Chapter 10: Geology, Hydrology, Hydrogeology and Peat

Contents

10 Geology, Hydrology, Hydrogeology and Peat

10.1 Executive Summary

10.1.1 An assessment has been undertaken of the potential effects on geology (including soils and peat) and the water environment (hydrology and hydrogeology) during the construction, operation and decommissioning phases of the Proposed Development.

10.1.2 The scope of the assessment was informed by scoping responses received from statutory and non-statutory consultees.

10.1.3 Information for the study area was compiled using baseline information from a desk study and was then verified by an extensive programme of field work. The field work included investigation of private water supply sources in order to determine those which might be hydrologically connected to and at risk from the Proposed Development. Measures required to protect these sources have been confirmed. A site-specific private water supply (PWS) risk assessment has been prepared and is presented as supporting Technical Appendix 10.3.

10.1.4 The field work also included a programme of peat depth probing and condition assessment and a hydrological walkover survey by an experienced SLR hydrologist.

10.1.5 The assessment undertaken considered the sensitivity of receptors identified during the baseline study and confirmed by the field work, and the (embedded) mitigation measures incorporated in the development design. It has also considered potential future changes to baseline conditions.

10.1.6 The assessment has considered designated sites and, where these are water dependent and have a potential hydrological connection to the Proposed Development, they have been included in the assessment.

10.1.7 The design of the Proposed Development has been informed by a detailed programme of peat depth probing as required by National Planning Framework 4 (NPF4) and it has been shown that wherever possible areas of deep peat have been avoided. The assessment of peat and carbon rich soils has considered all of the proposed infrastructure, including new and upgraded permanent access tracks. A project specific peat management plan has been prepared which confirms the soils disturbed by the Proposed Development are limited in volume and that these soils can be readily and beneficially reused in restoration works on site.

10.1.8 Subject to adoption of best practice construction techniques and a site-specific Construction Environmental Management Plan (CEMP), no significant adverse effects on geology (including soils and peat) and the water environment have been identified. The outline CEMP includes provision for drainage management plans which will be agreed with statutory consultees, including Scottish Environment Protection Agency (SEPA) and Scottish Borders Council (SBC) which will be used to safeguard water resources and manage flood risk. A commitment to deploy Sustainable Drainage Systems (SuDS) in these plans has been made. The outline CEMP also includes provision of a Pollution Prevention Plan which would also be agreed with statutory consultees including SEPA prior to any construction works being undertaken. An outline CEMP has been prepared and is presented as Technical Appendix 3.1. The final CEMP will be agreed with statutory consultees prior to construction.

10.1.9 Notwithstanding these safeguards, a programme of baseline and construction phase water quality monitoring is proposed which would be used to confirm that the Proposed Development does not have a significant effect on geology and the water environment. Monitoring of watercourses that drain from the site, including those that discharge to the River Tweed, will be included in the monitoring plan. It is proposed that the monitoring schedule includes one PWS source. Monitoring would commence prior to construction and continue throughout the construction phase and immediately post construction. It is anticipated that the monitoring programme would be secured by a pre-development planning condition to be agreed with statutory consultees.

10.2 Introduction

10.2.1 This chapter considers the likely significant effects of the Proposed Development on geology (including peat and soils) and the water environment (hydrology and hydrogeology). The assessment of potential impacts has been made on the basis of the Proposed Development layout as fully described in Chapter 3 and as shown on Figure 3.2. It outlines the embedded good practice methods which have been incorporated into the design and would be used during the construction and operation of the Proposed Development to prevent or reduce identified effects and risks.

10.2.2 Further mitigation methods to address any potential effects are proposed, where appropriate, and residual effects are assessed.

10.2.3 The chapter is supported by:

- Technical Appendix 10.1: Peat Landslide Hazard Risk Assessment (PLHRA);
- Technical Appendix 10.2: Peat Management Plan (PMP);
- Technical Appendix 10.3: Private Water Supply Risk Assessment (PWSRA);
- Technical Appendix 3.1: Outline CEMP; and
- Technical Appendix 3.2: Borrow Pit Assessment.

10.2.4 Supporting Figures 10.1 to 10.8 are referenced in the text where relevant.

10.2.5 The assessment uses information and findings presented in Chapter 8 to inform the assessment of potential effects on possible areas of Groundwater Dependent Terrestrial Ecosystems (GWDTEs) which are presented in this chapter.

10.2.6 This assessment has been completed by SLR Consulting Ltd (SLR). Production of this chapter has been overseen and reviewed by Gordon Robb (BSc, MSc, MBA, C.WEM, FCIWEM). He is a Technical Director (Hydrology and Hydrogeology) and has more than 30 years' experience assessing renewable energy and electrical infrastructure projects and specifically their potential effects on soils, geology and the water environment. He is based in Scotland and has worked throughout Scotland, including on sites in similar settings to the Proposed Development. He has also prepared and given expert witness testimony for renewable and electrical infrastructure projects.

10.3 Legislation, Policy and Guidelines

10.3.1 Soils, geology and the aquatic environment in Scotland are afforded significant protection through key statutes and the regulatory activity of SEPA and the local authorities. Relevant legislation and guidance documents have been reviewed and considered as part of this assessment.

Legislation

10.3.2 Relevant legislation includes:

- EU Water Framework Directive (2000/60/EC);
- EU Drinking Water Directive (98/83/EC);
- The Environmental Act 1995;
- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations (2017);
- Environmental Protection Act 1990;
- The Flood Risk Management (Scotland) Act 2009;
- Water Environment and Water Services (Scotland) Act 2003 (WEWS Act);
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR);
- The Water Supply (Water Quality) (Scotland) Regulations, 2001;
- Private Water Supplies (Scotland) Regulations 2006; and
- The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017.

Planning Policy

10.3.3 Chapter 4 provides an overview of the relevant planning policy position in full. In summary, NPF4 provides planning guidance and policies regarding sustainable development, tackling climate change and achieving net zero. Policies relevant to this chapter include:

- Policy 2 (Climate Mitigation and Adaptation);
- Policy 4 (Natural Places);
- Policy 5 (Soils);
- Policy 11 (Energy);
- Policy 20 (Blue and Green Infrastructure); and
- Policy 22 (Flood Risk and Water Management).

10.3.4 In addition, SBC's Local Development Plan (LDP) provides planning guidance on the type and location of the development that can take place in the region. The LDP presents development policies of which are relevant to this study:

- Policy PMD1: Sustainability;
- Policy ED9: Renewable Energy Development;
- Policy ED10: Protection of Prime Quality Agricultural Land and Carbon Rich Soils;
- Policy ED11: Safeguarding of Mineral Deposits;
- Policy ED12: Mineral and Coal Extraction;
- Policy EP1: International Nature Conservation Sites and Protected Species;
- Policy EP2: National Nature Conservation Sites and Protected Species;
- Policy EP15: Development Affecting the Water Environment;
- Policy IS8: Flooding; and
- Policy IS9: Waste Water Treatment Standards and Sustainable Urban Drainage.

Guidance

10.3.5 Planning Advice Notes (PANs) and Specific Advice Sheets, published by the Scottish Government of relevance to this assessment, include:

- PAN 50 Controlling the Environmental Effects of Surface Mineral Workings;
- PAN 61 Planning and Sustainable Urban Drainage Systems; and
- Online Planning Advice on Flood Risk (which supersedes PAN 69).

10.3.6 SEPA Guidance for Pollution Prevention (GPP) documents:

- GPP01 Understanding your environmental responsibilities – good environmental practices;
- GPP02 Above Ground Oil Storage;
- GPP03 Use and Design of Oil Separators in Surface Water Drainage Systems;
- GPP05 Works and Maintenance in or near Water;
- GPP06 Working at Construction and Demolition Sites;
- GPP08 Safe Storage and Disposal of Used Oils;
- GPP13 Vehicle Washing and Cleaning;
- GPP21 Pollution Incident Response Planning; and
- GPP22 Dealing with Spills.

10.3.7 CIRIA publications:

- Control of Water Pollution from Construction Sites C532 (2001);
- Environmental Good Practice on Site C741 (2015);
- The SUDS Manual C753 (2015); and
- Ground Engineering Spoil: Good Management Practice R179 (1997).

10.3.8 SEPA publications:

- Engineering in the Water Environment: Good Practice Guide – River Crossings (2010);
- Engineering in the Water Environment: Good Practice Guide – Sediment Management (2010);
- Guidance: Development on Peat and Off-site Uses of Waste Peat (2017);
- Groundwater Protection Policy for Scotland, Version 3 (2009);
- Land Use Planning System Guidance Note 4, Version 9 – Onshore Windfarm Developments (2017);
- Land Use Planning System SEPA Guidance Note 2a, Version 2 – Flood Risk (2018);

- Land Use Planning System SEPA Guidance Note 2e, Version 1 – Soils (2015);
- Land Use Planning System SEPA Guidance Note 31, Version 3 – GWDTE (2017);
- Position Statement, Version 2 – Culverting of Watercourses (2015); and
- Regulatory Position Statement – Developments on Peat (2010).

10.3.9 Other relevant guidance documents include:

- Scottish Natural Heritage (now NatureScot), Constructed Tracks in Scottish Uplands, 2nd Edition (2013);
- Scottish Government, Proposed Electricity Generation Developments: Peat Landslide Hazard Best Practice Guide (2017);
- Scottish Government, Guidance on Development on Peatland, Peatland Survey (2017);
- A joint publication by Scottish Renewables, Scottish Natural Heritage (now NatureScot), Scottish Environment Protection Agency, Forestry Commission Scotland and Historic Environment Scotland, Good Practice during Windfarm Construction, Version 4 (2019);
- Scottish Renewables and SEPA, Developments on Peatland: Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste (2012); and
- Scottish Government, The Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Second Edition) (2017).

10.4 Consultation

10.4.1 Consultation for the Proposed Development was undertaken with statutory and non-statutory bodies, as set out in Chapter 6.

10.4.2 The outcome of the relevant consultation with regards to geology (including soils and peat) and the water environment is summarised in Table 10.1.

Table 10.1– Consultation Responses

Consultee and Date	Consultation Response	Applicant Response
Energy Consents Unit Scoping 24 April 2023	Scottish Water provided information regarding drinking water protected areas and Scottish Water assets which the development could have a significant effect upon. Scottish Ministers request that the Applicant contacts Scottish Water (via EIA@scottishwater.co.uk) and makes further enquires to confirm whether there any Scottish Water assets which may be affected by the development, and includes details in the EIA Report of any relevant mitigation measures to be provided.	Assessments of potential impacts on the water environment, including Scottish Water assets and Drinking Water Protected Areas, is included in this chapter. No further consultation was required with Scottish Water to complete the assessment.
Energy Consents Unit Scoping 24 April 2023	Scottish Ministers request that the Applicant investigates the presence of any private water supplies which may be impacted by the development. The EIA Report should include details of any supplies identified by this investigation, and if any supplies are identified, the Applicant should provide an assessment of the potential impacts, risks, and any mitigation which would be provided.	Potential impacts to private water supplies are discussed in full in Technical Appendix 10.3 (PWSRA) and a summary is presented in this chapter. Private Water Supply sources have been confirmed by site investigation and have informed this assessment.
Energy Consents Unit Scoping 24 April 2023	Scottish Ministers consider that where there is a demonstrable requirement for peat landslide hazard and risk assessment (PLHRA), the assessment should be undertaken as part of the EIA process to provide Ministers with a clear understanding of whether the risks are acceptable and capable of being controlled by mitigation measures. The Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Second Edition), published at http://www.gov.scot/Publications/2017/04/8868 should be followed in the preparation of the EIA Report, which should contain such an assessment and details of mitigation measures. Where a PLHRA is not required clear justification for not carrying out such a risk assessment is required.	A comprehensive programme of peat depth probing and condition assessment has been completed. Potential impacts on peat and proposed mitigation measures are summarised in this chapter and discussed in full in Technical Appendix 10.1 (PLHRA) and Technical Appendix 10.2 (PMP).
Energy Consents Unit Scoping 24 April 2023	Where borrow pits are proposed as a source of on-site aggregate they should be considered as part of the EIA process and included in the EIA Report detailing information regarding their location, size and nature. Ultimately, it would be necessary to provide details of the	A Borrow pit assessment is presented in Technical Appendix 3.2.

Consultee and Date	Consultation Response	Applicant Response
	proposed depth of the excavation compared to the actual topography and water table, proposed drainage and settlement traps, turf and overburden removal and storage for reinstatement, and details of the proposed restoration profile. The impact of such facilities (including dust, blasting and impact on water) should be appraised as part of the overall impact of the working. Information should cover the requirements set out in 'PAN 50: Controlling the Environmental Effects of Surface Mineral Workings'.	
SBC Scoping	No objection in principle to this proposal in terms of flood risk, however the following should be adhered to; – The formation of any newly formed hard surfaces such as access roads should be attenuated to at least existing Greenfield runoff rates so that there is no increased effect on downstream receptors. Likewise, any discharges from SUDS and other drainage should be kept to existing Greenfield runoff rates. – A buffer zone between the turbines and watercourses. – For all culverts, watercourse crossings or alterations to crossings, these must not reduce the flow conveyance of the watercourse and should ideally allow for the 1 in 200 year flood flow to pass through. – Details of any silt traps and any other functions that the applicant proposes to minimise the amount of sediment entering the water course should be submitted. Content that the proposed assessment detailed in the Scoping Report from a Flooding perspective and further comments will be given once a detailed application is submitted. Please note that this information must be taken in the context of material that this Council holds in fulfilling its duties under the Flood Risk Management (Scotland) Act 2009.	A (Level 1) screening of flood risk sources is presented and required mitigation measures and best practice that would be adopted to control the quality and rate of run-off from site is presented in this chapter. It has been confirmed that new watercourse crossings would be sized to pass the 0.5 % Annual Exceedance Probability (AEP) plus an allowance for climate change. It is confirmed that a buffer of 50 m to watercourses and waterbodies has been included in the site design. Design standards and commitment to deploy SuDS has been given and will be included in the final CEMP agreed with SBC as part of the detailed design stage of the Proposed Development.
SBC Scoping	The elements of this development which have the potential to impact nearby residential amenity are noise (both construction and operational), impact on private water supplies and shadow flicker. Environmental Health would expect to see each of these matters addressed in an EIA.	Potential impacts to private water supplies are discussed in full in Technical Appendix 10.3 and a summary is presented in this chapter.
NatureScot Scoping 10 January 2023	Potential impacts on the qualifying interests of the River Tweed Special Area of Conservation (SAC) will need to be considered given that the watercourses within the site flow into the River Tweed SAC and Site of Special Scientific Interest (SSSI). Potential impacts can usually be addressed by good wind farm design, including embedded mitigation, and by commitment to the employment of good construction and pollution prevention methods, the preparation and implementation of a CEMP or similar and having an Ecological Clerk of Works (ECoW) on site at appropriate stages of the development.	Assessment on the potential impacts to the River Tweed SAC and SSSI is included in this chapter and Chapter 8. Required mitigation measures and best practice that would be adopted to safeguard the SSSI and SAC is presented in this chapter.
NatureScot Scoping 10 January 2023	Desk studies using our Carbon and Peatland 2016 mapping show the site contains Class 3 peatland. This is not classed as priority peatland habitat, although the carbon-rich soils can contain some areas of deep peat. Initial peat depth surveys for the site shown in Figure 12 of the Scoping Report indicate peatland is relatively shallow across the site. Potential impacts on the River Tweed SAC/SSSI arising from peatland will be covered elsewhere in the EIA Report.	Potential impacts on peat and proposed mitigation measures to safeguard peat and carbon rich soils are summarised in this chapter and discussed in full in Technical Appendix 10.1 and Technical Appendix 10.2.
SEPA Scoping 21 December 2022	We agree that a Private Water Supply (PWS) risk assessment is scoped into the EIA. We would recommend that the developer refers to SEPA's LUPS-GU31 (11/09/2017 v3) for the applicable buffer zones that would apply to PWS sources identified, the PWS source information required, the risk assessment and, if applicable, the mitigation and monitoring (including baseline) requirements. The PWS source information required includes clearly identifying together on a diagram the proposed infrastructure (not just turbines), PWS sources and applicable buffer zones.	Potential impacts to private water supplies are discussed in full in Technical Appendix 10.3 and a summary is presented in this chapter.
SEPA Scoping 21 December 2022	We note that there are localised areas of deep peat in the north-west area of the site. We would highlight that peat greater than 1 m in depth is considered deep peat, and that the submission must demonstrate how the layout has been designed to avoid areas of	Potential impacts on peat and carbon rich soils are summarised in this chapter and discussed in full in

Consultee and Date	Consultation Response	Applicant Response
	deep peat. We note that site specific targeted peat probing will be used to identify areas of potential deep peat and these will be avoided where possible, and we agree with this approach. In order to avoid delays and potential objection at a later stage, we would welcome the opportunity to review the proposed layouts and peat probing data in advance of the finalised EIA Report. We would ask that the phase 1 and phase 2 peat probing data is made available as part of the application submission.	Technical Appendix 10.1 and Technical Appendix 10.2. A site specific PMP has been prepared (Technical Appendix 10.2).
SEPA Scoping 21 December 2022	We note that a minimum 50 m buffer around watercourses / waterbodies which all elements will avoid is proposed and we are supportive of this approach. All watercourses must be identified, by mapping and ground truthing and a plan provided to show all watercourses and buffer zones, with proposed infrastructure overlain. Information on the scale of forestry felling must also be provided as there may be forest drains which could act as a pollution pathway. Watercourse crossings must be minimised. T4 appears to be located in a steep sided area to watercourses and we would encourage consideration of an alternative location for this turbine as in the current location it may be difficult to accommodate adequate space for mitigation. Please refer to Section 2 in the attached appendix.	It is confirmed that a buffer of 50 m to watercourses and waterbodies has been included in the site design. Turbine 4 (within the scoping layout) was removed in order to comply with watercourse setback distances, amongst other environmental considerations.
SEPA Scoping 21 December 2022	Provided watercourse crossings are designed to accommodate the 1 in 200 year event and other infrastructure is located well away from watercourses we do not foresee from current information a need for detailed information on flood risk.	It has been confirmed that any new watercourse crossings would be sized to pass the 0.5 % AEP event plus an allowance for climate change.
River Tweed Commission Scoping	It is recommended that construction avoids water bodies wherever possible. If construction is to be carried out near watercourses, a buffer zone of at least 50 m should be established. The potential for sediment transport and deposition should be carefully considered and the installation of appropriate siltation controls should be employed. Where river crossings are proposed SEPA's Engineering in the Water Environment Good Practice Guide should be consulted. The use of 'clear span bridge crossings' is encouraged wherever possible.	It is confirmed that a buffer of 50 m to watercourses and waterbodies has been included in the site design. It has been confirmed that any new watercourse crossings would be sized to pass the 0.5 % AEP event plus an allowance for climate change and crossing designs will be in in accordance with SEPA guidance.
River Tweed Commission Scoping	Peat slides can have a direct impact on fisheries and peat disturbance can have indirect effects on water quality and quantity and abundance of invertebrates. A detailed survey of peat deposits present within the site should be undertaken to ascertain the risk of peat slide during construction. All construction should avoid areas of deep peat and where this is not possible appropriate mitigation measures should be put in place. Natural peat drainage channels should be preserved throughout the development; excavated material should not be stock piled in areas of unstable peat; concentrated water flows onto peat slopes should also be avoided.	A comprehensive peat probing campaign has been completed and has included characterising the condition and characteristics of peat. This data has been used to prepare a PLHRA which is presented in Technical Appendix 10.1, of which a summary is presented in this chapter.
River Tweed Commission Scoping	SEPA, through The Water Environment (Controlled Activities) (Scotland) Regulations 2011 – more commonly known as the Controlled Activity Regulations (CAR) – and their further amendments of 2013 and 2017, regulates abstraction from and discharge of polluting matter to all wetlands, surface waters and ground waters. Where water abstraction is proposed, the developer should ensure that they comply with The Salmon (Fish Passes and Screens) (Scotland) Regulation 1994 which states that screens, at the point of water abstraction, should serve to prevent the entry and injury of salmon. Other fish species should also be considered in the same manner. Surface water run-off must be discharged in such a way to minimise the risk of pollution of the water environment.	Required mitigation measures and best practice that would be adopted to safeguard the water environment are presented in this chapter.
River Tweed Commission Scoping	Controlled Activity Regulations require any activity that is liable to cause water pollution authorised by SEPA. This includes point source pollution (e.g. sewage and trade effluent diffuse pollution (fuel, concrete spills, sediment discharge) all of which can be detrimental to the survival of fish. SEPA has produced guidelines for the prevention of pollution.	Required mitigation measures and best practice that would be adopted are presented in this chapter. This includes the requirement to apply for and obtain a Construction Site Licence, as

Consultee and Date	Consultation Response	Applicant Response
		required by CAR, prior to any construction commencing.
River Tweed Commission Scoping	Particular attention should be paid to acidification issues if they are known to be a problem in the area. Anthropogenic acidification of freshwaters is largely caused by the input of sulphur and nitrogen compounds, derived from the combustion of fossil fuels, exceeding the buffering capacity of the soils and underlying rocks through which the streams flow. Peat deposits and marine derived sulphates can also contribute to acidity. Salmonid fish are particularly sensitive to acid water, particularly due to the increased mobility of labile aluminium in acid conditions which is toxic to aquatic organisms.	Assessment of potential impacts on the water environment, including water quality is presented in this chapter. Potential impacts on fish are discussed in Chapter 8. A water quality monitoring programme is proposed and which would be used to confirm the efficacy of the mitigation measures and be used to record water quality in the watercourses that drain the site.
River Tweed Commission Scoping	The developer should assess the potential impacts of tree felling on the aquatic environment including nutrient release, increased acidification risk, loss of habitat, impacts on hydrology, increased fine sediment transport and deposition, all of which can have a detrimental impact on fish populations and should therefore be addressed in the ES. In addition, the mulching of fallen trees in situ should be avoided. The Forest and Water Guidelines should be consulted for further information.	Assessment of potential impacts on the water environment, including water quality impacts as a result of forestry felling is presented in this chapter.
River Tweed Commission Scoping	Monitoring throughout the development phase should be carried out to identify impacts and allow remediation at the earliest opportunity for sites where there are thought to be risks to fish populations. The experimental design of the monitoring programme should focus on the risks presented by the development and be clearly justified. Methods of analysis, reporting mechanisms and links to site management should also be clearly identified.	Noted. A draft schedule for water quality monitoring, to confirm the efficacy of proposed mitigation measures is presented in this chapter.
River Tweed Commission Scoping	Adherence to best available techniques would be expected throughout the development. Site specific mitigation measures and/or enhancement programmes to protect and/or compensate freshwater habitats should always be included in the Environmental Statement. Examples of mitigation measures include: – Avoidance of water bodies – Avoidance of peat – Hydrological buffer zones – Timing of works – Drainage schemes (which allow no direct discharges to water courses) – Pollution prevention – Adherence to current legislation and guidelines (e.g. river crossing for migratory fish) Other aspects of mitigation might include habitat restoration more generally, installation/repair of riparian fencing or riparian tree planting. Large scale terrestrial wind farms have been built in important river catchments with little or no observable impact on either water quality, quantity or fish populations. However, there remains the possibility of significant impacts on water quality, even on very well managed developments. Changes in water quality such as pH can be altered by development and there are have been examples of catastrophic failure of wind farm developments (Derry Bran – Republic of Ireland). There is therefore potential for considerable long and short term damage to the freshwater environment and it is these risks and subject areas that the Commission would seek to mitigate. If designed and located properly and if proper care and attention is taken during construction the wind farm development need not be incompatible with a high quality freshwater environment.	Noted. Required mitigation measures and best practice that would be adopted is presented in this chapter. It is confirmed that a buffer of 50 m to watercourses and bodies has been included in the site design. This is shown on Figure 10.1. Areas of deep peat have been avoided, which is discussed in full in Technical Appendix 10.1 and Technical Appendix 10.2. Potential impacts on fish and the aquatic environment are discussed in Chapter 8. A water quality monitoring schedule is proposed as is a geotechnical risk register.
Scottish Water Scoping 05 January 2023	A review of our records indicates that the proposed activity appears to fall partly within a drinking water catchment where a Scottish Water abstraction is located. Scottish Water abstractions are designated as Drinking Water Protected Areas (DWPA) under Article 7 of the Water Framework Directive. Megget Reservoir supplies Glencorse, Rosebury, Marchbank and Bonnycraig Water Treatment	Noted. Assessment of potential impacts on the water environment, including potential impacts on DWPAs is presented in this chapter.

Consultee and Date	Consultation Response	Applicant Response
	Works (WTW) and it is essential that water quality and water quantity in the area are protected. The activity is a sufficient distance from our intake that it is likely to be low risk, however water quality protection measures must be implemented.	Measures required to safeguard water quality and existing water flow paths are presented in this chapter.
Scottish Water Scoping 05 January 2023	As the proposed site is west of the River Tweed the impact on Talla and Fruid our neighbouring reservoirs and catchments is not affected. However you should be aware that local heavy construction traffic has the potential to impact the nearby Talla Aqueduct although again is likely low risk. This should be confirmed however through obtaining plans from our Asset Plan Providers, listed in the SW list of precautions for assets, which can be found on the activities within our catchments page of our website at www.scottishwater.co.uk/slm.	Asset plans have been requested. Should construction traffic associated with the Proposed Development utilise the public highway where it passes over the Talla Aqueduct, the Applicant will undertake a structural assessment of the aqueduct at these location(s).
Tweedsmuir Community Council Scoping 24 February 2023	A concern has also been raised - – about the potential for this development to impact upon local private water supplies during the period of both the enabling works and operation – the impact of excavating and subsequently siting large areas for laying of concrete foundations on surface water and water run off Should this proposal go ahead the residents of Tweedsmuir will be further impacted by wind turbines and/or commercial forestry. The resources associated with our relatively remote rural community will continue to be developed to the detriment of residents.	Assessment of potential impacts on the water environment, including water quality and impact on private water supplies is presented in this chapter and Technical Appendix 10.3. Measures required to maintain existing water flows paths and rates (and to ensure no increase in flood risk) are presented in this chapter.

Effects Scoped Out

10.4.3 On the basis of the desk based and survey work undertaken, policy, guidance and standards, the professional judgement of the EIA team, feedback from consultees and experience from other relevant projects, the following topics have been scoped out of the assessment:

- Detailed flood risk assessment: Published mapping confirms that most of the site is not located in an area identified as being at flood risk. A (Level 1) screening of potential flooding sources (fluvial, coastal, groundwater, infrastructure etc.) is presented in the EIA Report and measures that would be used to control the rate and quality of run-off have been specified and would be included in the CEMP at the detailed design stage of the Proposed Development;
- Drainage Impact Assessment: Principles for the design of any watercourse crossings and for the control of drainage shed from the Proposed Development have been specified in this chapter. It is expected that these would be developed as part of the detailed site design, should the site be granted planning permission, and a site-specific drainage plan would be a pre-development planning condition;
- Water quality monitoring: As the assessment is informed by classification data available from SEPA and there are no known sources of potential water pollution, no additional baseline water quality monitoring is considered necessary to complete the assessment. Note water quality monitoring is proposed prior to construction, throughout the construction phase and immediately post construction if the Proposed Development were to be granted consent. Details of monitoring suites, locations, frequencies, and reporting would be specified in the CEMP; and
- Potential effects on geology: With the exception of peat, there are no protected geological features within the site boundary or study area. Furthermore, the nature of the activities during construction, operation and decommissioning of the Proposed Development would not alter regional superficial or solid geology. Potential effects on peat and carbon rich soils are not scoped out of the assessment and are considered in full;
- Potential effects on the water environment due to forestry felling have also been scoped out of the assessment. Details of forestry felling required to facilitate construction and operation of the Proposed Development are provided in Chapter 15. Table 10.2 compares the proposed felling areas to the surface water catchments in which the felling will occur.

Table 10.2– Forestry Felling and Water Catchment Areas

Catchment	Total Water Catchment Area (km^2)	Forestry Felling Area (km^2)	Percentage of Catchment (%)
River Tweed	82.94	0.135	0.16

Catchment	Total Water Catchment Area (km^2)	Forestry Felling Area (km^2)	Percentage of Catchment (%)
Kingledores Burn	15.14	0.045	0.30
Riggs Burn	1.05	0.086	8.19
Hallow Burn	0.52	0.078	14.93
Gala Burn	0.74	0.162	21.87

10.4.4 The proposed areas of felling are below or just above the forest best practice felling guidance threshold[1] (20% of the total catchment area) and therefore no impact on water quality or rainfall run-off response is anticipated as a result of felling, subject to the adoption of industry standard best practice. Felling will be undertaken in accordance with national standards and best practice measures, as discussed in Chapter 15, which will safeguard water quality and minimise the risk from the use of machinery used in forestry operations. A Forestry Waste Management Plan will also form part of the final CEMP.

10.4.5 In addition, a programme of baseline, construction and post construction phase water quality monitoring is proposed which would be used to confirm that felling as a result of the Proposed Development would not have a significant effect on the water environment. The monitoring data will be used to confirm the acid neutralising capacity of the surface water catchments.

10.5 Assessment Methodology and Significance Criteria

10.5.1 The potential effects associated with the Proposed Development on soils, geology and the water environment have been assessed by completing an initial desk study followed by an impact assessment. Characterisation of baseline conditions and the impact assessment have been informed by a detailed programme of site investigation.

Study Area

10.5.2 The study area encompasses the area over which all desk-based and field data were gathered to inform the assessment presented in this chapter. The study area comprises all elements of the Proposed Development and a 500 m buffer to the site boundary, as shown on Figure 10.1.

10.5.3 The study area for potential cumulative effects uses the catchments within the study area and within 5 km of the proposed site infrastructure

Desk Study

10.5.4 An initial desk study was undertaken to determine baseline characteristics by reviewing available information on geology, soils and the water environment. The following sources of information have been consulted:

- Ordnance Survey (OS) 1:50,000 and 1:25,000 scale mapping;
- NatureScot SiteLink;
- James Hutton Institute, 1:250,000 National Soils Map of Scotland and Carbon and Peatland 2016 data;
- British Geological Survey (BGS) Onshore Geoindex;
- BGS Hydrogeological Maps of Scotland (1:100,000 scale Aquifer Productivity and Groundwater Vulnerability datasets);
- UK Centre for Ecology and Hydrology, Flood Estimation Handbook (FEH) webservice;
- UK Centre for Ecology and Hydrology, National River Flow Archive (NFRA);
- SEPA rainfall data;
- SEPA flood maps and reservoir flooding maps;
- SEPA environmental data;
- Data requests to SEPA regarding details of registered / licenced abstractions and discharges (March 2023); and
- Data requests to SBC regarding details of historical flooding records and private water abstractions (January 2023).

[1] The UK Forestry Standard – The Government's Approach to Sustainable Forestry, 2023.

Field Survey

10.5.5 The project hydrologists, hydrogeologists, geologists, and ecologists have worked closely on this assessment to ensure that appropriate information is gathered to allow a comprehensive impact assessment to be completed. Detailed site visits and walkover surveys have been undertaken by the authors of this assessment on the following dates:

- September 2022, December 2023 and February 2024 to undertake peat depth probing, augering and peat characterisation; and
- December 2023 to complete a watercourse crossing survey and private water supply survey.

10.5.6 The field work has been undertaken to:

- verify the information collected during the desk and baseline study;
- allow appreciation of the site, determine gradients, assess access routes, ground conditions etc, and to assess the relative location of all the components of the Proposed Development;
- assess peat depths and condition, and undertake geomorphological mapping;
- undertake visual assessment of the main surface waters and identify and verify the location of private water supplies;
- identify drainage patterns, areas vulnerable to erosion or sedimentation deposition and any pollution risks; and
- visit proposed watercourse crossings and prepare a schedule of these, as required.

10.5.7 The desk study and field surveys have been used to identify potential development constraints and have been used as part of the iterative design process.

10.5.8 The data obtained as part of the desk study and collected as part of the field work has been processed and interpreted to complete the impact assessment and recommend mitigation measures where appropriate.

Assessment of Potential Effect Significance

10.5.9 The significance of potential effects of the Proposed Development has been assessed by considering two factors: the sensitivity of the receiving environment and the potential magnitude of impact, should that effect occur.

10.5.10 The assessment methodology has also been informed by experience of carrying out such assessments for a range of wind farm and other renewable energy and electrical transmission developments, knowledge of the geology and water environment characteristics in Scotland and cognisance of good practice.

10.5.11 This approach provides a mechanism for identifying the areas where mitigation measures are required and for identifying mitigation measures appropriate to the significance of potential effects presented by the Proposed Development, such as is detailed in the site-specific private water supply risk assessment, peat management plan and peat landslide hazard risk assessment.

10.5.12 The criteria for determining the significance of effect are provided in Table 10.3, Table 10.4, and Table 10.5.

Sensitivity Criteria

10.5.13 The sensitivity of the receiving environment (i.e. the baseline quality of the receiving environment) is defined as its ability to absorb an effect without a detectable change and can be considered through a combination of professional judgement and a set of pre-defined criteria as set out in Table 10.3. Receptors in the receiving environment only need to meet one of the defined criteria to be categorised at the associated level of sensitivity.

Table 10.3 – Sensitivity of Receptor Criteria

Sensitivity	Definition
High	– soil type and associated land use is highly sensitive (e.g. unmodified blanket bog peatland); – SEPA WFD Water Body Classification: High-Good or is close to the boundary of a classification Moderate to Good or Good to High; – receptor is of high ecological importance or national or international value (e.g. Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC), habitat for protected species) which may be dependent upon the hydrology of the site;

Sensitivity	Definition
	– receptor is at risk from flooding in the future (2080) and/or water body acts as a current active floodplain or flood defence; – receptor is used for public and/or private water supply (including Drinking Water Protected Areas (DWPA)); – groundwater vulnerability is classified as high; and – if a GWDTE is present and identified as being of high sensitivity.
Moderate	– soil type and associated land use is moderately sensitive (e.g. arable, commercial forestry); – SEPA Water Framework Directive Water Body Classification: Moderate or is close to the boundary of a classification: Low to Moderate; and – moderate classification of groundwater aquifer vulnerability.
Low	– soil type and associated land use not sensitive to change in hydrological regime and associated land use (e.g. intensive grazing of sheep and cattle); – SEPA Water Framework Directive Water Body Classification Poor or Bad; – receptor is not at risk of flooding in the future (2080); and – receptor not used for water supplies (public or private).
Not Sensitive	– receptor would not be affected by the Proposed Development, e.g., lies within a different and unconnected hydrological / hydrogeological catchment.

Magnitude of Impact

10.5.14 The potential magnitude of an impact would depend upon whether the potential impact would cause a fundamental, material, or detectable change. In addition, the timing, scale, size, and duration of the potential impact resulting from the Proposed Development are also determining factors.

10.5.15 The criteria that have been used to assess the magnitude of impact are defined in Table 10.4. The characteristics of the impacts are described as: direct/indirect, temporary (reversible) or permanent (irreversible), together with timescales (short, medium and long term).

Table 10.4 – Magnitude of Impact

Magnitude of Impact	Criteria	Definition
Major	Results in loss of attribute	Long term or permanent changes to the baseline geology, hydrology, hydrogeology and geology such as: – permanent degradation and total loss of soils habitat (inc. peat) and geology; – loss of important geological structure/features; – wholesale changes to watercourse channel, route, hydrology or hydrodynamics; – changes to the site resulting in an increase in run-off with flood potential and also significant changes to erosion and sedimentation patterns; – major changes to the water chemistry; and – major changes to groundwater levels, flow regime and risk of groundwater flooding.
Medium	Results in impact on integrity of attribute or loss of part of attribute	Material and short to medium term changes to baseline geology, hydrology, hydrogeology and water quality, such as: – loss of extensive areas of soils and peat habitat, damage to important geological structures/features; – some changes to watercourses, hydrology or hydrodynamics; – changes to site resulting in an increase in run-off within system capacity; – moderate changes to erosion and sedimentation patterns; – moderate changes to the water chemistry of surface run-off and groundwater; and – moderate changes to groundwater levels, flow regime and risk of groundwater flooding.
Low	Results in minor impact on attribute	Detectable but non-material and transitory changes to the baseline geology, hydrology, hydrogeology and water quality, such as: – minor or slight loss of soils and peat or slight damage to geological structures/feature; – minor or slight changes to the watercourse, hydrology or hydrodynamics;

Magnitude of Impact	Criteria	Definition
		– changes to site resulting in slight increase in run-off well within the drainage system capacity; – minor changes to erosion and sedimentation patterns; – minor changes to the water chemistry of surface run-off and groundwater; and – minor changes to groundwater levels, flow regime and risk of groundwater flooding.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect the use/integrity	No perceptible changes to the baseline geology, hydrology, hydrogeology and water quality such as: – no impact or alteration to existing important soils (inc. peat) geological environs; – no alteration or very minor changes with no impact to watercourses, hydrology, hydrodynamics, erosion and sedimentation patterns; – no pollution or change in water chemistry to either groundwater or surface water; and – no alteration to groundwater recharge or flow mechanisms.

Significance of Effect

10.5.16 The sensitivity of the receptor together with the magnitude of impact determines the significance of the effect, which can be categorised into a level of significance as identified in Table 10.5.

Table 10.5 – Significance of Effect

Magnitude of Impact	Sensitivity of Receptor			
	High	**Moderate**	**Low**	**Not Sensitive**
Major	Major	Major	Moderate	Negligible
Medium	Moderate	Moderate	Minor	Negligible
Low	Moderate	Minor	Minor	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

10.5.17 Table 10.5 provides a guide to assist in decision making. However, it should not be considered as a substitute for professional judgment and interpretation. In some cases, the potential sensitivity of the receiving environment or the magnitude of potential impact cannot be quantified with certainty and, therefore, professional judgement remains the most robust method for identifying the predicted significance of a potential effect.

10.5.18 Effects of 'Major' and 'Moderate' significance are considered to be 'significant' in terms of the EIA Regulations.

Cumulative Assessment

10.5.19 The assessment also considers potential cumulative effects associated with other developments within 5 km of the nearest element of the Proposed Development and in the same surface water catchments as the Proposed Development. A cumulative effect is considered to be the effect on a hydrological, hydrogeological or geological receptor arising from the site in combination with other developments which are likely to affect soils or geology, surface water and groundwater.

Mitigation

10.5.20 Any potential effects of the Proposed Development on soils, geology and the water environment identified by the assessment have been addressed and mitigated by the conceptual site design and the application of good practice guidance implemented as standard during construction, operation and decommissioning to prevent, reduce or offset effects where possible. As such, a number of measures would form an integral part of the design/construction process, and these have been considered prior to assessing the likely effects of the Proposed Development. Where appropriate, further tailored mitigation measures have been identified prior to determining the likely significance of residual effects.

10.5.21 Good practice measures would be applied in relation to pollution risk, sediment management, soil and peat management and management of surface run-off rates and volumes. This would form part of the CEMP to be implemented for the Proposed Development which would be secured by a planning condition and would be prepared prior to construction commencing. An outline CEMP is provided as Technical Appendix 3.1.

10.5.22 The final CEMP would include details and responsibilities for environmental management on-site and would outline the necessary measures for surface water management, oil and chemical delivery and

storage requirements, waste management, traffic and transport management. It would also specify monitoring requirements for wastewater, water supply including an Environmental Incident Response Plan (EIRP) and all appropriate method statements and risk assessments for the construction of the Proposed Development.

Residual Effects

10.5.23 A statement of residual effects, following consideration of any further specific mitigation measures where identified, is provided below.

Limitations to Assessment

10.5.24 The assessment uses site investigation, survey data and publicly available data sources, including but not limited to information published by SEPA, NatureScot, Met Office, SBC and commercial data supply companies, as well as additional information supplied from stakeholders during the scoping and consultation stages.

10.5.25 It is considered that the data and information used to complete this assessment is robust and that there are no significant data gaps or limitations.

10.6 Baseline Conditions

10.6.1 This section outlines the baseline soils (including peat), geology and water conditions within the study area. The study area is shown on Figure 10.1.

Site Setting

10.6.2 The Proposed Development is located to the north-west of Tweedsmuir and is centred on National Grid Reference (NGR) 308300, 624200. Access to the site would be afforded via an existing track to the south of the site, from the A701.

10.6.3 Elevations across the site generally decrease south-eastwards towards the River Tweed. Across the site, ground elevations range from 490 m Above Ordnance Datum (AOD) along the north-eastern boundary of the site, near the summit of Upper Oliver Dod, to the River Tweed (south-east), at approximately 260 m AOD.

Statutory Designated Sites

10.6.4 Review of the NatureScot Sitelink webpage confirms that two statutory designated sites are located within the study area, as shown on Figure 10.1.

10.6.5 The River Tweed Site of Special Scientific Interest (SSSI) which is also part of the River Tweed Special Area of Conservation (SAC) is located along the south-eastern border of the site. The SAC and SSSI has been designated for several fish populations (including Atlantic salmon (*Salmo salar)*, brook lamprey *(Lampetra planeri)*, river lamprey (*Lampetra fluviatilis*) and sea lamprey (*Petromyzon marinus*)), beetle assemblage, fly assemblage, otters (*Lutra lutra*), vascular plant assemblage and several freshwater habitats including trophic range river / stream and rivers with floating vegetation often dominated by water-crowfoot. The SSSI and SAC are hydraulically connected to the Proposed Development, as they lie downstream of the Proposed Development. They have therefore been considered further in this assessment.

10.6.6 Potential effects as a consequence of the Proposed Development on the designated sites are also considered within Chapter 8.

10.6.7 No other designated sites are noted within the study area.

Geology

Soils

10.6.8 An extract of the 1:250,000 National Soil Map of Scotland is presented as Figure 10.2 which shows that the majority of the site is underlain by peaty podzols. Small areas of peaty gleys, brown soils and alluvial soils are noted within the south-eastern extent of the site, in the Tweed Valley.

Peat and Superficial Deposits

10.6.9 An extract of BGS superficial deposit mapping is presented as Figure 10.3.

10.6.10 Superficial geological mapping shows that the majority of the site is shown to be absent of any superficial deposits. Glacial till and glaciofluvial deposits are shown to bound watercourses within the site whilst alluvium is shown along the south-eastern boundary and to bound the River Tweed.

10.6.11 Peatland classification mapping (Figure 10.4) shows that the majority of the site lies within Class 3 peatland. Class 3 peatland is not considered priority peatland although occasional peatland habitats can be found and most soils are considered carbon rich with some areas of deep peat.

10.6.12 Small areas of Class 4, Class 5 and Class 0 peatlands are noted within the site, particularly within the south-eastern extent of the site. Class 4 and Class 5 peatlands are considered to be areas unlikely to be associated peatland habitats however the soils may remain carbon rich and contain areas of deep peat. Class 0 is a mineral soil and does not represent a peatland habitat.

10.6.13 As part of the baseline assessment, a comprehensive peat probing and condition assessment programme has been completed, the results of which are presented in full in Technical Appendix 10.1 and Technical Appendix 10.2. A review of the investigation data confirms:

- nearly 2,000 peat probes were advanced across all survey phases;
- peat depths of between 0 m and 7 m were recorded across the site;
- approximately 85 % of the peat probes recorded peat depths of less than 0.5 m;
- the deepest areas of peat (greater than 4 m) were noted the north-eastern extent of the site, on the northern slopes of Weird Law; and
- the peat within the Proposed Development has been recorded as fibrous to pseudo-fibrous and would be classified as between H2 and H5 in the von Post classification, showing insignificant to moderate decomposition.

Bedrock Geology and Linear Features

10.6.14 An extract of the regional BGS bedrock geological mapping is presented on Figure 10.5 which shows that the site is underlain by metasandstones and metamudstones of the Mindork Formation and Shinnel Formation.

10.6.15 A thrust fault is noted between the two bedrock units with a north-western and south-eastern trend, across the north-western extent of the site. Another inferred fault is noted within the centre of the site with a north to south trend.

Hydrogeology

Aquifer Characteristics and Groundwater Vulnerability

10.6.16 An extract of the BGS 1:625,000 scale Hydrogeological Map of Scotland and 1:100,000 scale Aquifer Productivity and Groundwater Vulnerability datasets are presented as Figure 10.6 and Figure 10.7 respectively.

10.6.17 Figure 10.6 confirms that the Proposed Development is underlain by bedrock classified as a low productivity aquifer whereby small amounts of groundwater are expected near surface weathered zones and secondary fractures.

10.6.18 A description and hydrogeological classification of the geological units at the site is presented in Table 10.6.

Table 10.6 – Hydrogeological Characterisation

Geological Period	Geological Unit	Hydrogeological Characterisation	Hydrogeological Classification
Quaternary	Blanket Head	Fragments of angular rock from an undifferentiated source.	Not a significant aquifer
	Glacial Till	Sand and gravel horizons within this unit can store groundwater, although their lateral and vertical extent realises a variable and often small groundwater yield. Clay within this unit acts as an aquitard to the more permeable sand and gravel lenses and will hinder/prevent large scale groundwater movement. Regionally, groundwater flow will be limited by the variability of these deposits and consequently any groundwater yields are normally low.	
	Alluvium	The deposit is predominantly silt and clays with some sand, pebbles and cobbles. Groundwater storage and movement typically limited by small regional extent of this unit. Local differences in thickness, material type and its sorting can cause a considerable range in hydraulic conductivity. Commonly in	Intergranular Flow Moderate to High Productivity

Geological Period	Geological Unit	Hydrogeological Characterisation	Hydrogeological Classification
		hydraulic continuity with nearby watercourses and can support locally important potable water supplies.	
	Glaciofluviual deposits	The deposits are predominantly gravel, sand and silts. Groundwater storage and movement typically limited by small regional extent of this unit. Commonly in hydraulic continuity with nearby watercourses and can support locally important potable water supplies.	Intergranular Flow High Productivity
Silurian	Mindork Formation	Metasandstone and metamudstone. Groundwater flow can occur in the upper weather surface of the bedrock and secondary permeability occurs in deeper fractures and faults. Groundwater flow typically follow surface topography (e.g. from high ground to low ground)	Intergranular and Fracture Flow Low Productivity
Ordovician	Shinnel Formation		

10.6.19 Groundwater vulnerability is divided into five classes (1 to 5) with 1 being least vulnerable and 5 being the most vulnerable. Review of Figure 10.7 shows that the potential groundwater vulnerability in the uppermost aquifer beneath the site has a vulnerability of Class 4a and 5. The highest vulnerability is noted within the northern and central extent of the site, where no superficial deposits are recorded, and therefore, little attenuation of potential pollutants prior to entry to potential shallow groundwater in the weathered bedrock surface.

Groundwater Levels and Quality

10.6.20 Groundwater recharge at, and surrounding, the site is limited by the following factors:

- steeper topographic gradients will result in rainfall forming surface water run-off; and
- the underlying bedrock displays a low permeability that inhibits groundwater recharge.

10.6.21 At lower elevations (outwith the proposed turbine area) where alluvium and glaciofluvial deposits are recorded, incident rainfall will more readily form groundwater recharge as a result of the shallower surface gradients and more permeable nature of these geological units.

10.6.22 SEPA has confirmed it does not maintain any groundwater level monitoring locations within the study area. In the absence of published information or data held by SEPA, it is anticipated that limited groundwater will be present as perched groundwater within the more permeable horizons of the till, glaciofluvial and alluvium deposits and within weathered zone, fractures or faults within the bedrock deposits.

10.6.23 All of Scotland's groundwater bodies have been designated as Drinking Water Protected Areas under the Water Environment (Drinking Water Protected Area) (Scotland) Order 2013 and require protection for their current use or future potential as drinking water resources.

10.6.24 The current status of groundwater bodies in Scotland has been classified by SEPA in accordance with the requirements of the Water Framework Directive (WFD). SEPA identify two groundwater bodies beneath the site:

- Peebles, Galashiels and Hawick (SEPA ID: 150697) groundwater body, was classified in 2022 (the latest reporting cycle) with an Overall Status of Good and no pressures were identified; and
- Upper Tweeddale Sand and Gravel (SEPA ID: 150738) groundwater body, was classified in 2022 with an Overall Status of Good and no pressures are identified.

Groundwater Dependent Terrestrial Ecosystem (GWDTE)

10.6.25 A National Vegetation Classification (NVC) habitat mapping exercise was conducted as part of the ecology baseline survey and this has been used to identify potential GWDTE within the site. The methodology and results of the NVC habitat mapping exercise are discussed in detail within Chapter 8. With reference to SEPA's LUPS-31 guidance, areas of potential GWDTE are shown on Figure 10.8.

10.6.26 The location of potential GWDTE and their likely dependency on groundwater is discussed in Table 10.7.

Table 10.7 – Groundwater Dependent Terrestrial Ecosystems

NVC Community	Potntial GWDTE Classification	Location and Distribution
M23	High	M23 dominated polygons are noted in small areas within or adjacent to the watercourse corridors across the site. It is likely that these habitats are not groundwater dependent

NVC Community	Potntial GWDTE Classification	Location and Distribution
		and instead sustained by surface water and waterlogging of soils adjacent to watercourses. In these locations the M23 habitat is not considered to be sustained by groundwater. M23 habitat is also noted as part of larger polygons (see highly sub dominant areas on Figure 10.8) which are located within the centre of the site near the Hallow Burn on the southern slopes of the Upper Oliver Dod. Three springs are noted on OS mapping near the Hallow Burn within the sub dominant polygons containing M23. Figure 10.3 (Superficial Geology) shows the springs are associated with glaciofluvial deposits and that none of the Proposed Development lies within this deposit. No development, except for a small part of an existing access track, is located within 250 m of these springs. The existing access track is noted > 100 m from the springs. Given the distance to the Proposed Development and the differing geology, these springs are not considered at risk. Notwithstanding this, works upstream (e.g. T5, BP-C and T7) of these communities should be supervised by a project EnvCoW to ensure existing water flow paths are maintained, as discussed in Section 10.7.
M25	Moderate	M25 dominated polygons are noted across the site, typically in linear polygons along the existing access track and within forest rides where a surface water channel was noted during the site visit. It is therefore considered that these habitats are sustained by surface water, run-off and waterlogging of soils rather than by groundwater. M25 is also noted as part of larger polygons (see moderately sub dominant areas on Figure 10.8). These are noted along the edge of the forestry blocks and within forestry rides particularly within the north-western corner of the site, across a range of different geologies. This distribution is not typical of that of emergent groundwater and therefore it's considered likely that any M25 within these larger polygons are sustained by surface water, ponding and waterlogging of soils above the low permeability bedrock.
M27	Moderate	M27 is noted only as part of a larger polygon (see moderately sub dominant areas on Figure 10.8) which is located within the southern extent of the site near the banks of the Gala Burn. No development is noted within 250 m of the polygon and therefore it is not considered further.
W2	Moderate	A W2 dominated polygon is noted within the southern corner of the site, adjacent to the River Tweed and underlain by alluvium deposits. This distribution is not typical of that attributable to a dominant groundwater discharge but rather by rainfall, surface water and waterlogging of soils. Any groundwater will also be hydraulically connected to and sustained by the River Tweed.

10.6.27 Review of Table 10.7 shows that potential high and moderate GWDTE are generally located on ground adjacent to watercourses. This distribution is not typical of a habitat sustained by groundwater but rather it is likely to be supported by rainfall, surface water ponding and water logging of soils.

10.6.28 Buffers to areas of potential GWDTE specified in SEPA guidance therefore do not apply, but safeguards to maintain these habitats, and the surface water sources to these habitats will need to be maintained during construction, operation and decommissioning of the Proposed Development, details of which are included in Section 10.7 and Section 10.8.

Hydrology

Local Hydrology

10.6.29 The Proposed Development is entirely located within the surface water catchment of the River Tweed which flows north-eastwards along the south-eastern boundary of the site.

10.6.30 Part of the north-western extent of the site, including Turbine 5 and BP-C, is located within the Kingledores Burn sub catchment, which is a tributary of the River Tweed. The Kingledores Burn is located approximately 700 m north-west of the site and flows generally north-eastwards before discharging into the River Tweed some 3.1 km north-east of the site.

10.6.31 All other elements of the Proposed Development lie in sub-catchments of the River Tweed which drain southwards to the River Tweed; these include Rigs Burn, Hallow Burn, Gala Burn and Bield Burn.

10.6.32 None of the surface water catchments which drain the site have been designated as a DWPA.

10.6.33 To the south and south-east of the site, several surface water catchments have been designated as DWPAs, all of which are tributaries of the River Tweed, including the Fingland Burn, Hawkshaw Burn and Menzion Burn. These catchments are noted on the opposite side of the River Tweed. No development is proposed within these catchments and the Proposed Development is not considered to be hydraulically connected to the DWPA catchments. Scottish Water in their consultation response (see Table 10.1) confirmed that their water abstraction in these DWPAs is not at risk from the Proposed Development.

10.6.34 As also noted in Table 10.1, Megget, Talla and Fruid Reservoirs have also been designated as DWPAs. The reservoirs are located approximately 8.4 km south-east, 1.7 km south-east and 2.5 km south of the

site respectively, at their closest extent. The reservoirs lie beyond the study area and no development is proposed within the catchments that serve the reservoirs. Scottish Water in their consultation response confirmed these sources are not considered at risk from the Proposed Development.

10.6.35 The DWPAs are therefore not considered at risk and are not assessed further in this chapter. Measures to safeguard existing surface water flow paths and quality, to the tributaries of the River Tweed that drain the site, are discussed in Section 10.7 and Section 10.8.

10.6.36 Should construction traffic associated with the Proposed Development utilise the public highway where it passes over the Talla Aqueduct, the Applicant will undertake a structural assessment of the aqueduct at these location(s).

Rainfall and Surface Water Flows

10.6.37 SEPA has provided precipitation data for Glenbreck rain gauge (station number 368490) which is located approximately 1.7 km south-west of the site. In 2023, the annual rainfall was recorded to be 1,333 mm.

10.6.38 SEPA has provided stream flow data for the River Tweed at Glenbreck and Kingledores which are located approximately 1.7 km south-west (upstream) and 3.1 km north-east (downstream) of the site respectively. In 2022, mean flows of 1.6 m3/s and 4.7 m3/s were recorded at these gauges respectively.

10.6.39 Table 10.8 summarises the surface water catchment characteristics of the main watercourses that drain the Proposed Development.

Table 10.8 – Surface Water Catchment Descriptors

Watercourse	Downstream Point (NGR)	Area (km^2)	SAAR (mm)	ALTBAR (mASL)	DPSBAR (m/km)	LPD (km)	BFIHOST19 (dim)
Rigs Burn	NT 08100 23050	1.05	1398	390	176.5	2.06	0.273
Hallow Burn	NT 08900 23850	0.52	1359	379	203.1	1.9	0.297
Gala Burn	NT 09250 24200	0.72	1332	377	154.1	1.45	0.309
Note: Grid reference of downstream point is either the Proposed Development application boundary or confluence with another watercourse; SAAR – surface average annual rainfall between 1961 and 1990; ALTBAR – mean catchment altitude (metres above sea level); DPSBAR – index of catchment steepness; and LDP – longest drainage path; BFIHOST – revised base flow index (2019) which is a measure of catchment responsiveness to precipitation.							

Surface Water Quality

10.6.40 Water quality in the River Tweed and the Kingledores Burn is monitored by SEPA and classified annually in accordance with the requirements of the WFD. Table 10.9 summarises classifications reported in 2022 (the latest reporting cycle). Smaller watercourses within the Proposed Development are not monitored nor classified by SEPA.

Table 10.9 – Surface Water Classification Data

Watercourse (SEPA ID)	Overall Status	Overall Ecology	Physio-Chemical Status	Hydromorphology	Pressures
River Tweed – source to Talla Water confluence (5205)	Moderate	Moderate	Not monitored	Good	Barrier to fish migration.
River Tweed – Talla Water confluence to Scotsmill (5204)	Good ecological potential	Moderate	High	Moderate	Pressures on water flows and level due to water storage for public water supplies.
Kingledores Burn	High	High	High	High	None.

Fisheries

10.6.41 Fisheries interests are managed by the River Tweed Commission and Tweed Foundation and are discussed and assessed in Chapter 8.

Watercourse Crossings

10.6.42 The Proposed Development has sought to utilise existing tracks and access routes where possible. As a result, no new watercourse crossings are required to facilitate the Proposed Development. However, subject to structural analysis at the detailed design stage of the Proposed Development, one existing crossing may need to be upgraded. The location of the existing crossing is shown on Figure 10.1 and details of the existing crossing and watercourse is included in Table 10.10.

Table 10.10 – Existing Watercourse Crossing

Watercourse Crossing Details	**NGR**: NT 07703 24259 **Status**: Existing **Culvert Diameter**: 0.5 m **Culvert Construction Type**: Plastic circular culvert **Watercourse Width**: 0.4 m **Watercourse Depth**: 0.4 m
Photograph Looking at Culvert Entrance from Upstream	
Photograph Looking at Culvert Exit from Downstream	

10.6.43 In addition, two new small watercourse crossings will be required for the proposed recreational heritage trail. Good practice measures associated with construction of these crossings are discussed in the Section 10.7.

Flood Risk

10.6.44 SEPA has developed national flood maps that present modelled flood extents for river, coastal, surface water and groundwater flooding. The river, coastal, surface water and groundwater maps were developed using a consistent methodology to produce outputs for the whole of Scotland, supplemented with more detailed, local assessments where available and suitable for use. Flood extents are presented in three likelihoods:

- high likelihood: A flood event is likely to occur in the defined area on average more than once in every ten years (1:10). Or a 10 % chance of happening in any one year;
- medium likelihood: A flood event is likely to occur in the defined area on average more than once in every two hundred years (1:200). Or a 0.5 % chance of happening in any one year; and
- low likelihood: A flood event is likely to occur in the defined area on average more than once in every thousand years (1:1000). Or a 0.1 % chance of happening in any one year.

10.6.45 The flood risk from each of these potential sources is discussed in Table 10.11.

Table 10.11 – Potential Flood Risk

Potential Source	Potential Flood Risk to the Proposed Development	Justification
Coastal Flooding	No	The site is remote from the coast and situated at an elevation of at least 270 m AOD. SEPA flood maps confirm no risk of tidal flooding within the site.
River Flooding	No	SEPA flood maps confirm that the majority of the site is not at risk from fluvial flooding. Flooding associated with the River

Potential Source	Potential Flood Risk to the Proposed Development	Justification
		Tweed is noted along the south-eastern boundary of the site, to the south of the A701, however no development is proposed within the mapped floodplain. It is noted that the SEPA flood maps do not show flooding of the smaller watercourses within the site, however, floodplains associated with these watercourses are likely to be limited and confined to watercourse corridors. With the exception of the existing access track, no development is proposed within 50 m of the watercourses. The site is therefore not considered to be at risk from fluvial flooding.
Surface Water Flooding	No	SEPA has identified several areas of surface water flood risk across the site which generally coincides with watercourse corridors. Flood extents are shown to be small, localised, never forming large, linked areas or flow paths. Therefore, surface water is not considered a development constraint.
Groundwater Flooding	No	Review of the SEPA groundwater flood map confirms that the site is not at risk from groundwater flooding. This concurs with the desk-based assessment which has shown that there is little potential for significant groundwater at the site.
Flood Defence Breach (Failure)	No	SEPA has produced reservoir inundation maps for those sites currently regulated under the Reservoirs Act 1975. Review of the SEPA mapping highlights that there is a potential risk of reservoir inundation from Talla and Fruid Reservoirs located to the south of the site. Flood extents associated with any breach are shown to extent to the A701, however, no development is proposed within the mapped inundation area. Given the safeguards afforded by the Reservoirs Act the risk of such an event occurring is very low. Therefore, flooding from this source is not considered further.
Flooding from artificial drainage system	No	The Proposed Development is located within a remote area and no artificial drainage systems are recorded.
Flooding due to infrastructure failure	No	The Proposed Development is remote from any flood defences.

10.6.46 SEPA also publish potential future fluvial flood extents (2080) which account for the potential upfit in rainfall depths and intensities as a consequence of climate change. An extract of this mapping is show on Figure 10.1 and confirms, no element of the Proposed Development is located within the predicted floodplain extents.

Private Water Supplies and Licenced Sites

10.6.47 Consultation with SBC and SEPA has been undertaken to gather details of private and licenced water abstractions within the study area.

10.6.48 A data request was made to SBC for details of private water supplies (PWS) sources. In addition, a programme of site investigation has been undertaken to confirm the location of PWS sources.

10.6.49 The risk the Proposed Development poses to confirmed PWS sources has been considered as part of this assessment and is presented as Technical Appendix 10.3. The assessment confirms there are no PWS sources that are at risk from the Proposed Development (however confirmatory monitoring is recommended at one PWS source).

10.6.50 SEPA has provided information of Controlled Activity Regulation (CAR) authorisations within the study area. Nine CAR authorisations are recorded (see Figure 10.1) and in summary include:

- six private and public sewage discharges;
- two engineering works (bridge / sediment removal) over watercourses; and
- one licensed abstraction and impoundment.

10.6.51 The licenced abstraction (CAR/L/1089966) is at Oliver House located approximately 100 m south-east of the site. No development is proposed within the same hydraulic catchment of the abstraction and no development is proposed within 1 km of the abstraction point. It is, therefore, not considered further in this assessment.

Summary of Sensitive Receptors

10.6.52 Table 10.12 outlines the receptors identified as part of the baseline study, and their sensitivity based upon the criteria contained in Table 10.3. These receptors form the basis of the assessment, and as per the previously introduced methodology, are used in conjunction with an estimate of the magnitude of an effect to determine significance.

10.6.53 Table 10.12 outlines the receptors identified as part of the baseline study, together with a description of their sensitivity to potential impacts associated with Proposed Development.

Table 10.12 – Summary of Identified Receptors

Receptor	Sensitivity	Reason for Sensitivity
Geological and Water Dependent Statutory Designated Sites	High	River Tweed SSSI and SAC is located downstream of the Proposed Development.
Peat and Carbon Rich Soils	High	Areas of peat and carbon rich soils have been recorded within the site.
Superficial and Bedrock Geology	Not Sensitive	Deposits have been shown to be common regionally and have no rarity value. No geological designated sites are recorded within the study area,
Groundwater	High	Groundwater beneath the site has been classified as Good and vulnerability is classified as High. All of Scotland's groundwater bodies have been designated as DWPAs.
GWDTE	High	Areas of potential GWDTE have been identified by NVC mapping. It has been shown that the habitats are not sustained by groundwater but by rainfall and surface water flow paths. Surface water flow paths to these habitats will need to be safeguarded to ensure these habitats are sustained.
Surface water	High	Surface watercourses that drain the site have been classified by SEPA as Moderate to High.
Flooding	Moderate	Little flood risk has been identified on-site, but the development has potential, without appropriate design, to alter surface water flow paths and could increase flood risk downstream of the site.
DWPA	Not Sensitive	None of the surface water catchments which drain the site have been designated as a DWPA. Scottish Water in their consultation response have confirmed that the Proposed Development poses a low risk to DWPAs and their water abstraction sources.
Private Water Supplies	Not Sensitive	Several private water supplies have been confirmed within the study area however none are considered to be at risk from the Proposed Development.
Licenced sites	Not Sensitive	One licensed water abstraction noted in the study area however no development is proposed within the same surface water catchment as the abstraction.

Future Baseline

10.6.54 Climate change studies predict a decrease in summer precipitation and an increase in winter precipitation alongside higher average temperatures. This is likely to increase pressures on water supplies and lower water levels in summer months in the future.

10.6.55 Summer storms are also predicted to be of greater intensity. Peak fluvial flows associated with more extreme summer storm events and wetter winters will increase the volume and velocity of run-off.

10.6.56 These potential changes are considered in the assessment of effects.

10.7 Standard Mitigation

Embedded Mitigation

Design Iterations

10.7.1 The Proposed Development has undergone design iterations and evolution in response to the geological, hydrological, and hydrogeological constraints identified as part of the baseline studies and field studies so to avoid and/or minimise likely effects on receptors where possible. This has included using existing access tracks, areas of deep peat or potential peat instability, watercourse locations, areas of potential flooding, PWS and GWDTE.

Peat Occurrence and Avoidance

10.7.2 The presence of peat within the site formed a key consideration of the design of the Proposed Development. Informed by the extensive programme of peat probing undertaken across the site, the design has tried to avoid areas of deeper peat (>1 m) where technically feasible and where possible limited development to areas of peat less than 1 m or where peat is absent.

Buffer to Watercourses

10.7.3 It is proposed that a 100 m micrositing tolerance of turbines and all other infrastructure would be applied to the Proposed Development (so long as infrastructure does not move into the watercourse buffers).

Within this distance, any changes within 50 m from the consented locations would be subject to approval of the ECoW, any changes within 50-100 m of the consented locations will require approval of SBC in consultation with NatureScot and SEPA.

10.7.4 No new watercourse crossings are proposed to facilitate construction of the wind farm element of the Proposed Development.

10.7.5 Two new small watercourse crossings will be required for the proposed recreational heritage trail. Good practice measures associated with construction of these crossings are discussed in the sections below.

Groundwater Dependent Habitats

10.7.6 SEPA's wind farm planning guidance states that an NVC survey should be undertaken to identify wetland areas that might be dependent on groundwater. If potential GWDTE are identified within (a) 100 m of roads, tracks and trenches, or (b) within 250 m of borrow pits and foundations, then it is necessary to assess how the potential GWDTE may be affected by the proposed development.

10.7.7 It has been shown (Table 10.7) that areas identified as being potentially highly or moderately groundwater dependent are likely to be sustained by incident rainfall and local surface water run-off rather than by groundwater. Accordingly, the buffers proposed in SEPAs GWDTE guidance need not apply.

10.7.8 Measures to safeguard existing water flow paths and maintain existing water quality are proposed in the sections that follow. It is considered therefore that the water dependent habitats identified by the NVC mapping can be sustained. This would be confirmed, in accordance with good practice, by the Environmental Clerk of Works (EnvCoW) at the time of the construction who would ensure existing surface water flow paths and water flushes are maintained.

10.7.9 As discussed in Table 10.7, three springs are noted within sub-dominant polygons containing M23 habitat. Works upstream (e.g. Turbine 5, BP-C and Turbine 7) of these communities should be supervised by a project EnvCoW to ensure existing water flow paths are maintained.

Good Practice Methods

10.7.10 In undertaking the assessment of potential effects from the Proposed Development, good practice measures are assumed to be embedded mitigation. As appropriate, these mitigation measures would be outlined within the CEMP or by an appropriately worded condition post determination, as required.

Peat Safeguarding and Management

10.7.11 The peat depth probing data has been used to accurately determine the volume of peat which will be disturbed by the Proposed Development. This data has been used to prepare a site-specific PMP, (Technical Appendix 10.2) which details the volume of acrotelmic and catotelmic peat which would be disturbed and how this would be safeguarded and reused on site. The condition of the peat and areas of peat that would potentially benefit from restoration have been identified and are discussed in Chapter 8.

10.7.12 As shown in Technical Appendix 10.1 and Technical Appendix 10.2, measures have been proposed to ensure the stability of peat and carbon rich soils and that peat and soils that would be disturbed by the Proposed Development can be safeguarded and beneficially re-used on site. The Policy aims of NPF4, regarding soils and peat, are therefore met; further details are provided below.

Peat Management

10.7.13 A detailed review of the distribution and depth of peat at the site is contained in Technical Appendix 10.2. The site design has largely avoided areas of deep peat and where peat would be encountered by the Proposed Development it can be readily managed and accommodated within the site layout with no significant environmental impact. No surplus peat would be generated, and the volumes of peat / peaty soil generated from the proposed excavations would be used to reinstate track verges, turbine bases, crane hardstandings and restoration of on-site borrow pits.

Peat Landslide Hazard

10.7.14 The site-specific PLHRA (Technical Appendix 10.1) confirms, regarding peat stability, that there are very few areas of peat instability risk across the Proposed Development and the hazard impact assessment concluded that, with the employment of appropriate mitigation measures, all of the areas of peat instability can be considered as an insignificant risk.

10.7.15 A Design and Geotechnical Risk Register would be compiled to include risks relating to peat instability, as this would be beneficial to both the Applicant and the Principal Contractor in identifying potential risks that may be involved during construction.

10.7.16 Good construction practice and methodologies to prevent peat instability within areas that contain peat deposits are identified in Appendix 10.1. These include:

- measures to ensure a well-maintained drainage system, to include the identification and demarcation of zones of sensitive drainage or hydrology in areas of construction;
- careful micrositing of turbine bases, crane hardstandings and access track alignments to minimise effects on the prevailing surface and sub-surface hydrology;
- raising peat stability awareness for construction staff by incorporating the issue into the site induction (e.g. peat instability indicators and good practice);
- introducing a 'Peat Hazard Emergency Plan' to provide instructions for site staff in the event of a peat slide or discovery of peat instability indicators;
- developing methodologies to ensure that degradation and erosion of exposed peat deposits does not occur as the break-up of the peat top mat has significant implications for the morphology, and therefore hydrology, of the peat (e.g. minimisation of off-track plant movements within areas of peat);
- developing robust drainage systems that would require minimal maintenance; and
- developing drainage systems that would not create areas of concentrated flow or cause over/under-saturation of peat habitats.

10.7.17 Notwithstanding any of the above good construction practices and methodologies, detailed design and construction practices would need to consider the particular ground conditions and the specific works at each location throughout the construction period. An experienced and qualified engineering geologist/geotechnical engineer would be appointed as a supervisor, to provide advice during the setting out, micrositing and construction phases of the Proposed Development.

General Good Practice Methods

10.7.18 Good practice measures would be applied in relation to pollution risk, and management of surface run-off rates and volumes. This would form part of the final CEMP to be implemented for the Proposed Development.

10.7.19 Key good practice measures are stated below, and the assessment incorporates these measures as part of the Proposed Development. Any further specific mitigation which may be required to reduce the significance of a potential effect is identified in the assessment of likely effects during the construction and operation phases.

General Measures

10.7.20 As a principle, preventing the release of any pollution/sediment is preferable to dealing with the consequences of any release. There are several general measures which cover all effects assessed within this chapter, details of which are given below.

10.7.21 Prior to construction, a site-specific drainage plan would be produced. This would consider existing local drainage which may not be mapped and incorporate any site-specific mitigation measures identified during the assessment.

10.7.22 Measures would be included in the final CEMP for dealing with pollution / sedimentation / flood risk incidents and would be developed prior to construction. This would be adhered to should any incident occur, reducing the effect as far as practicable.

10.7.23 The final CEMP would contain details on the location of spill kits, would identify 'hotspots' where pollution may be more likely to originate from, provide details to site personnel on how to identify the source of any spill and state procedures to be adopted in the case of a spill event. A specialist spill response contractor would be identified to deal with any major environmental incidents.

10.7.24 A wet weather protocol would be developed. This would detail the procedures to be adopted by all staff during periods of heavy rainfall. Toolbox talks would be given to engineering / construction / supervising personnel.

10.7.25 Roles would be assigned to different engineering / construction / supervising personnel and the inspection and maintenance regimes of sediment and run-off control measures would be adopted during these periods. In extreme cases, the above protocol would dictate that work on-site may have to be temporarily suspended until weather/ground conditions allow.

Environmental Clerk of Works

10.7.26 To ensure all reasonable precautions are taken to avoid adverse effects on the water environment, a suitably qualified Environmental Clerk of Works (EnvCoW) will be appointed prior to the commencement of construction to advise the Applicant and the Principal Contractor on all ecological and hydrological matters. The EnvCoW will be required to be present on-site during the construction phase and will carry

out monitoring of works and briefings with regards to any ecological and hydrological sensitivities on the site to the relevant staff of the Principal Contractor and subcontractors.

10.7.27 With respect to the water environment, the EnvCoW would also have responsibility to ensure water flow paths and quality to water dependant habitat are sustained.

Water Quality Monitoring

10.7.28 It has been confirmed that the Proposed Development lies within with the River Tweed surface water catchment and hydraulically connected to the River Tweed SSSI and SAC.

10.7.29 Water quality monitoring during the construction phase would be undertaken for the surface water catchments that drain from the Proposed Development to ensure that none of the tributaries of the main channels are carrying pollutants or suspended solids. Monitoring would be carried out at a specified frequency (depending upon the construction phase) on these catchments.

10.7.30 Monitoring would commence prior to construction and continue throughout the construction phase and immediately post construction. Monitoring would be used to allow a rapid response to any pollution incident as well as assess the efficacy of good practice or remedial measures. Monitoring frequency would increase during the construction phase if remedial measures to improve water quality were implemented. Detailed water quality monitoring plans would be developed during detailed design stage of the project. The monitoring programme would be secured by a pre-development planning condition to be agreed with statutory consultees.

10.7.31 It is also proposed that the spring that serves PWS05, as discussed in Technical Appendix 10.4, is included as part of the monitoring programme.

10.7.32 The performance of the good practice measures would be kept under constant review by the water monitoring schedule, based on a comparison of data taken during construction with a baseline data set, sampled prior to the construction period.

Pollution Risk

10.7.33 Good practice measures in relation to pollution prevention would include the following:

- refuelling would take place at least 50 m from watercourses and would not occur when there is risk that oil from a spill could directly enter the water environment;
- foul water generated on-site would be managed in accordance with best practice and be drained to a sealed tank and routinely removed from the site;
- a vehicle management plan and speed limit would be strictly enforced on-site to minimise the potential for accidents to occur;
- drip trays would be placed under vehicles which could potentially leak fuel/oils when parked;
- areas would be designated for washout of vehicles which are a minimum distance of 50 m from a watercourse;
- washout water would also be stored in the washout area before being treated and disposed of;
- if any water is contaminated with silt or chemicals, run-off would not enter a watercourse directly or indirectly without treatment;
- water would be prevented as far as possible, from entering excavations;
- procedures would be adhered to for storage of fuels and other potentially contaminative materials in line with the Contolled Activities Regulations (CAR) to minimise the potential for accidental spillage; and
- a plan for dealing with spillage incidents would be designed prior to construction, and this would be adhered to should any incident occur, reducing the effect as far as practicable. This would be included in the final CEMP.

10.7.34 Site investigation (e.g. trial pits and/or boreholes) would be undertaken prior to any construction works where excavation would be required to establish the Proposed Development and it would inform detailed design and construction methods to ensure pollution risk is further considered prior to construction. These methods would be specified in the final CEMP.

Erosion and Sedimentation

10.7.35 Good practice measures for the management of erosion and sedimentation would include the following:

- all stockpiled materials would be located outwith a 50 m buffer from watercourses, including on up-gradient sides of tracks and battered to limit instability and erosion;

- stockpiled material would either be seeded or appropriately covered, minimising the area of exposed bare ground;
- monitoring of stockpiles/excavation areas during rainfall events;
- water would be prevented as far as possible, from entering excavations through the use of appropriate cut-off drainage;
- where this is not possible, water that enters excavations would pass through a number of silt/sediment traps to remove silt prior to discharge into the surrounding drainage system. Detailed assessment of ground conditions would be required to identify locations where settlement lagoons would be feasible;
- clean and dirty water on-site would be separated, and dirty water would be filtered before discharge and entering the stream network;
- if the material is stockpiled on a slope, silt fences would be located at the toe of the slope to reduce sediment transport;
- the amount of ground exposed, and time period during which it is exposed, would be kept to a minimum and appropriate drainage would be in place to prevent surface water entering deep excavations;
- a design of drainage systems and associated measures to minimise sedimentation into natural watercourses would be developed - this may include silt traps, check dams and/or diffuse drainage;
- silt/sediment traps, single size aggregate, geotextiles or straw bales would be used to filter any coarse material and prevent increased levels of sediment. Further to this, activities involving the movement or use of fine sediment would avoid periods of heavy rainfall where possible; and
- construction personnel and the Principal Contractor would carry out regular visual inspections of watercourses to check for suspended solids.

Fluvial Flood Risk

10.7.36 Sustainable Drainage Systems (SuDS) shall be incorporated as part of the Proposed Development.

10.7.37 SuDS techniques aim to mimic pre-development run-off conditions and balance or throttle flows to the rate of run-off that might have been experienced at site prior to development. Good practice in relation to the management of surface water run-off rates and volumes and reducing these to mitigate localised fluvial flood risk would include the following:

- drainage systems would be designed to ensure that any sediment, pollutants or foreign materials which may cause blockages are removed before water is discharged into a watercourse;
- on-site drainage would be subject to routine checks to ensure that there is no build-up of sediment or foreign materials which may reduce the efficiency of the original drainage design causing localised flooding;
- appropriate drainage would attenuate run-off rates and reduce run-off volumes to ensure minimal effect upon flood risk;
- where necessary, check dams would be used within cable trenches in order to prevent trenches developing into preferential flow pathways and trenches shall be backfilled with retained excavated material; and
- as per good practice for pollution and sediment management, prior to construction, section-specific drainage plans would be developed and construction personnel made familiar with the implementation of these.

Water Abstractions

10.7.38 Any water abstraction (for example, for dust suppression during construction) would only be made with authorisation from SEPA and in accordance with the CAR. Good practice that would be followed in addition to the CAR includes:

- water use would be planned so as to minimise abstraction volumes;
- water would be re-used where possible;
- abstraction volumes would be recorded; and
- abstraction rates would be controlled to prevent significant water depletion in a source.

Watercourse Crossings

10.7.39 The site design requires no new watercourse crossings to facilitate construction of the wind farm element of the Proposed Development; however, one existing watercourse crossing may be upgraded as part of the Proposed Development as detailed within Table 10.10 and shown on Figure 10.1.

10.7.40 Should the watercourse crossing be upgraded, the crossing would be designed to pass the 200-yr flood event plus an allowance for climate change and the design and construction details would be agreed with SEPA and SBC as part of the final CEMP.

10.7.41 Two new small watercourse crossings will be required for the proposed recreational heritage trail.

10.7.42 The water crossing requirements for the recreational heritage trail will be assessed in advance of construction commencing and any required authorisations will be gained from SEPA in accordance with the CAR prior to works commencing . It is expected that all works will be able to be completed under appropriate General Binding Rules set out in the CAR.

10.7.43 All proposed crossing locations and methodologies would be reviewed and approved by the EnvCoW, prior to any works being undertaken.

Protection of Scottish Water Distribution Infrastructure

10.7.44 Scottish Water has confirmed that the Talla Aqueduct needs to be safeguarded. Should construction traffic associated with the Proposed Development utilise the public highway where it passes over the Talla Aqueduct, the Applicant will undertake a structural assessment of the aqueduct at these location(s). This assessment will be shared with Scottish Water and, if required, reinforcement to protect the aqueduct outlined.

Battery Energy Storage System (BESS)

10.7.45 The proposed BESS would be sited within the Scottish Power Energy Networks (SPEN) construction compound, following installation of the wind turbines. This is discussed further in Chapter 3.

10.7.46 The BESS compound would be constructed with an impermeable lining and with stormwater storage provided above this. This will include an automatic fire suppression system with a control point or shut off valve so that in the unlikely event of a leak or pollution event occurring it can be retained within this area. Contained pollution or firewater would be pumped to a tanker and removed from the site for treatment and disposal at a suitable licenced facility.

10.7.47 The risk of contamination to the water environment will be detailed in the final CEMP and confirmation of management of firewater will be agreed during the detailed design stage. It is expected this will be secured by a suitable planning condition post determination.

10.8 Potential Effects

Potential Construction and Decommissioning Effects

10.8.1 During the construction and decommissioning phases, the Proposed Development has the potential to result in the following effects without appropriate controls or mitigation:

- adverse effects on carbon rich soils and peat through inappropriate handling and safeguarding;
- an adverse effect on surface water or groundwater quality from pollution, fuel, oil, concrete or other hazardous substances;
- potential adverse change of surface and groundwater flow paths and contribution to areas of peat and GWDTEs, water dependent habitat and water supplies;
- increased flood risk to areas downstream of the site through increased surface water run-off; and
- potential pollution impacts and adverse effect to designated sites.

Peat and Soils

10.8.2 It has been shown (see Technical Appendix 10.1, Technical Appendix 10.2 and Section 10.7) that the disturbance of peat and soils as a result of the construction of the Proposed Development can be minimised and the peat deposits safeguarded.

10.8.3 Peat is a high sensitivity receptor. With the identified safeguards and proposed good practice methods, the potential impact on deposits of carbon rich soil and peat is assessed as negligible and the significance of effect is **negligible** and therefore not significant.

Pollution Risk

10.8.4 During the construction and decommissioning phases, there is the potential for a pollution event to affect surface waterbodies impacting on their quality. This would have an adverse impact on the receptor, potentially resulting in degradation of the water quality which would impact on any aquatic life and private and public water supplies abstracting from the watercourses and on water dependent designated sites, such as the River Tweed.

10.8.5 Pollution may occur from excavated and stockpiled materials during site preparation and excavation of borrow pits. Contamination of surface water run-off from machinery, leakage and spills of chemicals from vehicle use and the construction of hardstanding also have the potential to affect surface water bodies. Potential pollutants include sediment, oil, fuels and cement.

10.8.6 The risk of a pollution incident occurring would be managed using industry standard good practice measures. Many of these practices are concerned with undertaking construction activities away from watercourses, sensitive peat and vegetation habitats and identifying safe areas for stockpiling or storage of potential pollutants that could otherwise lead to the pollution.

10.8.7 The magnitude of a pollution event on peat, surface water dependent habitat, groundwater and surface water receptors is considered negligible following adherence to good practice measures. The potential impact of negligible magnitude on these receptors of high sensitivity would be an effect of **negligible** significance and therefore not significant in EIA terms.

Erosion and Sedimentation

10.8.8 Site traffic during the construction and decommissioning phases has the potential to cause erosion and increase sedimentation loading during earthworks, and due to increased areas of hardstanding and such features as stockpiles, tracks and excavations etc., which could be washed by rainfall or inappropriate site practices into surface water features. This has the potential to reduce surface water quality, increase turbidity levels, reduce light and oxygen levels and affect ecology including fish populations.

10.8.9 Excavation of borrow pits and construction of hardstanding associated with the Proposed Development are the key sources of erosion and sediment generation. Adherence to good practice measures would ensure that any material generated is not transported into nearby watercourses, to groundwater, or onto areas of peat.

10.8.10 Location specific good practice measures will form part of the final CEMP and would be used to minimise the potential for erosion and sedimentation.

10.8.11 After consideration of good practice measures, the magnitude of impact associated with erosion and sedimentation is assessed as negligible. Peat, surface water dependent habitat, groundwater and surface water are considered high sensitivity receptors. The level of effect is therefore assessed as **negligible** and not significant.

Fluvial Flood Risk

10.8.12 Construction of hardstanding including the substation compound, construction compounds and turbine bases would create impermeable surface areas which could increase run-off rates and volumes.

10.8.13 Adherence with good practice measures including appropriate drainage design and compliance with the final CEMP would limit potential impacts to being local and short duration and so of negligible magnitude.

10.8.14 It is proposed that any rainwater and limited groundwater ingress which collects in the turbine excavations during construction would be stored and attenuated prior to controlled discharge to ground adjacent to the excavation.

10.8.15 Attenuation of run-off generated within the proposed turbine excavations would allow settlement of suspended solids within the run-off prior to discharge in accordance with the 'Site control' component of the SuDS 'management train'.

10.8.16 The potential level of effect on flood risk, which is considered to have a moderate sensitivity, is therefore assessed as being **negligible** and not significant.

10.8.17 The magnitude of the increase in impermeable area is not sufficient to have a measurable effect on groundwater levels, as the extent of the impermeable area is insignificant compared to the extent of the underlying geology and groundwater.

Infrastructure and Man-made Drainage

10.8.18 Excavations associated with construction works (e.g. turbine bases foundations, cable trenches, borrow pits etc.) can result in local lowering of the water table. This is an important consideration in areas of peat deposits, where the water table is characteristically near the ground surface.

10.8.19 Dewatering associated with construction of turbine foundations is temporary and would not be required post construction. Cable laying, without appropriate mitigation measures, can also lower high groundwater levels and provide a preferential drainage route for groundwater movement that can lead to local and permanent drying of soils, superficial deposits and/or water supplies.

10.8.20 The design of the Proposed Development has avoided areas of high ecological or habitat interest, including GWDTE. Furthermore, the superficial and bedrock deposits have little groundwater and therefore limited or little dewatering is likely to be required. There remains potential however, for local dewatering of soils near cable trenches, turbine bases and borrow pits, without incorporation of mitigation measures.

10.8.21 Location specific good practice measures will form part of the final CEMP and would be used to minimise the potential for drainage and dewatering effects.

10.8.22 The sensitivity of the receptor (groundwater and habitat that may be dependent on groundwater) has been assessed as being High. Without mitigation the magnitude of impact is assessed as negligible and therefore the potential significance of effect of changing groundwater levels and flow due to dewatering is considered **negligible**, not significant.

Water Abstraction

10.8.23 During the construction of the Proposed Development, water may be abstracted for uses such as dust suppression, vehicle washing, batching plant activities and welfare facilities. The volume of water and mitigation required would be regulated through a CAR abstraction licence which would be agreed with SEPA. With this safeguard, the magnitude of impact on groundwater-surface water interactions is considered negligible. The significance of effect is therefore **negligible**, and not significant.

Designated Sites within Hydraulic Connection to the Proposed Development

10.8.24 The baseline assessment has confirmed that the River Tweed SSSI and SAC is hydraulically connected to the Proposed Development.

10.8.25 The controls which would be adopted at site in accordance with best practice and discussed above would be used to ensure water resources are not impaired and significant erosion and sedimentation does not occur. This will ensure that the potential impact magnitude on the River Tweed SSSI and SAC is negligible and thus the significance of effect is **negligible**.

Potential Operation Effects

10.8.26 During the operational phase of the Proposed Development, it is anticipated that routine maintenance of infrastructure and tracks would be required across the site. This may include work such as maintaining access tracks and drainage and carrying out maintenance of turbines.

10.8.27 Should any maintenance be required on-site during the operational life of the Proposed Development which would involve construction type activities; mitigation measures would be adhered to along with the measures in the final CEMP to avoid potential adverse effects.

Peat and Soils

10.8.28 Peat is a high sensitivity receptor. No excavation, movement or storage of peat or soils is anticipated during the operational life of the Proposed Development.

10.8.29 The potential effect on deposits of soil and peat during operation is therefore assessed as **negligible** and not significant.

Pollution Risk

10.8.30 The possibility of a pollution event occurring during operation is very unlikely. There would be a limited number of vehicles required on-site for routine maintenance and for the operation of the Proposed Development. Storage of fuels/oils on-site would be limited to the hydraulic oil required in turbine gearboxes and this would be bunded to prevent fluid escaping.

10.8.31 As detailed in the Good Practice Measures section above, provision will be made to positively drain the substation and battery storage area and collect and prevent any discharge and pollution that might occur from this area, either from leakage from a transformer or as a result of fire. Based upon this, the potential risk associated with frequency, duration and likelihood of a pollution event is low. It is therefore anticipated that the impact magnitude of a pollution event during the operational phase of the Proposed Development would be negligible, as no detectable change would likely occur. Therefore, the significance of effect for a pollution event during the operational phase of the Proposed Development is predicted to be **negligible** for all receptors and not significant.

Erosion and Sedimentation

10.8.32 During the operation of the Proposed Development, it is not anticipated that there would be any significant excavation or stockpiled material beyond the clearing of SuDS features to maintain their efficiency, reducing the potential for erosion and sedimentation effects.

10.8.33 Immediately post-construction, newly excavated drains and track dressings may be prone to erosion as any vegetation would not have matured. Appropriate design of the drainage system, incorporating sediment traps, would reduce the potential for the increased delivery of sediment to natural watercourses. Potential impacts from sedimentation or erosion during the operational phase are considered to come from linear features on steeper slopes, where velocities in drainage channels are higher. Immediately post-construction, flow attenuation measures would remain and be maintained to slow run-off velocities and prevent erosion until vegetation becomes established.

10.8.34 The likelihood, magnitude and duration of a potential erosion and sedimentation event occurring within the surface water catchments would be negligible following adherence to good practice measures. Therefore, the potential significance of effect on these high sensitivity receptors is of **negligible** significance.

10.8.35 Should any non-routine maintenance be required at the sections of track crossing wet areas (defined visually on-site by a contractor or operational personnel) there would be potential for erosion and sedimentation effects to occur due to the existence of disturbed material. Should this type of activity be required, then the good practice measures as detailed for the construction and decommissioning phases would be required on a case by case basis. Extensive work adjacent to the water environment may require approval from SEPA under the CAR (depending upon the nature of the activity).

Fluvial Flood Risk

10.8.36 The risk of an effect on fluvial flood risk arises as a result of a potential restriction of flow at a permanent water crossing following intense rainfall. In accordance with good practice, routine inspection and clearing of the culverts or bridges at site would be undertaken, reducing the likelihood of a blockage occurring. In the unlikely event of a blockage any flooding would be localised and the magnitude of impact is assessed as negligible, and therefore the significance of effect is assessed as **negligible.**

Infrastructure and Man-made Drainage

10.8.37 Operation of the Proposed Development would require limited activities relative to the construction and decommissioning phases.

10.8.38 The magnitude of a potential impact on groundwater and sub-surface flows as a result of permanent hardstanding and associated drainage would be negligible on the overall groundwater body due to the dispersed nature of the proposed hardstanding. The significance of effect is **negligible** and not significant.

Designated Sites within Hydraulic Connection to the Proposed Development

10.8.39 The controls which would be adopted at site during the operational phase, and which are in accordance with best practice, will safeguard surface water and groundwater quality, surface water and groundwater flows, and mitigate flood risk. They would ensure that the potential impact on the River Tweed SSSI and SAC is negligible and thus the significance of effect is **negligible**.

10.9 Additional Mitigation and Enhancement

10.9.1 As all the predicted effects are negligible and therefore not significant under the EIA Regulations, no specific mitigation during construction, operation or decommissioning is required other than the good practice measures that the Applicant would implement as standard (and as described above).

10.9.2 Methods for decommissioning and mitigation measures to be employed at decommissioning stage will follow best practice measures and guidance at that time.

10.10 Residual Effects

10.10.1 Subject to adoption of best practice construction techniques, no significant residual effects are predicted during the construction, operation and decommissioning of the Proposed Development.

10.11 Cumulative Assessment

10.11.1 The assessment also considers potential cumulative effects associated with other wind farm developments within 5 km of the nearest element of the Proposed Development and in the same surface water catchments as the Proposed Development. A cumulative effect is considered to be the

effect on a hydrological, hydrogeological or geological receptor arising from the site in combination with other developments which are likely to affect soils or geology, surface water and groundwater.

10.11.2 The following operational and consented wind farms that are within 5 km and in the same water catchments as the Proposed Development include:

- Glenkerie Wind Farm (operational) located within the Kingledores Burn surface water catchment.
- Clyde Wind Farm Extension (consented) located within the River Tweed surface water catchment, upstream of the Proposed Development.
- Whitelaw Brae Wind Farm (consented) located within the River Tweed surface water catchment, upstream of the Proposed Development.

10.11.3 These developments have either been developed or consented recently and therefore will be managed in accordance with best practice, industry standards and relevant legislation, planning policy and guidance regulated by statutory consultees. These standards ensure, with respect to soils, geology and the water environment, potential impacts are mitigated and controlled at source.

10.11.4 The magnitude of cumulative impact is therefore considered negligible and the potential effect on identified receptors is **negligible** and not significant.

10.12 Summary

10.12.1 An assessment of the potential effects of the Proposed Development on soils, geology, hydrology, hydrogeology within a defined study area (comprising land within 500 m of the site boundary) has been undertaken. The assessment has considered the construction, operation and decommissioning phases of the Proposed Development.

10.12.2 Following the identification and assessment of the key receptors, taking into account the potential effects listed above, a comprehensive suite of embedded mitigation and good practice measures has been incorporated into the design, including extensive water buffer areas. In addition, a site-specific CEMP as well as detailed design of infrastructure and associated mitigation will be implemented to protect the groundwater and surface water resources from pollution and minimise changes to the hydrological environment. An outline version of the CEMP (Technical Appendix 3.1) supports this application, which will be built upon as more site-specific information and ground investigation results are provided post-consent.

10.12.3 The impact assessment has taken into account the soil, geological and hydrological regime, highlighting that the principal effects will occur during the construction phase. Impacts as a result of decommissioning are predicted to be no greater than those identified for the construction phase. Following the successful design and implementation of mitigation measures the significance of construction effects on all identified receptors are considered negligible and are not defined as significant. The assessment of predicted operational effects has also determined that the significance of effects on all receptors is negligible and therefore not significant.

10.12.4 Good practice design and construction of the Proposed Development delivered through a skilled team of competent workers, with mitigation and compliance monitored in collaboration with SEPA, SBC and other engaged stakeholders, will result in an effect that is considered to be not significant in terms of the EIA Regulations. Methods for decommissioning and mitigation measures to be employed at decommissioning stage will follow best practice measures and guidance at that time.

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