Vale of Leven Wind Farm Limited

Vale of Leven Wind Farm

Environmental Impact Assessment Report (Volume 1)

Chapter 8 – Geology, Hydrogeology, Hydrology and Peat

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8.1 Introduction

8.1.1 This Chapter assesses the impacts 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 2: Proposed Development.** It outlines the embedded good practice methods which have been incorporated into the design and would be used during construction, operation and decommissioning of the Proposed Development to prevent or reduce identified effects and risks.

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

8.1.3 This Chapter presents summary information from the following Appendices:

- Appendix 8.1: Peat Landslide Hazard and Risk Assessment (PHLRA)
- Appendix 8.2: Peat Management Plan (PMP);
- Appendix 8.3: Schedule of Watercourse Crossings; and
- Appendix 8.4: Borrow Pit Assessment

8.1.4 The assessment uses information and findings presented in **Chapter 6: Ecology and Biodiversity** to inform the assessment of potential effects on possible areas of Groundwater Dependent Terrestrial Ecosystems (GWDTEs) which are presented in this Chapter.

8.2 Scope and Methodology

Scope

8.2.1 The scope of the assessment has been determined through a combination of professional judgement, reference to relevant guidance documents and consultation with stakeholders.

8.2.2 The assessment uses site investigation and survey data and publicly available data sources, including but not limited to Scottish Environment Protection Agency (SEPA), NatureScot, Met Office, West Dunbartonshire Council (WDC) and commercial data supply companies, as well as additional information supplied from stakeholders during the scoping and consultation stages.

8.2.3 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.

Study Area

8.2.4 The study area includes all the proposed site infrastructure located within the Site. In addition, details of local water use and quality within a buffer of 500 m from the Proposed Development has been considered, as shown on Figure 8.1.The study area includes Dumbarrton Muir and Auchenreoch Glen Sites of Special Scientific Interest Beyond this

500 m any effect is considered to be so diminished as to be undetectable and therefore not significant.

8.2.5 The study area for potential cumulative effects uses the catchment within the study area, with a maximum downstream distance of 5 km from nearest element of Proposed Development infrastructure..

Desk Study

8.2.6 An initial desk study has been undertaken to determine and confirm the baseline characteristics by reviewing available information on geology, hydrology, and hydrogeology. The following sources of information have been consulted to characterise baseline conditions:

- Ordnance Survey (OS) 1:50,000 and 1:10,000 scale mapping data;
- Flood Estimation Handbook (FEH) web service (https://fehweb.ceh.ac.uk/);
- NatureScot SiteLink (https://sitelink.nature.scot/home);
- Natural England Magic Map (http://magic.defra.gov.uk/MagicMap.aspx);
- James Hutton Institute, Soil map of Scotland (partial cover) (1:25,000 scale) (http://soils.environment.gov.scot/maps/);
- British Geological Survey (BGS) Onshore Geoindex (http://mapapps2.bgs.ac.uk/geoindex/home.html);
- BGS Hydrogeological Maps of Scotland (1:100,000 scale) (https://www.bgs.ac.uk/datasets/hydrogeological-maps-of-scotland/);
- SEPA rainfall data (https://www2.sepa.org.uk/rainfall);
- SEPA flood maps (Flood Risk Management Maps (sepa.org.uk);
- SEPA environmental data (https://www.sepa.org.uk/environment/environmental-data/);
- Data requests with SEPA regarding details of registered/licensed abstractions and discharges (May 2022 and April 2023); and
- Data requests with WDC regarding details of historic flooding records and private water abstractions (June 2022).

Field Survey

8.2.7 The project hydrologists, hydrogeologists, geologists, and ecologists have worked closely on this assessment to ensure that appropriate information is gathered to allow a comprehensive assessment of effects to be completed.

8.2.8 Detailed site visits and walkover surveys have been undertaken by the authors of this assessment on the following dates:

- August and November 2022 to conduct initial peat / soil depth probing exercise;
- January 2023 to conduct additional peat / soil depth probing exercise and assess borrow pit locations;
- March 2023 to conduct additional peat / soil depth probing exercise and visit identified potential GWDTE;
- April 2023 to conduct a watercourse crossing survey and a private water supply assessment; and
- June 2023 to collect additional peat probing data.

8.2.9 The field work has been undertaken to:

- verify the information collected during the desk and baseline study;
- allow an 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 extent and depth, peat slide landslide risk and geomorphology;
- undertake a visual assessment of the main surface waters and identify and verify the location and presence of private water supplies;
- identify drainage patterns, areas vulnerable to erosion or sediment deposition, and any pollution risks;
- assess areas of potential GWDTE; and
- visit potential watercourse crossings and prepare a schedule of potential watercourse crossings.

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

8.2.11 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 Methods

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

8.2.13 The assessment methodology has also been informed by the experience of the authors of this chapter in carrying out such assessments for a range of wind farm and other developments, knowledge of the geology and water environment characteristics in Scotland and cognisance of good practice.

8.2.14 This approach provides a mechanism for identifying the areas where mitigation measures are required and for identifying site specific mitigation measures appropriate to the significance of potential effects presented by the Proposed Development, such as the Peat Management Plan and habitat management proposals

8.2.15 Criteria for determining the significance of effect are provided in **Table 8.1**, **Table 8.2** and **Table 8.3.**

Sensitivity of Receptor

8.2.16 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 which is set out in **Table 8.1.** Receptors in the receiving environment only need to meet one of the defined criteria to be categorised at the associated level of sensitivity.

Table 8.1: Criteria for Assessing Sensitivity of Receptor

Sensitivity	Definition
High	• soil type and associated land use is highly sensitive (e.g. unmodified blanket bog peatland); • SEPA Water Framework Directive 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; • receptor is at high risk from flooding above 0.5% Annual Exceedance Probability (AEP) and/or water body acts as an 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); • receptor is at moderate risk from flooding (0.1% AEP to 0.5% AEP) but does not act as an active floodplain or flood defence; 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 at low risk from flooding (less than 0.1% AEP); 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 Change

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

8.2.18 Good practice measures implemented and embedded as part of the design and construction of the Proposed Development are relevant and considered when assessing the potential magnitude of change. Good practice measures (i.e., embedded mitigation) are discussed later in the Chapter.

8.2.19 The criteria that have been used to assess the magnitude of change are defined in **Table 8.2.** The characteristics of the changes are described as: direct / indirect, temporary

(reversible) or permanent (irreversible), together with timescales (short, medium and long term).

Table 8.2: Criteria for Assessing Magnitude of Change

Magnitude	Criteria	Definition
Major	Results in loss of attribute	Long term or permanent changes to the baseline hydrology, hydrogeology and geology such as: • permanent degradation and total loss of the soils habitat; • loss of important geological structures / features; • wholesale changes to watercourse channel, route, hydrology or hydrodynamics; • changes resulting in an increase in runoff 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 hydrology, hydrogeology and water quality, such as: • loss of extensive areas of soils habitat, damage to important geological structures / features; • some changes to watercourses, hydrology or hydrodynamics; • changes to the Site resulting in an increase in runoff within system capacity; • moderate changes to erosion and sedimentation patterns; • moderate changes to the water chemistry of surface runoff 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 hydrology, hydrogeology and water quality, such as: • minor or slight loss of soils or slight damage to geological structures / features; • minor or slight changes to the watercourse, hydrology or hydrodynamics; • changes to Site resulting in slight increase in runoff well within the drainage system capacity; • minor changes to erosion and sedimentation patterns; • minor changes to the water chemistry of surface runoff 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	No perceptible changes to the baseline hydrology, hydrogeology and water quality such as: • no impact or alteration to existing important geological environs;

Magnitude	Criteria	Definition
	magnitude to affect the use/integrity	• 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

8.2.20 The sensitivity of the receptor together with the magnitude of change determines the significance of the effect, which can be categorised into a level of significance as identified in **Table 8.3**.

8.2.21 In some cases, the potential sensitivity of the receiving environment or the magnitude of potential change cannot be quantified with certainty and therefore professional judgement remains the most robust method for identifying the predicted significance of a likely effect.

Table 8.3: Significance of Effect

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

Cumulative Effects

8.2.22 The assessment also considers potential cumulative effects associated with other wind farm developments within 5 km of the nearest Proposed Development infrastructure 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 wind farm developments which are likely to affect soils, geology, surface water and groundwater.

8.2.23 With reference to **Chapter 5: Landscape and Visual Assessment**, there are no other wind farm developments both within 5 km of the proposed turbines and within the same surface water catchment as the Proposed Development. Cumulative effects, are therefore, not considered further in this assessment.

Mitigation

8.2.24 Any likely potential effects of the Proposed Development on geology or the water environment identified by the assessment have been addressed and mitigated by the design and the application of good practice guidance to be implemented as standard during construction and operation to prevent, reduce or offset effects where possible. As such, a number of measures would form an integral part of the construction process and these have been considered prior to assessing the likely effects of the Proposed

Development (embedded mitigation), where appropriate. Furthermore, tailored mitigation measures have been identified prior to determining the likely significance of residual effects.

8.2.25 Good practice measures would be applied in relation to pollution risk, sediment management, peat management and management of surface runoff rates and volumes. This would form part of the Construction and Environmental Management Plan (CEMP) to be implemented for the Proposed Development which would be secured by a planning condition and would be prepared prior to construction commencing.

8.2.26 The final CEMP would include details and responsibilities for environmental management onsite for environmental aspects and would outline the necessary surface water management, oil and chemical delivery and storage requirements, waste management, and traffic management, and would specify monitoring requirements for wastewater, water supply and all appropriate method statements and risk assessments for the construction of the proposed development.

Residual Effects

8.2.27 A statement of residual effects, following consideration of any further specific mitigation measures where identified, is then given where required.

Statement of Significance

8.2.28 The assessment provides a statement of significance associated with the Proposed Development. Residual effects of 'major' and 'moderate' significance, as outlined in **Table 8.3**, are considered to be 'significant' in terms of the EIA Regulations.

8.3 Consultation Undertaken

Consultation for the Proposed Development was undertaken with statutory and non-statutory bodies during 2022 and 2023 as set out in Chapter 3: Environmental Impact Assessment Process. The outcome of the relevant consultations with regards to soils, geology and the water environment are summarised in Table 8.4Table 8.4: Summary of Scoping Responses

Consultee	Summary of Key Issues	Where Addressed in Chapter
Scottish Government - Energy Consents Unit Scoping Opinion June 2022	• 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. • Scottish Water confirmed that there is live infrastructure in the proximity of the proposed development that may impact on existing Scottish Water assets. The EIA must identify any potential conflicts with Scottish Water assets. The proposed activity also falls partly within a drinking water catchment where a Scottish Water abstraction is located. • The EIA should assess the presence of any private water supplies which may be impacted by	Addressed in **Appendix 8.4**. See Existing Conditions and Embedded Mitigation Sections of this Chapter.

	the development. The EIA report should include details of any supplies identified by this investigation, and if any supplies are identified, and should provide an assessment of the potential impacts, risks, and any mitigation which would be provided. • 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. • Provided generic Marine Science Scotland advice which states: In addition to identifying the main watercourses and waterbodies within and downstream of the proposed development area, developers should identify and consider, at this early stage, any Special Areas of Conservation where fish are a qualifying feature and proposed felling operations particularly in acid sensitive areas.	Refer to Existing Conditions and Embedded Mitigation Sections of this Chapter Considered in **Appendix 8.1: PLHRA** and **Appendix 8.2: PMP**. See Existing Conditions and Embedded Mitigation Sections of this Chapter.
WDC Scoping Response 10 June 2022	• The potential impact upon the Ancient Woodland, Dumbarton Muir SSSI, Auchenreoch Glen SSSI, as well as other designated sites in the area, potential impacts upon protected species of the area should be assessed in the EIA. • The EIA should clearly demonstrate that water quality will be safeguarded during the construction phase, operational phase and future decommissioning of the development. • Detailed peat probing and private water surveys are welcomed. • There is potential to displace and/or degrade peat. The Planning Authority will review the calculations and survey/assessment results as part of the EIAR. • Should a potential impact be identified, the applicant should clearly demonstrate in the EIAR that the water quality will be safeguarded during the construction phase, operational phase and future decommissioning of the development. • Detailed peat probing and private water surveys are welcomed. Planning Authority looks forward to reviewing any proposed habitat / peat land improvement proposals.	Addressed in Existing Conditions and Embedded Mitigation Sections of this Chapter. See Embedded Mitigation Sections of this Chapter. Noted. Refer to **Appendix 8.2: PMP and Appendix 8.1 PLHRA**. See Existing Conditions and Embedded Mitigation Sections of this Chapter. See **Appendix 6.6: OBEMP**.
Fisheries Management Scotland 30 May 2022	• The proposed development falls within the catchment relating to the River Leven. It is important that the proposals are conducted in full consultation with the Loch Lomond Fisheries trust.	Addressed in **Chapter 6 (Ecology)** and **Appendix 6.4: LLFT Fish Survey Report**
John Muir Trust	• We would welcome a thorough assessment of the peatland impacts of the proposed	See **Appendix 8.2: PMP** and **Appendix**

24 May 2022	development with a peatland management plan that includes habitat restoration plans. We would also welcome an accurate estimate of the whole lifecycle carbon emissions from the proposed development.	**15.1: Carbon Calculator**
SEPA Scoping Response 19 May 2022	• Peat condition assessment should be included as part of the assessment to identify pristine or near-natural areas which must be avoided and to identify modified, drained and actively eroding areas for restoration and enhancement. • Assessment must clearly demonstrate how the potential damage to the blanket bog of the Dumbarton Muir SSSI will be avoided. • A hydrogeological assessment will be required to demonstrate whether potential GWDTE are groundwater dependent. • A minimum buffer of 50m around each loch or watercourse from any proposed infrastructure is required. • Where activities such as watercourse crossings are unavoidable each breach must be numbered on a plan with an associated photograph of the location, dimensions of the loch or watercourse and drawings of what is proposed in terms of engineering works. • Watercourse crossings must be designed to accommodate 0.5% AEP flows and potential flood risk should be considered.	Considered in **Chapter 6 (Ecology)** and **Appendix 8.2: PMP** Addressed in Existing Conditions and Embedded Mitigation Sections of this Chapter. See **Figure 8.1: Local Hydrology** and **Appendix 8.3: Schedule of Watercourse Crossings.** Considered in Flood Risk Screening and Embedded Mitigation Sections of this Chapter
SEPA Further Consultation Response 30 May 2023	In response to consultation by the project team (12 May 2023) which provided the results of site surveys and merging site design in May 2023, SEPA provided the following additional advice: • Areas of Class 2 and Class 1 peatland are present within the Site. We request the EIAR is supported by a peat condition assessment. • Our expectation that peat depths >1m are avoided and request modifications to the design to avoid areas >1m and use of floating road construction methodology. • Assessment must clearly demonstrate how potential for damage to the Auchenreoch SSSI and Dumbarton Muir SSSI will be avoided. • Agree large sections of where the presence of moderately or highly dependent species are near watercourses and therefore likely to be surface fed. Further hydrogeological justification is required to demonstrate areas away from the watercourse are not highly groundwater dependent (inc. near T5, T8 and T9). • Satisfied that the majority of the development is outwith the 50m buffer and areas which are within this buffer should be amended.	This is provided in **Chapter 6 (Ecology)**. Addressed in **Appendix 8.1: PLHRA** and **Appendix 8.2: PMP**. See Existing Conditions and Embedded Mitigation Sections of this Chapter.

	• EIA must include assessment on private water supplies and the required SEPA buffers are applied to any existing groundwater abstractions.	Noted, and amended, refer to **Figure 8.1**. See Existing Conditions.
NatureScot Scoping Response 26 May 2022	• The applicant will need to demonstrate in the EIA Report that any significant effects on the qualities of the peat in the area of the Proposed Development can be substantially overcome by siting, design or other mitigation. • The applicant's intention to use the results of the peat survey work to inform a peat slide assessment and peat management plan is welcomed. • The final siting and design of the proposed development and how this may affect peatland must be fully described and assessed in the EIA Report. How significant effects will be mitigated must also be fully described. • The EIA Report should assess any potential for loss of Dumbarton Muir Site of Special Scientific Interest (SSSI) and Auchenreoch Glen SSSI habitats as a result of either construction /decommissioning or operation of the wind farm.	Addressed in **Appendix 8.1: PLHRA** and **Appendix 8.2: PMP**. Noted. See Existing Conditions and Embedded Mitigation Sections of this Chapter.
Scottish Water Scoping Response 19 May 2022	• Scottish Water records indicate that there is live infrastructure in the proximity of the development area that may impact on existing Scottish Water assets. The applicant must identify any potential conflicts with Scottish Water assets. • Records indicate that the proposed development falls partly within a drinking water catchment where a Scottish Water abstraction is located. Loch Lomond supplies Blairlinnans and Balmore Water Treatment Works (WTW) and it is essential that water quality and water quantity in the area are protected. The development appears to be just within the catchment and a sufficient distance from our abstraction point making it of lower risk to water quality.	See Existing Conditions and Best Practice Sections of this Chapter where this is addressed. Noted. See Embedded Mitigation Sections of this Chapter.

Effects Scoped Out

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

- Detailed flood risk and drainage impact assessment. Published mapping confirms the Site is not located in an area identified as being at flood risk. A simple screening of potential flooding sources (fluvial, coastal, groundwater, infrastructure etc.) is presented in the EIA Report (see Existing Conditions) and measures that would be used to control the rate and quality of runoff will be specified in the CEMP;

- Water quality monitoring: As the assessment is informed by classification data obtained from SEPA and which shows that there are no known sources of potential water pollution, no additional water quality monitoring is considered necessary to complete the assessment. Note water quality monitoring is proposed prior to, during and 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;
- Potential effects on geology: With the exception of peat, there are no protected geological features within the application 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; and
- Potential decommissioning effects are expected to be the same as potential construction effects. Decommissioning the wind farm and its associated infrastructure would be carried out in accordance with an approved decommissioning plan which would be expected to include the same safeguards as those provided during the construction stage of the project. Potential decommissioning effects are therefore scoped out of this assessment.

8.4 Statutory and Planning Context

Planning Context

8.4.1 Chapter 4: Planning Policy Context addresses the planning policy position in full and should be referred to. However, in summary, National Planning Framework 4 (NPF4) adopted by the Scottish Government on 13 February 2023 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 20 (Blue and Green Infrastructure); and
- Policy 22 (Flood Risk and Water Management).

8.4.2 In addition, WDC'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 the following are relevant to this study:

- Policy E2B (National Nature Conservation Sites (SSSI);
- Policy DC6 (Renewable Energy);
- Policy DC8 (Minerals);
- Policy F1 (Flood Prevention); and
- Policy F2 (Waste Water, Sustainable Urban Drainage, Drainage Impact Assessment and Culverts).

Legislation and Guidance

8.4.3 The following legislation and guidance documents are applicable to this assessment.

Legislation

- EU Water Framework Directive (2000/60/EC);
- EU Drinking Water Directive (98/83/EC);
- The Environmental Act 1995;
- 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) Amendment Regulations (CAR) 2013 (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.

Guidance

8.4.4 Planning Advice Notes (PANs), published by the Scottish Government, including:

- PAN 50 Controlling the Environmental Effects of Surface Mineral Workings;
- PAN 61 Planning and Sustainable Urban Drainage Systems; and
- PAN 69 Planning and Building Standards Advice on Flooding.

8.4.5 Scottish Environment Protection Agency (SEPA) Pollution Prevention Guidance Notes (PPG) and Guidance of Pollution Prevention (GPP):

- 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;
- PPG06 Working at Construction and Demolition Sites;
- PPG07 Safe Storage - The Safe Operation of Refuelling Facilities;
- GPP08 Safe Storage and Disposal of Used Oils;
- GPP13 Vehicle Washing and Cleaning;
- GPP21 Pollution Incident Response Planning; and
- GPP22 Dealing with Spills.

8.4.6 CIRIA publications:

- C532, 2001, Control of Water Pollution From Construction Sites;
- C648, 2006, Control of Water Pollution from Linear Construction Projects – Technical Guidance;
- C741, 2015, Environmental Good Practice on Site; and
- C753, 2015, The SUDS Manual.

8.4.7 SEPA publications;

- SEPA, 2010, Engineering in the Water Environment: Good Practice Guide – River Crossings;

- SEPA, 2010, Engineering in the Water Environment: Good Practice Guide – Sediment Management;
- SEPA, 2017, Guidance: Development on Peat and Off-site Uses of Waste Peat;
- Groundwater Protection Policy for Scotland, Version 3 (2009);
- SEPA, 2017, Land Use Planning System Guidance Note 4, Version 9;
- SEPA, 2018, Land Use Planning System SEPA Guidance Note 2a, Version 2;
- SEPA, 2015, Land Use Planning System SEPA Guidance Note 2e, Version 1;
- SEPA, 2017, Land Use Planning System SEPA Guidance Note 31, Version 3;
- SEPA, 2015, Position Statement – Culverting of Watercourses, Version 2.0; and
- SEPA, 2010, Regulatory Position Statement – Developments on Peat.

8.4.8 Other Guidance

- Scottish Natural Heritage (now NatureScot), 2013, Constructed Tracks in Scottish Uplands, 2nd Edition;
- Scottish Government, 2017, Proposed electricity generation developments: peat landslide hazard best practice guide;
- Scottish Government, 2017, Guidance on Development on Peatland, Peatland Survey;
- A joint publication by Scottish Renewables, Scottish Natural Heritage (now NatureScot), Scottish Environment Protection Agency, Forestry Commission Scotland and Historic Environment Scotland, 2019, Good Practice during Windfarm Construction, Version 4; and
- Scottish Renewables and SEPA, 2012, Developments on Peatland: Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste.

8.5 Existing Environment

8.5.1 This section presents information gathered regarding the existing geological, hydrogeological, and hydrological conditions at the Site and its immediate surroundings.

Site Setting

8.5.2 The Proposed Development is located within the Kilpatrick Hills, approximately 2.5 km east of Bonhill and is centred at National Grid Reference (NGR) NS437797. Access to the Proposed Development would be from a new track to the south-west of the Site, from the A813 near Murroch Farm.

8.5.3 Ground elevations across the Proposed Development generally range from approximately 210 m Above Ordnance Datum (AOD) in the north and west of the Site to 310 m AOD within the south of the Site on the northern slopes of Meikle White Hill. The Site access near the A813 is located at approximately 20 m AOD.

8.5.4 SEPA has records of precipitation data for the closest rain gauge (Quinloch Farm located at NGR NS 52477 80810), approximately 8km east of the Site. In 2022, a precipitation total of 1,219 mm was recorded. Average annual rainfall data provided by the Flood Estimation Handbook for the Murroch Burn and Grugies Burn catchments which drain the site record similar annual precipitation totals of 1,346 mm and 1,360 mm respectively.

8.5.5 An extract of OS mapping for the Site, which shows its setting, is presented as **Figure 8.1.**

Statutory Designated Sites

8.5.6 Review of the NatureScot Sitelink (2023) and Magic Map (DEFRA, 2023) webpages confirms that there are no statutory designated sites within the Application Boundary.

8.5.7 The locations of nearby statutory designated sites are shown on **Figure 8.1**. Two designated sites are recorded within the study area:

- Auchenreoch Glen SSSI is situated 70m west of the proposed Site and access track and bounds the banks of an unnamed tributary of the Murroch Burn. The SSSI is designated for lowland calcareous grassland habitat and springs (including flushes). The hydrological characteristics of the area and potential hydraulic connection between the Proposed Development the SSSI is considered later in this Section.
- Dumbarton Muir SSSI is located approximately 75 m east of the Site and is designated for blanket bog and raised bog habitats. Again, the hydrological characteristics of the area and potential hydraulic connection between the Proposed Development and the SSSI is considered later in this Section.

8.5.8 No other designated sites are noted within the study area of the Proposed Development.

Geology

Soils

8.5.9 An extract of the Soil map of Scotland (1:25,000 scale) is presented as **Figure 8.2.** The principal soil types underlying the Site are peaty gleys. Small areas of peat are noted within the north-eastern extent of the Site whilst small areas of mineral gleys and brown soils are noted along the proposed access.

Superficial Deposits (inc. Peat)

8.5.10 BGS mapping (see **Figure 8.3**) indicates that peat and till are the most prominent superficial deposits within the Site. Peat deposits are shown within the northern and eastern extent of the Site whilst glacial till deposits are found to the west and south. Parts of the Site are shown to be absent of any superficial deposits, particularly the areas which have steeper slopes. The hill tops locally, particularly Meikle White Hill and Pappert Hill are also shown not to have any superficial deposits.

8.5.11 An extract of the peatland classification dataset published by Scottish Natural Heritage (now NatureScot) is shown on **Figure 8.4**. This shows that the majority of the Site is underlain by Class 3 peatland. Class 3 peatland areas are areas associated with wet and acidic habitats where occasional peatland habitats, carbon-rich soils, and areas of deep peat can be found. It is not considered to be a priority peatland habitat.

Areas of Class 2 and Class 1 peatland are recorded within the northern and eastern extent of the Site respectively. Class 2 and 1 peatland are nationally important carbon rich soils, deep peat and priority peatland habitats.

8.5.12 As part of the baseline assessment, a comprehensive peat probing exercise has been conducted and informs the PLHRA and PMP (**Appendix 8.1: PLHRA** and **Appendix 8.2: PMP**). In summary:

- the depth of soils and peat was recorded at more than 2,300 locations;
- all elements of the proposed site infrastructure have benefited from peat probing;

- a programme of peat augering has also been undertaken to assess the characteristics of the peat at site;
- 90% of the peat probes recorded a peat depth of <1m; and
- where encountered, most of the peat is classified as between H2 and H5 in the von Post classification, showing insignificant to moderate decomposition.

Bedrock Geology and Linear Features

8.5.13 An extract of the regional BGS bedrock geological mapping is presented in **Figure 8.5** and shows the Site is under**l**ain by three main geological formations:

- Stockiemuir Sandstone Formation which comprises red cross-bedded sandstones with scattered mudstone clasts that underlies the northern most extent of the Site;
- Kinnesswood Formation which comprises metre thick sandstone beds with carbonate horizons that underlies part of the northern and eastern extent of the Site; and
- Ballagan Formation which comprises grey mudstones and siltstones with nodules and beds of dolomite and sandstones that underlies the central and south-western sections of the Site.

8.5.14 Several igneous intrusions and metamorphic rocks are also noted. Three inferred faults with a north-east to south-west trend are noted across the Site. Refer to the PLHRA and PMP (**Appendix 8.1: PLHRA** and **Appendix 8.2: PMP**) for further details.

Hydrogeology

Aquifer Characteristics and Groundwater Vulnerability

8.5.15 Extracts of the BGS groundwater vulnerability and regional hydrogeological mapping (see **Figure 8.6** and **Figure 8.7**) confirm that the superficial deposits are not considered a significant aquifer.

8.5.16 The bedrock is shown to contain groundwater and intergranular and fracture flow in the bedrock can occur. It is classified as moderately productive (**Figure 8.7).** Further details are given in **Table 8.5**.

Table 8.5: Hydrogeological Characteristics

Geological Period	Geological Unit	Hydrogeological Characteristics	Hydrogeological Classification
Pleistocene to Recent	Peat	Where not degraded or eroded, characteristically wet underfoot and dominated by Sphagnum. Typically peat consists of two layers: the upper very thin (up to 30cm) acrotelm layer contains upright stems of Sphagnum mosses and allows relatively free water movement and the lower catotelm layer comprising the thicker bulk of peat where individual plant stems have collapsed. Water movement in the catotelm layer is very slow and normally the water table in a peat never drops below the acrotelm layer	Not classified as an aquifer
	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.	Not a significant aquifer
Carboniferous	Ballagan	Argillaceous rock (mudstone and siltstones), dolostone and sandstone	Moderate Productivity Aquifer Intergranular and fracture flow
Devonian	Kinnesswood	Sandstone	High Productivity Aquifer Intergranular and fracture flow
	Stockiemuir	Sandstone	High Productivity Aquifer Intergranular and fracture flow

8.5.17 Groundwater vulnerability is divided into five classes (1 to 5) with 1 being least vulnerable and 5 being the most vulnerable. Review of **Figure 8.6** shows that the potential groundwater vulnerability in the uppermost aquifer, and with respect to the Proposed Development, has been ascribed a vulnerability of Class 4 to 5. Lower vulnerabilities (4a and 4b) are noted within the south-western and parts of the northern and eastern extent of the Site, where the glacial till and peat superficial deposits are recorded on BGS maps. The high vulnerability is likely to represent the limited cover of superficial deposits and

the potential presence of shallow groundwater in the upper weathered surface of the bedrock.

Groundwater Levels and Quality

8.5.18 Groundwater recharge at and surrounding the Site is limited by the following factors:

- steeper topographic gradients will result in rainfall forming surface water runoff; and
- the peat and glacial till deposits inhibit infiltration owing to their generally low bulk permeability.

8.5.19 SEPA do 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 groundwater will be present as perched groundwater within the more permeable horizons of the glacial till deposits and within the bedrock deposits. Groundwater flow is likely to follow topography.

8.5.20 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.

8.5.21 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;

- Dumbarton (SEPA ID: 150505) groundwater body, was classified in 2020 with an Overall Status of Good and no pressures are identified; and
- Balloch (SEPA ID: 150651) groundwater body, was classified in 2020 with an Overall Status of Good and no pressures are identified.

Groundwater Dependent Terrestrial Ecosystems

8.5.22 A national vegetation classification (NVC) habitat mapping exercise was conducted in August 2022 as part of the ecology baseline assessment and this has been used to identify potential GWDTE within the Application Boundary. The results of the NVC habitat mapping exercise are discussed in detail within **Chapter 6: Ecology and Biodiversity** (see **Figures 6.3** and **6.4**) and areas of potential GWDTE are shown on **Figure 8.8A to 8.8K.**

8.5.23 The assessment of GWDTE has been undertaken with reference to the NVC communities which are cited in SEPA guidance (SEPA, 2017). Four categories have been used to classify potential GWDTE areas:

- highly dominant, where potential high GWDTEs dominate the polygon (over 50% of the polygon);
- highly sub-dominant, where potential high GWDTEs make up a sub-dominant percentage of the polygon (less than 50% of the polygon);
- moderately dominant, where potential moderate GWDTEs dominate the polygon (over 50% of the polygon) and no potential high GWDTEs are present; and
- moderately sub-dominant, where potential moderate GWDTEs make up a sub-dominant percentage of the polygon (less than 50% of the polygon) and no potential high GWDTEs are present.

8.5.24 The location of potential GWDTE, is summarised in **Table 8.6.**

Table 8.6: Groundwater Dependent Terrestrial Ecosystems

NVC Community	GWDTE Potential	Location
CG10	High	CG10 dominant polygons are located outside of the Application Boundary, along the banks of the unnamed tributary of the Murroch Burn, near Auchenreoch Glen SSSI.
M23	High	M23 dominant polygons are generally located on sloped ground adjacent to or upstream of watercourses within the Site.
M6	High	M6 dominated polygons are located within watercourse corridors or on sloped ground upstream of watercourses within the Site.
W4	High	W4 dominated polygons are located outside of the Application Boundary, along the banks of the Finland Burn and its tributary to the north-east of the Site.
W7	High	W7 dominated polygons are located outside of the Application Boundary, along the banks of the Gallangad Burn to the north-east of the Site.
M15	Moderate	M15 dominated polygons are located in large areas across the Site, particularly on the northern slopes of Meikle White Hill within the south-eastern extent of the Site and the sloped ground within the centre of the Site.
M25	Moderate	M25 dominated polygons are located in large areas across the Site, particularly on the northern extent of the Site Access and within the western extent of the Site.
MG10	Moderate	MG10 dominated polygons are located in sloped ground adjacent to watercourses, including a small polygon adjacent to the Site Access.
U6	Moderate	U6 dominated polygons are located outside of the Application Boundary, generally on sloped ground upstream or adjacent to watercourses.

8.5.25 A review of **Table 8.6** shows that the majority of the potential high and moderate GWDTE are located within watercourse corridors or on sloping ground upstream or adjacent to watercourses, with the exception of M15 and M25 which are more widely spread. M15 and M25 are not associated with a particular ground elevation nor any specific geological units. In addition, no flush features were recorded by the NVC survey. This distribution is not typical of a habitat sustained by groundwater but rather it is likely to be supported by rainfall, surface water runoff and water logging of soils.

8.5.26 Further consultation was conducted with SEPA (see **Table** 8.4) with regard to potential GWDTE and it was agreed that large sections where the presence of potentially moderately or highly dependent GWDTE was recorded near watercourses it was likely that this habitat was sustained by surface water rather than groundwater and therefore

buffers specified in SEPA guidance to this habitat do not apply. However, further assessment was requested at the following locations:

- high potential GWDTE near T5; and
- high potential GWDTE near the access track leading to T8 and T9.

8.5.27 The habitats near T5 and the access track leading to T8 and T9 is an area dominated by M23 and M6 respectively, both of which are shown by BGS mapping to be underlain by superficial glacial till deposits. In addition, surface water ponding and boggy areas were noted during the site visit in these areas. The distribution is not typical of that attributable to a dominant groundwater discharge and it is considered that rainfall and surface water sustain these habitats. Rainwater and runoff will pond on the low permeability geology which will result in waterlogging of the soils. Further, the track between T8 and T9, and of T5 is on high ground above the elevation of nearby watercourses; and as a result there is very little surface or groundwater catchment above these locations which could generate and sustain groundwater flow to these habitats.

8.5.28 It is concluded based on the site inspection discussed above that the areas mapped as potential high and moderate GWDTE are not sustained by groundwater but rather are sustained by incident rainfall and surface water runoff which ponds on areas of shallow gradient above the low permeability peat and glacial deposits.

8.5.29 Accordingly, the buffers to potential GWDTE specified in SEPA guidance need not apply. Safeguards would be required, however, to sustain existing surface water flow paths so that incident rainfall can continue to sustain these habitats (see Predicted Impacts and Embedded Mitigation later in this Chapter).

Hydrology

Local Hydrology

8.5.30 The Site is located within three main surface water catchment areas; the Gallangad (Catter) Burn to the east, the River Leven to the west and the Gruddies Burn to the south.

8.5.31 The Gallangad Burn flows generally northwards to the east of the Site before discharging into the Endrick Water approximately 7 km north-east of the Proposed Development. T2, 3 and 4 lie in the headwater of this catchment.

8.5.32 The River Leven flows from Loch Lomond to the north-west of the Site and flows southwards approximately 700m west of the Site, at its closest extent. The river discharges into the River Clyde approximately 3.1 km south-west of the Site. The Site is drained by two main sub-catchments of the River Leven, the Carrochan Burn which drains the north-western extent of the Site and the Murroch Burn which drains the western and central extent of the Site. T1, 5, 6, 7 and 8 lie within this catchment.

8.5.33 The southern extent of the Site is drained by tributaries of the Gruddies Burn, in particular Sprouts Burn which flows south-westwards before discharging into the Garshake Burn initially and then to the Gruddies Burn approximately 1.7 km south of the Site Access. The Gruddies Burn continues to flow south-westwards before discharging into the River Clyde approximately 3.1 km south of the Site. T9 and 10 as well as the access track, site compound and substation lie within this catchment.

8.5.34 None of the catchments which drain the Site have been designated as a Drinking Water Protected Area (DWPA).

8.5.35 Loch Lomond is approximately 4.5 km north-west of the Site and the loch has been designated as a DWPA. The Endrick Water drains into the loch approximately 8.5 km north of the Site. The loch and the DWPA lie beyond the study area and the distance will allow significant dilution such that any potential effects would not be discernible. The DWPA is not, therefore, considered at risk and is not assessed further. It is noted by Scottish water, in their consultation response, considered that the Proposed Development posed a low risk to this DWPA. Measures to safeguard existing surface water flow paths and water quality are discussed in Section 8.6.

8.5.36 The proposed access track to the turbine area crosses Scottish Water infrastructure at three locations, as shown on **Figure 8.1**. As part of the detailed design stage of the project measures required to maintain the integrity of this infrastructure will be agreed with Scottish Water

Surface Water Quality

8.5.37 Water quality of the Gallangad Burn, River Leven, Carrochan Burn and Clyde Estuary is monitored by SEPA and classified annually in accordance with the requirements of the Water Framework Directive (WFD). **Table 8.7** summarises classification data reported in 2020 (the last reporting cycle). Smaller watercourses within the Proposed Development are not monitored nor classified by SEPA.

Table 8.7: Surface Water Quality

Watercourse (SEPA ID)	Overall Status	Overall Ecology	Physico-Chemical Status	Hydro-morphology	Pressures
Gallangad Burn (10154)	Good	Good	High	Good	Barrier to fish migration
Carrochan Burn (10151)	Moderate Ecological Potential	Bad	Good	Bad	Diffuse source pollution
River Leven (10150)	Moderate Ecological Potential	Moderate	High	Moderate	Heavily modified waterbody to alleviate subsidence and flood issues and unknown pressures on water quality
Clyde Estuary (200320)	Moderate Ecological Potential	Moderate	Poor	Moderate	Modifications to bed, banks and shores

Fisheries

8.5.38 Fisheries for watercourses that are downstream of the Proposed Development are managed by the Loch Lomond Fisheries Trust (LLFT) and Clyde River Foundation (CRF).

Fishery interests are discussed and assessed within **Chapter 6: Ecology and Biodiversity.**

Flood Risk

8.5.39 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. The flood risk from each of these potential sources is discussed in **Table 8.8**.

8.5.40 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.

Table 8.8: Flood Risk Evaluation

Potential Source	Potential Risk to the Site	Justification
Coastal Flooding	No	SEPA flood maps confirms that the Site is not at risk of tidal flooding associated with the Clyde Estuary. The lowest elevations across the Site are approximately 20 m AOD and the Application Boundary is located approximately 300 m from the mapped coastal flooding extent, at its closest extent. The Site is therefore considered not at risk of tidal flooding.
Fluvial Flooding	No	SEPA flood maps confirm flood extents are generally confined to the watercourse corridors and away from the proposed infrastructure. A larger extent of flooding is noted near the confluence of the Murroch Burn and River Leven, near the proposed access point, however this does not extend to the Site itself. Therefore the Site is not considered at risk from fluvial flooding and it is not considered further.
Surface Water Flooding	Yes (Minor)	SEPA have identified several areas of surface water flood risk across the Site which generally coincide with the watercourse corridors within the Site. Flood extents outside of the watercourse corridors are shown to be small, localised areas, never forming large, linked areas or flow paths. Therefore, surface water is not considered a development constraint.
Groundwater Flooding	No	A desk-based review of the Site showed that the Site lies on elevated ground above a moderately productive aquifer. Review of the SEPA groundwater flood map shows that the Site is not at risk from groundwater flooding.
Flooding from Infrastructure 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 no risk of reservoir inundation within the Proposed Development. Flooding from this source is not considered further.

Private Water Supplies and Licenced Sites

8.5.41 As part of this assessment, a data request was made to WDC for details of Private Water Supplies (PWS) sources within the study area. A programme of site investigation has also been undertaken to confirm the location and number of PWS sources.

8.5.42 No private water supplies have been identified within the Proposed Development and the properties located within the study area have confirmed they are on mains supply.

8.5.43 There are no identified PWS sources at risk from the development and this is not considered further.

8.5.44 SEPA has provided records of Controlled Activity Regulations (CAR) authorisations within the study area. None are recorded within the Application Boundary. One authorisation for private sewage was recorded at the south-western extent of the study area, beside the A813. The SEPA online database showed two more authorisations within this area, as shown on **Figure 8.1**. SEPA was not able to provide details of these authorisations at the time of reporting. No authorisations are for water abstraction.

Hydraulic Connection to Auchenreoch Glen SSSI & Dumbarton Muir SSSI

8.5.45 The Section assesses the potential hydraulic connection between the Proposed Development and Auchenreoch Glen SSSI and Dumbarton Muir SSSI in turn.

Auchenreoch Glen SSSI

8.5.46 Auchenreoch Glen SSSI is located west of the Proposed Development access track, at an elevation of between approximately 170 mAOD (in the east) and 100 mAOD in the west at its boundary with the Murroch Burn. It is formed in a steeply incised tributary of the Murroch Burn, as shown in **Photograph 8.1**.

Photograph 8.1 - Auchenreoch Glen SSSI from the South (looking west)

8.5.47 The SSSI designation, as described earlier in this Section (refer to Statutory Designated Sites), is for lowland calcareous grassland habitat and springs (including flushes). The flushes are likely to be dependent on groundwater flow, which given the east-west orientation of the SSSI and incised valley, would originate from the north and south of the SSSI.

8.5.48 With regard to the SSSI and its relationship to the Proposed Development, the following observations are made:

- None of the Proposed Development is within the boundary of the SSSI and no part of the Proposed Development crosses the SSSI boundary. At is closest extent, the Proposed Development is 70m from the SSSI;
- the stream which flows through the base of the SSSI rises to the north-east of the SSSI and lies within the same surface water catchment as part of the proposed site access track, site compound, substation, access track to turbine T9 (and turbine T9), and a small section for the track leading to turbine T8 (but not turbine T8);
- a buffer of at least 50 m has been maintained to this watercourse and elements of the Proposed Development;
- with reference to SEPA LUPS-31 guidance only the proposed access track is located within 100 m and 250 m of the SSSI; and
- elements of Proposed Development are at a much higher elevation that the SSSI and the flushes within the SSSI (e.g. the site access track passes between 180 mAOD and 200 mAOD and the site compound and substation is located at an elevation of above 200 mAOD).

8.5.49 Given these observations, the following conclusions are made:

- there are no direct effects on the SSSI;
- construction of the access track, site compound, substation and turbine T9 would not affect groundwater flows contributing to the flushes in the SSSI as:
    - within 250 m of the SSSI only lies the site access track and any foundations associated with this are shallow and would not be >1 m deep and thus little or no groundwater would be intercepted as a consequence of construction;
    - the Proposed Development is at a higher elevation than the flushes and would not intercept the groundwater which support the flushes;
    - the Proposed Development is not in the same local water catchments that contribute to the flushes (e.g., which receive groundwater flow form the south and north, where no development is proposed).

8.5.50 Therefore, the stream which flows through the base of Auchenreoch Glen SSSI is hydraulically connected to the Proposed Development and should be considered further in this assessment. But groundwater, which sustains the flushes in the SSSI (and one of its qualifying interests) is not hydraulically connected to the Proposed Development and does not need to be considered further in this assessment.

Dumbarton Muir SSSI

8.5.51 Dumbarton Muir SSSI is located east of the Application Boundary and as noted earlier in this Section (refer to **Statutory Designated Sites**) is designated for its blanket bog and raised bog habitats. Blanket and raised bogs typically are sustained by incident rainfall and waterlogging of low permeability peat deposits.

8.5.52 None of the Proposed Development is within the boundary of the SSSI and a buffer of 75 m has been applied as a design constraint between the SSSI and Application Boundary.

8.5.53 Elements of the Proposed Development on the eastern site boundary and within surface water catchments that drain to or through the SSSI are limited to Turbine T4 and the access track leading to this from the junction with the track to Turbine T3. They are located in the catchment of a tributary of the Gallangad Burn which flows through the SSSI.

8.5.54 Turbines T2, T3, T7 and T10, and the access tracks leading to these, which are located in the east of the Proposed Development, are not in surface water catchments that drain to Dumbarton Muir SSSI – they lie in surface water catchments that drain to the north (T2 and T3), west (T7) and south (T10).

8.5.55 Only Turbines T4 and T7 are located within 250 m of the SSSI, and with reference to the peat depth plans presented in the PMP (**Appendix 8.2: PMP**) it is evident that areas of deep peat have been avoided by the design of the Proposed Development. Areas of deeper peat are shown to the east and within the SSSI.

8.5.56 The tributary of the Gallangad Burn (noted above) lies between Turbine T4 and the SSSI. The tributary forms a hydraulic barrier between the two, which would ensure that any temporary dewatering associated with construction of the turbine would have no effect on the SSSI.

8.5.57 As described earlier in this Section (refer to **Table 8.5: Hydrogeological Characteristics**) peat has a very low bulk permeability and does not readily allow water movement. The depth of peat at T4 and T7 has been proven to be shallow and as a result construction activity at these locations, where temporary dewatering may be required, will not extend far and not as far as the SSSI. No permanent dewatering is required and following construction existing water flow paths would remain.

8.5.58 In summary, the Gallangad Burn which flows through Dumbarton Muir SSSI and Turbine T4 are hydraulically connected and should be considered further in this assessment. But water within shallow deposits of peat at the proposed infrastructure locations in the east of the site are not hydraulically connected to the SSSI and does not need to be considered further in this assessment.

Summary of Sensitive Receptors

8.5.59 **Table 8.9** outlines the receptors identified as part of the baseline study, and their sensitivity based upon the criteria contained in **Table 8.1**. These receptors are assessed as per the previously introduced methodology and are used in conjunction with an assessment of the magnitude change to determine whether an effect is significant or not in EIA Regulation terms..

Table 8.9: Receptor Sensitivity

Receptor	Sensitivity	Reason for Sensitivity
Statutory Designated Sites	High	Parts of Dunbarton Muir SSSI and Auchenreoch Glen SSSI are located downstream of sub-catchments which drain from the Proposed Development. They are, therefore, partly in hydraulic continuity with the Proposed Development and are considered further in this assessment. It has been shown that neither SSSI is at risk from dewatering associated with the Proposed Development. This is not considered further in the assessment.
Soils and Geology	High	Areas of peat and carbon rich soils have been recorded within the Site and are considered further in this assessment. With the exception of peat, the superficial and bedrock geology is not rare and is not considered sensitive.
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.
Surface Water	High	Surface watercourses that drain the Site have been classified by SEPA with a Good to Moderate status.
Flooding	Moderate	Little or no flood risk has been identified, but the development has potential, without appropriate design, to alter surface water flow paths and could increase flood risk downstream of the site.
Private Water Supplies	Not Sensitive	No private water supplies have been identified within the study area.
Licenced Sites	Not Sensitive	No licenced water abstractions are recorded within the study area.
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 surface water.

8.6 Predicted Impacts

Embedded Mitigation

8.6.1 The Proposed Development has undergone many design iterations in response to the geological, hydrological and hydrogeological constraints identified as part of the baseline studies and field studies so as to avoid and/or minimise likely effects on receptors where possible. This has included designated sites including Auchenreoch and Dunbarton Muir

SSSIs, areas of deep peat or potential peat instability, watercourses, areas of potential flooding and GWDTE.

Peat and Peat Management

8.6.2 The presence of peat formed a key consideration in the design of the Proposed Development. Informed by the extensive programme of peat probing undertaken across the Site, the design has largely avoided areas of deeper peat (typically >1 m) and where possible limited development to areas of peat less than 1m or where peat is absent.

8.6.3 A comprehensive programme of peat depth probing has been undertaken in order 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 (see **Appendix 8.2: PMP**) which details the volume of acrotelmic and catotelmic peat which would be disturbed and how this would be safeguarded and reused on site. Further, the condition of the peat, and areas of peat that would benefit from restoration have been identified and are discussed in **Chapter 6: Ecology and Biodiversity**.

8.6.4 As shown in **Chapter 6: Ecology and Biodiversity, Appendix 8.1: PLHRA** and **Appendix 8.2: PMP** 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 (refer to Habitat Management Plan).

Peat Management

8.6.5 A detailed review of the distribution and depth of peat at the Site is contained in **Appendix 8.2: PMP**. The Site design has largely avoided areas of deep peat. Where peat would be encountered by the Proposed Development, it can be readily managed and accommodated within the Site layout without significant environmental impact. No surplus peat would be generated, and the limited volumes of peat generated from the proposed excavations would be used to reinstate track verges, turbine bases, crane hardstandings and restoration of onsite borrow pits.

Peat Landslide Hazard

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

8.6.7 The site specific PLHRA (**Appendix 8.1: PLHRA**) confirms regarding peat stability that there are very few areas of medium risk of peat instability across the Proposed Development and the hazard impact assessment concluded that, with the employment of appropriate mitigation measures, all of the areas can be considered as an insignificant risk.

8.6.8 Good construction practice and methodologies to prevent peat instability 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;
- minimisation of ‘undercutting’ of peat slopes, but where this is necessary, a more detailed assessment of the area of concern would be required;

- 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 thus 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.

8.6.9 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.

Buffer to watercourses

8.6.10 In accordance with consultation advice from SEPA and wind farm construction best practice guidelines, a 50 m buffer has been applied to watercourses (shown on OS 1:25,000 mapping) and any proposed construction activities or infrastructure has been located outside of this buffer (see **Figure 8.1**).

8.6.11 The layout of the access track was also designed to minimise the requirement for watercourse crossings (see **Good Practice Measures**).

Groundwater Dependent Habitats

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

8.6.13 Measures, such as permeable access tracks and regular cross track drains, have been proposed to safeguard existing water flow paths and maintain existing water quality. 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 Ecological Clerk of Works (ECoW) at the time of the construction who would ensure existing surface water flow paths and water flushes are maintained.

Good Practice Measures

8.6.14 Good practice measures would be applied in relation to pollution risk, and management of surface runoff rates and volumes. This would form part of the final CEMP to be implemented for the proposed development.

8.6.15 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

8.6.16 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.

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

8.6.18 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.

8.6.19 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.

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

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

Water Quality Monitoring

8.6.22 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.

8.6.23 The monitoring scheme would also allow the quality of water draining toward Dumbarton Muir SSSI and Auchenreoch Glen SSSI to be assessed and quantified.

8.6.24 Monitoring would 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. WDC, SEPA, NatureScot, Marine Scotland, LLFT and CRF would be consulted on the plans and would be contained within the final CEMP.

8.6.25 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.

Protection of Scottish Water Distribution Pipework

8.6.26 It has been confirmed that the access track to the proposed turbines crosses Scottish Water distribution pipework at three locations, as shown on **Figure 8.1**. As part of the detailed design stage of the project the location of the pipework at these locations will be confirmed and necessary protection agreed with Scottish Water to ensure the integrity of their infrastructure is maintained.

Pollution Risk

8.6.27 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 onsite 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 onsite 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 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.

8.6.28 Site investigation (e.g., trial pitting and/or boreholes) would be undertaken prior to any construction works where excavation would be required to establish the wind farm 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

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

- all stockpiled materials would be located out with 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 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

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

8.6.31 SuDS techniques aim to mimic pre-development runoff conditions and balance or throttle flows to the rate of runoff that might have been experienced at the Site prior to development. Good practice in relation to the management of surface water runoff rates and volumes and potential for 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;
- onsite 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 runoff rates and reduce runoff 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

8.6.32 Any water abstraction 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 Licence regulations 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

8.6.33 Four new watercourse crossings are required for the Proposed Development as detailed within **Appendix 8.3: Schedule of Watercourse Crossings** and shown on **Figure 8.1**.

8.6.34 The crossings would be designed to pass the 200-yr flood event and their design and construction details would be agreed with SEPA and WDC as part of the final CEMP.

Potential Construction Impacts

Statutory Designated Sites

8.6.35 It has been shown (refer to Baseline Conditions - Hydraulic Connection to Auchenreoch Glen SSSI & Dumbarton Muir SSSI) that parts of both Auchenreoch Glen SSSI and Dumbarton Muir SSSI lie downstream of the Proposed Development. To ensure that neither SSSI is impaired it will be necessary to sustain existing surface water flows and quality that is shed from the Proposed Development area toward the SSSI's.

8.6.36 The SSSI's are high sensitivity receptors. The Proposed Development design and the Embedded Mitigation, includes provision for the implementation of measures to maintain existing surface water flow paths and quality. Consequently, the potential magnitude of change on the SSSI's is assessed as negligible and thus the significance of effect is **negligible**.

Peat and Soils

8.6.37 It has been shown (see **Appendix 8.1: PLHRA**, **Appendix 8.2: PMP** and Embedded Mitigation Section) 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.

8.6.38 Peat is a high sensitivity receptor. With the implementation of the identified safeguards and proposed good practice methodologies, including supervision of works by a dedicated site ECoW, the potential magnitude of change on deposits of soil and peat is assessed as negligible and thus the significance of effect is **negligible**..

Pollution Risk

8.6.39 During the construction phase, there is the potential for a pollution event to impair surface waterbodies impacting on their quality. This would have a negative impact on the receptor, potentially resulting in degradation of the water quality which would impact on any aquatic life.

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

8.6.41 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 and identifying safe areas for stockpiling or storage of potential pollutants that could otherwise lead to the pollution.

8.6.42 The baseline assessment has shown that the watercourses surrounding the Proposed Development are considered a High sensitivity receptor.

8.6.43 The Good Practice Measures (to be set out in the outline CEMP) would minimise the risk of a pollution event occurring to negligible and there are measures which would be put in place in the case of an accident occurring to mitigate pollution risk. The magnitude of change associated with a pollution event is considered negligible. The potential effect on watercourses of High sensitivity would be **negligible**.

Erosion and Sedimentation

8.6.44 Site traffic during the construction phase 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 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.

8.6.45 Excavation of borrow pits, construction of hardstanding, diversion of drainage channels and the construction of water crossings 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.

8.6.46 The implementation of location specific good practice measures will form part of the final CEMP and will minimise the potential for erosion and sedimentation.

8.6.47 With implementation of good practice measures, the potential magnitude of change to groundwater and surface water is assessed as negligible. Groundwater and surface water are considered high sensitivity receptors. The level of effect is therefore assessed as **negligible**.

Fluvial Flood Risk

8.6.48 Construction of hardstanding including the substation, construction compound and turbine bases would create impermeable surface areas which could increase runoff rates and volumes.

8.6.49 Adherence to 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.

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

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

8.6.52 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.

8.6.53 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

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

8.6.55 Dewatering associated with construction of turbine foundations is temporary and would not be required post construction and during the operational life of the Proposed Development. 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 dependent habitats.

8.6.56 The design of the Proposed Development has avoided areas of ecological or habitat interest, including GWDTE, wherever possible. Proposed earthworks are shallow and no or little temporary dewatering is likely to be required during the construction phase. .

8.6.57 The sensitivity of groundwater (and habitats that may be dependent on groundwater) receptors has been assessed as high. However, as discussed in the hydrogeological characteristics of the Baseline Conditions text the geology at site has a low bulk hydraulic conductivity which means the extent of any dewatering would be very small when compared to surface and groundwater catchments and the potential magnitude of temporary groundwater ingress would be small. Notwithstanding this, the best practice measures listed above would be included in the CEMP and would be used to control and manage surface and groundwater flows and ensure existing water flow paths to water dependent habitats are maintained. The magnitude of change is assessed as negligible and therefore the potential level of effect of changing groundwater levels and flow due to dewatering is considered to be **negligible**.

Water Abstractions

8.6.58 During the construction of the Proposed Development, water may be abstracted for uses such as dust suppression, vehicle washing and welfare facilities. The volume of water and mitigation required would be regulated through a CAR abstraction licence and therefore the magnitude of change on groundwater-surface water interactions is considered negligible. The significance of effect is therefore **negligible**,.

Potential Operational Impacts

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

8.6.60 Should any maintenance be required onsite during the operational life of the project which would involve construction activities; mitigation measures would be adhered to along with the measures in the final CEMP to avoid potential effects.

Statutory Designated Sites

8.6.61 During the operational phase no excavation of soils, temporary or permanent control of surface or groundwater is required.

8.6.62 Both Auchenreoch Glen SSSI and Dumbarton Muir SSSI are high sensitivity receptors. The potential operational impact on the SSSI's is assessed as negligible and thus the resultant significance of effect is **negligible**..

Peat and Soils

8.6.63 No excavation, movement or storage of peat or soils is anticipated during the operational site life.

8.6.64 Peat and carbon rich soil is a high sensitivity receptor. The potential impact on deposits of soil and peat is assessed as negligible and thus the resultant significance of effect is **negligible**..

Pollution Risk

8.6.65 The possibility of a pollution event occurring during operation is very unlikely. There would be a limited number of vehicles required onsite for routine maintenance and for the operation of the proposed development. Storage of fuels/oils onsite for turbine maintenance would be limited to the hydraulic oil required in turbine gearboxes and this would be bunded (satisfying storage guidance) to prevent fluid escaping.

8.6.66 The proposed BESS would be installed and operated in accordance with manufacturers and SEPA guidelines. As part of the detailed site design drainage of the BESS, and measures that would be used to control and management storm water runoff, during routine operation would be agreed with SEPA and NatureScot In addition, the drainage design would consider the necessary controls required to manage spills or firewater in the unlikely event of an accident occurring during operation of the BESS.

8.6.67 The Good Practice Measures (to be set out in the outline CEMP) would minimise the risk of a pollution event occurring to negligible and there are measures which would be put in place in the case of an accident occurring to mitigate pollution risk. The magnitude of change associated with a pollution event during the operational phase of the Proposed Development is assessed negligible, as no detectable change will likely occur. Therefore, the level of effect of a pollution event during the operational phase of the Proposed Development is predicted to be **negligible** for all receptors.

Erosion and Sedimentation

8.6.68 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.

8.6.69 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 effects 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 runoff velocities and prevent erosion until vegetation becomes established.

8.6.70 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 level of effect on these receptors is **negligible**.

8.6.71 Should any non-routine maintenance be required at the sections of track crossing wet areas (defined visually onsite 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 phase would be required on a case by case basis. Extensive work at water crossings/adjacent to the water environment may require approval from SEPA under the CAR (depending upon the nature of the activity).

Fluvial Flood Risk

8.6.72 The risk of an effect from fluvial flood risk arises as a result of a potential restriction of flow at the existing watercourse crossings following intense rainfall. In accordance with good practice, routine inspection of the culverts or bridges at the Site would be undertaken, reducing the likelihood of a blockage occurring. In the unlikely event of a blockage any flooding would be localised. The magnitude of change is assessed as negligible, and thus the level of effect is assessed as **negligible**,.

Infrastructure and Man-made Drainage

8.6.73 Operation of the proposed development requires limited activities relative to the construction phase.

8.6.74 The magnitude of a potential effect 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 level of effect is **negligible**.

8.7 Mitigation

8.7.1 As there are no predicted significant effects under the terms of the EIA Regulations, other than the good practice measures that the developer would implement as standard (and as described above), no additional specific mitigation during construction is required.

8.7.2 It has been recognised in this assessment that a programme of water monitoring would be required prior to any construction activity and during construction of the Proposed Development. The monitoring programme would be agreed with SEPA, NatureScot, WDC, Marine Science Scotland, LLFT and CRF and it is expected to include monitoring of the watercourses which drain from the site.

8.7.3 As detailed in **Appendix 8.1: PLHRA**, it is proposed a peat landslide hazard emergency plan and geotechnical risk register is maintained during the construction and post-construction phase of the Proposed Development. It is expected that this would be maintained by the developer, and again, secured by an appropriately worded predevelopment condition of consent.

8.7.4 As detailed in the PMP (**Appendix 8.2: PMP**) during and following construction the drainage measures deployed at the Site (temporary and permanent) the works would be subject to routine inspection by the dedicated Site ECoW and developer. This would include areas of temporary stockpiling of materials and would be specified in a site-specific CEMP which would be secured by an appropriately worded predevelopment condition of consent.

8.8 Summary of Residual Effects

8.8.1 No significant residual effects on soils and peat, geology, surface water or groundwater receptors are predicted during the construction and operational periods of the Proposed Development.

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