LQAS highlighting the minimum requirements for a peat map. LQAS adds that overlayed maps should be provided of peat depth and distribution, NVC communities and subcommunities, habitats present (aligned to Section 7 list habitats) and all infrastructure locations.	A map showing the peat soil depth distribution with NVC communities, habitats present, and infrastructure locations is provided in **ES Volume IV, Figure 7.9: Potential Groundwater-Dependent Terrestrial**

ID no.	Issue	Summary of comment raised	Applicant response
		The applicant's attention is further drawn to comments from LQAS recommending the preparation of a constraints map to advise the design phase. The map should be supported by field survey information in the ES and should take account of the advice provided in LQAS' response.	**Ecosystem Habitats (GWDTE) and Peat Soil Depth.** A constraints map was used to guide and refine the design process to avoid sensitive areas and minimise potential impacts. The constraints map is provided in **ES Volume IV, Figure 3.1: Environmental Constraints** and Designated Sites are shown in **ES Volume IV, Figure 7.8: Designated Sites.**
ID.48	NVC	The applicant's attention is drawn to comments from NRW and LQAS regarding the NVC habitat map, highlighting issues with identification of NVC types and advising an overlay over peat depth mapping. NRW also recommends the NVC report is shared with them to check if NVC (sub) communities have been correctly assigned. PEDW recommends the applicant liaises directly with NRW on this matter and ensures the agreed approach is clearly represented in the ES.	**ES Volume IV, Figure 7.9** demonstrates NVC habitats overlaid on the peat depth mapping. NRW have been contacted regarding NVC data, so far there has been no response (details are provided in **Table 7.2** below).
ID.49	Assessment methodology	The Scoping Report states that effects significance is assessed using a matrix based on sensitivity of the receptor, magnitude of effect [sic impact] and likelihood of effect. Regarding the effects considered likely to require assessment for construction and operation outlined in the Scoping Report, NRW states that in addition to peat instability, impact on peat soils and peatland habitats also needs to be considered. They add that it is their understanding the provisions in Planning Policy Wales (PPW) make no reference to effect significance	The impacts of the Proposed Development on peat soil are assessed and addressed in **Table 7.19** and **Appendix 7.4**. 'Peatland' refers to the habitat on peat soils and is assessed in **ES Volume II, Chapter 5: Terrestrial Ecology**. The policies and guidance recommended by NRW and LQAS have been used in the preparation of this ES chapter (further details are provided in **Section 7.3**).

ID no.	Issue	Summary of comment raised	Applicant response
		regarding peatland habitat and peat soils, but relate to irreplaceable habitats and peat. NRW also highlights a correction to the reference to PPW in the Scoping Report, needing to be PPW 12, 2024. The applicant's attention is further drawn to comments from LQAS highlighting policies and guidance which are also applicable in determining significance.	
ID.51	Peatland definition	The applicant's attention is drawn to LQAS' comments regarding the definition of peatlands to be used for assessment. They add that it will need to be acknowledged that peatlands function as an ecosystem and shallow peat soils (<30 cm deep) supporting peatland habitat and/or integral to the hydrological functioning of wider peat bodies (either on site or adjoining) should also be included in the assessment.	The definition of peat soils as specified by the Welsh Government has been used as a basis for determining impacts on peat soils. It is acknowledged that shallower soils adjacent to areas of peat soils can play a role in the hydrological function of peat soil bodies and this is taken into account in all assessment of peat soil. 'Peatland' refers to the habitat on peat soils and is assessed in **ES Volume II, Chapter 5: Terrestrial Ecology.**
ID.52	Peat, peat soils and peatland	The applicant's attention is drawn to comments from LQAS stating development and loss of peatland is contrary to Chapter 6 of PPW 12, in respect of the step-wise approach. The department highlights that in relation to consideration of alternative sites and infrastructure siting, it expects the assessment to clearly demonstrate the application of the step-wise approach. They state it is not clear how the step-wise approach has been considered to avoid irreplaceable peatland habitats, including the natural resources that underpin them.	The stepwise approach has been considered to avoid irreplaceable peatland habitats where possible. This is detailed further in **Appendix 7.4** and the **Green Infrastructure Statement** submitted as part of the application as a standalone report.

ID no.	Issue	Summary of comment raised	Applicant response
		NRW also draws the applicant's attention the strong emphasis given to the avoidance of peat resources in PPW and the stepwise approach. NRW further highlights that in order to safeguard irreplaceable habitats and peat, the infrastructure should seek to avoid areas of shallow peat connected to areas of deep peat.	
ID.53	Soil Management Scheme	The applicant's attention is drawn to comments from LQAS stating a soil management scheme should be prepared. LQAS adds this should set out how all soils and their functions will be conserved and reinstated at decommissioning. LQAS in their response provide further detail on the requirement for the scheme. PEDW recommends this is included as a technical appendix to the ES.	Details relating to soils and their function can be found in **ES Volume III, Appendix 7.9: Outline Soil Management Plan.**
ID.54	Excavation	The applicant's attention is drawn to comments from LQAS stating the volumes of each peaty and mineral soil unit that will be excavated for any on site infrastructure should be clear and based on survey evidence. They add that for all infrastructure, information should be provided on the current condition of the site, sufficient to clearly demonstrate that resources are available to put in place the appropriate standard of reclamation.	Details relating to volumes of each peaty and mineral soil unit can be found in **Appendix 7.4** and **Appendix 7.9.**
ID.55	Dewatering	The applicant's attention is drawn to comments from NRW seeking clarity on dewatering requirements. NRW advises that a dewatering assessment is provided as the nature and extent of this can affect local receptors such as peat, GWDTE, baseflow to water courses, springs and potentially PWS.	It is not anticipated that dewatering would be required for extraction of aggregates from borrow pits. Impacts to vulnerable receptors are assessed and addressed in **Table 7.19**.

ID no.	Issue	Summary of comment raised	Applicant response
ID.56	Cable trenches	The applicant's attention is drawn to comments from NRW regarding cable trenches, advising that an assessment and suitable mitigation be in place to ensure that cable trenches do not act as preferential flow paths for the movement of shallow water / stormwater. They note this is also relevant to the access tracks stormwater management and is important for Construction, and Operational Drainage Design.	This has been addressed in **Table 7.18**.
ID.57	Water Framework Directive (WFD)	NRW highlights the development involves works in the vicinity of a number of watercourses and has the potential to affect their status. NRW advises a standalone WFD Compliance Assessment is provided, which clearly demonstrates that the development will not prevent any water bodies from meeting their objectives or cause deterioration. NRW states they expect reference to impacts on ecology (including fish), hydromorphology and water quality and highlights where details can be found on GWDTE and WFD protected areas. NRW highlights they can provide further advice on the scope of this assessment. PEDW recommends the applicant liaises directly with NRW on the scope of this assessment and includes it as a technical appendix to the ES.	Details relating to this can be found in the WFD assessment **ES Volume III, Appendix 7.3: Water Framework Directive Assessment**. Impacts on ecology (including fish) can be found in **ES Volume II, Chapter 5: Terrestrial Ecology**.
ID.58	Foul drainage	The applicant's attention is drawn to comments from NRW regarding foul drainage and the potential impact of the Proposed Development on water quality, noting the proposed site is within the River Dee and Bala Lake Special Area of Conservation (SAC).	A commitment will be made to tankering foul drainage offsite for disposal at a wastewater treatment works outside a phosphate-sensitive catchment. The welfare facilities would have a suitably sized holding tank to contain the wastewater for storage until the tanker can remove it for treatment.

ID no.	Issue	Summary of comment raised	Applicant response
ID.59	Flood risk	As highlighted in earlier sections above, NRW advises a Flood Consequence Assessment (FCA) is produced in support of the application and that this should be informed by the Flood Map for Planning. This should include reference to changes to surface water flows. They add that Cyngor Gwynedd should also be consulted on flood risk as the Lead Local Flood Authority. PEDW recommends the FCA is included as a technical appendix to the ES.	Gwynedd Council were contacted at scoping. Following comments from consultees, a FCA is provided as a technical appendix in **ES Volume III, Appendix 7.1: Flood Consequences Assessment.** Gwynedd Council were consulted at scoping.
ID.60	Impoundments	NRW draws the applicant's attention to two impoundment licences, the operation of which should not be adversely impacted by the Proposed Development.	The FCA provided in **Appendix 7.1** concludes that there would be no adverse impacts from the two impoundments.
ID.61	Contamination risks	The applicant's attention is drawn to comments from NRW advising that an assessment of the operational contamination risks posed by any new infrastructures and their components over the expected lifespan of the infrastructures is carried out, to assess the potential for pollutants to be released from infrastructure components. The applicant's attention is also drawn to comments from MotVind on this matter. NRW advises this should be considered within the windfarm design to assess if additional engineering measures are required to protect the environment during operation and adds this may include considerations of chemicals being released to the drainage / stormwater management system.	The impacts of spillages and contaminants are considered in the chapter and PWS assessment, detailed **Table 7.17** and **ES Volume III, Appendix 7.8: Private Water Supply Risk Assessment.**

Additional Consultation

7.2.3 **Table 7.2** provides a summary of the additional consultation activities undertaken in support of the preparation of this assessment outside of the EIA Scoping process.

Table 7.2 Summary of Additional Consultation Undertaken

Consultee	Date of engagement	Summary of matters discussed	Applicant response
Conwy Council	20 November 2024	Request for the locations of PWS within a 15 km radius of the Site.	A list of PWS was received and is discussed in .
National Resources Wales (NRW)	3 June 2025	Informed NRW that baseline monitoring is not proposed. Also informed NRW of the GWDTE assessment and which NVC classification is being used.	NRW suggested that further site ground investigations should be undertaken before the post-consent phase.

Scope of the Assessment

7.2.4 The technical scope of this assessment has been established through an ongoing scoping process. As a result of this process, the technical scope of the assessment reported in this chapter comprises:

- Surface water;
- Flood risk;
- Peat, peat soils and peatland;
- Groundwater, GWDTE and PWS sources;
- Designated sites; and
- Geological receptors.

7.2.5 The following matters are considered unlikely to result in likely significant effects, and therefore have been scoped out of the assessment, as agreed through the EIA scoping process:

- Mineral mining.

7.2.6 As set out in **Table 7.1**, effects on peatland habitats are considered elsewhere within this ES.

7.2.7 **Table 7.3** summarises where the scope of the assessment has changed since the receipt of the Scoping Direction, which is presented in **Appendix 1.2**.

Table 7.3 Receptor/Matters Changed Since the Scoping Direction

Receptor/matter	Phase	Justification
Geological receptors	Construction	Scoped out as no sensitive receptors were identified.

7.3 Methodology

7.3.1 This assessment has been undertaken in accordance with the following legislation, and with regard to the following planning policy and guidance. It should be noted that this chapter does not assess the compliance of the Proposed Development against relevant planning policy. Such an assessment is presented in the Planning Statement.

Legislation

- Water Act 2014
- Flood and Water Management Act 2010
- Water Supply (Water Quality) Regulations 2018
- Private Water Supplies (Wales) Regulations 2017
- Pollution Prevention and Control (England and Wales) Regulations 2000
- Water Environment (WFD) (England and Wales) Regulations 2017

National Planning Policy

- Future Wales: The National Plan 2040, February 2021
- Planning Policy Wales (12th edition), February 2024, with particular reference to Chapter 6 Distinctive and Natural Places

Local Planning Policy

- Cyngor Gwynedd: Anglesey and Gwynedd Joint Local Development Plan 2011 – 2026, July 2017

Guidance

- Technical Advice Note 15: Development, flooding and coastal erosion, March 2025
- Design Commission for Wales, Guidance: Designing for Renewable Energy in Wales, November 2023
- The Environment Agency's approach to groundwater protection (2018) (GP3) Version 1.2 adopted by NRW
- The Environment Agency and the Department for Environment, Food and Rural Affairs' Guidance on Groundwater risk assessment for your environmental permit (2018)
- NRW's How to comply with Sustainable Drainage Systems (SuDS) standards (2022)
- The Sustainable Drainage Systems (SuDS) Manual C753 (CIRIA, 2015)
- Guidance for Pollution Prevention, with particular reference to:
- Understanding your environmental responsibilities-good environmental practices 2021 (GPP1) Version 1.2;
- The Environment Agency's approach to groundwater protection (2018) (GP3) Version 1.2 adopted by NRW; and
- GPP5: Works and maintenance in or near water: GPP 5 2018 (Version 1.2).

Baseline Characterisation

Extent of the Study Area

7.3.2 For most constraints and sensitivities, the study area is considered to be up to 2 km from the Site. Geological and soil sensitivities do not transmit over any significant distance, therefore the study area for geological considerations is 1 km from the application boundary. For hydrological and hydrogeological aspects, a distance up to 5 km downstream of the application boundary has been considered, as impacts such as pollution events can be transmitted downstream for greater distances. The study areas considered for this assessment are shown in **ES Volume IV, Figure 7.1: Study Area.**

Desk Study

7.3.3 The initial desk studies were undertaken to determine and verify the baseline conditions through review and collation of available and relevant information relating to hydrology, hydrogeology, geology and soils. This included review of the following data sources:

- Meteorological (Met) Office (Met Office, 2016)
- British Geological Survey (BGS) GeoIndex (BGS, 2025)
- Geological Survey of England and Wales 1:63,360/1:50,000 geological map series ((BGS, 1993); (BGS, 2025))
- Cranfield University's National Soils Mapping (Cranfield University, 2015)
- The Peatlands of Wales Map (Welsh Government, 2022)
- Flood Estimation Handbook (FEH, 2025)
- Environmental Information Portal (NRW, 2025d), and
- NRW Water Watch Wales Map Gallery (NRW, 2021).

7.3.4 PWS data was requested and provided from Gwynedd County Council's Environmental Health Department with additional data provided by local landowners, property owners and tenants.

Field Study

7.3.5 Four site visits and a walkover survey were undertaken to:

- Verify information collected during the baseline desk study;
- Undertake a visual assessment of the main surface waters, and verify any PWS, including intakes that could be affected by the Proposed Development;
- Identify drainage patterns, areas vulnerable to erosion or sediment deposition, and any pollution risks;
- Allow appreciation of the Site including awareness of gradients, access track options including potential watercourse crossings, prevailing ground conditions, and to assess the relative location of all the components of the Proposed Development; and
- Collection of peat soil and substrate information where exposures are present, for example in watercourse channels and alongside existing infrastructure.

7.3.6 The walkover survey was undertaken on 14 and 15 October 2024. The weather was overcast with fog and occasional rain showers.

7.3.7 In addition to the walkover survey, peat soil depth surveys were also undertaken. The Phase 1 survey involved undertaking a peat soil depth survey with a hand-held probe on a 100 m grid across the Site, to identify areas of peat soil and natural variation in the peat soil substrate across the area. These surveys were undertaken in December 2023 and followed survey guidance (Scottish Government, Scottish Natural Heritage and SEPA, 2017).

7.3.8 Following commencement of the infrastructure design process, a Phase 2 survey was undertaken for areas of infrastructure and access tracks. Probing was undertaken at approximately 10 m intervals for infrastructure and 25 m intervals with 25 m offsets along proposed access track routes and in areas nearby to ensure that sufficient peat soil depth data was available to inform track design. These surveys were undertaken between 13 and 25 October 2024. Infrastructure design was further reviewed following the initial Phase 2 survey and a further Phase 2 peat soil survey was undertaken between 25 November and 1 December 2024, with additional gap-filling surveys undertaken between 19 and 21 February and on 17 April 2025 to cover areas of infrastructure relocation following further design amendments.

7.3.9 Peat soil coring surveys were undertaken between 25 November 2024 and 1 December 2024, 19 and 21 February and on 17 April 2025 to collect peat soil core samples for analysis at various locations across the Site including within the proposed infrastructure and access track locations.

Assessment Methodology

7.3.10 The assessment has been undertaken through a desk study and site inspection of existing geology, hydrogeology, hydrology and soils-related features on and surrounding the Site. The existing conditions within the study area have been characterised and described within **Section 7.4** and the potential risks that may be associated with the Proposed Development identified and assessed in **Sections 7.6** and **7.8**.

7.3.11 Following the field surveys described in the previous paragraphs, a geomorphological mapping exercise was undertaken to link the topographical features with the underlying geology, and to identify areas of the Site that may be potentially at risk from peat landslide. This made use of collected field data, digital terrain model (DTM), topographical mapping and aerial and satellite photography.

7.3.12 Information obtained from the review of existing data, site surveys and guidance documentation formed the basis of assessment of the potential effects associated with the Proposed Development. Where potential likely significant effects were identified, mitigation measures have been proposed.

7.3.13 In addition to the impact assessment contained within this chapter, a number of Appendices have been prepared to address specific areas of interest raised by consultees. These are outlined in the following paragraphs.

7.3.14 An assessment of flood consequence, focusing on downstream flood risk and surface water management, was undertaken for the Proposed Development. The assessment includes an overview of the current hydrological setting onsite and ways to control surface water runoff such that post-development discharge is no greater than greenfield runoff levels. These assessments are provided in **Appendices 7.1** and **7.10**.

7.3.15 An assessment of watercourse crossings was undertaken to identify locations where watercourse crossings are required within the Proposed Development. The assessment provides rationale for their need within the Proposed Development, as well as background descriptions of the watercourse crossing locations and the process of layout design. Two new crossings and one upgraded crossing would be required. One new crossing and the upgraded crossing would be bottomless arch or box culverts. The other new crossing would be a single-span bridge. The assessment is provided in **Appendix 7.2**.

7.3.16 A WFD compliance assessment was undertaken to consider potential impacts to WFD waterbodies within and downstream of the Proposed Development. The assessment identifies the current 'baseline' hydromorphological, biological and chemical status of the waterbodies and assesses the potential impacts of the Proposed Development on that status. The WFD assessment determines if the proposals are compliant with the WFD in terms of prevention of deterioration of ecological status of the WFD waterbody and the potential achievement of future targets for the waterbody. The assessment is provided in **Appendix 7.3.**

7.3.17 A peat management plan was prepared to investigate anticipated volumes of peat soil required to be removed for construction of the Proposed Development and appropriate reuse of the excavated material. The assessment was informed by the collated peat soil depth probing described above, combined with a full appraisal of potential reuse opportunities, for example reinstatement and landscaping associated with the infrastructure. Where opportunities were identified to integrate the peat management plan with wider environmental enhancement measures, such as peatland restoration and biodiversity enhancement, the peat management plan identifies the volume and type of peat soil to be used for this activity. The assessment is provided in **Appendix 7.4**.

7.3.18 A peat slide risk assessment was undertaken for the Proposed Development. The assessment was informed by the peat soil depth data, peat soil depth surveys and coring, walkover survey, geomorphological mapping and terrain classification produced from a DTM. The assessment used a combined qualitative (contributory factor) and quantitative (factor of safety) approach to determine the likelihood of peat landslides within the Site. Areas with the highest likelihood were compared with identified receptors to identify and determine appropriate mitigation measures. The assessment is provided in **ES Volume III, Appendix 7.5: Peat Slide Risk Assessment.**

7.3.19 A borrow pit assessment was undertaken for the Proposed Development. The assessment outlined the details with respect to the operational design for the borrow pits that are needed to provide aggregate for proposed access track and infrastructure within the Proposed Development. The assessment reviewed potential effects from the operation of the borrow pits and recommended best practice working methods and the implementation of appropriate mitigation during the operation of the borrow pits. The assessment is provided in **ES Volume III, Appendix 7.6: Borrow Pit Assessment.**

7.3.20 An assessment of GWDTE was undertaken based on the NVC and Phase 1 habitat mapping has been undertaken and is provided in **Appendix 7.7**. Where areas of potentially moderate or high GWDTE were identified in proximity to proposed infrastructure, additional investigation was undertaken to:

- identify if the wetland areas were truly groundwater-dependent;
- refine their mapped extent;
- conceptualise the hydrogeology; and
- assess any potential effects on these areas.

7.3.21 A PWS risk assessment was undertaken for the Proposed Development. The assessment outlined each water supply, and a risk assessment was undertaken on an individual basis, to determine if there is any potential linkage to Proposed Development infrastructure. Any supplies identified as potentially at risk had further detailed assessment undertaken. Control and mitigation measures have been set out if any risk of impact to supply is identified. The assessment is provided in **Appendix 7.8**.

Assessment Criteria

7.3.22 The assessment methodology outlined in this section is based on the guidance provided in the NatureScot's Environmental Impact Assessment Handbook 2018 (NatureScot, 2018) which has been adopted by NRW.

7.3.23 The approach to determine the significance of an effect has been as follows:

- Identify the relevant receptors;
- Derive their sensitivity based on the criteria set out in

- **Table** 7.4**;**
- Identify and consider the likely impacts from each activity (associated with the Proposed Development);
- Determine the magnitude of change likely as a result of the impacts **(Table 7.5**); and
- Present the environmentally significant effects and then consider how additional mitigation may reduce negative effects.

Receptor Sensitivity

7.3.24 The sensitivity of a receptor represents its ability to absorb the anticipated effect without resulting in perceptible change. Four levels of sensitivity have been used as defined in

7.3.25 **Table** 7.4. While the terminology has changed, the methodology for assigning sensitivity, magnitude, likelihood and significance remains the same as is set out in the scoping report.

Table 7.4 Receptor Sensitivity

Sensitivity	Description
High	The receptor has very limited ability to absorb change without fundamentally altering its present character, is of high environmental value and/or is of international importance, for example hydrologically connected SAC and Ramsar sites.
Medium	The receptor has limited ability to absorb change without significantly altering its present character, is of medium environmental value and/or is of national importance, for example National Nature Reserves, hydrologically connected Sites of Special Scientific Interest (SSSI), surface watercourses and groundwater bodies.
Low	The receptor has moderate capacity to absorb change without significantly altering its present character, has low environmental value and/or is of regional importance, for example Geological Conservation Review sites and soils.
Negligible	The receptor is tolerant of change without detriment to its present character, is of low environmental value and/or of local importance, for example Local Nature Reserves, Local Geodiversity Sites.

Likelihood of Effect

7.3.26 The likelihood of an effect occurring is evaluated to three levels: highly unlikely, unlikely or likely. The determination of likelihood is based on professional judgement and past experience of similar developments.

Magnitude of Impact

7.3.27 The magnitude of impact includes the timing, scale, size and duration of the potential impact. Four levels of magnitude have been used, as defined in **Table 7.5.**

Table 7.5 Definitions of Impact Magnitude

Magnitude	Summary
High	Substantial changes, over a significant area, to key characteristics or to the geological/hydrogeological/hydrological/peat soil classification or status for more than 2 years.
Medium	Noticeable but not substantial changes for more than 2 years or substantial changes for more than 6 months but less than 2 years, over a substantial area, to key characteristics or to the geological/hydrogeological/hydrological/peat soil classification or status.
Low	Noticeable changes for less than 2 years, substantial changes for less than 6 months, or barely discernible changes for any length of time.
Negligible or no change	Any change would be negligible, unnoticeable or there are no predicted changes.

Determination of Significance

7.3.28 The following significance criteria (**Table 7.6**) have been applied within this chapter to ensure identified environmental effects are assessed consistently with other ES chapters.

7.3.29 The findings in relation to the three criteria discussed above have been brought together to provide an assessment of significance for each potential effect, as shown in **Table 7.6**.

7.3.30 An effect is considered to be significant if it meets any of the following criteria:

- It could lead to an exceedance of defined guidelines or widely recognised levels of acceptable change;
- It is likely that the consenting authority will reasonably consider applying a planning condition, requirement or legal agreement to the consent to require specific additional mitigation to reduce or overcome the effect;
- It threatens or enhances the viability or integrity of a receptor or receptor group of concern; and
- It is likely to be material to the ultimate decision about whether the planning application should be approved.

7.3.31 When applied to the criteria set out in **Table 7.6**, effects assessed as High or Medium are deemed to be Significant (highlighted grey); those assessed as Low or Negligible are deemed to be Not Significant.

7.3.32 The significance of an environmental effect has been established by way of reference to the importance/value of affected resources; the number and sensitivity of affected receptors; impact magnitude, duration, likelihood or frequency and extent of effect; and the reversibility of effect.

Table 7.6 Effects Significance Matrix

Sensitivity	Magnitude	Likelihood	Significance
High	High	Likely	High
		Unlikely	High
		Highly unlikely	Medium
	Medium	Likely	Medium
		Unlikely	Medium
		Highly unlikely	Low
	Low	Likely	Low
		Unlikely	Low
		Highly unlikely	Low
	Negligible/ no change	Likely	Low
		Unlikely	Negligible

Sensitivity	Magnitude	Likelihood	Significance
		Highly unlikely	Negligible
Medium	High	Likely	High
		Unlikely	Medium
		Highly unlikely	Low
	Medium	Likely	Medium
		Unlikely	Low
		Highly unlikely	Low
	Low	Likely	Low
		Unlikely	Low
		Highly unlikely	Negligible
	Negligible/no change	Likely	Negligible
		Unlikely	Negligible
		Highly unlikely	Negligible
Low	High	Likely	Medium
		Unlikely	Low
		Highly unlikely	Negligible
	Medium	Likely	Low
		Unlikely	Low
		Highly unlikely	Low
	Low	Likely	Low
		Unlikely	Negligible
		Highly unlikely	Negligible
	Negligible/no change	Likely	Negligible
		Unlikely	Negligible
		Highly unlikely	Negligible
Negligible	High	Likely	Low
		Unlikely	Low
		Highly unlikely	Negligible
	Medium	Likely	Low
		Unlikely	Negligible

Sensitivity	Magnitude	Likelihood	Significance
		Highly unlikely	Negligible
	Low	Likely	Negligible
		Unlikely	Negligible
		Highly unlikely	Negligible
	Negligible/no change	Likely	Negligible
		Unlikely	Negligible
		Highly unlikely	Negligible

7.3.33 Typical descriptions of the level (significance) of effect criteria are set out **in Table 7.7.**

Table 7.7 Typical Description of the Level of effect (Significance) Criteria

Level of effect	Description
High	Very large or large change in environmental conditions. These effects, both adverse and beneficial, are likely to be important considerations at a national to regional level because they contribute to achieving national/regional objectives or are likely to result in exceedance of statutory objectives and/or breaches of legislation.
Medium	Intermediate change in environmental or socio-economic conditions. These effects are likely to be important considerations at a regional and local level or are likely to result in exceedance of statutory objectives and/or breaches of legislation.
Low	Small change in environmental or socio-economic conditions. These effects may be raised as local issues but are unlikely to be of importance in the decision-making process.
Negligible	No discernible change in environmental or socio-economic conditions (i.e. variation within normal bounds or below measurable levels). An effect that is likely to have a negligible or neutral influence, irrespective of other effects.

7.3.34 In addition to determining the significance of the effect, the assessment process also includes a qualitative description regarding the nature of the effect. These terms are provided in

7.3.35 **Table** 7.8 and add additional information about how the effect would affect receptors.

Table 7.8 Assessment Descriptors

Term	Nature of effect descriptors
Adverse	An effect which has the potential to decrease receptor value or status relative to baseline conditions.
Beneficial	An effect which has the potential to increase receptor value or status relative to baseline conditions.
Short-term	Effects that persist only for a short time, for example during the construction (or decommissioning) phase only; includes reversible effects.
Medium-term	Effects that may persist until additional mitigation measures have been implemented and become effective.
Long-term	Effects that persist for a much longer time, for example for the duration of the operational phase (essentially until the development ceases or is removed or reinstated); includes effects which are permanent (irreversible) or which may decline over longer timescales.
Temporary	A reversible effect where recovery is possible and for which effects would persist only for a short or medium-term.
Frequent	Refers to a recurring effect that occurs on a regular basis and often (e.g. once a month through construction); in some cases, a lower level of impact may occur with sufficient frequency to reduce the ability of a receptor to recover effectively.

7.4 Baseline Conditions

Existing Baseline

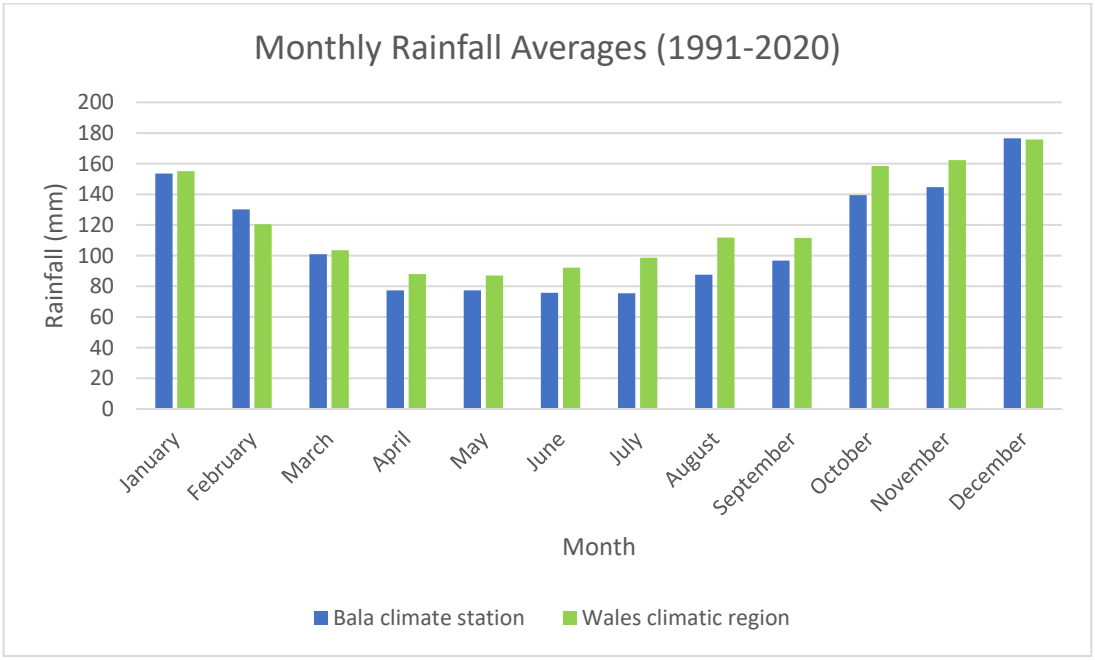
Meteorology and Climate

7.4.1 The Site is located in the northern region of the UK Met Office's 'Wales regional climatic area'. Wales has an essentially maritime climate, characterised by often mild, wet and windy conditions (Met Office, 2016).

7.4.2 The climate of the site is highly influenced by the variable and undulating topography of the Site, with elevations ranging from approximately 250 m to 569 m above Ordnance Datum (AOD). For further information on topography, refer to the topography section below.

Rainfall

7.4.3 Rainfall in Wales varies widely, with highest average annual totals recorded in the central upland spine between the Bannau Brycheiniog and Eryri (Met Office, 2016). Bala monitoring station is the nearest monitoring station to the Site, situated approximately 4 km south (Met Office, 2025a). Rainfall data from this station is thus likely to provide a good representation of the Site and surrounding area. **Graph 7.1** provides a comparison between the average monthly rainfall distribution for the Bala climate monitoring station with that of the Wales climatic region.



Graph 7.1 Monthly Rainfall Averages for both the Bala Climate Station and Wales Climatic Region. Averages Cover Period 1991-2020 (Met Office, 2025).

7.4.4 Most of the rainfall occurs during the autumn and winter months (October to January), with December and January having the highest recorded monthly rainfall totals (up to 177 mm). From January to July, rainfall declines to a monthly low of 75 mm. From July, rainfall slowly increases towards the end of the year. Rainfall recorded at the Bala climate station is slightly lower than the Wales climatic region, however seasonal fluctuations are consistent with the rest of the region.

Topography

7.4.5 The Site is located on relatively high ground, with elevations ranging from 250 m to 569 m AOD. The highest point within the Site is the peak of Garnedd Fawr in the north which lies at 569 m AOD. The topography of the Site slopes downward from north-east to south.

7.4.6 The Site is surrounded by four prominent hills: Cerrig y Gordref (497 m AOD) to the north, Foel Goch (611 m AOD) to the north-east, Moel Darren (509m AOD) to the east at the edge of the application boundary and Garw Fynydd (490 m AOD) to the south. Craig y Garn (461 m AOD) is located at a greater distance to the west, across the Afon Mynach valley.

7.4.7 The southern part of the Site slopes gently down from the peaks of Moel Emoel (549 m AOD) and Eglwys-Anne Warren Ffridd (463 m AOD) towards Llyn Maen Bras at approximately 355 m AOD.

Geology

7.4.8 Geological information is derived from the BGS GeoIndex and the Geological Survey of England and Wales 1:63,360/1:50,000 geological map series (BGS, 2025; BGS, 1993). Bedrock and superficial geology are shown in **ES Volume IV, Figure 7.2: Bedrock Geology** and **ES Volume IV, Figure 7.3: Superficial Geology**.

Bedrock Geology

7.4.9 The Site is underlain by bedrock of Ordovician age, primarily belonging to four named formations: Nant Ffrancon Subgroup, Glyn Gower Siltstones, Ceiswyn Formation and the Moelfryn Mudstones Formation. These formations mainly consist of interbedded mudstones, siltstones and sandstones (BGS, 2025). All four formations have been dated to the Caradoc Series, from the Upper Ordovician period.

7.4.10 The Nant Ffrancon subgroup covers a small area in the west of the Site. The Glyn Gower Siltstones covers a larger part of the central and eastern areas of the Site. The Ceiswyn Formation covers the majority of the central area of the Site. These formations are characterised by coarse to fine-grained sedimentary units forming interbedded sequences (BGS, 2025).

7.4.11 The Moelfryn Mudstones Formation covers the southern central region of the Site. It comprises mainly fine-grained mudstone beds with thin siltstone and sandstone beds in places (BGS, 2025).

7.4.12 A number of historical earthquakes have been recorded in the region, two of which are within 5 km of the Site (BGS, 2025). These occurred in 1744 and 1903, and with a Richter local magnitude (RML) of 2.9 and 2.3 respectively. Two modern instrument earthquakes are also located with 5 km of the Site, both towards the north-east near Ty-nant. The earthquake recorded in 1974 has a RLM of 3.5 and earthquake recorded in 1995 has a RML of 1.4.

Superficial Geology

7.4.13 The superficial geology consists primarily of diamicton till, with a small pocket of peat soil to the north of the Site at the col between Foel Tyn-y-ddol and Pen y Bwlch Gwyn (BGS, 2025). Diamicton till is a variable glacial sediment deposited in the Devensian Stage of the late Pleistocene, consisting of unsorted material ranging in size from clay to boulders, usually with a matrix of clay to sand.

7.4.14 No artificial ground was identified within the Site (BGS, 2025).

Mineral Extraction

7.4.15 No records of active mining or quarrying have been identified within the Site; however, there are a few disused quarries present within the Site indicating that quarrying has taken place in the past (BGS, 2025). All former quarries are of small size and do not represent a ground stability risk to the Proposed Development.

Soils and Peat Soils

7.4.16 Soil and peat soil information is derived from Cranfield University's National Soils Mapping (Cranfield University, 2015) and extensive peat survey data gathered for the Proposed Development.

7.4.17 Soils and peat soil mapping are shown on **ES Volume IV, Figure 7.4: Soils and Peat Soils** and **ES Volume IV, Figure 7.5** respectively.

7.4.18 The Site is primarily underlain by soils described as very acidic loamy upland soils with a wet peaty surface. The south-west is underlain by freely draining acidic loamy soils over rock, while the west is underlain by slowly permeable seasonally wet acidic loamy and clayey soils. Within the central region of the Site, to the north, there is a small area of soils described as slowly permeable wet very acidic upland soils with a peaty surface (Cranfield University, 2015). Further details of soils within the Site are provided in **Table 7.9.**

Table 7.9 Soil Types Within the Site (Cranfield University, 2015)

Soil association	Description	Drainage	Habitats	Area %
Hafren	Very acid loamy upland soils with a wet peaty surface	Surface wetness	Grass moor and heather moor with flush and bog communities in wetter parts	65.92
Manod	Freely draining acid loamy soils over rock	Freely draining	Steep acid upland pastures dry heath and moor; bracken gorse and oak woodlands	20.41
Brickfield 1	Slowly permeable seasonally wet acid loamy and clayey soils	Impeded drainage	Seasonally wet pastures and woodlands	10.36
Wilcocks 2	Slowly permeable wet very acid upland soils with a peaty surface	Impeded drainage	Grass moor and some heather with flush and bog communities in wetter parts	2.77
Lake	Lake or water body	N/A	N/A	0.54

7.4.19 There is no internationally accepted definition of peat. The International Peatland Society (IPS, 2025) defines peat as the following:

*'Peat is the surface organic layer of a soil that consists of partially decomposed organic matter, derived mostly from plant material, which has accumulated under conditions of waterlogging, oxygen deficiency, high acidity and nutrient deficiency***.'**

7.4.20 In Wales, organic-rich soils are considered to be peat soil if they have a thickness of more than 40 cm of organic material within the upper 80 cm of a soil profile. The exception to this is where the organic-rich soils sit directly over bedrock, in which case a thickness greater than 30 cm is required for the soil to be considered peat soil (Welsh Government, 2022).

7.4.21 Organic soils which are 0.4 m or thinner can also support peatland vegetation and as a result are also considered within Wales' broader peatland system. These soils are typically described as 'peaty gleys' or 'peaty podzols', or as having a 'peaty surface layer'. Peaty soils typically have a higher plant fibre content and are less decomposed than peat soil.

7.4.22 The Peatlands of Wales Map indicates that 1.9% of the land within the Site has peat soil present (Welsh Government, 2022). The map uses an evidence score from 1 (low) to 10 (high) to indicate the level of confidence that peat soil is present in any given cell. Only those cells scoring more than 2 on this scale of 1-10 are captured in the Peatlands of Wales peat soil distribution map[1].

7.4.23 The peat soil mapped onsite consists exclusively of evidence score 2 peatland (1.9% of the land within the Site) and is located to the south of Foel Tyn-y-ddôl and to the north of Llaithgwm.

7.4.24 An area covering 16.3% of the Site has an evidence score of 1 and is therefore not considered to be peat soil, as a result of weak confidence. The remaining 81.8% of the Site does not have an evidence score assigned, indicating the absence of peat soil.

7.4.25 The Peatlands of Wales Map also provides carbon dioxide-equivalent emission factors for each grid cell, this is derived from the Broad Habitat Condition category (Welsh Government, 2022). Given the unfavourable habitat condition onsite, none of the grid cells were classified as near-natural bog, which indicates the presence of peat soil which is a net sink of carbon dioxide. Of the peat soil onsite, 96.3% has emissions of 16.5 t ha^{-1} $year^{-1}$, 1.85% has emissions of 3.9 t ha^{-1} $year^{-1}$ and 1.81% has emissions of 31.89 t ha^{-1} $year^{-1}$. Therefore, the mapped peat soil is considered a net emitter of carbon dioxide.

7.4.26 The conducted peat soil surveys identified areas of peat soil within parts of the Site, with recorded depths of up to 1.92 m.

7.4.27 Most of the Site (approximately 78%) has soils or peaty soils under 0.3 m in thickness. Areas of peat soil are restricted to pockets of boggy ground, with a higher concentration in the north-eastern part of the Site. More details of peat soil and peatland condition are provided in **Appendices 7.4** and **7.5**.

7.4.28 The Site is predominantly used for rough grazing for cattle and sheep. There are two common land parcels next to each other, located towards the east of the Site on the western slope of Moel Darren.

Hydrogeology

7.4.29 The Site is underlain by Caradoc Rocks (undifferentiated), considered to be a low productivity aquifer with limited yields, flowing through fractures and other discontinuities in mudstone, siltstone and sandstone (BGS, 2025).

7.4.30 The groundwater body associated with the Site is the Dee Silurian/Ordovician. NRW Water Watch Wales (NRW, 2025b) identifies the groundwater body as having 'good' overall status.

1 Full details of the data sources, and their combined ranking, used to produce the peatland evidence index are provided in the Production of the Peatlands of Wales Map, Soil Policy Evidence Programme 2020-21 report (Report code: SPEP2020-21/03). Soil Policy Evidence Programme 2020-21: Production of the Peatlands of Wales Map

7.4.31 Regional groundwater flow will tend to mimic the natural topography. Within the northern and western areas of the Site, groundwater is likely to flow west towards the Afon Mynach valley, along the western Site boundary. Within the southern part of the Site groundwater is likely to flow south into Llyn Maen Bras and the River Dee. For groundwater within the eastern part of the Site, flow would be towards the Nant Cefn-coch.

7.4.32 There are no superficial aquifers within the Site.

7.4.33 Ordnance Survey (OS) base mapping identifies one spring in the western part of the Site (SH 91921 40665), one well immediately outside the application boundary in the south-western part of the Site (SH 91634 40450) and one 28 m outside the application boundary to the north-west (SH 91625 41518).

7.4.34 Two additional wells are present at the Site entrance (SH 91124 40906 and SH 91095 40907). These wells are both located adjacent to the access track into the Proposed Development.

7.4.35 A further 24 springs and wells are identifiable on OS base mapping within 2 km of the application boundary.

Groundwater Vulnerability

7.4.36 The groundwater vulnerability map has five risk categories: High, Medium-High, Medium, Medium-Low, Low and Unproductive (BGS, 2025). High vulnerability groundwaters are high priority groundwater resources that have very limited natural protection. This results in a high overall pollution risk to groundwater from surface activities. Medium vulnerability groundwaters are medium priority resources that have some natural protection resulting in a moderate overall groundwater risk.

7.4.37 Within the Site, the groundwater has predominantly been assigned a vulnerability level of Medium. Small areas at the Site entrance and to the east of Moel Emoel have Medium-Low and Low vulnerability. A small area to the south of Moel Darren has a High vulnerability.

GWDTE

7.4.38 GWDTE are defined by the UK Technical Advisory Group on the WFD (UKTAG, 2004) as:

7.4.39 ‘A terrestrial ecosystem of importance at Member State level that is directly dependent on the water level or flow of water from a groundwater body (that is, in or from the saturated zone). Such an ecosystem may also be dependent on the concentrations or substances (and potentially pollutants) within that groundwater body, but there must be a direct hydraulic connection with the groundwater body’.

7.4.40 In line with the guidance provided in (UKTAG, 2004), a dual approach to identifying GWDTE has been used. This involves detailed study of vegetation communities in order to determine the potential level of groundwater dependency, combined with a detailed hydrogeological study in order to identify locations where groundwater reaches the surface and is able, therefore, to provide a source of water to associated habitats.

7.4.41 A habitat mapping exercise was completed as part of the ecology baseline assessment, which was used to identify potential GWDTE within the Site. The results of the habitat mapping exercise are discussed in ES Volume II, Chapter 5: Terrestrial Ecology.

Hydrology

7.4.42 Catchment data obtained from the Flood Estimation Handbook (FEH, 2025), shows that the Site lies within five catchment areas: Medrad to the north, Meloch to the east, Dee-Alwen to Llyn Tegid to the south, Tryweryn-Dee to Mynach to the south-west, and Mynach to the north-west. Catchment areas and key watercourses are shown in **ES Volume IV, Figure 7.6: Hydrological Catchments and Watercourses**.

Afon Medrad

7.4.43 The Afon Medrad catchment, covering a small area at the northern edge of the Site, has a total area of 15.2 km^2 and drains 0.03% of the Site.

7.4.44 Drainage for the catchment is provided by the Afon Medrad and its tributaries.

7.4.45 Within the Site, the Medrad catchment is described by (NRW, 2025d) as an area of unimproved acid grassland with areas of wet modified bog, acid flush and bracken.

Afon Meloch

7.4.46 The Afon Meloch catchment, covering the eastern part of the Site, has a total area of 16.1 km^2 and drains 39.42% of the land within the Site.

7.4.47 Drainage is provided by the Nant Cefn-coch, which is a minor tributary of the Afon Meloch, and the Afon Meloch itself.

7.4.48 The Afon Meloch catchment has been described by (NRW, 2025d) as an area of unimproved acid grassland on Moel Darren, including large areas of wet modified bog, acid flush and bracken.

River Dee-Alwen to Llyn Tegid

7.4.49 The River Dee-Alwen to Llyn Tegid catchment, covering the central southern part of the Site, has a total area of 6.2 km^2 and drains 26.70% of the land within the Site.

7.4.50 Drainage is provided by unnamed minor watercourses feeding Llyn Maen Bras, and by the Nant Hafhesp and its tributaries downstream of Llyn Maen Bras.

7.4.51 The River Dee-Alwen to Llyn Tegid catchment is described by (NRW, 2025d) an area of unimproved acid grassland with large areas of wet modified bog, acid flush and bracken.

Afon Tryweryn-Dee to Mynach

7.4.52 The Afon Tryweryn-Dee to Mynach catchment, covering the south-western corner of the Site, has a total area of 20 km^2 and drains 0.12% of the land within the Site.

7.4.53 Drainage is provided by unnamed minor watercourses feeding into the Afon Tryweryn.

7.4.54 The Afon Tryweryn-Dee to Mynach catchment is described by (NRW, 2025d) as a mixture of enclosed improved grassland, improved and marshy grasslands with small areas of woodland, and an area of unimproved acid grassland with wet, modified bog.

Afon Mynach

7.4.55 The Afon Mynach catchment, covering the north-western part of the Site, has a total area of 17.1 km^2 and drains 33.72% of the land within the Site.

7.4.56 Drainage is provided by the Afon Mynach and its tributaries.

7.4.57 Within the Site, the eastern part of the Afon Mynach catchment is described by NRW's Environmental Information Portal (NRW, 2025d) as an area of unimproved acid grassland with large areas of wet modified bog, acid flush and bracken. Conversely, the western part towards the application boundary is described as semi-improved neutral grassland.

Catchment Statistics

7.4.58 Catchment statistics are derived from the FEH Web Service (FEH, 2025) and are shown in **Table 7.10**. The catchment wetness index (PROPWET) for the Site is 0.71 indicating the Site is wet 71% of the time. The area has a moderate baseflow index (BFIHOST19) of between 0.325 and 0.407, indicating a low to moderate groundwater contribution to regional watercourses, although this may have a strong seasonality. The standard percentage runoff (SPRHOST) is moderate, indicating that 39-45% of rainfall within the Site is converted into surface runoff from rainfall events. BFIHOST19 and SPRHOST are likely to vary within the study area as a result of local changes in bedrock, superficial geology and soil types.

Table 7.10 Catchment Statistics for the Site

Catchment name	PROPWET	BFIHOST19	SPRHOST	Area %
Afon Mynach	0.71	0.325	45.03%	34.03%
Afon Meloch	0.71	0.367	41.95%	39.16%
River Dee-Alwen to Llyn Tegid	0.71	0.407	39.26%	26.50%
Afon Tryweryn-Dee to Mynach	0.71	0.325	45.03%	0.44%
Afon Medrad	0.71	0.353	41.95%	0.03%

Water Quality

Surface Waterbodies

7.4.59 NRW's Water Watch Wales Map Gallery (NRW, 2025b) has been consulted to determine the existing baseline water quality for all waterbodies within the Site that are included in The Water Environment (WFD) (England & Wales) Regulations 2017 Cycle 3 (Welsh Government, 2025). The details are summarised in **Table 7.11** and surface waterbodies can be found in **ES Volume IV, Figure 7.6**.

Table 7.11 Baseline Surface Water Quality Status Summarised

Waterbody name	Status	
Meloch	Water Watch Wales Cycle 3 (Welsh Government, 2025) Rivers and Waterbodies Map	Overall: Moderate Ecological: Moderate Chemical: High

Groundwater

7.4.60 The entire Site lies within the Dee Silurian/Ordovician groundwater body. NRW's Water Watch Wales Map Gallery (NRW, 2025b) classifies the overall status of this groundwater body as Good.

Receiving Waterbodies

7.4.61 Five catchments intersect the Site: the Afon Mynach, Afon Meloch, River Dee-Alwen to Llyn Tegid, Afon Tryweryn-Dee to Mynach, and Afon Medrad catchments.

7.4.62 In the north-west of the Site the Afon Mynach catchment ultimately drains into the River Dee (Alwen to Llyn Tegid). NRW (NRW, 2025b) describes the River Dee (Alwen to Llyn Tegid) as having a Moderate overall status.

7.4.63 At the north-eastern boundary of the Site the Afon Medrad catchment ultimately drains into the River Ceirw (Alwen to Medrad). NRW (NRW, 2025b) describes the River Ceirw (Alwen to Medrad) as having a Good overall status.

7.4.64 Within the western, central and south-western areas of the Site, the Afon Meloch, River Dee-Alwen to Llyn Tegid, and the Afon Tryweryn-Dee to Mynach catchments all drain into the River Dee (Alwen to Llyn Tegid), which has a Moderate overall status (NRW, 2025b).

Water Resources

Flood Risk

7.4.65 NRW's online Flood Map for Planning (NRW, 2025a) shows that the Site lies within Flood Zone A, with a small area of Zone C2 along the western edge of the application boundary. Flood Zone A indicates the area is considered to be at little or no risk of fluvial or coastal/tidal flooding.

7.4.66 Zone C2 indicates that the area is without significant flood defence infrastructure, and has a likelihood of flooding from surface water, small watercourses and rivers of 0.1% (1 in 1,000) in any given year.

7.4.67 The Flood Risk Assessment Wales Map on NRW's Environmental Information Portal (NRW, 2025a) indicates there is a medium risk of flooding from rivers within the Site, with areas of flood risk confined to the main watercourse channels. Several areas within the Site are noted to have high risk of surface water flooding, particularly an area in the south of the Site where two watercourses feed into Llyn Maen Bras. An unnamed watercourse in the north-west of the Site is noted to have high risk of surface water flooding.

7.4.68 Downstream and to the south of the Site towards Bala, the Afon Tryweryn at the confluence to the River Dee (Dee to Mynach) has a high risk of flooding both within the periphery of, and confined to, the watercourse channel (NRW, 2025a). Downstream and to the north of the Site at the confluence of the Afon Medrad and Afon Ceirw, there is a high flood risk from rivers confined to, and within the periphery of, the watercourse channel (NRW, 2025a).

7.4.69 Flood risk downstream of the Proposed Development is given more detailed consideration in **Appendices 7.1** and **7.10**.

PWS

7.4.70 The PWS records of Gwynedd County Council and Conwy County Borough Council have been consulted to determine the presence of PWS within the Site and within a 5 km study area. A desk-based study identified further properties which were not accounted for in the Council records. Overall, 103 PWS have been identified within 5 km of the application boundary, two of which are present within the Site. Nine of the PWS identified were found to have potential linkage with proposed infrastructure development and were subject to a full Private Water Supply Risk Assessment (PWSRA). This is provided as a separate Technical Appendix. The nine properties included in the PWSRA are detailed in **Table 7.12** below. PWS within the 5 km study area are listed in **ES Volume III, Appendix 7.8: PWS** - Annex A and are shown in **ES Volume IV, Figure 7.7: Private Water Supplies.**

Table 7.12 PWS Carried Forward into Private Water Supply Risk Assessment

Council ID	Source Location	Source Type	Grid Ref	Distance from nearest infrastructure
Null	Llaithgwm	Spring	292268, 340790	275 m south of proposed access track
Null	Wern Fawr	Spring	291923, 340665	230 m south-east of proposed access track
Null	Glan-yr-afon (three properties)	not provided	291028, 340934	200 m north of proposed site entrance.
5649	Ty Cipar	Unknown	290975, 341385	490 m north of proposed entrance compound
Null	Nant Gau	Unknown	291283, 341898	875 m north of proposed entrance compound
Null	Bromhault	Unknown	291167, 341827	800 m north of proposed entrance compound
Null	Maespyllan	Spring	292364, 341794	575 m north of proposed access track
Null	Hendre-bach	Unknown	291879, 342153	1,080 m north of proposed access track
Null	Pentre-tai-yn-y-cwm	Spring	295574, 340261	960 m south-east of turbine infrastructure
7336	Cwm Hwylfod	Unknown	295608, 339995	1,220 m south-east of turbine infrastructure

Drinking Water Protected Areas

7.4.71 No surface water drinking water protected areas are present within the Site or within 5 km of the application boundary (NRW, 2025c). The Site is wholly within the Dee Silurian/Ordovician groundwater drinking water protected area (NRW, 2025c). All of Wales is in a groundwater drinking water protected area.

Designated Sites

7.4.72 Designated sites of relevance to geology, hydrogeology, hydrology and peat soil that are located within 5 km of the Site are identified in **Table 7.13** and are shown in **ES Volume IV, Figure 7.8**. Data was collated from the Peatland Data Portal Map on NRW's Environmental Information Hub (NRW, 2025d). Designated sites reviewed include SSSI, SAC and Ramsar sites (internationally recognised wetlands). Geological Conservation Review sites have also been included for completeness; these do not have a statutory designation but are considered to be important for geological understanding and many are also protected as SSSI.

Table 7.13 Designated Sites Within 5 km of the Site

Site Name	Qualifying features relating to assessment	Distance from application boundary	Potential linkage?
Afon Dyfrdwy a Llyn Tegid/River Dee and Bala Lake (SAC) Afon Dyfyrdwy/River Dee (SSSI)	Fluvial geomorphology, Carboniferous geology, range of river habitat types, saltmarsh transition habits, populations of floating water plantain.	Adjacent	Yes – designated site includes Afon Mynach, which drains western part of Site
Migneint-Arenig-Dduallt (SSSI, SAC)	Biological and geological features-breeding populations of upland bird species, blanket bog and heathland vegetation. Geological features of mineralisation, contains type locality of Lower Ordovician Arenig Series. Blanket bog and heathland vegetation.	806 m	None – located in separate catchment
Tryweryn River Sections (SSSI)	Contains type locality of Rhiwlas Limestone	2.45 km	None – geological site

Site Name	Qualifying features relating to assessment	Distance from application boundary	Potential linkage?
Cors y Sarnau (SSSI)	Valley mire exhibiting range of habitats and plant associations relating to its succession from a shallow lake to its present condition	2.6 km	None – located in separate catchment
Llyn Tegid/Bala Lake (SSSI, Ramsar, SAC)	Largest natural Welsh lake considered nationally important ecological site with a variety of aquatic species	3.9 km	None – located in separate catchment

Sensitive Receptors

7.4.73 **Table 7.14** sets out the receptors scoped in as relevant to this assessment and their assigned sensitivity.

Table 7.14 Sensitive Receptors

Receptor	Discussion	Sensitivity
Surface water	Surface water forms a key element in sustaining ecosystems and agriculture. Surface water from the Site drains into European protected areas.	High
Groundwater	Groundwater is limited within the Site area.	Medium
PWS sources	As the sole source of drinking water for properties on private supplies, PWS sources are considered to be a high sensitivity receptor.	High
GWDTE	GWDTE are considered to be sensitive habitats and are therefore considered to be a high sensitivity receptor.	High
Designated sites with hydrological linkage	Special Areas of Conservation (SAC) are European-level designations and identify highly sensitive habitats. Sites of Special Scientific Interest (SSSI) are national level designations and identify sensitive areas.	High
Infrastructure and property downstream of Proposed Development	Homes and major infrastructure including main roads can all be affected by increased flooding. They are considered to be sensitive as a result of the significant disruption and distress caused by flooding.	High
Soils	Soils are moderately sensitive as a result of their varied composition and texture, their stored carbon and ability to support a range of habitats and agriculture.	Medium

Receptor	Discussion	Sensitivity
Peat soil	Peat soil is highly sensitive as a result of its slow growth rate and high carbon storage capacity.	High
Human receptors	Construction personnel are sensitive due to potential exposure to risks on Site. Heath risks could include injury and in extreme circumstances, loss of life.	High

Future Baseline in the Absence of the Proposed Development

7.4.74 It is possible that the existing baseline conditions as described above may be subject to change in the future due to natural and human factors. Climate change is considered to be the primary driver for the evolution of the land, soil and water baseline conditions.

7.4.75 Climate change is anticipated to result in changes in precipitation patterns and seasonality, temperature and extreme weather events. As such, there may be a variety of impacts on the geology and hydrology receptors of the area, including:

- Erosion: increased precipitation and extreme weather events can lead to increased erosion of soils and rock, potentially leading to landslides and other geological hazards.
- Temperature changes: air temperature changes can lead to changes in the rate of weathering of rocks and soils, as well as changes in the distribution of plants and animals that can impact erosion and sedimentation patterns. Temperature increases can also lead to drying-out of soils.
- Changes in precipitation patterns: changes in precipitation patterns can lead to changes in the availability of water resources, as well as changes in surface water flow and groundwater recharge. Fluvial and pluvial flooding events may increase in frequency and severity, particularly during winter, although effects could be highly localised. Reduced precipitation can lead to drying up of PWS and drying out of soil.
- Changes in vegetation: changes in vegetation can impact erosion and sedimentation patterns. This may particularly affect wetland habitats if the availability of water decreases and ambient temperatures increase, raising evaporation rates.

7.4.76 Climate change also poses a threat to peat soils within the study area; this could lead to the following changes in baseline conditions:

- Extreme drying: peat soils are typically wet, but with increasing temperatures and changing rainfall patterns, they can dry out and become more susceptible to wildfires, erosion and landslides.
- Carbon emissions: peat soils store considerable amounts of carbon, and increased drying would cause further carbon to be released into the atmosphere as carbon dioxide, contributing to climate change.
- Loss of biodiversity: drying peat soils can lead to loss of biodiversity, impacting species and habitats that are rare and only found in areas of peat soils. Changes in habitat can also mean that peat soils lose their ability to sequester carbon.

7.5 Mitigation Embedded into the Design

7.5.1 This assessment has been based on the principle that measures have been 'embedded' into the design of the Proposed Development to remove potential significant effects as far as practicable, for example by the considered placement of infrastructure. **ES Volume II, Chapter 2: Description of the Proposed Development** identifies the project principles and design mitigation that has been embedded into the design of the Proposed Development. The embedded mitigation relevant to this assessment is detailed in **Table 7.15**.

Table 7.15 Embedded Mitigation

Embedded mitigation measure	Function
Watercourse crossings have been kept to a minimum by careful infrastructure design.	To reduce the number of watercourse crossing locations and reduce impacts upon watercourses.
The watercourse crossing design, at all locations where the access track will cross watercourses, be designed to accommodate the 1-in-100 year flow level plus allowance for climate change.	To maintain the flow of the watercourses as near to their original state as possible.
Watercourse crossings will make use of bottomless culverts or bridge structures where possible.	To minimise effects on the watercourse channel and banks.
Infrastructure has been sited outside a 50 m buffer from all major watercourses within the Site.	To minimise works in close proximity to watercourses. To minimise the risk of spillages of contaminating materials or release of sediment into watercourses.
The access track has been designed to promote good visibility where possible and include two-way access or passing places where visibility is restricted.	To minimise the risk of vehicular collision and the associated potential for pollution incidents that could affect surface water and groundwater bodies.
PWS source locations within or in close proximity to the Site have been avoided carefully by infrastructure design.	To reduce the risk of PWS contamination.
Incursion into areas of peat soils has been avoided by careful infrastructure design, and minimised where complete avoidance is not possible.	To reduce the loss of peat soils and their associated hydrological systems.

7.6 Assessment of Likely Effects (Without Additional Mitigation)

Construction

7.6.1 An assessment of the potential effects during construction on the sensitive receptors outlined in **Table 7.14** is presented in **Table 7.16** below.

Table 7.16 Assessment of Likely Effects (Without Additional Mitigation) During the Construction Phase

Paragraph number	Receptor/receptor groups	Description of impact	Magnitude of impact	Description of likely effect
7.16.1	Surface water ('High' sensitivity)	Physical changes to overland drainage and surface water flows	Medium	Changes to overland drainage and surface water flows would arise from all construction activity, notably construction of the access tracks and drainage infrastructure, including new and upgraded crossing structures, with subsidiary effects from turbine foundations, crane pads and ancillary infrastructure. This may cause concentration of flows within the Site and diversion of flows between sub-catchment areas. The likelihood of effect is considered to be 'Likely'. The nature of effect is determined to be adverse and long-term given that new infrastructure would be constructed during the construction phase and would remain in place until the Proposed Development is decommissioned.
7.16.2	Surface water (High sensitivity)	Water contamination from particulates and suspended solids	Medium	All construction works involving earthworks, including access tracks, turbines, crane pads, borrow pits, temporary storage areas (if required) and drainage infrastructure including watercourse crossings, would generate loose sediment, which could potentially gain

Paragraph number	Receptor/receptor groups	Description of impact	Magnitude of impact	Description of likely effect
				access to surface watercourses and waterbodies through entrainment in surface runoff. This could potentially have an adverse effect on the downstream watercourses through damage to fish spawning habitat and changes to dissolved oxygen and nutrient levels in watercourses and waterbodies, as well as potentially increasing downstream flood risk. The likelihood is considered to be 'Likely'. The nature of effect is determined to be adverse, medium-term and temporary.
7.16.3	Surface water (High sensitivity) Groundwater (Medium sensitivity)	Water contamination from fuels, oils, concrete batching or foul drainage	Medium	Spillage of fuels, oils, wet concrete, concrete washout water or foul drainage from welfare facilities could have an adverse effect on surface or groundwater quality. The likelihood of effect for both receptors is considered to be 'Unlikely'. The nature of effect is determined to be adverse, medium-term and temporary.
7.16.4	PWS sources (High sensitivity) GWDTE (High sensitivity) Designated sites with linkages to surface or groundwater (High sensitivity)	Changes in or contamination of water supply to vulnerable receptors	Medium	All excavations and changes to surface water or groundwater flow paths could potentially affect water supply to GWDTE, PWS or hydraulically connected designated sites. Spills and incidents involving polluting materials, and excavation works and temporary storage areas generating loose sediment, could potentially affect GWDTE within the Site, and PWS and hydraulically connected designated sites within 5 km of the application boundary.

Paragraph number	Receptor/receptor groups	Description of impact	Magnitude of impact	Description of likely effect
				The likelihood of effect is considered to be 'Unlikely'. The nature of effect is determined to be adverse and long-term.
7.16.5	Infrastructure and property downstream of Proposed Development (High sensitivity)	Increased flood risk	Medium	Although the Proposed Development itself is located in an area largely without risk of flooding, areas downstream of the Site have a high risk of flooding from surface water, small watercourses and rivers. There is potential for the Proposed Development to increase flood risk to areas downstream due to the increase in impermeable surfaces and changes to the existing drainage regime. The likelihood of effect is considered to be 'Unlikely'. The nature of effect is determined to be adverse and long-term.
7.16.6	Soils within the Site (Medium sensitivity)	Soil erosion and compaction	Medium	Construction activity, particularly plant and vehicle movements, soil stripping and stockpiling or temporary storage, would affect the nature of the soils within the Site. Plant movements would act to compact soils through movements over unstripped ground. All activity requiring removal, transport, stockpiling and temporary storage of soils would have potential to lead to soil erosion and loss of structure, resulting in overall soil degradation. The likelihood of effect is considered to be 'Likely'. The nature of effect is determined to be adverse, medium-term and temporary.

Paragraph number	Receptor/receptor groups	Description of impact	Magnitude of impact	Description of likely effect
7.16.7	Peat soils within the Site (High sensitivity)	Peat soil excavation, storage, reinstatement, erosion and compaction	Medium	All construction activity, particularly plant and vehicle movements, peat soil stripping, stockpiling, temporary storage, reinstatement and reuse would affect the nature of the peat soil within the Site. Plant movements would act to compact peat soil through movements over unstripped ground. All activity requiring removal, transport, stockpiling, temporary storage and re-placing of peat soil would have potential to lead to peat soil erosion and loss of structure, resulting in overall peat soil degradation. The likelihood of effect is considered to be 'Likely'. The nature of effect is determined to be adverse, medium-term and temporary.
7.16.8	Peat soils (High sensitivity) Surface water (High sensitivity) Proposed Development infrastructure (Medium sensitivity) Construction personnel (High sensitivity).	Peat instability	Medium	Construction activity on peat soils can affect the natural stability of the peat soil deposits in areas near to or associated with construction works. Particular risk areas are associated with works at or near breaks-in-slope, areas where natural peat soil instability has been recorded and locations where peat soil has degraded through, for example, erosion processes, drying out or overgrazing. Peat instability can lead to increased sediment inputs and changes in surface water pH, nutrient concentrations and coloration, with subsequent downstream impacts on hydrology and ecology. The likelihood of effect is considered to be 'Unlikely'. The nature of effect is determined to be adverse and long-term.

Paragraph number	Receptor/receptor groups	Description of impact	Magnitude of impact	Description of likely effect
7.16.9	Groundwater (Medium sensitivity)	Modification to groundwater flow paths	Medium	Physical changes to the shallow subsurface as a result of all excavation work have potential to interrupt shallow groundwater flow paths. This would include proposed cut-and-fill track sections, turbine foundations, hardstanding areas, substation, laydown area, construction compound and cable trenches. Physical changes to the deeper subsurface (>5 m below ground surface) have potential to interrupt deeper groundwater flow paths. This would include borrow pit excavations and some turbine foundation areas. There are limited superficial deposits within the Site, although some groundwater would be present within the peat soil bodies and occasionally in parts of the glacial till. There is likely to be some limited groundwater flow via weathered zones and fracture networks / linear faults within the bedrock. The likelihood of effect is considered to be 'Likely'. The nature of effect is determined to be adverse and long-term.

Operational

7.6.2 An assessment of the potential effects during operation on the sensitive receptors outlined in **Table 7.14** is presented in **Table 7.17** below.

Table 7.17 Assessment of Likely Effects (Without Additional Mitigation) During the Operational Phase

Paragraph number	Receptor / receptor groups	Description of impact	Magnitude of impact	Likely effect
7.17.1	Surface water (High sensitivity)	Physical changes to overland drainage and surface water flows	Negligible/ no change	No additional changes to overland drainage and surface water flows are anticipated during the operational phase. Trackside and infrastructure drainage would remain in place during the operational phase. The likelihood of effect is considered to be 'Highly Unlikely'. The nature of effect is determined to be adverse and long-term.
7.17.2	Surface water (High sensitivity)	Water contamination from particulates and suspended solids	Low	The main operational phase work would involve maintenance and repair of tracks, hardstanding areas and all operational phase drainage infrastructure. This could generate loose sediment, which could potentially gain access to surface watercourses and waterbodies through entrainment in surface runoff. The likelihood is considered to be 'Unlikely'. The nature of effect is determined to be adverse, short-term and temporary.
7.17.3	Surface water' (High sensitivity)	Water contamination from fuels, oils or foul drainage	Negligible/ no change	The risk of water contamination from fuels, oils or foul drainage is considerably lower during operation than during construction as there would be significantly

Paragraph number	Receptor / receptor groups	Description of impact	Magnitude of impact	Likely effect
	Groundwater bodies (Medium)			decreased levels of activity within the Proposed Development. The majority of potential pollutants would no longer be present within the Proposed Development. Lubricants for turbine gearboxes, transformer oils and maintenance vehicle fuels would remain present but in small quantities. These materials would be stored at the substation or otherwise brought to the Site to undertake maintenance activities. The likelihood of effect is considered to be 'Highly Unlikely'. The nature of effect is determined to be adverse, short-term and temporary.
7.17.4	PWS sources (High sensitivity), GWDTE (High sensitivity) Designated sites with linkages to surface or groundwater (High sensitivity)	Changes in or contamination of water supply to vulnerable receptors	Negligible/ no change	Only minor works would take place within the Proposed Development during the operational phase, to allow necessary maintenance activities to be undertaken. The likelihood of effect is considered to be 'Highly Unlikely'. The nature of effect is determined to be adverse and long-term.
7.17.5	Infrastructure and property downstream of Proposed Development (High sensitivity)	Increased flood risk	Negligible/ no change	The potential for increases to downstream flood risk during the operational phase are much lower than during construction. This reduction relates mainly to effective operation and maintenance of drainage and attenuation infrastructure within the Proposed Development.

Paragraph number	Receptor / receptor groups	Description of impact	Magnitude of impact	Likely effect
				The likelihood of effect is considered to be 'Highly Unlikely'. The nature of effect is determined to be adverse and long-term.
7.17.6	Soils within the Site (Medium sensitivity)	Soil erosion and compaction	Negligible/ no change	No soil stripping or stockpiling activities are planned for the operational phase. Ongoing monitoring and maintenance work would require limited vehicle activity within the Site. This would be much reduced from the construction phase and would involve considerably lighter vehicles than heavy construction plant. No activity away from constructed access tracks would take place during the operational phase. The likelihood of effect is considered to be 'Highly Unlikely'. The nature of effect is determined to be adverse, medium-term and temporary.
7.17.7	Peat soils within the Site (High sensitivity)	Peat soil excavation, storage, reinstatement, erosion and compaction	Negligible/ no change	No peat soil stripping or stockpiling activities are planned for the operational phase. Ongoing monitoring and maintenance work would require limited vehicle activity within the Site. This would be much reduced from the construction phase and would involve considerably lighter vehicles than heavy construction plant. No activity away from constructed access tracks would take place during the operational phase. The likelihood of effect is considered to be 'Highly Unlikely'. The nature of effect is determined to be adverse and long-term.

Paragraph number	Receptor / receptor groups	Description of impact	Magnitude of impact	Likely effect
7.17.8	Peat soils (High sensitivity) Surface water (High sensitivity) Groundwater (Medium sensitivity) Proposed Development infrastructure (Medium sensitivity)	Peat instability	Negligible/ no change	No further changes to the proposed infrastructure are anticipated during the operational phase of works and therefore peat instability effects are not anticipated as a result of the Proposed Development's operation. The likelihood of effect is considered to be 'Highly Unlikely'. The nature of effect is determined to be adverse and long-term.
7.17.9	Groundwater (Medium sensitivity)	Modification to groundwater flow paths	Negligible/ no change	No further changes to the proposed infrastructure are anticipated during the operational phase of works and therefore no changes to groundwater flow paths are anticipated as a result of the Proposed Development's operation.. The likelihood of effect is considered to be 'Highly Unlikely'. The nature of effect is determined to be adverse and long-term.

Decommissioning

7.6.3 During decommissioning, levels of activity within the application boundary would be similar to the construction phase, although lower magnitude. Therefore, the effects during the decommissioning phase of the Proposed Development would be the same as or less than those anticipated for the construction phase.

7.6.4 The most likely impacts would be pollution from spillages and leaks associated with plant and machinery, and sediment release from decommissioning ground works and temporary storage of excavated materials. Mitigation similar to that implemented during the construction phase, suitably updated to reflect changes in legislation, guidance and best practice, would ensure that there is only a 'Low Adverse' change to the baseline environment. The severity of these impacts is therefore assessed as 'Negligible' and 'Not Significant'.

7.6.5 Discussions would be held with the Applicant and the relevant Regulatory Authorities to seek approval for an appropriate Decommissioning Strategy and Decommissioning Environmental Management Plan, which will be informed by baseline monitoring work and secured by planning condition to be produced prior to decommissioning works taking place on site.

7.7 Additional Mitigation Meas

7.7.1 **Table 7.18** sets out the additional mitigation measures required to mitigate the likely effects identified in **Table 7.16** and **Table 7.17.**

Table 7.18 Additional Mitigation

Phase	Description of additional mitigation measure	Securing mechanism
Construction phase Impact Physical changes to overland drainage and surface water flows Receptor Surface water	Constructed drains would be no longer or deeper than necessary to provide required track drainage. Cross-drains would be installed at an appropriate frequency to minimise concentration of flows from above the track, where cross-slopes are present, and to prevent additional diversion of flows between sub-catchment areas, to minimise further changes to the hydrological regime. All long-term and temporary drainage infrastructure would be established on a running basis ahead of excavation works. This includes temporary bunding and cut-off drains around turbines and hardstanding areas. Where possible, trackside drainage would be laid up to 100 m ahead of construction works on a running basis. Under-track drainage would be required in areas of boggy ground to maintain existing flow pathways. All drainage infrastructure would be designed with suitable capacity for a rainfall intensity of 1-in-100-year storm event, plus allowance for climate change, in line with current best practice guidance. Use of a single-span bridge at WC03 would ensure that the bed and immediate banks of the watercourse remain unaffected by the works, retaining habitat and water flow continuity. All necessary permissions required for watercourse crossing and drainage works would be obtained prior to commencement of associated works.	The mitigation measures would be set out in a detailed drainage strategy, which would be secured by planning condition prior to construction. **Appendix 7.10** provides drainage strategy details. **ES Volume III, Appendix 7.2: Watercourse Crossing Schedule** provides details of the proposed crossings.
Construction phase Impact Water contamination from particulates and suspended solids	Surface water from the areas surrounding the turbine bases, all hardstanding areas and the borrow pit would be prevented from entering the working areas by appropriate use of peripheral bunding and cut-off drains. These would help to divert clean water around and away from working areas. Earth bunds would be covered with a geotextile to prevent mobilisation of sediment from the bund. Bunds planned to be in place for more than 3 months would be seeded to provide stability and erosion protection.	All necessary permissions relating to construction works, plus accompanying Pollution Prevention Plans would be obtained by the Principal Contractor and agreed with NRW, Conwy and Gwynedd Councils

Phase	Description of additional mitigation measure	Securing mechanism
Receptor Surface water	During works requiring excavation or stripping of ground, or areas being for temporary storage of stockpiled materials, silt fencing or appropriate alternative sediment control protection measures would be installed on the downslope side of the working or storage area to prevent inadvertent discharge of silty water into watercourses. Pre-construction installation of long-term drainage would provide an additional level of sediment control. All engineering work adjacent to watercourses, including track construction and installation of all watercourse crossings including the single-span bridge at WC03, would have appropriate sediment control measures established prior to groundworks. Vegetation would be retained along watercourse banks to act as additional protection. Minor in-stream works may be required for some watercourse crossings or drainage areas. If required, this work would be undertaken using a temporary dam to control flow while crossing structures are installed. Over-pumping would only be used if flow conditions require it. For areas of larger excavation, such as turbine bases, crane pads and borrow pit, temporary water control measures may be used. These are anticipated to include use of temporary settlement ponds or proprietary treatment systems such as Siltbusters, as appropriate. Construction activities would be restricted during periods of wet weather, particularly for any works occurring within 20 m of a watercourse, to minimise mobilisation of sediment in heavy rainfall. The following 'stop' conditions would be applied to guide construction activity (CH2M & Fairhurst, 2018): • High intensity rainfall-rainfall during construction greater than 10 mm per hour • Long duration rainfall-rainfall in the preceding 24 hours greater than 25 mm • 7-day cumulative rainfall (1)-preceding 7 days of rainfall greater than 50% of the monthly average • 7-day cumulative rainfall (2)-preceding 7 days of rainfall greater than 50 mm.	prior to any construction work beginning on the Site. The management and control measures, including emergency response procedures, would be set out in the CEMP, to be secured by planning condition. An outline CEMP is included in **ES Volume III, Appendix 2.1: Outline CEMP**. This would be a live document and would be updated as required throughout construction.

Phase	Description of additional mitigation measure	Securing mechanism
	Any water collecting within excavations would be pumped out prior to further work in the excavation. This water is likely to require treatment to remove suspended solids prior to discharge to ground. This would be undertaken at designated treatment locations within the Site and water from deep excavations would be tested to ensure appropriate quality prior to discharge; details would be provided in the Construction Environmental Management Plan (CEMP). Vegetation cover would be re-established as quickly as possible on track, verges, screening bunds and cut slopes by re-laying of excavated soil turves, to improve slope stability and provide erosion protection. Additional methods, including hydroseeding and/or use of biodegradable geotextile, would be considered, if necessary, in specific areas and areas of particular sensitivity as identified onsite by the Environmental Clerk of Works (ECoW).	
Construction Impact Water contamination from fuels, oils, concrete batching or foul drainage Receptors Surface water and groundwater bodies	Oil and fuel storage handling within the Site would be undertaken following published guidance, in particular Guidance on Pollution Prevention 2 - Above ground oil storage tanks (NetRegs, 2018) and in compliance with the Water Environment (WFD) (England and Wales) Regulations 2017 as amended. The details would be contained in the CEMP and are summarised as follows: Risk assessments would be undertaken and all hazardous substances and non-hazardous pollutants that would be used and/or stored within the Proposed Development would be identified. Hazardous substances likely to be onsite include oils, fuels, hydraulic fluids and anti-freeze. No non-hazardous pollutants have been identified as likely to be present and herbicides would not be used. Storage for all potentially hazardous materials would be provided within a secure, dedicated part of the construction compound with protective bunding and contained drainage system to ensure that any drainage from this area can be suitably treated to remove traces of oil and other materials prior to removal offsite by tanker for treatment and disposal at a suitably licensed location. All deliveries of oils and fuels would be supervised by the Site Manager or designated deputy.	A Pollution Prevention and Spillage Management Plan would be included within the CEMP and secured by condition prior to construction.

Phase	Description of additional mitigation measure	Securing mechanism
	All storage tanks would be located within impermeable, bunded containers where the bund is sufficient to contain 110% of the tank's capacity. For areas containing more than one tank, the bund would be sufficient to contain 110% of the largest tank's capacity or 25% of the total capacity, whichever is greater. Any valve, filter, sight gauge, vent pipe or other ancillary equipment would be located within the containment area. Waste oil would not be stored within the Proposed Development but would be removed to dedicated storage or disposal facilities. Management procedures and physical measures would be put in place to deal with spillages, such as spill kits and booms. Maintenance procedures and checks would ensure the minimisation of leakage of fuels or oils from plant. Refuelling and servicing would be undertaken on a dedicated impermeable surface with lipped edges to contain any contaminants. Where vehicle repair/maintenance is necessary in the field, owing to breakdown, additional precautions would be taken to contain contaminants, such as drip trays or absorbent mattresses. It is anticipated that concrete batching would be required within the Site. Concrete batching would take place within one designated location adjacent to the substation, in an area with protective bunding to prevent alkaline water escaping into the environment. Water contained in the bund would be treated and reused within the concrete batching process as far as possible, and disposal would be via tanker to an offsite treatment facility. Washing-out of concrete mixing plant would only be permitted in one designated location with protective bunding and a dedicated and contained drainage system to ensure that wash-out water can be suitably treated to reduce alkalinity and suspended sediment load prior to removal offsite by tanker for treatment and disposal at a suitably licensed location.	

Phase	Description of additional mitigation measure	Securing mechanism
	It is anticipated that foul drainage provision would be provided via a suitably sized holding tank within the welfare facilities, and wastewater would be removed by tanker for treatment and disposal at a suitably licensed wastewater treatment works. Spillage and emergency procedures would form part of the CEMP and would be prominently displayed within the Site, and staff would be trained in their application. The procedure document would incorporate guidance from the relevant NRW guidance documents. In the event of any spillage or discharge that has potential to harm or pollute the water environment (surface or groundwater), all necessary measures would be taken to remedy the situation. These measures would include: Identifying and stopping the source of the spillage. Containing the spillage to prevent it spreading or entering watercourses by means of suitable material and equipment. Using absorbent materials, including those capable of absorbing oils, to mop up spillages. These would be in the form of oil booms and pads and, for smaller spillages, quantities of proprietary absorbent materials. Sandbags would be readily available for use to prevent spread of spillages and create dams if appropriate. Where an oil/fuel spillage may have soaked into the ground, the contaminated ground would be excavated and removed offsite by a licensed waste carrier to a suitable landfill facility. The emergency contact number of a specialist oil pollution control company would be displayed within the Proposed Development. Sub-contractors would be made aware of the guidance for handling oils/fuels and of the procedures to follow when dealing with spillages. NRW would be informed of any discharge or spillage that may be harmful or polluting to the water environment. Written details of the incident would be forwarded to NRW no later than 14 days after the incident, in line with current best practice guidance.	

Phase	Description of additional mitigation measure	Securing mechanism
Construction Impact Changes in or contamination of water supply to vulnerable receptors Receptors PWS sources, GWDTE and designated sites with linkages to surface or groundwater	All groundworks requiring excavation would be minimised as far as practicable, within the necessary engineering constraints for construction. All works in areas upslope of the four potentially linked PWS and one linked designated site would have additional protection measures installed prior to any excavation or construction works beginning. These would include additional sections of silt fencing, cut-off ditches, water diversion bunds and settlement ponds to trap and treat any surface water with entrained sediment from reaching the PWS sources or draining into the Afon Dyfrdwy SSSI/SAC. No potentially polluting materials would be stored in areas directly upslope or within 250 m of any of the PWS or the SSSI/SAC. Any emergency repairs of plant in these areas would have additional protection measures put in place as a priority, to include absorbent mattresses and spill protection. Excavation of cable trenches could lead to groundwater flows between catchments if the trenches act as preferential flow paths. Where possible, cables would be laid in disturbed ground adjacent to access tracks. In areas where cable routes cross up or down notable slopes, particularly if the cable requires to be laid in a permeable substrate such as sand for reasons of protection, clay bunds or alternative impermeable barriers would be placed for every 0.5 m change in elevation along the trench to minimise in-trench groundwater flow. Any groundwater seepage into excavated areas would be removed to adjacent water storage in infiltration ponds or trenches, to allow re-infiltration of groundwater as near to its abstraction as practicable. Should any potential spillage or pollution incident be identified in an area with groundwater seepage, water testing would be undertaken prior to removal to a settlement pond or infiltration trench to ensure it has not been contaminated. Should contamination be identified, the water would be removed for treatment rather than allowed to infiltrate to groundwater. Collected and treated water would not be permitted to discharge directly into or directly upslope of potential GWDTE in order to avoid flushing with nutrients.	The Pollution Prevention measures and spillage and emergency procedures set out above would also provide mitigation for this potential impact and this would be implemented via a CEMP, secured by condition.

Phase	Description of additional mitigation measure	Securing mechanism
	Track drainage would be installed to mimic natural water flow paths as far as possible, to maintain hydrological connections for potential GWDTE in areas where tracks are required.	
Construction Impact Increased flood risk Receptor Infrastructure and property downstream of Proposed Development	A Flood Consequence Assessment and an Outline Drainage Strategy for the Proposed Development are provided in **Appendices 7.1** and **7.10** respectively. The Flood Consequence Assessment and Outline Drainage Strategy would be implemented to ensure that Site runoff remains at greenfield levels and to provide treatment and attenuation of surface water arising within the Site.	A Surface Water Management Plan (SWMP) and an Emergency Incident Plan would be prepared prior to construction and would be secured by planning condition.
Construction Impact Soil erosion and compaction Receptor Soils within the Site	An Outline Soil Management Plan for the Proposed Development is provided in **Appendix 7.9.** All traffic routes would be clearly demarcated, and vehicles would not be permitted access outside these areas. Only tracked or low ground pressure vehicles would be permitted access to unstripped ground. Soil stripping would be undertaken with care and would be restricted to as small a working area as practicable. Topsoil would be removed and laid in a stockpile, up to 2 m in height, on unstripped ground adjacent to the working area. It would be attempted to retain the turf layer vegetation-side-up where possible, although ground conditions may make this challenging. Subsoils and superficial geology deposits would be removed subsequently and would be laid in stockpiles, also up to 2 m in height, clearly separated from the topsoil stockpile. Care would be taken to maintain separate stockpiles for separate soil types in order to preserve the soil quality.	The mitigation measures would be set out in a Soil Management Plan, which would be secured by planning condition prior to construction.

Phase	Description of additional mitigation measure	Securing mechanism
	Limited smoothing or 'blading' of stockpiled soils would be undertaken to help shed rainwater and prevent ponding of water on the stockpile. Stockpiles on notably sloping ground would have sediment control measures installed near the base, on the downslope side, to collect and retain any sediment mobilised by rainfall. Excavated soil would be used in restoration and rehabilitation of long-term infrastructure at the end of the construction period, in order to promote fast re-establishment of vegetation cover in worked ground and areas of bare soil that are not required for the operational phase of the Proposed Development. Soils would be stored for as short a time as practicable, in order to minimise degradation through erosion and desiccation.	
Construction Impact Peat soil excavation, storage, reinstatement, erosion and compaction Receptor Peat soils within the Site	Works within areas of peat soil have been avoided by careful design. Should areas of peat soil be identified during ground investigation, micrositing would be employed where possible to avoid works in these areas. Peat soil stripping would be undertaken by the Principal Contractor with care and would be restricted to as small a working area as practicable. For work within areas of peat soil, acrotelm (the uppermost 0.3 m of the peat soil) would be removed as for the topsoil. It would be attempted to retain the acrotelm vegetation-side-up where possible, although ground conditions may make this challenging. The underlying catotelm would be stored in stockpiles up to 1 m in height. Catotelm is sensitive to handling, and loses its internal structure easily, so would be transported as short a distance as possible to its storage location. Excavation of catotelm has been limited by careful infrastructure design. Limited smoothing or 'blading' of stockpiled soils and catotelmic peat soils would be undertaken by the Principal Contractor to help shed rainwater and prevent ponding of water on the stockpile. Stockpiles of peat soils would only be located on flat or nearly flat ground. Excavated peat soil would be used in restoration and rehabilitation at the end of the construction period, in order to promote fast re-establishment of vegetation cover on worked areas and areas of bare peat soil that are not required for the operational	The mitigation measures would be set out in the Construction Peat Management Plan, which would be secured by condition prior to construction. The Construction Peat Management Plan would be a live document, with revisions added as necessary during the construction process.

Phase	Description of additional mitigation measure	Securing mechanism
	phase. Peat soils would be stored for as short a time as practicable, in order to minimise degradation through erosion and desiccation. Should prolonged periods of dry weather occur, a damping spray would be employed to maintain surface moisture on the peat soil stockpiles. This would help to maintain vegetation growth in the turves and to retain the soil structure. Construction work would make use of the current best practice guidance relating to developments in peatland areas. A risk management system, such as a geotechnical risk register, would be compiled and maintained at all phases of the Proposed Development and developed as part of the post-consent detailed design works, and would be updated as new information becomes available. Micrositing would be used to avoid possible problem areas identified during ground investigation or other detailed design works. This would be assisted by additional verification of peat soil depths, to full depth, in any highlighted areas where construction work is required. Track drainage would be installed in accordance with published good practice documentation and would be minimised in terms of length and depth in order to minimise concentration of flows. An Outline Peat Management Plan for the Proposed Development is provided in **Appendix 7.4**. The Outline Peat Management Plan would be developed into a Peat Management Plan which would be implemented to ensure that excavation, handling, stockpiling and reuse of peat soils are undertaken in accordance with best practice, in order to ensure that peat soils are retained in as good a condition as possible.	
Construction Impact Peat instability Receptor	Construction activities would be restricted during periods of wet weather, particularly for any work occurring within 20 m of a watercourse or within areas of identified peat soil. Careful track design would ensure that the volume and storage timescale for excavated materials would be minimised as far as practicable during construction works. Vegetation cover would be re-established as quickly as possible on track and infrastructure verges and cut slopes, by re-laying of excavated turves or acrotelm, to improve slope stability and provide erosion protection. Additional methods, including	The mitigation measures would be set out in the Construction Peat Management Plan and the CEMP, both of which would be secured by condition prior to construction. The Construction Peat

Phase	Description of additional mitigation measure	Securing mechanism
Peat soils, surface and groundwater, Proposed Development infrastructure and construction personnel	hydroseeding and/or use of a biodegradable geotextile, would be considered, if necessary, in specific areas. During construction, members of the construction staff would undertake advance inspections and carry out regular monitoring for signs of peat landslide indicators. A geotechnical specialist would be on call to provide advice should any peat landslide indicators be identified. Construction staff would be made aware of peat slide indicators and emergency procedures. Emergency procedures would include measures to be taken in the event that an incipient peat slide is detected. A detailed Peat Slide Risk Assessment has been undertaken for the Proposed Development and is provided in **Appendix 7.5**. The key effects assessment findings are provided below. The Peat Slide Risk Assessment found that the risk of induced or natural peat instability is low or negligible across the Site.	Management Plan and CEMP would be live documents, with revisions added as necessary during the construction process.
Construction Impact Modification to groundwater flow paths Receptor Groundwater	Groundwater monitoring boreholes would be established within the proposed borrow pit area and at each turbine foundation prior to any construction work beginning, to a depth at least 1 m below the deepest expected excavation. Groundwater level monitoring would be undertaken to determine whether groundwater is present within the proposed borrow pit area and, if it is, at what level the seasonally highest groundwater table stands. Any groundwater within the borrow pit area or turbine foundations would be managed in line with best practice, with discharge via a settlement pond to allow any entrained sediment to be removed prior to discharge. Any required discharge licence would be obtained prior to excavation commencing. Excavation of cable trenches could lead to groundwater flow between catchments if the trenches act as preferential flow paths. This can be avoided by laying cables in disturbed ground adjacent to access tracks. In areas where cable routes cross up or down notable slopes, clay bunds or alternative impermeable barrier would be placed for every 0.5 m change in elevation along the length of the trench to minimise in-trench groundwater flow.	The mitigation measures and groundwater monitoring would be set out in the CEMP, which would be secured by condition prior to construction. The CEMP would be a live document, with revisions added as necessary during the construction process.

Phase	Description of additional mitigation measure	Securing mechanism
Operational phase Impact Water contamination from particulates and suspended solids Receptors Surface water	Any sections of track or hardstanding showing signs of excessive wear would be repaired as necessary with suitable rock from external sources. Any sections of drainage infrastructure showing build-up of sediment or any signs of damage would be cleaned and repaired as necessary. Any watercourse crossing structures showing signs of blockage or debris build-up would be cleared and checked for damage. Where possible, maintenance work would be undertaken during periods of dry weather. If emergency repairs are required, additional sediment protection measures would be installed, such as use of temporary dams and silt fencing, to control suspended sediment.	Where appropriate, measures from the SWMP approved prior to the construction phase would remain in place throughout the operational phase. These mitigation measures would be secured via the agreed SWMP.
Operational phase Impact Water contamination from fuel, oils or foul drainage Receptor Surface water	Procedures for storage and handling of potentially polluting materials and for dealing with spills and emergencies would remain in place throughout the operational phase. No concrete batching is anticipated during the operational phase. If required, foul drainage provision would include suitably sized holding tanks with removal by tanker for offsite treatment and disposal at a suitably licensed wastewater treatment plant.	Where appropriate, measures from the Pollution Prevention Plan approved prior to the construction phase would remain in place throughout the operational phase. These measures would be secured via the agreed SWMP.
Operational phase Impact Changes in or contamination of water supply to vulnerable receptors	Procedures for storage and handling of potentially polluting materials and for dealing with spills and emergencies would remain in place throughout the operational phase. Measures to protect surface water from suspended sediment would be employed as set out above. Any works within 250 m of the identified PWS with potential linkage and the designated site would have additional protection measures installed, such as silt fencing, as necessary. This would be overseen by the Site Manager.	Where appropriate, measures from the Pollution Prevention Plan approved prior to the construction phase would remain in place throughout the operational phase. These measures would be

Phase	Description of additional mitigation measure	Securing mechanism
Receptor PWS sources, GWDTE and designated sites with linkage to surface or groundwater	Additional works affecting GWDTE would be negligible and therefore no additional mitigation is proposed during the operational phase.	secured via the agreed SWMP.
Operational phase Impact Increased flood risk Receptor Infrastructure and property downstream of the Proposed Development	Operational phase maintenance of long-term drainage and attenuation infrastructure would prevent increases to the downstream flood risk. This would form a key part of the Proposed Development's SWMP, to ensure that any areas of concern are addressed promptly.	The SWMP and Emergency Incident Plan approved during the construction phase would remain in place throughout the operational phase.

7.7.2 The mitigation measures implemented during the construction phase would be implemented during the decommissioning phase via a Decommissioning Management Plan prepared prior to the decommissioning of the Proposed Development, and this would be secured by condition.

7.8 Assessment of Residual Effects (With Additional Mitigation)

Construction

7.8.1 An assessment of the residual effects during construction with additional mitigation in place is provided in **Table 7.19** below.

Table 7.19 Assessment of Residual Effects During Construction with Additional Mitigation

Paragraph number	Receptor/ receptor groups	Description of impact	Magnitude of impact	Likely effect	Monitoring requirements
7.19.1	Surface water (High sensitivity)	Physical changes to overland drainage and surface water flows	Low	The likelihood of effect is considered to be 'Unlikely'. The nature of effect is determined to be adverse and long-term given that new infrastructure would be constructed during the construction phase and would remain in place until the Proposed Development is decommissioned. The significance of effect is assessed as **low, adverse** and therefore **'Not Significant'.**	A water quality monitoring programme would be established at key locations around the Proposed Development (**Table 7.21**). Monitoring would begin prior to any construction works, to corroborate the baseline conditions set out within this Chapter and provide a pre-construction baseline quality to enable future comparison to be determined. Details would be agreed with NRW but are anticipated to include: visual checks for entrained sediment in-situ measurements of pH, temperature and specific conductivity

Paragraph number	Receptor/ receptor groups	Description of impact	Magnitude of impact	Likely effect	Monitoring requirements
					in-situ measurements of turbidity and dissolved oxygen may be recommended for locations with particular sensitivity. All works through and adjacent to wetland areas would be supervised by the ECoW as per the CEMP (An outline CEMP is provided in **Appendix 2.1**).
7.19.2	Surface water (High sensitivity)	Water contamination from particulates and suspended solids	Low	The likelihood is considered to be 'Unlikely'. The nature of effect is determined to be adverse, medium-term and temporary. The significance of effect is assessed as **low, adverse,** and therefore '**Not Significant'.**	A water quality monitoring programme would be established at key locations within the Proposed Development. Monitoring would begin prior to any construction works. Details are provided in **Table 7.21.**
7.19.3	Surface water (High sensitivity) Groundwater (Medium sensitivity)	Water contamination from fuel, oils, concrete or foul drainage	Low	The likelihood of effect for both receptors is considered to be 'Highly unlikely'. The nature of effect is determined to be adverse, medium-term, and temporary. The significance of effect for surface water is assessed as low, adverse, and therefore 'Not Significant'.	A water quality monitoring programme would be established at key locations within the Proposed Development. Monitoring would begin prior to any construction works. Details are provided in **Table 7.21**.

Paragraph number	Receptor/ receptor groups	Description of impact	Magnitude of impact	Likely effect	Monitoring requirements
				The significance of effect for groundwater is assessed as **negligible, adverse**, and therefore **'Not Significant'**.	
7.19.4	PWS sources GWDTE Designated sites with linkages to surface or groundwater (High sensitivity)	Changes in or contamination of water supply to vulnerable receptors	Low	The likelihood of effect is considered to be 'Highly unlikely'. The nature of effect is determined to be adverse and long-term. The significance of effect on PWS sources, GWDTE and designated sites is assessed as **low** and therefore '**Not Significant'.**	Four potentially at-risk PWS on a twice-daily basis (morning and afternoon) while works are ongoing within 500 m of the supply sources. Should any concerns be raised, the Applicant would provide an alternative supply of water until any concerns have been fully resolved. Monitoring would begin prior to any construction works, to enable future comparison against pre-construction baseline quality. Details would be agreed with NRW but are anticipated to include: visual checks for entrained sediment; and in-situ measurements of pH, temperature and specific conductivity.

Paragraph number	Receptor/ receptor groups	Description of impact	Magnitude of impact	Likely effect	Monitoring requirements
					In situ measurement of turbidity and dissolved oxygen may be recommended by NRW or the ECoW for locations with particular sensitivity, such as upstream of the designated site. Pre-construction monitoring would be undertaken by the Principal Contractor on a monthly basis for a minimum period of six months prior to any work taking place. During construction, the monitoring would be undertaken by the ECoW or suitably experienced alternative individual. Any change from baseline conditions of pH and/or specific conductivity would potentially indicate an incident and additional investigation would be required in order to identify the origin of the change. Control locations (WQ01

Paragraph number	Receptor/ receptor groups	Description of impact	Magnitude of impact	Likely effect	Monitoring requirements
					and 7) are intended to help differentiate between incidents arising from and those unrelated to, the Proposed Development. Locations and recommended frequency of monitoring are provided in **Table 7.21**.
7.19.5	Infrastructure and property downstream of Proposed Development (High sensitivity)	Increased flood risk	'Negligible'	The likelihood of effect is considered to be 'Highly Unlikely'. The nature of effect is determined to be adverse and long-term. The significance of effect on infrastructure and property downstream of the Proposed Development from construction works is assessed as **negligible**, and therefore '**Not Significant'**.	No monitoring is proposed.
7.19.6	Soils within the Site (Medium sensitivity)	Soil erosion and compaction	Low	The likelihood of effect is considered to be 'Unlikely'. The nature of effect is determined to be adverse, medium-term and temporary. The significance of effect on soils from construction works is assessed as **low** and therefore **'Not Significant'**.	No monitoring is proposed.

Paragraph number	Receptor/ receptor groups	Description of impact	Magnitude of impact	Likely effect	Monitoring requirements
7.19.7	Peat soil within the Site (High sensitivity)	Peat soil excavation, storage reinstatement and erosion	Low	The likelihood of effect is considered to be 'Likely'. The nature of effect is determined to be adverse and long-term. The significance of effect on peat soils from construction works is assessed as **low**, adverse, and therefore **'Not Significant'.**	All areas where peat soils are used in construction area reinstatement would require monitoring to ensure that the reinstatement and restoration methods are effective and to identify any interventions that may be required. Monitoring of reinstated areas would take place weekly for the first year following reinstatement, monthly for a further two years and quarterly for the subsequent five years. Future monitoring would be determined by need and agreed by planning condition. Monitoring would involve visual checks for signs of erosion or vegetation die-off and probe monitoring of moisture levels. Additional monitoring would be required following any heavy rainfall or storm

Paragraph number	Receptor/ receptor groups	Description of impact	Magnitude of impact	Likely effect	Monitoring requirements
					events to check for erosion or damage to reinstated areas.
7.19.8	Peat soils (High sensitivity) Surface water (High sensitivity) Groundwater (Medium sensitivity) Proposed Development infrastructure (Medium sensitivity) Construction personnel (High sensitivity).	Peat instability	Low	The likelihood of effect is considered to be 'Highly Unlikely'. The nature of effect is determined to be adverse and long-term. For all receptors the significance of effect is assessed as **low or negligible**, adverse and therefore '**Not Significant'.**	Monitoring around all excavations where peat soils are affected would be undertaken to check for early signs of peat soil instability. Details are provided in **Appendix 7.5.**
7.19.9	Groundwater (Medium sensitivity)	Modification to groundwater flow paths	Low	The likelihood of effect is considered to be 'Likely'. The nature of effect is considered to be adverse and long-term. The significance of effect of modification to groundwater flow paths from construction works is assessed **as low, adverse** and therefore **'Not Significant'.**	No monitoring is proposed.

Operational

7.8.2 An assessment of the residual effects during operation with additional mitigation in place is provided in **Table 7.20** below.

Table 7.20 Assessment of Residual Effects During Operation with Additional Mitigation

Paragraph number	Receptor/ receptor groups	Description of impact	Magnitude of impact	Likely effect	Monitoring
7.20.1	Surface water (High sensitivity)	Physical changes to overland drainage and surface water flows	**'Negligible/ no change'**	The likelihood of effect is considered to be 'Highly Unlikely'. The nature of effect is determined to be adverse and long-term. The significance of effect of physical changes to overland drainage from operational works is assessed as **negligible,** and therefore '**Not Significant'.**	Monitoring during the operational phase would be undertaken quarterly for the first year, and subsequently as agreed with NRW. Any signs of siltation or suspended sediment, changes in pH or electrical conductivity in the water would be recorded and reported immediately to the Site Manager for further investigation.
7.20.2	Surface water (High sensitivity)	Water contamination from particulates and suspended solids	**Low**	The likelihood is considered to be 'Unlikely'. The nature of effect is determined to be adverse, short-term and temporary. The significance of effect on surface watercourses of particulates and suspended solids from operational works is assessed as **low, adverse**, and therefore '**Not Significant'**.	Monitoring during the operational phase will be undertaken monthly for the first year, and subsequently as agreed with NRW. Any signs of siltation or suspended sediment, changes in pH or electrical conductivity in the water would be recorded and reported immediately to the Site Manager for further investigation.

Paragraph number	Receptor/ receptor groups	Description of impact	Magnitude of impact	Likely effect	Monitoring
7.20.3	Surface water (High sensitivity) Groundwater (Medium sensitivity)	Water contamination from fuel, oils, concrete or foul drainage	**'Negligible/ no change'**	The likelihood of effect for both receptors is considered to be 'Highly Unlikely'. The nature of effect for both receptors is determined to be adverse, short-term and temporary. The significance of effect on surface watercourses and groundwater bodies of contamination from fuels, oils or foul drainage from operational works is assessed as **negligible**, and therefore '**Not Significant'**.	No monitoring is proposed.
7.20.4	PWS sources GWDTE Designated sites with linkages to surface or groundwater (High sensitivity)	Changes in or contamination of water supply to vulnerable receptors	**'Negligible/ no change'**	The likelihood of effect is considered to be 'Highly Unlikely'. The nature of effect is determined to be adverse and long-term. The significance of effect of changes in or contamination of water supply on PWS sources, GWDTE and designated sites from operational works is assessed as **negligible**, and therefore '**Not Significant'**.	If works are required within 250 m of an identified PWS source, daily monitoring of the source would take place while works are ongoing and for a minimum of one week after completion of works.

Paragraph number	Receptor/ receptor groups	Description of impact	Magnitude of impact	Likely effect	Monitoring
7.20.5	Infrastructure and property downstream of Proposed Development (High sensitivity)	Increased flood risk	**'Negligible/ no change'**	The likelihood of effect is considered to be 'Highly Unlikely'. The nature of effect is determined to be adverse and long-term. The significance of effect of increased flood risk on infrastructure and property downstream of the Proposed Development from operational works is assessed as **negligible**, and therefore '**Not Significant'**.	No monitoring is proposed.
7.20.6	Soils within the Site (Medium sensitivity)	Soil erosion and compaction	**'Negligible/ no change'**	The likelihood of effect is considered to be 'Highly unlikely'. The nature of effect is determined to be adverse, medium-term and temporary. The significance of effect on soils from construction works is assessed as **Negligible**, and therefore '**Not Significant'**.	No monitoring is proposed.
7.20.7	Peat soils within the Site (High sensitivity)	Peat soil excavation, storage reinstatement and erosion	**'Negligible/ no change'**	The likelihood of effect is considered to be 'Highly Unlikely'. The nature of effect is determined to be adverse and long-term. The significance of effect on peat soils from operational works is assessed as **negligible** and therefore '**Not Significant'.**	No monitoring is proposed.

Paragraph number	Receptor/ receptor groups	Description of impact	Magnitude of impact	Likely effect	Monitoring
7.20.8	Peat soils (High sensitivity) Surface water (High sensitivity) Groundwater (Medium sensitivity) Proposed Development infrastructure (Medium sensitivity)	Peat instability	**'Negligible/ no change'**	No changes to the proposed infrastructure are anticipated during the operational phase of works. Therefore, the effect of natural or induced peat instability during the operational phase works is assessed as no change. The significance of effect on peat instability from operational works is therefore assessed as **negligible** and '**Not Significant'.**	No monitoring is proposed.
7.20.9	Groundwater (Medium sensitivity)	Modification to groundwater flow paths	**'Negligible/ no change'**	The likelihood of effect is considered to be 'Highly Unlikely'. The nature of effect is considered to be adverse and long-term. The significance of effect of modification to groundwater flow paths from construction works is assessed as **negligible** and therefore '**Not Significant'.**	No monitoring is proposed.

Decommissioning

7.8.3 Levels of activity within the application would be similar to the construction phase, although lower. Therefore, residual effects during the decommissioning phase of the Proposed Development would be the same as or less than those related to the construction phase.

7.9 Monitoring

7.9.1 A water quality monitoring programme would be established at key locations around the Site during the construction phase. Monitoring would begin prior to any construction works, to allow pre-construction baseline water quality to be determined.

7.9.2 Details are provided in **Table 7.21** and proposed monitoring locations are shown in **ES Volume IV, Figure 7.10: Water Quality Monitoring Locations**.

Table 7.21 Water Quality Monitoring Locations and Recommended Monitoring Frequency by Phase of Development

Location ID	Location	Monitoring schedule
WQ01 (Control)	Tributary of Nant Cefn-coch. West of T05 and north-east of T06.	Baseline: Monthly, minimum 6 months. Construction: Daily during construction of WT05 and WT06, and associated track works; otherwise, weekly. Operation: Quarterly for first year. Decommissioning: Daily during decommissioning of T05 and T06, and track works, otherwise weekly
WQ02	Tributary of Nant Cefn-coch. South-east of T05. Along eastern Site boundary.	Baseline: Monthly, minimum 6 months. Construction: Daily during construction of WT05 and associated track works; otherwise, weekly. Operation: Quarterly for first year. Decommissioning: Daily during decommissioning of T05 and track works, otherwise weekly
WQ03	Unnamed tributary, upstream of Nant Gau, north-west of T01 and west of T02 and north of the main site access track.	Baseline: Monthly, minimum 6 months. Construction: Daily during construction of T02 and associated track works, and main site access track; otherwise weekly. Operation: Quarterly for first year. Decommissioning: Daily during decommissioning of T02 and associated track works, and main site access track, otherwise weekly

Location ID	Location	Monitoring schedule
WQ04	Nant Cefn-coch, where several tributaries meet. South of T08 and T09. WQ03 downstream of proposed bridge works.	Baseline: Monthly, minimum 6 months. Construction: Daily during construction of T03, T04, T07, T08, T09, T10, substation, batching compound, and associated track works; otherwise weekly. Operation: Quarterly for first year. Decommissioning: Daily during decommissioning of T03, T04, T07, T08, T09, T10, substation, batching compound and track works, otherwise weekly
WQ05	Tributary of Nant Hafhesp, located 40 m north of Llyn Maen Bras.	Baseline: Monthly, minimum 6 months. Construction: Daily during construction of T01, LiDAR compound and associated track works; otherwise weekly. Operation: Quarterly for first year. Decommissioning: Daily during decommissioning of T01, LiDAR compound and track works, otherwise weekly
WQ06	Afon Mynach; west of site entrance, to the right of existing access track.	Baseline: Monthly, minimum 6 months. Construction: Daily during construction of main site access track and borrow pit, otherwise weekly. Operation: Quarterly for first year. Decommissioning: Daily during decommissioning of main site access track and borrow pit, otherwise weekly
WQ07 (Control)	Afon Mynach; north-west of the site entrance, south of footpath.	Baseline: Monthly, minimum 6 months. Construction: Daily during construction of main site access track and borrow pit, otherwise weekly. Operation: Quarterly for first year. Decommissioning: Daily during decommissioning of main site access track, otherwise weekly

7.10 Opportunities for Environmental Enhancement

7.10.1 Degraded peatlands have been identified in a number of locations within the Site. Restoration measures would be undertaken to improve the condition of the peatland and restore active peat soil development. It is anticipated that restoration measures would include blocking or damming of drains, ditches and peat channels to slow the flow of water and help raise the water table, and reprofiling of channels and peat hags to manage erosion and surface water flow paths. Additional techniques including use of heather mulches and biodegradable geotextiles may be employed to protect areas of bare peat soil from erosion and to promote re-establishment of peatland vegetation.

7.10.2 Together, these measures would be set out in detail in the HMP as enhancements, to help to control erosion and slow down water movement within peatland areas, retain water and raise the water table. This will promote the development of active peatland vegetation and peat soil formation.

7.11 Difficulties and Uncertainties

7.11.1 The Site visits followed a standard 'reconnaissance level' walkover survey to obtain an overview of Site conditions at the time of the visit. A reconnaissance level survey involves walking through and around an area to gather visual information concerning elements such as slope, rock outcrop, ground wetness and bogginess, nature and type of watercourses, and the presence or absence of groundwater seepages or spring points. No ground investigation was undertaken as part of the Site visits. As a result, information is limited to detail that can be gathered from a visual survey of this kind. Uncertainties may arise as a result of preceding weather conditions, for example very wet preceding conditions may cause an over-estimation of the watercourse nature or ground bogginess than would be considered 'normal' for the area. Notwithstanding the uncertainties and limitations, the data obtained is sufficiently robust to ensure that the assessment is based on a worst-case scenario. Therefore, it is unlikely that any errors due to these types of uncertainties would occur.

7.11.2 Although all reasonable attempts were made to ensure that good coverage of the Site was included, it is possible as a result of the type of surveys undertaken that some information was not collected as a result of access restrictions (including unsafe ground), the lack of intrusive investigation or the areas visited during the surveys. However, the information gathered has been combined with information from Site visits for other disciplines, including site surveys to map peat soil depths and vegetation classes, and available photography to provide enough information of site conditions to undertake a robust assessment.

7.12 Inter-project Cumulative Effects

7.12.1 The potential for the Proposed Development to contribute to cumulative effects in relation to other projects within 5 km was assessed. Two developments, Rhiwlas Home Farm (C20/0963/04/YA) wetlands and Moel Chwa Energy Park (DNS CAS-02646-S1G1Q8) were identified within this area. Rhiwlas Home Farm wetlands is located 2.45 km south of the Proposed Development and Moel Chwa Energy Park is located 4.3 km north-east of the Proposed Development.

Geology and Soils

7.12.2 Effects relating to geology and soils are very localised. As a result, there are no cumulative effects relating to geology and soils from the Proposed Development as effects do not transmit over any noticeable distance. As no other developments lie within 1 km of the Proposed Development, there are no cumulative effects relating to geology or soils.

Peat Soils

7.12.3 Effects relating to peat soils are very localised within the same hydrological catchments as the Proposed Development. As a result, there are no cumulative effects relating to peat soils as no other developments lie within the same hydrological catchments as the Proposed Development.

Hydrogeology

7.12.4 Effects on hydrogeology are confined to shallow groundwater found within the same hydrological catchments as the Proposed Development.

7.12.5 Neither Rhiwlas Home Farm wetlands or Moel Chwa are located in the same hydrological or hydrogeological catchments. As a result, no cumulative effects are anticipated in relation to hydrogeology.

Hydrology

7.12.6 Effects on hydrology are generally confined to developments located within the same hydrological catchments as the Proposed Development, or that drain into the same receiving waterbodies.

7.12.7 The Tier 3 development Moel Chwa is not located within any of the same catchments as Foel Fach Wind Farm. However, part of Moel Chwa and a small part of Foel Fach Wind Farm both drain into the Afon Alwen, giving potential for cumulative impacts on the receiving waterbody. As both developments are currently in the planning system, it is possible that construction would overlap.

7.12.8 Rhiwlas Home Farm wetlands and the Proposed Development also do not share catchments, but both drain into the Afon Tryweryn. The Tryweryn River Sections SSSI is located downstream of both developments, although as a geological site no effects are anticipated. No proposed date for construction is available; however, the wetlands have been granted planning consent, and it is likely therefore that the wetlands will have been constructed prior to the Proposed Development entering the construction phase. It is unlikely that the construction phases would overlap.

7.12.9 Assuming that best practice construction methods, including best practice surface water and sediment management techniques and pollution control and prevention methods, are put in place for all three developments, cumulative effects on the Afon Tryweryn and Afon Alwen catchments are considered to be low and temporary. It is also assumed that ongoing maintenance will ensure that satisfactory surface water and sediment management will be continued into the operational phase. As a result, cumulative impacts arising from the Proposed Development are considered to be **not significant**.

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