CONTENTS

TABLES

FIGURES

APPENDICES

Introduction

10.1 This Chapter presents the assessment of likely significant effects (as per the Environmental Impact Assessment (EIA) Regulations) on hydrology, hydrogeology, and geology (including peat and soils) arising from Windburn Wind Farm (the proposed development) during construction and operation.

10.2 The objectives of the Chapter are to:

- describe the assessment methodology and significance criteria used in completing the impact assessment;
- describe the hydrological, hydrogeological, geological and soil baseline conditions established from desk studies, site-specific surveys and feedback obtained during engagement with stakeholders;
- describe the potential effects, including direct, indirect, and cumulative effects;
- describe the mitigation measures proposed to address the likely significant effects; and
- assess the residual effects following the implementation of mitigation measures.

10.3 The assessment has been carried out by SLR Consulting Limited. Production of this chapter has been overseen by Gordon Robb.

10.4 This Chapter presents summary information from the following Technical Appendices:

- **Technical Appendix 10.1: Peat Landslide Hazard Risk Assessment (PLHRA)**;
- **Technical Appendix 10.2: Peat Management Plan (PMP)**;
- **Technical Appendix 10.3: Borrow Pit Assessment (BPA)**;
- **Technical Appendix 10.4: Schedule of Watercourse Crossings**;
- **Technical Appendix 10.5: Private Water Supply Risk Assessment**; and
- **Technical Appendix 10.6: Groundwater Dependent Terrestrial Ecosystems (GWDTE) Assessment**.

10.5 **Figures 10.1** to **10.8** are referenced in the text where relevant.

10.6 The assessment uses information and findings presented in **Chapter 8: Ecology** to inform the assessment of potential effects on possible areas of Groundwater Dependent Terrestrial Ecosystems (GWDTE) which are presented in this Chapter.

10.7 Further, during the design stage of the proposed development, the Applicant consulted extensively with Highland Spring Limited and their hydrogeological advisors. Their feedback has informed the design of the proposed development presented in this EIA Report.

Scope and Consultation

Scope of the Assessment

10.8 This Chapter takes topic specific approach to assessment of the proposed development within the parameters identified in **Chapter 3: Description of the Development**.

10.9 The scope of the assessment has been determined through a combination of professional judgement, reference to relevant guidance documents and consultation with stakeholders including statutory and non-statutory consultees and Highland Spring Limited and their advisors. Further details are given in **Chapter 6: Scoping and Consultation**.

Consultation

10.10 The outcome of the relevant consultations with statutory and non-statutory consultees with regard to hydrology, hydrogeology and geology are summarised in **Table 10-1.**

Table 10-1: Consultation Responses

Consultee	Summary of Key Issues	Where Addressed in Chapter
Scottish Environment Protection Agency (SEPA) Scoping Response 1 May 2023	We consider that the following key issues must be addressed in the Environmental Impact Assessment process. To avoid delay and potential objection, the information outlined below and in the attached appendix must be submitted in support of the application. a) Map and assessment of all engineering works within and near the water environment including buffers, details of any flood risk assessment and details of any related CAR applications. b) Map and assessment of impacts upon Groundwater Dependent Terrestrial Ecosystems and buffers. c) Map and assessment of impacts upon groundwater abstractions and buffers. d) Peat depth survey and table detailing re-use proposals. e) Map and table detailing forest removal. f) Map and site layout of borrow pits. g) Schedule of mitigation including pollution prevention measures. h) Borrow Pit Site Management Plan of pollution prevention measures. i) Map of proposed waste water drainage layout. j) Map of proposed surface water drainage layout. k) Map of proposed water abstractions including details of the proposed operating regime. l) Decommissioning statement.	Maps which show the proposed development and its relationship to the water environment are given in **Figures 10.1** to **10.8**. Private water supplies, including groundwater abstractions, are discussed in this Chapter and **Technical Appendix 10.5**. Potential impacts on GWDTE and peat are summarised in this Chapter and discussed in full in **Technical Appendices 10.6**, **10.1** and **10.2** respectively. A borrow pit appraisal is included as **Technical Appendix 10.3**. Principles, design standards and best practice measures for the management and control of drainage that would be adopted are included within this Chapter and in **Technical Appendix 10.5**. Decommissioning will be less than potential construction effects and has been scoped out of this assessment, see Paragraph 10.15 and **Chapter 3**.
	The Peat Management Plan will need to demonstrate that the proposal accords with the	A comprehensive programme of peat depth

Consultee	Summary of Key Issues	Where Addressed in Chapter
	requirements of NPF4 (Policy 5 – Soils). Additional survey work will need to be undertaken to cover all parts of the site where turbines and associated infrastructure is proposed factoring in appropriate allowances for micrositing.	probing assessment has been completed. Potential impacts on peat and proposed mitigation measures are summarised in this Chapter and discussed in full in **Technical Appendix 10.1** and **Technical Appendix 10.2**.
	Survey work will need to be undertaken to cover all parts of the site where turbines and associated infrastructure are proposed factoring in appropriate allowances for micrositing and buffer requirements. Please note that whilst we accept UKHab as an alternative to Phase 1 habitat surveys detailed habitat surveys must use the NVC classification. It is important that the detailed survey is conducted in NVC and the results presented using the NVC; it is not acceptable to use UKHab for the survey then to convert to NVC equivalents for presentation of the results.	Noted. A comprehensive NVC survey has been completed, the methodology and results are presented in **Chapter 8**.
	Provided watercourse crossings are designed to accommodate the 1 in 200 year event with an appropriate allowance for climate change and other infrastructure is located well away from watercourses we do not foresee from current information a need for detailed information on flood risk.	It is confirmed that watercourse crossings will be sized to accommodate the 1 in 200 year event with an appropriate allowance for climate change. A schedule of watercourse crossings is presented in **Technical Appendix 10.4**.
Scottish Water Scoping Responses 09 May 2023	Scottish Water has no objection to this planning application; however, the applicant should be aware that this does not confirm that the proposed development can currently be serviced.	Noted.
	A review of our records indicates that the proposed activity falls partly within a drinking water catchment where a Scottish Water abstraction is located. Scottish Water abstractions are designated as Drinking Water Protected Areas (DWPA) under Article 7 of the Water Framework Directive. The Upper Glendevon Reservoir supplies Glendevon Water Treatment Works (WTW) and it is essential that water quality and water quantity in the area are protected. The activity is sufficient distance from the intake that it is likely to be low risk, however water quality must be protected, and we expect appropriate mitigations to be implemented. Thought must be given to how site run off will be	Noted. Assessment of potential impacts on the water environment, including the Glendevon DWPA is included within this Chapter.

Consultee	Summary of Key Issues	Where Addressed in Chapter
	managed and how the risks from hydrocarbon spills will be mitigated against.	
	For reasons of sustainability and to protect our customers from potential future sewer flooding, Scottish Water will not accept any surface water connections into our combined sewer system.	Noted. It is confirmed that no connection to Scottish Water infrastructure is proposed.
NatureScot Scoping Response 10 May 2023	The applicant should include measures which will seek to avoid both direct and indirect impacts to the most sensitive and high quality peatland habitats and this should be considered as part of the site design. The applicant should consider mitigation such as revising the proposed site design to exclude and protect areas of deep peat and priority peatland habitats, mitigation should be detailed where impacts on peatland habitats are unavoidable. Measures to minimise peat disturbance should be considered during the excavation, construction and decommissioning phases of the proposal. We recommend consideration of degraded peatland areas which could be included as part of a Habitat Management Plan which may be used as compensatory and enhancement measures.	Site-specific peat depth probing, peat depth and condition data has been used to inform the proposed development design. Potential impacts on peat and proposed mitigation measures are summarised in this Chapter and discussed in full in **Technical Appendices 10.1** and **10.2**. An Outline Habitat Management Plan is provided in **Technical Appendix 8.4**.
	We are supportive of the inclusion of a Peat Management Plan. This should include methods to restore and improve the condition of existing peatland habitat to compensate for unavoidable residual effects. Habitat enhancement should go beyond compensation and should provide overall positive effects or net benefit for peatland interest.	Noted. A site specific PMP is presented in **Technical Appendix 10.2**. An Outline Habitat Management Plan is provided in **Technical Appendix 8.4**.
	We refer the applicant to SEPA for advice on the methodology and scope of the hydrology and hydrogeology assessment.	Noted. See SEPA's response above.
Perth and Kinross Council Scoping Response 19 May 2023	The assessment methodology is comprehensive and covers all the main areas where potential significant effects may occur. The proposed assessment of effects should adequately identify and assess the significance of the potential environmental impacts.	Noted.
Energy Consents Unit (ECU) Scoping Response 07 June 2023	Scottish Water provided information on whether there are any drinking water protected areas or Scottish Water assets on which the development could have any significant effect. Scottish Ministers request that the company to confirm whether there any Scottish Water assets which may be affected by the development and includes details in the EIA report of any relevant mitigation measures to be provided.	Noted. See Scottish Water's response above.

Consultee	Summary of Key Issues	Where Addressed in Chapter
	Scottish Ministers request that the Company investigates the presence of any private water supplies which may be impacted by the development. The EIA report should include details of any supplies identified by this investigation, and if any supplies are identified, the Company should provide an assessment of the potential impacts, risks, and any mitigation which would be provided.	Potential impacts on private water supplies and proposed mitigation measures, as required, are discussed in full in **Technical Appendix 10.5: PWSRA** and summarised in this Chapter.
	Scottish Ministers consider that where there is a demonstrable requirement for peat landslide hazard and risk assessment (PLHRA), the assessment should be undertaken as part of the EIA process to provide Ministers with a clear understanding of whether the risks are acceptable and capable of being controlled by mitigation measures.	A site specific PLHRA report has been completed and is presented in **Technical Appendix 10.1**.
	Where borrow pits are proposed as a source of onsite aggregate they should be considered as part of the EIA process and included in the EIA report detailing information regarding their location, size and nature. Ultimately, it would be necessary to provide details of the proposed depth of the excavation compared to the actual topography and water table, proposed drainage and settlement traps, turf and overburden removal and storage for reinstatement, and details of the proposed restoration profile. The impact of such facilities (including dust, blasting and impact on water) should be appraised as part of the overall impact of the working. Information should cover the requirements set out in 'PAN 50: Controlling the Environmental Effects of Surface Mineral Workings'.	Noted. A borrow pit appraisal is included as **Technical Appendix 10.3**, which includes details of the likely excavation and restoration profile of the proposed borrow pits Mitigation measures presented in this chapter details how drainage and water quality would be managed, and turf and soil safeguarded.

10.11 In addition, and during the design stage of the proposed development, consultation was undertaken with Highland Spring Limited and their hydrogeological advisors. This consultation has informed the design presented and assessed in this Chapter. Whilst details of their water abstractions are not presented in this assessment as they are commercially sensitive and subject to a Non-Disclosure Agreement between SLR Consulting Limited and Highland Spring Limited the potential hydrological linkage between the proposed development and their water abstraction infrastructure has formed part of the assessment and informed the proposed mitigation measures presented in this Chapter. The mitigation measures that have been identified are wholly applicable to other water users in the same water catchments as the Highland Spring abstractions and can be used to safeguard these water sources.

Scoped into the Assessment

10.12 Without mitigation or adherence to best practice, impacts on hydrology, hydrogeology and geology could occur during the construction and operational phases of the proposed development. A summary of the potential effects on ground conditions and the water

environment resulting from construction and operation of a wind farm are considered below.

Potential Impacts During Construction

10.13 The following potential impacts during the construction phase are considered in this Chapter:

- disturbance and loss of carbon rich soils and peat deposits;
- ground instability (including peat slide risk);
- impacts on surface water and groundwater quality from pollution from fuel, oil, concrete, or other hazardous substances, including fire water runoff from the Battery Energy Storage System (BESS);
- discharge of sediment-laden runoff to drainage system and watercourses;
- increased flood risk to areas downstream of the site during construction through increased surface runoff;
- changes in groundwater levels from dewatering excavations;
- potential change of groundwater flow paths and contribution to areas of peat and GWDTE, and water abstractions, including those maintained by Highland Spring Limited;
- disturbance of watercourse bed and banks from the construction of culverts;
- potential pollution impacts to public and private water supplies; and
- disturbance and/or pollution resulting from borrow pit formation and use.

Potential Impacts During Operation

10.14 The following potential impacts during the operational phase are considered in this Chapter:

- increased runoff rates and flood risk, resulting from increases in areas of tracks and hard standing at turbines;
- changes in natural surface water drainage patterns which may affect water contribution to areas of peat and GWDTE, and water abstractions;
- changes to groundwater levels and groundwater movement;
- longer term impacts on abstractions for water supplies, particularly any supplies dependent on groundwater; and
- pollution impacts on surface water quality from maintenance work.

Effects Scoped Out

10.15 On the basis of the desk based and survey work undertaken, policy, guidance and standards, the professional judgement of the EIA team, feedback from consultees and experience from other relevant projects, the following topic areas have been ‘scoped out’:

- 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 and operation 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

- detailed Flood Risk Assessment (FRA): Published mapping confirms that most of the site is not located in an area identified as being at flood risk. A screening of potential flooding sources (fluvial, pluvial, coastal, groundwater, infrastructure etc.) is presented in this Chapter and measures that would be used to manage flood risk and control the rate and quality of runoff will be specified in the final CEMP at the detailed design stage of the proposed development;
- Drainage Impact Assessment (DIA): Principles for the design of any watercourse crossings and for the control of runoff from the proposed development have been specified in this Chapter. It is expected that these would be developed as part of the detailed site design should S36 consent and deemed planning permission for the proposed development be granted, and a site-specific drainage plan would be secured through a pre-commencement condition of the deemed planning permission. An outline concept for the potential drainage scheme to collect, attenuate and treat runoff from the access track from Carim Lodge (near the Sheriffmuir road) to the proposed turbine area has been scoped in and is presented in **Technical Appendix 10.5**.
- baseline water quality monitoring: As the assessment is informed by classification data available from SEPA and there are no known sources of potential water pollution, no additional 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 final CEMP and with the Planning Authorities in consultation with relevant consultees; and
- decommissioning effects: Potential decommissioning effects would be less than potential construction effects. Decommissioning the wind farm and its associated infrastructure would be subject to a decommissioning plan which would include the same safeguards as those identified during the construction stage of the project. Potential decommissioning effects are therefore scoped out of this assessment.

Approach and Methods

Study Area

10.16 The study area is shown on **Figure 10.1** to **Figure 10.8** and includes all the proposed site infrastructure and a 500m buffer from the application boundary. Beyond this distance any effect is considered to be so diminished as to be undetectable and therefore not significant.

10.17 The study area for potential cumulative effects uses the catchments within the study area, with a maximum distance of 5km from the application boundary.

Information and Data Sources

10.18 The following sources of information have been consulted in order to characterise baseline conditions:

- OS 1:50,000, 1:25,000 and 1:10,000 scale mapping data;

- UK Centre for Ecology and Hydrology, Flood Estimation Handbook (FEH) webservice;
- UK Centre for Ecology and Hydrology, National River Flow Archive (NRFA);
- NatureScot Sitelink;
- James Hutton Institute, National Soil Map of Scotland (1:250,000);
- Scottish Natural Heritage (now NatureScot) Carbon and Peatland 2016 data;
- British Geological Survey (BGS) Onshore Geoindex;
- BGS Hydrogeological Maps of Scotland (1:100,000 scale);
- SEPA rainfall data, flood maps, reservoir inundation maps, environmental data;
- The Scottish Flood Defence Asset Database (SFDAD);
- Data requests with SEPA regarding details of registered/licensed abstractions and discharges (December 2022); and
- Data requests with Perth and Kinross Council and Clackmannanshire Council environmental health departments regarding details of historic flooding records and private water abstractions (December 2022).

10.19 In addition, through consultation with Highland Spring Limited, information was collected regarding the location of their water abstractions, potential catchment areas and aquifer characteristics. This information was considered during the development of the design of the proposed development and has been taken into account for the purpose of the development design and assessments. The information provided by Highland Spring Limited is not presented in this Chapter as it is commercially sensitive and has been provided subject to adherence to a Non-Disclosure Agreement, but it is noted SEPA and Perth and Kinross Council have details of the abstractions.

Desk Study / Field Survey

10.20 A desk study has been undertaken to determine and confirm the baseline characteristics by reviewing available information on hydrology, hydrogeology and geology.

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

10.22 Detailed site visits and walkover surveys have been undertaken by SLR on the following dates:

- April and October 2023 to conduct an initial peat and soil depth probing exercise;
- November 2023 to conduct a hydrological site walkover, conduct a watercourse crossing and private water supply survey and review areas of potential GWDTE; and
- February 2024 and April 2025 to complete additional peat and soil depth probing.

10.23 The field work has been undertaken in order to:

- verify the information collected during the desk and baseline study;
- undertake a visual assessment of the main surface waters and identify and identify and verify private water supplies;

- identify drainage patterns, areas vulnerable to erosion or sediment deposition, and any pollution risks;
- visit any identified potential GWDTE (in consultation with the project ecologists);
- visit any potential watercourse crossings and prepare a schedule of potential watercourse crossings;
- inspect rock exposures and establish by probing, an estimate of overburden thicknesses, peat depth and stability;
- confirm underlying substrate, based on the type of refusal of a peat probe and by coring;
- assess peatland condition; and
- allow appreciation of the site, determine gradients, potential borrow pit locations, access routes, ground conditions, etc., and to assess the relative location of all the components of the proposed development.

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

10.25 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

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

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

10.28 The criteria for determining the significance of effect are provided in **Table 10-2, Table 10-3** and **Table 10-4.**

Sensitivity of Receptor

10.29 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 10-2.** Receptors in the receiving environment only need to meet one of the defined criteria to be categorised at the associated level of sensitivity.

Table 10-2: Criteria for Assessing Sensitivity of Receptor

Sensitivity	Definition
High	• soil type and associated land use is highly sensitive (e.g. unmodified blanket bog or peatland) • SEPA Water Framework Directive (WFD) water body classification of High to Good or is close to the boundary of a classification of Moderate to Good or Good to High;

Sensitivity	Definition
	• 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 risk from flooding in the future (2080s) and / or water body acts as a current active floodplain or flood defence; • receptor is used for public and/or private water supply (including DWPAs); • 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 moderately sensitive (e.g. arable, commercial forestry). • SEPA WFD water body classification of Poor to Moderate; and • moderate classification of groundwater aquifer vulnerability.
Low	• soil type and associated land use is not sensitive to change in hydrological regime and associated land use (e.g. intensive grazing of sheep and cattle); • SEPA WFD water body classification of Poor or Bad; • receptor is not at risk of flooding in the future (2080s); 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 or hydrogeological catchment.

Magnitude of Impact

10.30 The potential magnitude of impact 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.

10.31 The criteria that have been used to assess the magnitude of impact are defined in **Table 10-3.** The characteristics of the impacts are described as direct / indirect, temporary (reversible) or permanent (irreversible), together with timescales (short, medium and long term).

Table 10-3: Criteria for Assessing Magnitude of Impact

Magnitude	Criteria	Definition
Major	Results in loss of attribute	Long term or permanent changes to the baseline geology, hydrology, hydrogeology and water quality such as: • permanent degradation and total loss of the soils habitat (including peat) and geology; • loss of important geological structure/features; • wholesale changes to watercourse channel, route, hydrology or hydrodynamics; • changes to the site resulting in an increase in 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.

Magnitude	Criteria	Definition
Medium	Results in impact on integrity of attribute or loss of part of attribute	Material but non-fundamental and short to medium term changes to baseline geology, hydrology, hydrogeology and water quality, such as: • loss of extensive areas of soils and peat and damage to important geological structures/features; • some changes to watercourses, hydrology or hydrodynamics; • changes to site resulting in an increase in runoff within the drainage 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 geology, hydrology, hydrogeology and water quality, such as: • minor or slight loss of soils and peat or slight damage to geological structures/feature; • minor or slight changes to the watercourse, hydrology or hydrodynamics; • 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 magnitude to affect the use/integrity	No perceptible changes to the baseline soils, geology, hydrology, hydrogeology and water quality such as: • no impact or alteration to existing important geological environs including soils, peat and geological features; • 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 Effects

10.32 The sensitivity of the receiving environment together with the magnitude of the impact determines the significance of the effect, which can be categorised into level of significance as identified in **Table 10-4**.

10.33 **Table 10-4** provides a guide to assist in decision making. In some cases, the potential sensitivity of the receiving environment or the magnitude of potential impact cannot be quantified with certainty and therefore professional judgement remains the most robust method for identifying the predicted significance of a potential effect.

Table 10.4: Significant of Effect Criteria

Magnitude of Impact	Sensitivity			
	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

10.34 Effects of 'major' or 'moderate' significance are considered to be 'significant' in the context of the EIA Regulations.

Potential Cumulative Effects

10.35 The assessment also considers potential cumulative effects associated with other operational, consented and application stage developments within 5km of the application boundary 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 proposed development in combination with other developments which are likely to affect soils, geology, surface water and groundwater.

Approach to Mitigation

10.36 Any potential effects of the proposed development on hydrology, hydrogeology, geology and soils 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. Where appropriate, further tailored mitigation measures have been identified prior to determining the likely significance of residual effects.

10.37 Good practice measures would be applied in relation to pollution risk, sediment management, peat safeguarding and management, and management of surface runoff rates and volumes. These would form part of the final CEMP to be implemented for the proposed development which would be prepared during detailed design and secured by a planning condition prior to construction commencing. An outline CEMP is provided in **Technical Appendix 3.1.**

10.38 The final CEMP will include details and responsibilities for environmental management onsite for site environmental aspects and would outline the necessary measures for surface water management, oil and chemical delivery and storage requirements, waste management, traffic and transport 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.

Identification of Residual Significant Effects

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

Statement of Significance

10.40 A statement of significance is provided in the assessment. Effects of 'major' and 'moderate' significance, as outlined in **Table 10-4,** are considered to be 'significant' in terms of the EIA Regulations.

Assumptions, Limitations and Confidence

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

10.42 As a consequence, 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.

Baseline Conditions

Current Baseline

Site Setting

10.43 The site is located within the Ochil Hills approximately 3km north of Alva, Clackmannanshire and is centred on National Grid Reference (NGR) NN 87737 02889.

10.44 Ground elevations across the site range from approximately 142m Above Ordnance Datum (AOD) within the northern extent of the site, near the access from the A9, to approximately 677m AOD near the summit of Ben Buck within the south eastern extent of the site.

10.45 SEPA has provided precipitation data for Tillicoultry (station number 15158) and Glenquey (station number 464636) which are located approximately 5km south east and 5km east of the site respectively. In 2024, a precipitation total of 985mm and 1,639mm was recorded at the two rain gauges respectively. The Glenquey rain gauge is situated at a higher elevation than the Tilllicoultry rain gauge (approximately 280m AOD compared to 20m AOD).

10.46 The standard average annual rainfall (SAAR) has been obtained from the FEH webservice for the Danny Burn, Burn of Ogilvie, River Devon upstream of Upper Glendevon Reservoir and Alva Burn which are the principal surface water catchments that drain the site. These record a slightly higher annual rainfall of between 1,380mm and 1,724mm which are similar to the average annual rainfall in Scotland according to the Met Office (1,573mm for the 1991 to 2020 period).

Designated Sites

10.47 Review of NatureScot's SiteLink webpage confirms that there are no water dependent or geological designated sites located within the study area. The potential effect of the proposed development on water dependent or geological statutory designated sites is therefore not considered further in this Chapter.

10.48 There are no Geological Conservation Review sites within the study area.

Geology

Soils

10.49 An extract of the 1:250,000 National Soil Map of Scotland is presented as **Figure 10.2** which shows that majority of the site is underlain by peat and peaty podzols. Areas of brown soils and mineral podzols are also noted within the northern extent of the site, at lower elevations.

Peat and Superficial Geology

10.50 BGS mapping, shown on **Figure 10.3**, indicates that the superficial deposits within the site generally comprise of peat and glacial till. The northern extent of the site, the hill tops locally and some of slopes near watercourses within the site are shown to be absent of any superficial deposits.

10.51 Peatland classification mapping (see **Figure 10.4**) shows that the majority of the proposed turbine area lies within Class 1 peatland.

10.52 Small areas of Class 2, 3 and 5 peatland are recorded across the site, particularly along the southern extent of the site and near the banks of the Danny Burn and River Devon within the north eastern extent of the site. The northern extent of the site, near the existing access minor road (Sheriffmuir road) from the A9, is shown to be underlain by mineral soils (Class 0).

10.53 Class 1 and 2 peatlands are considered potentially nationally important priority peatland with carbon rich soils and areas of deep peat which are likely to be considered of high conservation value. Class 3 and 5 peatlands are not considered priority peatland habitats however soils may be carbon rich and deep peat may be present whilst mineral soils are not considered representative of peatland habitats.

10.54 As part of the baseline assessment, a comprehensive peat probing exercise and peatland condition has been undertaken and has informed the site specific PLHRA and PMP (see (**Technical Appendix 10.1** and **10.2**). A peatland condition survey has also been undertaken as is reported in as part of **Chapter 8: Ecology**.

10.55 In summary, the site investigations have confirmed:

- Phase 1 and Phase 2 peat depth surveys have been completed in accordance with current good practice guidance and as a result the depth and distribution of peat at site is well understood and characterised;
- more than 7,000 peat depth probes have been undertaken of which 70% of probe locations recorded peat depths of <1m;
- the peat depth and condition field work has been used to inform the wind farm design and where technically feasible areas of deeper peat have been avoided;
- peat deposits are typically localised and associated with topographic hollows, gentle slopes and flatter expanses that allow for the formation of peat. The main access track and areas of forestry plantation are largely absent of significant peat deposits;
- 6 peat cores and samples were collected during the Phase 2 and which recorded peat with fibrous to pseudo-fibrous condition between depths of 1m and 2.8m;
- the peat has a very distinct plant structure that is suitable for re-use during reinstatement work, e.g. dressing of infrastructure edges and restoration works;

- the site specific PMP (**Technical Appendix 10.2**) confirms peat disturbed as a consequence of the proposed development can be beneficially re-used as part of reinstatement works.

10.56 The condition of the peat at site was recorded as modified. The presence of active grazing, ATV tracks and active erosional and drainage features over large areas of the proposed development was confirmed.

Bedrock Geology and Linear Features

10.57 An extract of the regional BGS bedrock geological mapping is presented on **Figure 10.5** and shows that the majority of the site is underlain by igneous rocks of the Ochil Volcanic Formation.

10.58 The northern extent of the site, near the existing access from the A9, is underlain by sandstones of the Sherrifmuir Formation.

10.59 Several inferred faults are noted across the site as shown on **Figure 10.5.**

Hydrogeology

Aquifer Characteristics and Groundwater Vulnerability

10.60 Extracts of the BGS 1:625,000 regional hydrogeological mapping and 1:100,000 scale aquifer productivity mapping are presented in **Figures 10.6** and **Figure 10.7** respectively.

10.61 **Figure 10.6** confirms that the igneous rocks beneath the majority of the site are classified as a low productivity aquifer which are generally without groundwater except in the near surface weathered zone and secondary fractures.

10.62 The Sherrifmuir Formation sandstones beneath the northern extent of the site are classified as a moderately productivity aquifer which may yield moderate amounts of groundwater.

10.63 The Aquifer Productivity and Groundwater Vulnerability datasets (**Figure 10.7**) classify the underlying aquifer (superficial and bedrock) according to the predominant groundwater flow mechanism (fracture or intergranular) and the estimated groundwater productivity.

10.64 It is shown that the peat and glacial till superficial deposits at the site are not considered a significant aquifer.

10.65 The igneous bedrock across the majority of the site is confirmed to be a low productivity aquifer, generally without groundwater except at shallow depth with flow almost entirely through fractures and other discontinuities. The bedrock which underlies part of the eastern extent of the site and the northern extent of the site is classified as a moderate to high productivity aquifer where groundwater flow will occur through intergranular mechanisms.

10.66 Groundwater vulnerability is divided into five classes (1 to 5) with 1 being least vulnerable and 5 being the most vulnerable. Review of **Figure 10.7** shows that the potential groundwater vulnerability in the uppermost aquifer beneath the proposed development has a vulnerability of Class 4 and 5. This reflects the potential shallow depth to groundwater and the shallow superficial cover.

Groundwater Levels and Quality

10.67 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, glacial till and igneous deposits inhibit infiltration owing to their generally low bulk permeability.

10.68 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 limited groundwater will be present as perched groundwater within the more permeable horizons of the glacial till deposits, in the upper weathered surface of the igneous rocks, and within the sandstones of the Sherrifmuir sandstones. Secondary permeability may be evident where there are faults and fractures in the bedrock and which may exert local control on groundwater flow direction.

10.69 Groundwater flow regionally is expected to follow topography and in the north of the site be northwards toward the Allan Water, and in the south of the site southwards to the River Devon.

10.70 In the north of the site local variation of groundwater flow direction may occur where there are groundwater abstractions maintained by Highland Spring Limited and given the common absence of superficial cover in watercourse corridors potential for hydraulic connectivity between surface water and groundwater.

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

10.72 The current status of groundwater bodies in Scotland has been classified by SEPA in accordance with the requirements of the WFD. SEPA have identified that there are three groundwater bodies underlying the site:

- the northern extent of the site is located within the Dunblane groundwater body (SEPA ID: 150628);
- the central and north western extent of the site is located within the Ochils North groundwater body (SEPA ID: 150499); and
- the southern and north eastern extent of the site is located within the Ochils groundwater body (SEPA ID: 150611).

10.73 All three groundwater bodies were classified in 2023 (the latest reporting cycle). The Ochils and Ochils North groundwater bodies have been classified with a Good overall status classification and no pressures identified. The Dunblane groundwater body has been classified with a Poor overall status as a result of potential reduction in groundwater availability from surface water interactions.

Groundwater Dependent Terrestrial Ecosystems

10.74 A National Vegetation Classification (NVC) mapping exercise was conducted as part of the ecological baseline assessment, and this has been used to identify potential areas of GWDTE within the site. The methodology and results of the NVC habitat mapping exercise are discussed in detail within **Chapter 8**. With reference to SEPA guidance, areas of potential GWDTE are shown on **Figure 10.8**. An assessment of potential areas of GWDTE, and in particular a discussion whether the habitats are sustained by groundwater or surface water is presented in **Technical Appendix 10.6.**

10.75 The GWDTE assessment confirms that the majority of potential GWDTE habitat is sustained by rainfall, surface water runoff and water logging of low bulk permeability bedrock and superficial deposits. However, some base rich groundwater flushes are

recorded and have been confirmed as GWDTE habitats. These are assessed in full in **Technical Appendix 10.6** and discussed further in within this Chapter.

Hydrology

Local Hydrology

10.76 The north and western extent of the site is located within the surface water catchment of the Allan Water, whilst the south and eastern extent of the site is located within the River Devon surface water catchment.

10.77 The Allan Water is located approximately 1km north and north west of the site and flows generally westwards. The site is drained by several tributaries of the Allan Water including the Buttergask Burn, Burn of Ogilvie, Danny Burn and Wharry Burn. The Buttergask Burn, Burn of Ogilvie and Danny Burn all flow generally north eastwards within the northern extent of the site, whilst the Wharry Burn flows westwards to the west of the site. Several tributaries of the burns rise within the site.

10.78 The River Devon flows north eastwards through the eastern extent of the site. Several tributaries of the river rise within the site, including Alva Burn sub catchment which drains the southern extent of the site.

10.79 All of the proposed turbines are located within the River Devon surface water catchment.

10.80 The River Devon catchment up until its confluence with the Gairney Burn has been designated as a DWPA, as shown on **Figure 10.1**. This includes the tributaries within the site except for the Alva Burn sub catchment. Consultation with Scottish Water (see **Table 10-1**) confirms that the DWPA is associated with the Upper Glendevon Reservoir which supplies Glendevon WTW. The nearest proposed turbines (T11 and T13) are 1.8km and 2.1km north east respectively from the reservoir, and as shown on **Figure 10.1** the proposed development only forms a very small proportion of the catchment to the reservoir.

10.81 It is recognised that surface gradients to the south of the site are steep, and as a consequence of the shallow soils and low bulk permeability of the superficial geology, a rapid response to rainfall is likely to occur in the Alva Burn sub catchment. A slower response is expected in the wider River Devon catchment as Glendevon Reservoir will attenuate surface water runoff, and the shallower gradients and more permeable deposits of the Sherrifmuir Sandstone to the north will attenuate flow shed toward the Allan Water.

Surface Water Flow and Quality

10.82 Review of the National River Flow Archive database shows that the Allan Water (station number 18001) and River Devon (station number 18002) downstream of the site have a mean surface water flow of 5.4m^3/s and 4.9m^3/s respectively.

10.83 SEPA classify the larger watercourses within the study area as part of its responsibility under the WFD. The quality of watercourses relevant to the site are presented in **Table 10-5.** Smaller watercourses within the site are not monitored nor classified by SEPA.

Table 10-5: Surface Water Classification Data

Watercourse (and SEPA ID)	Overall Status	Overall Ecology	Physio-Chemical Status	Hydro-morphology	Water Quality	Pressures
Allan Water – source to Greenloaning (4601)	Moderate ecological potential	Bad	High	Bad	Good	Heavily modified waterbody on account of physical alterations for agricultural land and barriers to fish migration.
Wharry Burn (4602)	High	High	Not monitored	High	Not monitored	None.
River Devon – source to Gairney Burn confluence (4501)	Moderate ecological potential	Moderate	High	Moderate	Good	Heavily modified waterbody on account of physical alterations for public drinking water.
River Devon – Gairney Burn confluence to Estuary (4500)	Moderate ecological potential	Bad	Moderate	Bad	Moderate	Heavily modified waterbody on account of physical alterations for public drinking water.

Fisheries

10.84 Fisheries for watercourses that are downstream of the proposed development are managed by the Forth District Salmon Fishery Board (FDSFB) in partnership with Forth Rivers Trust (FRT). Fishery interests are discussed and assessed within **Chapter 8: Ecology.**

Watercourse Crossings

10.85 The proposed development has sought to utilise existing roads / access routes where possible. However, two new watercourse crossings are required to facilitate the proposed development.

10.86 The locations of the proposed crossings are shown on **Figure 10.1** and a schedule of these crossing points, which includes photographs and dimensions of each crossing, can be found in **Technical Appendix 10.4**.

Flood Risk

10.87 SEPA has developed national flood maps that present modelled flood extents for river, coastal, surface water and groundwater flooding using a consistent methodology to produce outputs for the whole of Scotland, supplemented with more detailed, local assessments where available and suitable for use.

10.88 Flood extents are presented in three likelihoods:

- high likelihood: A flood event is likely to occur in the defined area on average more than once in every ten years (1:10), or a 10% chance of happening in any one year;

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

10.89 SEPA also has produced reservoir inundation maps for impoundments currently regulated by the Reservoirs (Scotland) Act 2011.

10.90 A summary of potential sources of flooding and a review of the potential risks posed by each source is presented in **Table 10-6**. Current and future flood maps which account for the potential effects of climate change (to 2070 (pluvial flooding) and 2080 (fluvial flooding)) published by SEPA have been reviewed in order to complete the review.

Table 10-6: Flood Risk Screening

Potential source	Potential flood risk to the site	Justification
Coastal Flooding	No	The site is situated at an elevation of at least 142m AOD and is located approximately 4.6km north of the nearest area shown by SEPA to be at risk from tidal or coastal flooding associated with the Forth Estuary. Therefore, the site is not at risk of tidal or coastal flooding.
Fluvial Flooding	Yes	SEPA flood maps confirm that majority of the site is not at risk of fluvial flooding. Localised flooding is noted along the watercourse corridors of the Danny Burn and River Devon. Flood extents are small and generally confined to the immediate watercourse corridors and no development is proposed within 50m of the mapped floodplains. It is therefore considered that fluvial flooding at the site is not a design constraint. It is noted the proposed micro-siting allowance will maintain the 50m watercourse buffer. The northern extent of the study area is also shown to be within the Blackford Potentially Vulnerable Area (PVA) (02/09/03) associated with flooding of the Danny Burn. The south western extent of the site is located within the Hillfoots Village PVA (02/09/05) associated within flooding from the River Devon, flooding of small burns off the Ochil Hills and surface water flooding. Historical flooding in these areas have also been confirmed by Perth and Kinross Council and Clackmannanshire Council.
Surface Water and Small Watercourse Flooding	Yes	SEPA surface water flood mapping for smaller watercourses confirm that there are several floodplains and flow paths associated with the smaller watercourses within the site. Flooding extents are generally limited and confined to the watercourse corridors. Where these flood extents cross the proposed development, flood depths are generally shown as shallow (<0.3m). With the exception of watercourse crossings and part of the hardstanding associated with turbine T5, no development is proposed within 50m of the mapped flood extents. The proposed micro-sting allowance will maintain the 50m watercourse buffer. It is therefore considered that surface water flooding at the site is not a design constraint.

Potential source	Potential flood risk to the site	Justification
Groundwater Flooding	Yes	Review of the SEPA groundwater flood map shows that northern, western and southern extent of the site is at low risk from groundwater flooding.
Flooding due to dam or reservoir failure	No	A review of SEPA's reservoir inundation flood mapping confirms that the site is not at risk from flooding due to dam or reservoir failure.
Flood Defence Breach	No	There are no Flood Protection Schemes within the site and no formal flood defences are noted on the Scottish Flood Defence Asset Database within the site.
Flooding from artificial drainage systems	No	The proposed development is located within a remote area and no artificial drainage systems are recorded.

Private Water Supplies and Licenced Sites

10.91 Consultation with SEPA, Perth and Kinross Council and Clackmannanshire Council has been undertaken to gather details of private and licenced water abstractions within the study area.

Licenced Sites

10.92 SEPA has provided information of Controlled Activity Regulations (CAR) authorisations within the study area. Six authorisations are recorded within the study area, the details of which are as follows:

- one discharge for private sewage;
- four discharges to existing sewage treatment systems; and
- one engineering authorisations for pipeline or cable crossing and/or bridging culvert.

10.93 No licenced abstractions are recorded within the study area.

Private Water Supplies

10.94 A data request was made to Perth and Kinross Council and Clackmannanshire Council who provided details of private water supply (PWS) sources in the study area. In addition, a programme of site investigations has been undertaken to confirm the location of PWS sources which included consultation with Highland Springs Limited and Tullibardine Distillery.

10.95 The risk that the proposed development poses to the PWS within the study area has been considered as part of the assessment and is presented in **Technical Appendix 10.5**. It confirms that:

- no groundwater abstractions, including the Highland Spring groundwater abstractions, are located within the 250m of any element of the proposed wind farm infrastructure;
- three PWS source has been identified as potentially at risk from the proposed development, including a surface water abstraction for Tullibardine Distillery.
- three PWS sources are not at risk from the proposed development; and

- one property is confirmed to be supplied by mains but the distribution pipework may be at risk.

10.96 Measures required to safeguard the PWS are given in **Technical Appendix 10.5**. This includes an outline concept for the potential drainage scheme to collect, attenuate and treat runoff from the access track near Carim Lodge to the proposed turbine area, which will cross the water catchments that drain the PWS sources considered to be at potential risk. An example monitoring plan, which can be used to assess the efficacy of the identified mitigation measures is also given in **Technical Appendix 10.5**.

Summary of Sensitive Receptors

10.97 **Table 10-7** outlines the receptors identified as part of the baseline study, and their sensitivity based upon the criteria contained in **Table 10-2**. These receptors form the basis of the assessment, and in combination of magnitude of impact are used to determine significance of potential effects.

Table 10-7: Summary of Identified Receptor Sensitivity and Justification

Receptor	Sensitivity	Reason for Sensitivity
Water dependent and geological statutory designated sites	Not sensitive	No designated sites are located within the study area.
Peat and carbon rich soils	High	Class 1 and 2 peatland and areas of peat and carbon rich soils have been recorded within the site.
Superficial and bedrock geology	Not sensitive	Deposits have been shown to be common regionally and have no rarity value. No designated geological sites are recorded within the study area.
Groundwater	High	Groundwater beneath the site has been classified as Good and vulnerability is classified as Class 4 and 5.
GWDTE	High	Areas of potential GWDTE and flush features have been identified by NVC mapping.
Surface Water	High	Surface watercourses that drain the site have been classified by SEPA as between Moderate Ecological Potential to High.
Flood risk receptors downstream of the site including Blackford and Hillfoots Villages PVAs.	High	The site is shown to be at risk of flooding limited to discrete areas of fluvial flooding and shallow surface water adjacent to watercourses and groundwater flooding. The development has the potential to alter surface water flow paths and could increase flood risk downstream of the site. Further, the northern and southern extent of the study area is located within the Blackford and Hillfoots Villages PVAs respectively.
Surface Water DWPA	High	The River Devon surface water catchment has been designated as a DWPA associated with Upper Glendevon Reservoir which supplies Glendevon WTW.
Licenced sites	Not sensitive	No licenced abstractions have been recorded within the study area.
Private water supplies	High	Private water supplies have been confirmed within the study three of which are hydraulically connected to the proposed wind farm infrastructure.

Future Baseline

10.98 Climate change studies predict a decrease in summer precipitation and an increase in winter precipitation alongside higher average temperatures. This suggests that there may be greater pressures on water supplies and lower water levels in summer months in the future. Additionally, summer storms are predicted to be of greater intensity.

10.99 Peak fluvial and surface water (pluvial) flows associated with extreme storm events are likely to increase in volume and velocity. Whilst not relevant to this site, further sea level rise is also anticipated.

10.100 These potential changes are considered in the assessment of effects. Whilst there is uncertainty surrounding the future baseline environment, there are no other anticipated changes on the soils or geology, hydrological or hydrogeological environment throughout the anticipated lifetime of development besides climate change.

Assessment of Effects

10.101 The assessment of effects is based on the proposed development description outlined in **Chapter 3** and structured as follows:

- details of embedded mitigation included in the development design and good practice methods which will be adopted;
- construction effects of the proposed development; and
- operational effects of the proposed development

10.102 The effects have been identified with reference to relevant guidance, through consultation and project team discussions, by targeted research on hydrological and water quality effects and by considering the information provided by the project engineers on infrastructure and construction methods.

Embedded Measures

Design Iterations

10.103 As noted in **Chapter 2: Site Selection and Design Evolution**, the proposed development has undergone multiple design iterations in response to the constraints identified as part of the baseline studies so as to avoid and/or minimise potential effects on receptors where possible. This has included using existing roads, avoiding areas of peat and carbon rich soils, minimising development in sensitive water catchments, maintaining a buffer to watercourses and avoiding PWS sources, areas of potential flooding and GWDTE where practically possible.

Peat Identification and Avoidance

10.104 The potential presence of peat within the site formed a key consideration in the design of the proposed development. Informed by the extensive programme of peat probing and condition assessment undertaken across the site, the design has aimed to avoid areas of deeper peat (>1m) where technically possible. Where possible proposed infrastructure has been limited to areas where peat is less than 1m deep or where peat is absent, or where it has been degraded / previously modified.

Buffer to Watercourses

10.105 In accordance with wind farm construction best practice guidelines and SEPA consultation advice, a 50m buffer has been applied to watercourses (as shown on OS 1:10,000 mapping) where technically feasible. A commitment has been made maintain the 50m watercourse buffer in the proposed micro-siting allowance.

10.106 The design has strived to minimise the number of locations where infrastructure does encroach within the buffer. The layout of the access tracks was also development to minimise the requirement for additional watercourse crossings and existing crossings and tracks have been used where technically feasible.

10.107 The majority of the proposed development has been located outwith watercourse 50m buffers, as shown in **Figure 10.1**, with the exception of the following areas:

- some sections of public highway to be upgraded (along the Sheriffmuit road);
- two new watercourse crossing proposed;
- approximately 400m of the proposed access track south of Carim Lodge where the track has been routed in order to keep tree felling to a minimum, provide as large as possible standoff to Highland Spring Limited abstractions, and where surface gradients are shallower and suitable for the transport of wind farm components; and
- part of the crane hardstanding associated with turbine T5 in order to avoid areas of deep peat.

10.108 It is recognised during construction there is a need for increased monitoring and management of the works when they take place within the 50m watercourse buffer, and this is discussed further in this Chapter.

Groundwater Dependent Terrestrial Ecosystems (GWDTEs)

10.109 SEPA's guidance for assessing impacts of development on GWDTE confirms a NVC survey should be undertaken to identify wetland areas that might be dependent on groundwater. If potential GWDTE are identified within (a) 10m of any development, or (b) 100m of any excavations less than 1m deep or (c) within 250m of any excavations greater than 1m deep, then it is necessary to assess how the potential GWDTE may be affected by the proposed development.

10.110 It has been shown (see **Technical Appendix 10.6**) that the majority of potential GWDTE habitats are predominantly sustained by rainfall, surface water runoff and water logging of low permeability bedrock and superficial deposits. However, some base rich groundwater flushes are recorded and support GWDTE habitat, and without appropriate safeguards are potentially at risk from the proposed development.

10.111 Measures have been proposed to safeguard existing surface 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 in their current condition. This would be confirmed, in accordance with good practice, by the Environmental Clerk of Works (EnvCoW) at the time of the construction of the proposed development and verified by a programme of post construction monitoring.

Good Practice Measures

10.112 Good practice measures will be applied in relation to pollution risk, sediment management and management of surface runoff rates and volumes. These will form part of the final CEMP. An outline CEMP is presented in **Technical Appendix 3.1**.

10.113 In undertaking the key assessment of potential effects from the proposed development, good practice measures are assumed to be embedded mitigation. As appropriate, these mitigation measures will be outlined within the final CEMP or by an appropriately worded condition post determination, as required.

10.114 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 operational phases.

General Measures

10.115 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 are given below.

10.116 Prior to construction, a site-specific drainage plan would be produced. This will consider any existing local drainage which may not be mapped and incorporate any site-specific mitigation measures identified during the assessment. This will include developing the concept drainage scheme presented in **Technical Appendix 10.5** for the proposed public highway improvements from the A9 to Carim Lodge and the access track from the lodge to the proposed turbine area.

10.117 Further, measures would be included in the final CEMP for dealing with potential pollution, sedimentation or flood risk incidents and will be developed prior to construction. This would be adhered to should any incident occur, reducing the effect as far as practicable.

10.118 The final CEMP will contain details on the location of spill kits, will 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 will be identified to deal with any major environment incidents. The final CEMP would be shared with Highland Spring Limited and Tullibardine Distillery and agreed with statutory consultees.

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

10.120 Roles would be assigned to site staff and the inspection and maintenance regimes of sediment and runoff control measures will be adopted during these periods. In extreme cases, this protocol will dictate that work onsite may have to be temporarily suspended until weather/ground conditions allow.

Environmental Clerk of Works (EnvCoW)

10.121 To ensure all reasonable precautions are taken to avoid negative effects on soils, peat and the water environment, a suitably qualified EnvCoW will be appointed prior to the commencement of construction to advise the Applicant and the Principal Contractor on all ecological and hydrological matters. The EnvCoW will be required to be present onsite during the construction phase and will carry out monitoring of works and briefings with

regards to any ecological and hydrological sensitivities on the site to the relevant staff of the Principal Contractor and subcontractors.

10.122 With respect to the water environment, the EnvCoW will also have responsibility to ensure water flow paths and quality to water dependant habitats are sustained during all phases of the proposed development.

Safeguarding of Peat and Carbon Rich Soils

10.123 The peat depth probing data compiled as part of the baseline assessment has been used to accurately determine the volume of peat which will be disturbed by the proposed development. This data has been used to prepare a site-specific PMP (see **Technical Appendix 10.2**) which details the volume of acrotelmic and catotelmic peat which will be disturbed and how this will be safeguarded and reused on site.

10.124 The condition of the peat and areas of peat that would potentially benefit from restoration have been identified and are discussed in **Chapter 8** and **Technical Appendix 8.4**.

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

Peat Management

10.126 A detailed review of the distribution and depth of peat at the site is contained in **Technical Appendix 10.2**. The site design has largely avoided areas of deep peat and where peat will be encountered by the proposed development it can be readily managed and accommodated within the site layout without significant environmental impact. No surplus peat will be generated, and the volumes of peat or carbon rich soil generated from the proposed excavations will be used to reinstate track verges, turbine bases, crane hardstandings and for restoration of onsite borrow pits.

Peat Landslide Hazard

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

10.128 A Design and Geotechnical Risk Register will be compiled prior to construction to include risks relating to peat instability, as this will be beneficial to both the developer and the Principal Contractor in identifying potential risks that may arise during construction.

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

- measures to ensure a well-maintained drainage system, to include the identification and demarcation of zones of sensitive drainage or hydrology in areas of construction;
- minimisation of ‘undercutting’ of peat slopes, but where this is necessary, a more detailed assessment of the area of concern will be required;
- careful micro-siting 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 will require minimal maintenance; and
- developing drainage systems that will not create areas of concentrated flow or cause over/under-saturation of peat habitats.

10.130 Notwithstanding any of the above good construction practices and methodologies, detailed design and construction practices will 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 will be appointed as a supervisor, to provide advice during the refinement and construction phases of the proposed development.

Water Quality Monitoring

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

10.132 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 impact of good practice or remedial measures. Monitoring frequency will increase during the construction phase if remedial measures to improve water quality were implemented. Detailed water quality monitoring plans will be developed during detailed design. The monitoring programme would be secured by a pre-development planning condition to be agreed with statutory consultees. An example protocol which could be used as a basis to agree a water monitoring protocol is presented in **Technical Appendix 10.5**.

10.133 It is proposed that the Danny Burn, Burn of Ogilvie and River Devon upstream of the Upper Glendevon Reservoir is included in the monitoring plan.

10.134 Further consultation during the detailed design stage would also be undertaken with Highland Spring and Tullibardine Distillery to discuss the scope of proposed water monitoring in the Danny Burn and Burn of Ogilvie water catchments, as discussed in **Technical Appendix 10.5**.

Buffer to Watercourses

10.135 There is one location where there is a small encroachment within the 50m watercourse buffer. At these locations, additional safeguards will be deployed and included in the CEMP, and subject to agreement with consultees, include but not be limited to the following:

- increased induction and training for staff highlighting sensitivities;

- a wet weather working protocol and provision to cease works during prolonged rainfall or periods of high runoff (pluvial or fluvial);
- reduction in extent of working area to minimise the potential to disturb ground;
- additional passive water quality control measures, such as temporary water diversion ditches, silt fences and silt traps to control and treat runoff from working areas;
- daily inspection of works and watercourses and full-time supervision of construction and restoration and works;
- deployment of real-time water quality monitoring telemetry with predetermined water quality trigger levels based on baseline water quality data (e.g. for pH, dissolved oxygen, and electrical conductivity); and
- documentation that clearly identifies responsibilities and actions and contact details should a pollution event be recorded.

10.136 It is expected that similar measures will be deployed in the headwaters of the Danny Burn and Burn of Ogilvie.

Pollution Risk

10.137 Good practice measures in relation to pollution prevention will include the following:

- refuelling will take place at least 50m from watercourses and where there is no risk that oil from a spill could directly enter the water environment;
- no refuelling in the Danny Burn and Burn of Ogilvie surface water catchments;
- foul water generated onsite will be managed in accordance with best practice and be drained to a sealed tank and routinely removed from site;
- a vehicle management plan and speed limit will be strictly enforced onsite to minimise the potential for accidents to occur;
- drip trays will be placed under stationary vehicles which could potentially leak fuel/oils;
- areas will be designated for washout of vehicles which are a minimum distance of 50m from a watercourse and no washing out of vehicles will be permitted in the Danny Burn and Burn of Ogilvie water catchments;
- washout water will also be stored in the washout area before being treated and disposed of;
- no direct or indirect discharges to watercourses without prior treatment in buffer zones or adjacent to proposed infrastructure using appropriate SuDS measures. These measures would be included in the formal drainage management plan and the final CEMP;
- water will be prevented as far as possible, from entering excavations;
- procedures will 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 will be designed prior to construction, and this will be adhered to should any incident occur, reducing the effect as far as practicable. This will be included in the final CEMP.

10.138 Site investigation (e.g., trial pitting and/or boreholes) will be undertaken at the detailed design stage, prior to any construction works, where excavation will be required to construct the proposed development. The site investigation will inform detailed design and construction methods of the proposed development to ensure pollution risk is further considered and minimised prior to construction.

10.139 As part of this investigation works, the ground conditions will be assessed to inform the foundation designs and concrete specification. This will minimise the leaching into the surrounding soil and water environment. If necessary, the excavations would incorporate an adequate barrier to prevent the movement of any onsite pollutants to the underlying soils, groundwater and surface water environment.

Erosion and Sedimentation

10.140 Good practice measures for the management or erosion and sedimentation will include the following:

- all stockpiled materials will be located outwith a 50m buffer from watercourses, including on up gradient sides of tracks and battered to limit instability and erosion;
- stockpiled material will either be seeded or appropriately covered, minimising the area of exposed bare ground;
- monitoring of stockpiles/excavation areas during and after significant rainfall events;
- water will 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 will pass through a number of settlement lagoons and silt/sediment traps to remove silt prior to indirect discharge into the surrounding drainage system. Detailed assessment of ground conditions will be required to identify locations where settlement lagoons will be feasible;
- clean and dirty water onsite will be separated and dirty water will be filtered before entering the water environment;
- if the material is stockpiled on a slope, silt fences will 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, will be kept to a minimum and appropriate drainage will be in place to prevent surface water entering deep excavations;
- a design of drainage systems and associated measures to minimise sedimentation into natural watercourses will be developed - this may include silt traps, check dams and/or diffuse drainage;
- silt/sediment traps, single size aggregate, geotextiles or straw bales will 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 will avoid periods of heavy rainfall where possible; and
- construction personnel and the Principal Contractor will carry out regular visual inspections of watercourses to check for suspended solids in watercourses downstream of work areas.

Sustainable Drainage Systems

10.141 Sustainable Drainage Systems (SuDS) will be incorporated as part of the proposed development.

10.142 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 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 will include the following:

- drainage systems will 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 will 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 will attenuate runoff rates and reduce runoff volumes to ensure minimal effect upon flood risk;
- where necessary, check dams will 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, site-specific drainage plans will be developed and construction personnel made familiar with the implementation of these.

10.143 Best practice regarding firewater associated with BESS is outlined in **Technical Appendix 3.3.** The drainage system will also be sized to manage firewater, should, in the unlikely event of a fire, fire water and fire retardants be used to extinguish a fire at the BESS. To ensure that these do not impair ground or surface water quality provision will be made to collect this water in an onsite attenuation pond, which will be (a) be lined to prevent a pathway to groundwater, and (b) incorporate a shutoff valve to contain water in the attenuation lagoons and prevent a discharge to the water environment.

10.144 Further information on ground conditions and drainage designs will be provided in the final CEMP.

Water Abstractions

10.145 If water abstraction for construction activities is required a potential source will be identified at the detailed design stage of the project and following site investigation. An application for a CAR authorisation would then be made to SEPA and managed through the regulation of the CAR.

10.146 The abstraction location, and proposed abstraction rate will also be agreed with Highland Spring.

10.147 For any water for construction activities good practice that will be followed in addition to adherence to the CAR regulations includes:

- water use will be planned so as to minimise abstraction volumes;
- water will be re-used where possible;
- abstraction volumes will be recorded; and

- abstraction rates and volumes will be controlled to prevent significant water depletion in a source.

Watercourse Crossings

10.148 Two new watercourse crossings are required for the proposed development as detailed within **Technical Appendix 10.4** and shown on **Figure 10.1**.

10.149 The crossings will be designed to pass the 200-yr flood event plus an allowance for climate change and their design and construction details will be agreed with SEPA, Perth and Kinross Council and Clackmannanshire Council as part of the final CEMP.

Distribution Pipework

10.150 **Technical Appendix 10.5** has confirmed that the proposed access track near the A9 will cross the distribution pipework for a property which is supplied by mains water (M1).

10.151 The location of the Scottish Water distribution pipework will be confirmed as part of the detailed design stage of the project. Necessary protection will be implemented to ensure that the integrity of the infrastructure is maintained. A site investigation will be undertaken to review confirm the location of the pipework, review the condition of the pipework and provide any additional mitigation measures that would be required to safeguard the pipework. If required, additional protection to pipework will be placed for the duration of works / traffic movement as required. If damaged, distribution pipework would be repaired to the satisfaction of landowner.

Potential Construction Effects

Peat and Carbon Rich Soils

10.152 The baseline assessment has confirmed that Class 1 and Class 2 priority peatland are present across the site and areas of peat and carbon rich soils have been confirmed by site investigation. These are important carbon stores and need to be safeguarded.

10.153 Without appropriate mitigation and sensitive handling of peat and carbon rich soils, there is potential for the proposed development to degrade the peat and carbon rich soils. The degradation includes local lowering of the water table to facilitate excavations associated with construction works and the concentration of surface water flow as a result of construction of the proposed development so that the peat becomes eroded which can lead to the loss of important carbon stores and could potentially create ground instability resulting in peat slides.

10.154 It has been shown (see **Technical Appendix 10.1** and **10.2**) that the disturbance of peat and carbon rich soils as a result of the construction of the proposed development can be minimised and the peat deposits and carbon rich soils safeguarded.

10.155 In addition, the Applicant is committed to delivering a Habitat Management Plan (see **Technical Appendix 8.4: Outline Habitat Management Plan**) which includes peatland habitat restoration and enhancement. The final details will be provided and agreed with consultees prior to construction commencing, and which it is expected will be secured by a condition of consent. Habitat management works will be undertaken in accordance with the best practice detailed in this Chapter and which would mitigate potential effects on peat and carbon rich soils.

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

Pollution Risk

10.157 During the construction phase, there is the potential for a pollution event to affect surface water catchments and groundwater bodies, impacting their quality. This would have a negative impact on the receptor, potentially leading to adverse effects on any aquatic life, GWDTE areas, PWSs, Highland Spring abstraction boreholes, and the River Devon DWPA abstracting or dependent on water from the watercourses and groundwater.

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

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

10.160 The baseline assessment has shown that the watercourses within the study area and groundwater beneath the proposed development are considered high sensitivity receptors. GWDTE, PWSs (including Highland Spring Limited abstraction boreholes and surface water abstraction for Tullibardine Distillery) and the River Devon DWPA are also considered high sensitivity receptors.

10.161 The good practice measures discussed in this Chapter and that will be set out in the final CEMP, will minimise the risk of a pollution event occurring. These measures will also include an emergency response plan which will be triggered in the case of an accident occurring to minimise pollution risk. In addition, concept details for the collection, control and treatment of water in the Danny Burn and Burn of Ogilvie surface water catchments is also given in **Technical Appendix 10.5**.

10.162 The magnitude of effect associated with a pollution event during construction is therefore considered negligible and thus the significance of effect is negligible and not significant.

Erosion and Sedimentation

10.163 Site traffic during the construction phase has the potential to cause erosion and increase sediment loads in receiving watercourses. This has the potential to adversely impact water quality, increase turbidity levels, reducing light and oxygen levels and affect aquatic ecology including fish populations.

10.164 Excavation of borrow pits, material stockpiles and construction of access tracks, watercourse crossing and hardstanding areas associated with the proposed development are all potential sources of erosion and sediment generation.

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

10.166 After consideration of good practice measures, the magnitude of impact associated with erosion and sedimentation is assessed as negligible. The River Devon DWPA, PWSs (including Highland Spring abstraction boreholes and surface water abstraction for

Tullibardine Distillery), peat, GWDTE, groundwater and surface water are all considered high sensitivity receptors. The significance of effect is therefore assessed as negligible and not significant.

Flood Risk

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

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

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

10.170 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.

10.171 Given the recorded instances of flooding recorded previously downstream of the site, flood risk is considered a receptor of high sensitivity. With the deployment of SuDS measures, the magnitude of impact is mitigated and considered negligible. The significance of effect is therefore assessed as negligible and not significant.

Infrastructure and Man-made Drainage

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

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

10.174 The design of the proposed development has avoided areas of high ecological or habitat interest, including peat and GWDTE, wherever possible.

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

10.176 The sensitivity of the receptor (groundwater and habitat and water supplies that may be dependent on groundwater) has been assessed as being high. Taking into consideration of the embedded mitigation and good practice measures, the magnitude of impact is assessed as negligible and therefore the significance of effect of changing groundwater levels and flow direction due to dewatering is considered negligible and not significant.

Water Abstraction

10.177 During the construction of the proposed development, water may be abstracted for uses such as dust suppression, vehicle washing, batching plant activities and welfare facilities. Without mitigation this could result in local lowering of the water table, affecting local peat

deposits, and reducing flows in the local river network which supply public and private supplies.

10.178 The volume of water and mitigation of any required water abstractions would be regulated through a CAR abstraction licence which would be agreed with SEPA and discussed with Highland Spring. With this safeguard, the magnitude of effect on groundwater-surface water interactions is considered negligible. The significance of effect is therefore negligible, and not significant.

Private Water Supplies and Drinking Water Protected Areas

10.179 The baseline assessment has confirmed that the part of the proposed development is located within the River Devon surface water catchment which designated as a DWPA and supplies the Glendevon WTW. Scottish Water (see **Table 10-1**) has confirmed that the risk to the DWPA is low. However, potential construction effects outlined above, including impacts to water quality and quantity could potentially impact the public water supply.

10.180 It has been confirmed that the proposed access track from Carim Lodge to the proposed turbine area will pass through the upper catchments of the Burn of Ogilvie and Danny Burn. The access track is located upstream of three PWS surface water abstractions which are considered potentially at risk from the proposed development, without appropriate controls.

10.181 Groundwater abstractions maintained by Highland Spring Limited are also noted downstream of the proposed access track, however, with reference to SEPA guidance for the assessment of groundwater abstractions, no development is proposed within 250m of these.

10.182 The controls which would be adopted for the proposed development in accordance with best practice, will be used to ensure water resources are not adversely affected and significant erosion and sedimentation does not occur.

10.183 PWS sources and the River Devon DWPA are considered high sensitivity receptors. With the best practice construction techniques to protect the quality and quantity of surface water and groundwater receptors, in combination with the proposed monitoring programme (see example in **Technical Appendix 10.5**) the magnitude of effect is assessed as negligible, and the resultant significance of effect is assessed as negligible and not significant.

Potential Operational Effects

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

10.185 It is noted that potential effects will be similar to potential construction effects but likely to be on a smaller more localised scale.

10.186 Should any maintenance be required onsite during the operational life of the proposed development which would involve construction type activities; mitigation measures similar to those in the final CEMP will be employed to avoid potential effects. These would be adopted through a longer-term operational management plan, to avoid potential significant effects.

Peat and Carbon Rich Soils

10.187 No excavation, movement or storage of peat or carbon rich soils is anticipated during the operational life of the proposed development.

10.188 Carbon rich soils and peat are high sensitivity receptors. With the mitigation measures and next practice noted in this assessment the magnitude of effect on deposits of soil and peat is assessed as negligible and thus the significance of effect as negligible and not significant.

Pollution Risk

10.189 The possibility of a pollution event occurring during operation is very unlikely. There will be a limited number of vehicles required onsite for routine maintenance and for the operation of the proposed development. Storage of fuels/oils onsite would be limited to the hydraulic oil required in turbine gearboxes.

10.190 The good practice measures (to be set out in the final CEMP and will be adopted through a longer-term operational management plan) will minimise the risk of a pollution event occurring. Measures will also be put in place in the case of an accident occurring to contain pollutants and minimise the impacts of a spill. It is therefore anticipated that the magnitude of impact of a pollution event during the operational phase of the proposed development is assessed as negligible, as no detectable change will likely occur. Therefore, the significance of effect for a pollution event during the operational phase of the proposed development is predicted to be negligible for all receptors and not significant.

Erosion and Sedimentation

10.191 During the operation of the proposed development, it is not anticipated that there will be any significant excavation or stockpiled material beyond localised clearing of SuDS features to maintain their efficiency.

10.192 Immediately post-construction, newly excavated drains and track dressings may be prone to erosion as any vegetation would not have matured. 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.

10.193 Appropriate design of the drainage system, incorporating sediment traps, would reduce the potential for the increased delivery of sediment to natural watercourses.

10.194 The likelihood, magnitude and duration of a potential erosion and sedimentation event occurring within the surface water catchments would be mitigated following adherence to good practice measures. The magnitude of impact is therefore considered negligible and thus the significance of effect on identified receptors (which are all considered as high sensitivity receptors) is negligible and not significant.

10.195 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 will 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

10.196 The risk of an effect on fluvial flood risk arises as a result of a potential restriction of flow at a permanent water crossing following intense rainfall and an increase in runoff rates and flood risk resulting from the introduction of permanent hardstanding areas.

10.197 In accordance with good practice routine inspection and clearing of the watercourse crossings at the proposed development will be undertaken, reducing the likelihood of a blockage occurring.

10.198 The SuDS drainage measures deployed across the proposed development during construction will be maintained and used to locally collect, treat and discharge incident rainfall runoff. These measures will also attenuate the rate of runoff and mitigate the potential for flood risk to be increased offsite.

10.199 The magnitude of impact is therefore assessed as negligible, and thus the significance of effect is assessed as negligible and not significant.

Infrastructure and Man-made Drainage

10.200 Operation of the proposed development would require limited activities relative to the construction phase.

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

Private Water Supplies and Drinking Water Protected Areas

10.202 Potential operational effects outlined above, including impacts to water quality and quantity could potentially impact PWS sources (including Highland Spring Limited abstraction boreholes and surface water abstraction for Tullibardine Distillery) and the River Devon DWPA.

10.203 The controls which would be adopted at the proposed development during the operational phase, and which are in accordance with best practice, will safeguard these highly sensitive water receptors. The magnitude of impact is therefore assessed as negligible and the resultant significance of effect is assessed as negligible and not significant.

Additional Mitigation and Enhancement

10.204 As all the predicted effects are negligible and therefore not significant in the context of the EIA Regulations, no additional mitigation during construction or operation is required other than the embedded good practice measures and safeguards to be agreed with Highland Spring Limited that the Applicant will implement as standard (and as described in this Chapter).

10.205 It has been recognised in this assessment that a programme of water monitoring would be required prior to any construction activity, during construction and immediately post construction of the proposed development. The monitoring programme would be agreed with statutory consultees and is expected to include monitoring of the watercourses which drain from the site, including Burn of Ogilvie, Danny Burn and River Devon to ensure there are no impacts to local PWS or the River Devon DWPA (see **Technical Appendix 10.5**).

10.206 The Applicant is committed to delivering a Habitat Management Plan (see **Technical Appendix 8.4**) which includes peatland habitat restoration and enhancements. The final details will be provided and agreed with consultees prior to construction commencing, and it is anticipated that these will be secured by a condition of consent. Habitat management works will be undertaken in accordance with the best practice detailed in this chapter and will mitigate potential effects on peat and carbon rich soils.

Residual Effects

10.207 Subject to adoption of best practice construction techniques and measures, no significant residual effects are predicted during the construction and operational phases of the proposed development.

Cumulative Effects

10.208 The assessment also considers potential cumulative effects associated with other comparative operational, consented and application stage developments within 5km of the site and in the same surface water catchments as the proposed development. A cumulative effect is considered to be the effect on a hydrological, hydrogeological or geological receptor arising from the site in combination with other developments which are likely to affect soils or geology, surface water and groundwater.

- Rhodders Wind Farm (operational) located within the River Devon surface water catchment;
- Burnfoot Hill Wind Farm (operational) located within the River Devon surface water catchment;
- Burnfoot Hill North Wind Farm (operational) located within the River Devon surface water catchment;
- Burnfoot Hill East Wind Farm (operational) located within the River Devon surface water catchment;

10.209 These developments will have been constructed and will be maintained in accordance with best practice, industry standards and relevant legislation, planning policy and guidance regulated by statutory consultees. These standards ensure, with respect to the soils, geology and water environment, potential impacts are mitigated and controlled at source.

10.210 The magnitude of any cumulative is therefore considered negligible and the potential effect on identified receptors is negligible and not significant.

Summary

10.211 An assessment of the potential effects of the proposed development on hydrology, hydrogeology and geology (including peat and soils) within a defined study area (comprising land within 500m of the application boundary) has been undertaken. The assessment has considered the construction and operation phases of the proposed development.

10.212 As part of the design stage of the project detailed discussions have been held with Highland Spring Limited. Whilst the location of their water abstraction infrastructure is subject to a Non-Disclosure Agreement, it has been considered in detail as part of the scheme design and has influenced the design of the proposed development. For

example, no turbines or borrow pits are located in the catchment areas to their abstractions, and additional mitigation measures and requisite monitoring proposed where the proposed access track passes upstream of the catchments serving their water abstractions. It is confirmed no development is proposed within 250m of any of the Highland Spring Limited groundwater abstraction sources (see **Technical Appendix 10.5**).

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

10.214 The impact assessment has taken into account the geological, hydrological and hydrogeological regime, highlighting that the principal effects will occur during the construction and operational phases. Following the successful design and implementation of mitigation measures the significance of effects on all identified receptors are considered negligible and are not defined as significant.

10.215 Good practice design and construction of the proposed development delivered through a skilled team of competent workers, with mitigation and compliance monitored in collaboration with SEPA, Perth and Kinross Council, Clackmannanshire Council and other engaged stakeholders, will result in an effect that is considered to be not significant in the context of the EIA Regulations.

10.216 A summary of assessed effects and identified mitigation measures required to reduce the potential effects to acceptable levels are identified in **Table 10-8**.

Table 10-8: Summary of Residual Effects

Likely Significant Effect	Mitigation	Means of Implementation	Residual Effect
Construction Phase			
Degradation of peat and carbon rich soils.	Mitigation by design and good practice measures	• Final CEMP to be submitted for the written approval of the planning authority in consultation with relevant consultees. • Geotechnical Risk Register. • Implementation of Peat Management Plan.	Not significant.
Generation of pollution impairing surface water, groundwater, habitat and water supplies.	Good practice measures.	• Final CEMP to be submitted for the written approval of the planning authority in consultation with relevant consultees. • Use of EnvCoW during construction. • Implementation of confirmatory water quality monitoring, the scope and frequency of which will be agreed with SEPA, Perth and Kinross Council, and Scottish Water and consulted with Highland Spring Limited and Tullibardine Distillery.	Not significant.

Likely Significant Effect	Mitigation	Means of Implementation	Residual Effect
Erosion and sedimentation impairing surface water, groundwater, habitat and water supplies.	Good practice measures.	• Final CEMP to be submitted for the written approval of the planning authority in consultation with relevant consultees. • Use of EnvCoW during construction. • Implementation of confirmatory water quality monitoring, the scope and frequency of which will be agreed with SEPA, Perth and Kinross Council, Clackmannanshire Council and Scottish Water and consulted with Highland Spring Limited and Tullibardine Distillery.	Not significant.
Reduced surface water runoff contribution to water dependent habitats.	Good practice measures.	• Final CEMP to be submitted for the written approval of the planning authority in consultation with relevant consultees. • Use of EnvCoW during construction.	Not significant
Drainage and dewatering impairing surface water, groundwater, habitat and water supplies.	Good practice measures.	• Final CEMP to be submitted for the written approval of the planning authority in consultation with relevant consultees. • Use of EnvCoW during construction.	Not significant.
Flood risk.	Good practice measures.	• Commitment to deploy SuDS and prepare a detailed drainage design as part of the final CEMP. • Commitment to design watercourse crossings in accordance with best practice.	Not significant.
Private water supplies and DWPAs.	Good practice measures.	• Use of EnvCoW during construction. • Implementation of confirmatory water quality monitoring, the scope and frequency of which will be agreed with the planning authority in consultation with relevant consultees and consulted with Highland Spring Limited and Tullibardine Distillery.	Not significant.
Operational Phase			
Generation of pollution impairing surface water, groundwater, habitat and water supplies.	Good practice measures.	• Appropriate storage and handling of potential pollutants in accordance with CAR authorisations. • Good practice measures adopted through a long term operational drainage and monitoring programme.	Not significant.
Erosion and sedimentation impairing surface water, groundwater, habitat and water supplies.	Good practice measures.	• Appropriate drainage design that incorporates sediment management measures, including sediment traps, to attenuate and treat runoff. Adopted through a long-term operational drainage and monitoring programme. • Good practice measures adopted through a long term operational drainage and monitoring programme.	Not significant.

Likely Significant Effect	Mitigation	Means of Implementation	Residual Effect
Drainage and dewatering impairing surface water, groundwater, habitat and water supplies.	Good practice measures.	• Good practice measures adopted through a long term operational drainage and monitoring programme.	Not significant.
Flood risk.	Good practice measures.	• Inspection of the operational drainage system and compliance with the attenuated rate of runoff agreed the planning authority in consultation with relevant consultees at the detailed design stage. This would include removal of blockages at watercourse crossings as required.	Not significant.
Private water supplies and DWPAs.	Good practice measures.	• Good practice measures adopted through a long-term operational monitoring programme.	Not significant.
Cumulative			
No cumulative effects are anticipated as a result of the proposed development.			

Statement of Significance

10.217 Subject to adoption of good practice measures, no significant effects on hydrology, hydrogeology and geology (inc. peat and carbon rich soils) are anticipated as a result of the proposed development.

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