

10 HYDROLOGY, HYDROGEOLOGY, GEOLOGY AND SOILS

10.1 Executive Summary

- 10.1.1 This chapter has considered potential impacts and their associated effects on hydrological, hydrogeological, soils and peatland features, such as watercourses, surface water distribution, potentially groundwater dependent habitats, groundwater resources and water resources for both public and private supply, and carbon rich soils.
- 10.1.2 Without the implementation of suitable best practice and mitigation measures potential impacts could include impacts on water quality (including both surface water and groundwater bodies) from chemical pollution or sedimentation; flood risk at the site and downstream receptors; impacts on flow regimes, water quality or the geomorphological characteristics of watercourses as a result of proposed watercourse crossings; impact Groundwater Dependent Terrestrial Ecosystems and alterations (GWDTEs) to regimes of water supplying Private Water Supplies; compaction of soils; increased erosion of peat soils through disturbance, and loss of peatland habitats and carbon rich soils through excavations for infrastructure.
- 10.1.3 Taking into account measures that shall be detailed in a site Construction Environmental Management Plan (CEMP), the Peat Management Plan (PMP); and the implementation of best practice measures and regulations as set out by the Scottish Environment Protection Agency (SEPA) and the implementation of site specific mitigation measures where appropriate, this assessment concludes that there are **no predicted significant residual effects** on the hydrology, hydrogeology or the geology and soils of the site during the construction phase.
- 10.1.4 This assessment also concludes that there are **no predicted significant effects** on the hydrology or hydrogeology of the site during the operational phase of the development, due to the design layout of the Proposed Development and the proposed installation of appropriate Sustainable Drainage Design (SuDS) measures. **No significant cumulative effects** are considered to occur to hydrological, hydrogeological or geology and soils receptors.

10.2 Introduction

- 10.2.1 This chapter assesses the potential effects on hydrology, hydrogeology, geology, and soils resulting from the Proposed Development. This chapter (and its associated figures) is not intended to be read as a standalone assessment and reference should be made to the introductory chapters of this Environmental Impact Assessment Report (EIAR) (**Chapters 1-5, EIAR Volume 2**). The chapter also draws on ecological National Vegetation Classification (NVC) surveying, assessment of Potential Ground Water Dependent Terrestrial Ecosystems (GWDTEs) and proposed habitat restoration that are detailed in **Chapter 6: Biodiversity (EIAR Volume 2)**, to which reference should be made.
- 10.2.2 The hydrology assessment has been carried out by Jo Thorp, a Ramboll hydrologist with over four years' experience, and Chris Day with over 14 years' experience of carrying out hydrological and hydrogeological assessment for Environmental Impact Assessment in upland settings.
- 10.2.3 The geology, soils and peat assessment has been undertaken and reviewed by Jeff Turner, a Chartered Environmentalist and member of the Society for the Environment, Institute of Environmental Science, and Institute of Environmental Management and Assessment (CEnv, MEnvSc, PIEMA, BSc (Hons)). Jeff has over 21 years' experience in the co-ordination and management of Environmental Impact Assessments, including those for renewable energy developments. As part of this experience, Jeff has been responsible for managing the potential effects of electrical transmission infrastructure on peat and carbon rich soils, including the identification of suitable mitigation measures to minimise the effects from development.

10.2.4 This chapter is accompanied by the following Figures and Technical Appendices:

- **Figure 10.1: Hydrology, Hydrogeology, Geology and Soils Study Area;**
- **Figure 10.2: Peat Depths;**
- **Figure 10.3: Surface Water Features;**
- **Figure 10.4: Superficial Geology;**
- **Figure 10.5: Bedrock Geology;**
- **Figure 10.6: Hydrogeology;**
- **Figure 10.7: Water Resources;**
- **Figure 10.8: Soils Maps of Scotland;**
- **Technical Appendix 10.1 Peat Survey Results Report;**
- **Technical Appendix 10.2: Outline Peat Management Plan (PMP);**
- **Technical Appendix 10.3: Peat Landslide Hazard Risk Assessment (PLHRA);**
- **Technical Appendix 10.4: Watercourse Crossing Assessment;**
- **Technical Appendix 10.5: Private Water Supplies Assessment;**
- **Technical Appendix 10.6: Forestry Hydrology Assessment;**
- **Technical Appendix 10.7: SEPA Consultation Meeting Minutes; and**
- **Technical Appendix 10.8: Groundwater Dependent Terrestrial Ecosystem (GWDTE) Assessment.**

10.3 Assessment Methodology and Significance Criteria

Scope of the Assessment

10.3.1 This chapter considers effects on:

- Water quality (including both surface water and groundwater bodies) and assessment of the impacts from pollution;
- Flood risk, and the potential for direct and indirect impacts of the Proposed Development on the flood risk status of the Site or downstream areas;
- Water resources, impacts on hydrological flow regimes and the geomorphological characteristic of watercourses as a result of proposed watercourse crossings;
- Any alterations to the zones of contribution and therefore the regimes of water supplying Private Water Supplies (PWS) and public water supplies in the locale of the Proposed Development or within potential hydrological connection to the Site; and
- The potential for the Proposed Development to impact hydrology or hydrogeology with secondary effects on GWDTEs; and
- Potential effects from the construction of the Proposed Development on geology and soils, particularly impacts on peat and carbon rich soils. These include findings from field work (described in **Technical Appendix (TA) 10.1: Peat Survey Results Report**), discussion of peat management proposals (described in **TA10.2: Outline PMP**), and also consideration of potential peat landslide and hazard risks (as described in **TA10.3: PLHRA**).

10.3.2 This chapter considers cumulative effects arising from the Proposed Development in-combination with other foreseeable developments, considered as those consented (under construction or not yet construction), those in planning and those within the public domain, deemed reasonably foreseeable, with 10 km² of the Proposed Development (see **Chapter 14: Cumulative Assessment, EIAR Volume 2**).

Extent of the Study Area

- 10.3.3 The Study Area comprises a desk study area (a 2 km buffer around the Proposed Development) and a field study area (a 250 m buffer around the Proposed Development) (see **Figure 10.1, EIAR Volume 3a**). The desk study area includes the potential for downstream impacts on the water environment and therefore extends to the receiving waters into which the watercourses within the field study area discharge. These are predominantly Loch Awe and Loch Fyne at the southern extent of the Proposed Development. The Study Area for geology and soils has been limited to the developable areas of the Proposed Development.

Consultation Undertaken to Date

- 10.3.4 Consultation undertaken to date mainly pertains to the EIA Scoping Report (**TA 4.1: EIA Scoping Report, EIAR Volume 4**). Scoping responses received at the time of writing that are relevant to this chapter are captured in **Table 10.1**. Further information can be found in **TA 4.3: Consultation Register (EIAR Volume 4)**.

Table 10.1: Scoping Responses and Other Consultations of Relevance to Chapter 10			
Organisation	Type of Consultation	Response	How response has been considered
Argyll District Salmon Fishery Board	EIA Scoping Report; March 2021	We would like to draw attention to the important salmon and trout spawning and nursery habitats in the Teatle Water, Allt Fearnna and the Cladich River, which the Proposed Development will potentially cross. We ask that the Developer demonstrate that stream crossings, the development of the road network and construction of pylon foundations are undertaken in a sensitive manner that maintain the quality and accessibility of the habitat to fish.	While the Proposed Development crosses a number of watercourses, the OHL design has aimed to maintain a buffer of 30 m from watercourses to the proposed infrastructure and tower locations, where possible. General mitigation measures to protect watercourses would be included within the Construction Environmental Management Plan (CEMP) and detail of proposed watercourse crossings are set out in TA 10.4: Watercourse Crossing Assessment (EIAR Volume 4) .
Scottish Forestry	EIA Scoping Report; March 2021	The Woodland Reports, landscape and hydrology information relating to the woodland felling and woodland loss should be available at the same time as the EIAR and not left to post consent.	Detailed assessment of non-hydrological potential impacts related to forestry are assessed in Chapter 11: Forestry (EIAR Volume 2) .

Table 10.1: Scoping Responses and Other Consultations of Relevance to Chapter 10			
Organisation	Type of Consultation	Response	How response has been considered
			Assessment of potential hydrological impacts related to forestry operations during the construction phase of the Proposed Development are assessed in TA 10.6: Forestry Hydrology Assessment (EIAR Volume 4) .
Argyll and Bute Council	EIA Scoping Report; March 2021	Argyll and Bute Council set out that they are satisfied with the approach adopted to the assessment of potential impacts on hydrological and hydrogeological receptors, as set out by Ramboll in the submitted scoping report, and the inclusion of the following technical assessments: • Watercourse Crossing Assessment; • GWDTE Assessment (if required); and • Groundwater / Private Water Abstraction Protection (if required).	Assessment has been completed by Ramboll in line with the approach stated by Argyll and Bute Council. Protection of groundwater resources is discussed in this chapter and best practice construction methods would be implemented to protect PWS which are assessed in TA 10.5: Private Water Supplies Assessment (EIAR Volume 4). These are outlined in this chapter and shall be set out in detail through the implementation of a Construction Environmental Management Plan (CEMP).
NatureScot	EIA Scoping Opinion, March 2021	The following guidance should be followed for surveying the peatland resource: https://www.gov.scot/publications/peatland-survey-guidance. For information, the following guidance may help with identifying best practice for priority habitat:	Noted. This guidance has been followed as set out in this Scope and TA6.1: Biodiversity Methodology and Results (EIAR Volume 4).

Table 10.1: Scoping Responses and Other Consultations of Relevance to Chapter 10			
Organisation	Type of Consultation	Response	How response has been considered
		https://www.nature.scot/advising-carbon-rich-soils-deep-peat-and-priority-peatland-habitat-development-management	
SEPA	Response to consultation letter issued September 2021, followed by consultation meeting October 2021	Consultation seeking comments on the draft Outline Peat Management Plan, specifically regarding the proposed strategy for mitigating potential adverse effects on peat, and measures for re-using surplus peat from the construction of the associated Creag Dhubh substation, <u>but the same principles discussed apply for the Proposed Development</u>: SEPA Response: SEPA confirmed there were no objections with regard to the re-use of peat to dress slopes and shoulders around the substation platform and tracks. SEPA also support the minimising excavation for temporary infrastructure such as construction compounds through the use of geotextile membranes and stone on top of peat, and reinstated on completion. SEPA does not accept the use of peat in mounds and bunds. SEPA outlined that the Applicant are to explore potential restoration opportunities with possible partners such as Loch Lomond and Trossachs National Park, and to identify if any peat extraction sites are located close to the development site for restoration using surplus peat generated. Agreement in principle with potential land owners to be provided post submission. There are planning and waste permitting considerations to be aware of if taking peat off site.	Consultation with SEPA, as summarised in the meeting notes presented in TA 10.7 , has informed the Outline PMP as presented in TA 10.2 , EIAR Volume 4 .

Method of Baseline Data Collation

Desk Study

10.3.5 The desk study reviewed the Proposed Development and identified sensitive hydrological, hydrogeological, geological and soil receptors. Watercourses were identified using Ordnance Survey map data, aerial imagery, and Digital terrain Modelling (DTM) data (OS 5 m DTM) in order to survey crossings over minor channels.

10.3.6 The assessment of potential effects comprised the following approach:

- consultation with relevant statutory and non-statutory bodies;
- detailed desk studies to establish baseline conditions on the site and in the study area;

- identifying and establishing the sensitivity of water resource receptors on the basis of their use, proximity to the site, existing quality or resource value and consideration of potential source-pathway-receptor linkages;
- identifying the geological conditions present including peat and carbon rich soils, and where present, its depth;
- evaluation of the potential impacts of the Proposed Development and the effect that these could have on current site conditions;
- evaluating the magnitude of such impacts in terms of change to water and soil resources;
- classifying the significance of likely effects;
- identification of possible measures to avoid and mitigate against any identified adverse effects resulting from the Proposed Development; and
- the evaluation of the residual significance of these effects following consideration of mitigation measures.

10.3.7 The following information sources have been used in the assessment to characterise existing and / or future baseline conditions:

- Ordnance Survey 1:10,000, 1:25,000 and 1:50,000 mapping;
- 5 m Digital Terrain Model (DTM) data;
- Aerial and LiDAR imagery (ESRI world imagery);
- British Geological Survey (BGS) Geology of Britain Viewer (1:50,000 and 1:625,000) for superficial and bedrock geology;
- BGS Hydrogeological and Groundwater Vulnerability Maps of Scotland (1:625,000);
- Vulnerability of Groundwater in the Uppermost Aquifer, SNIFFER (September 2004);
- National Soils Map for Scotland (National Soils Inventory for Scotland (NSIS1));
- Hutton Institute National Soil Map of Scotland 1:25,000 scale;
- SEPA Flood Risk Management Maps (updated 23 April 2018) web mapping;
- SEPA Water Classification Hub;
- THC Private Water Supply Register (dated 16 October 2019);
- Drinking Water Quality Regulator for Scotland (DWQR) Private Water Supply Map;
- Argyll and Bute Council (ABC) Open Data on Private Water Supplies; and
- Drinking Water Protected Areas - Surface, Scottish Government.

10.3.8 The ESRI ArcGIS Pro hydrological toolset was used to characterise the hydrological regime and the distribution of surface water runoff across the study area. This tool provides methods for describing the physical components of a surface, allowing for identification of sinks (areas where surface water could pond), determination of likely flow direction and routes where flow accumulation would occur, delineation of watersheds, and mapping of stream networks. The topographic wetness index (TWI), combining local upslope contributing area and slope, was also calculated to assign a relative score indicating hydrological flow paths and probable areas of surface water accumulation. The flow paths based on areas of flow accumulation, and the scoring of the terrain using the TWI, were used to assess the potential for connectivity of habitats to surface water flow paths.

Field Survey

- 10.3.9 A field survey of the watercourses crossed by the Proposed Development was undertaken to determine the hydrological context of the Proposed Development and gain a more detailed understanding of the sensitivities associated with the main watercourses (**TA 10.4, EIAR Volume 4**). Where possible, watercourse crossing locations were recorded. Photographs and field notes were taken, reporting the dimensions of the watercourse channel and flood channel (where apparent), flow, instream vegetation and the type of substrate in line with SEPA requirements¹ for the assessment of watercourse crossings. The surveyed watercourse crossings vary from small headwater crossings to larger stream and river crossings.
- 10.3.10 To assess the baseline condition of potentially groundwater dependent vegetation communities, National Vegetation Classification (NVC) surveys of the field survey area were initially completed in September 2017 by WSP to identify potential Ground Water Dependant Terrestrial Ecosystems (GWDTE) and to provide a greater level of detail than the Phase 1 habitat survey for sensitive habitats, such as peatland. The NVC surveys were updated by Ramboll concurrently with the Phase 1 habitat surveys carried out in May 2019 and September 2020. The NVC surveys followed the methodology described in best practice guidance², detailed in **TA 6.1: Biodiversity Methodology and Results**, with five 2 m² quadrats surveyed within each habitat, and the species composition analysed. Surveys were undertaken by Ramboll ecologists alongside the Phase 1 habitat survey.
- 10.3.11 Three rounds of peat depth probing were undertaken within the Proposed Development area in March 2021, August 2021, and November 2021 (the methodology of peat depth surveying is detailed in **TA 10.1: Peat Survey Results Report**). The peat probe locations included in the surveys are shown in **Figure 10.2: Peat Depths, EIAR Volume 3a**.

Limitations and Assumptions

- 10.3.12 This assessment makes use of opensource and publicly available data resources, complimented by further site specific surveys. The assessment of potential impacts within this chapter is reliant on the accuracy of the public data, which is considered robust and sufficient to enable this assessment to be completed.
- 10.3.13 Where access to the locations of proposed watercourse crossing locations was not possible during field surveying (due to land access or the presence of dense vegetation cover) observation of indicative watercourse conditions were carried out at a downstream location. Alternatively, conditions have been drawn from the desk based assessment.

Method of Assessment

- 10.3.14 Potential impacts on hydrology, hydrogeology, geology, and soils have been predicted and assessed based on the proposals as described in **Chapter 2: Description of the Proposed Development (EIAR Volume 2)** and in accordance with best practice guidance for EIA assessment³. The Proposed Development would involve a range of enabling works, construction, and the eventual operation of the Overhead Line (OHL).

¹ SEPA, 2017. Land Use Planning System SEPA Guidance Note 4: Planning advice on windfarm developments. Version 9. Available online: <https://www.sepa.org.uk/environment/land/planning/> [Last accessed January 2022].

² Joint Nature Conservation Committee (JNCC) (2010), Handbook for Phase 1 Habitat Survey – a Technique for Environmental Audit. Peterborough: JNCC.

³ Scottish Natural Heritage, 2018. Environmental Impact Assessment Handbook, Version 5. Available online: <https://www.nature.scot/> [Last accessed January 2022].

10.3.15 Potential effects which may occur as a result of the Proposed Development were identified throughout the scoping process and on the basis of the responses listed in **Table 10.1**. Effects are described as: direct or indirect; permanent or temporary; and beneficial or adverse.

Sensitivity of Receptor

10.3.16 Effects on water resources are described as beneficial, neutral or adverse and are considered with reference to the value or sensitivity of the receptor, as described in **Table 10.2**

Table 10.2: Sensitivity of Environmental Resource		
Sensitivity of Receptor	Definition	Typical Criteria
High	International or national level importance. Receptor with a high quality and rarity, regional or national scale and limited potential for substitution / replacement.	High likelihood of fluvial/ tidal flooding in the sub catchment – defined as 1:10 probability in a year. EC Designated Salmonid / Cyprinid fishery. Surface water WFD class 'High'. Scottish Government Drinking Water Protected Areas. Aquifer providing regionally important resource such as abstraction for public water supply, abstraction for private water supply. Supporting a site protected under EC or UK habitat legislation / species protected by EC legislation. Protected Bathing Water Area. Active floodplain. Highly Groundwater Dependent Terrestrial Ecosystems. Average peat depth >1 m within the sub catchment.
Medium	Regional, county and district level importance. Receptor with a medium quality and rarity, regional scale and limited potential for substitution / replacement.	Medium likelihood of fluvial/ tidal flooding in the sub catchment – defined as a 1:200 probability in a year. Surface water WFD class 'Good' or 'Moderate'. Aquifer providing water for agricultural or industrial use. Local or regional ecological status / locally important fishery. Contains some flood alleviation features. Average peat depth >0.5 m within the sub catchment. Moderately Groundwater Dependent Terrestrial Ecosystems.
Low	Local importance. Receptor is on-site or on a neighbouring site with a low quality and rarity, local scale. Environmental equilibrium is stable and is resilient to changes that are greater than natural fluctuations,	Surface water WFD class 'Poor'. Unproductive strata / no abstractions for water supply. Sporadic fish present. No flood alleviation features. Sewer. Average peat depth <0.5 m within the sub catchment.

Table 10.2: Sensitivity of Environmental Resource		
Sensitivity of Receptor	Definition	Typical Criteria
	without detriment to its present character.	

Magnitude of Impact

10.3.17 The size or magnitude of each impact is determined as a predicted deviation from the baseline conditions during construction and operation, as described in **Table 10.3**

Table 10.3: Magnitude of Impact on a Receptor	
Magnitude of Impact	Criteria
Large	Large alteration / change in the quality or quantity of and / or to the physical or biological characteristics of environmental resource.
Medium	Medium alteration / change in the quality or quantity of and / or to the physical or biological characteristics of environmental resource.
Small	Small alteration / change in the quality or quantity of and / or to the physical or biological characteristics of environmental resource.
None	No alteration / change detectable in the quality or quantity of and / or to the physical or biological characteristics of environmental resource.

10.3.18 In describing a potential effect, consideration has also been given to its geographical scale and duration, which have been defined as follows:

- The geographical scale of an impact refers to the zone of influence, and can be described as: localised, site-wide, a specific distance / range from a source, regional, national, global; and
- The duration of an impact can be described as: short to long term, permanent or temporary for the duration of the construction / operational period.

Significance Criteria

10.3.19 The significance of residual effects is defined as a function of the sensitivity of receptors and the magnitude of change, as presented in **Table 10.4**, taking account of any mitigation proposed. Differentiations between categories, and thus the final significance ratings, are based upon professional judgement.

Table 10.4: Significance Criteria					
		Magnitude of Impact			
		None	Small	Medium	Large
Sensitivity of Receptor	High	None	Minor	Major	Major
	Medium	None	Minor	Moderate	Moderate
	Low	None	Negligible	Minor	Minor

10.3.20 Major and moderate effects (shaded in grey) are deemed significant in the context of the EIA Regulations. Minor and negligible effects are not considered significant in EIA terms.

10.4 Baseline Conditions

Surface Water Hydrology

10.4.1 The Proposed Development passes through a total of four river catchments comprising the River Orchy, Teatle Water, Cladich River and the River Aray. These catchments drain into Loch Awe, except for the River Aray, which discharges to Loch Fyne. There are smaller watercourses including Allt Fearn, Eas nan Ruadh, Allt Mhualuidh and Allt Fhuaran and numerous unnamed, minor watercourses crossing the Proposed Development (**Figure 10.3, EIAR Volume 3a**).

Flood Risk

10.4.2 The Indicative Proposed Alignment is shown by SEPA mapping⁴ to be located predominantly within an area at Very Low risk of fluvial flooding, this zone comprises land assessed as having a less than 1 in 1000 annual probability of river flooding (<0.1% in any year). The route crosses four areas of flood risk associated with watercourses as follows:

- River Cladich, between T9 and T10
- Unnamed stream, between T18 and T19
- Teatle Water, between T29 and T30b
- Allt Mhualuidh, between T39A and T40A

10.4.3 In each case the Indicative Proposed OHL crosses a very narrow corridor of elevated risk from fluvial flooding (High Risk, assessed by SEPA to have a 10% annual probability of flooding) directly associated with the watercourse. No tracks or tower locations are proposed within areas at risk of fluvial flooding.

10.4.4 The Indicative Proposed Alignment is not within an area assessed by SEPA to be at risk of coastal flooding.

10.4.5 Localised areas of potential flood risk from surface water flooding are present along the Study Area, these are indicative of small areas of surface water ponding. Areas of the Proposed Development are situated on peat soils on which low infiltration rates and corresponding high rates of surface water runoff could lead to overland flow, or near-surface flow. SEPA mapping does not suggest the accumulation of surface water runoff in potential flow paths that would lead to elevated flood risk.

Water Quality

10.4.6 According to the SEPA Water Classification Hub⁵ The River Aray, the River Cladich, Teatle Water and the River Orchy are Main Rivers and have been assessed against the Water Framework Directive (WFD) Classification Scheme. **Table 10.5** presents the most recent assessment findings for these watercourses.

⁴ SEPA Flood Maps. Available online: <https://map.sepa.org.uk/floodmaps> [Last accessed November 2021].

⁵ SEPA Water Classification Hub. Available online: <https://www.sepa.org.uk/data-visualisation/water-classification-hub/> [Last accessed November 2021].

Table 10.5: Water Framework Directive Assessment

Watercourse Name	Overall Status	Chemical Status	Ecological Status
River Aray	Moderate	Good	Moderate
River Cladich	Moderate Ecological Potential	<i>Not assessed</i>	Moderate
Teatle Water	Good	Good	Good
River Orchy	Moderate	Pass	Moderate
The River Cladich is classified by SEPA as a Heavily Modified waterbody (on account of physical alterations that cannot be addressed without a significant impact on water storage for hydroelectricity generation). The applicable WFD classification categories are presented for this watercourse.			

- 10.4.7 Loch Awe (to which the majority of the Proposed Development drains) is classified as a Heavily Modified waterbody under the WFD classification scheme. The overall status of Loch Awe is assessed as being of 'Moderate Ecological Potential', the overall ecology is 'Poor' and the Physico-Chemical status of the Loch is 'Good'.
- 10.4.8 The Loch Fyne Upper Basin is a coastal waterbody which is classified as being of 'Good' overall status, 'Good' ecological status, and 'High' physico-chemical status by SEPA.
- 10.4.9 The Proposed Development area is underlain by the Oban and Kintyre groundwater body. According to the SEPA Water Classification Hub5 the Oban and Kintyre groundwater body is assessed to be of 'Good' overall status, 'Good' Quantitative Status, and 'Good' chemical status under the WFD classification scheme.

Geology and Soils

- 10.4.10 The 1:625,000 and 1:50,000 scale geological mapping available from the British Geological Survey (BGS) (**Figures 10.4 and 10.5, EIAR, Volume 3a**) shows the majority of the Site to be underlain by glacial deposits of hummocky till (Diamicton till), sands and gravels. Alluvial river terrace deposits are also shown to be present within river valley formations. Small areas of peat or absent of superficial geology are also shown although no peat is shown within the areas crossed by the Proposed Development. Areas absent of superficial deposits could indicate locations where rockhead is shallow.
- 10.4.11 These are underlain by psammite, semipelite and pelites of the Argyll Group, interspersed with areas of unnamed igneous intrusions. Most of the central and eastern areas of the Proposed Development Site are shown to be underlain by the Ardrishaig Phyllite Formation of the Argyll Group, comprising metamorphic quartzite, metalimestone and phyllitic semipelite. Dalradian Supergroup, metagabbro and metamicrogabbro metamorphic rock are also noted to be present where igneous intrusions have occurred.
- 10.4.12 Overlying the Ardrishaig Formation to the south west of the Proposed Development Site are metamorphic quartzite rocks from the Crinan Grit Formation. The southernmost part of the Proposed Development is underlain by rocks belonging to the Argyll Group, Tayvallich Volcanic Formation, including metalava and metatuff.
- 10.4.13 A fault zone is shown to be present to the south west of Tower 21 trending northeast to southwest.

10.4.14 The Applicant and their engineer, Balfour Beatty, commissioned Card Geotechnics Limited (CGL) to undertake a geotechnical ground Investigation in 2018 to inform the ground conditions assessment. Whilst the tower locations have been refined since this time the factual report produced⁶ concluded that the BGS mapping was broadly consistent with the rock encountered during the investigation. Exceptions were; the Crinan formation was not encountered to the south of the Proposed Development site and microgabro from the Dalradian Supergroup was encountered at Towers T12 and T13.

10.4.15 NatureScot carbon rich soils, deep peat and priority habitat mapping⁷ shows the area between T33 and the SPEN Tie In at Glen Lochy (Succoth Glen) as predominantly 'Class 5' soils, particularly in areas covered by commercial plantation, which are defined as mineral or peat soils with no peatland vegetation. Large areas of 'Class 2' (nationally important carbon-rich soils, deep peat and priority peatland habitat of potentially high conservation value and restoration potential) and 'Class 3' soils (dominant vegetation cover is not priority peatland habitat but is associated with wet and acidic conditions, occasional peatland habitats) can be found. Most soils are carbon-rich soils, with some areas of deep peat) are present in the open areas around Creag a'Mhaol-diridh which are not dominated by commercial plantation. Further areas of Class 2 and 3 soils extend across open areas to the south of Achlian and on open land to the south of Cladich.

10.4.16 Peat depth surveys (Appendix 10.1) confirmed varying thicknesses of peat along the Proposed Development. A total of 58 % of peat probes recorded no peat and a total of 24 % recorded shallow peat between 0.1 and 0.5 m depth. The deepest peat recorded during the surveys was 4.3 m, located north of T33A. Peat depths are provided in **TA 10.1, EIAR Volume 4** and shown on **Figure 10.2**.

10.4.17 Deep peat (>0.5 m depth) was recorded at the remainder of the peat probe locations noted in **Table 10.6** (a total of 17 % of total peat probes taken).

Table 10.6: Areas of Deep Peat (>0.5m depth)			
Tower/Infrastructure	Maximum Peat Depth (m)	Tower/Infrastructure	Maximum Peat Depth (m)
Tower 1	1.7	Tower 31	1.8
Tower 2A	2.5	Tower 32	1.8
Tower 3A	1.6	Tower 33	1.8
Tower 4A	2.7	Tower 34	3.3
Tower 5B	1.2	Tower 35	0.8
Tower 7	0.6	Permanent Track T1 to T2A	1.7
Tower 8	0.6	Temporary Track T2A to T3	2.0
Tower 13	0.8	Permanent Track T13 to T15	0.8
Tower 14	0.8	Permanent Track T15 to T16A	0.9
Tower 15	2.5	Permanent Track T19 to T20	2.7
Tower 16	0.8	Permanent Track T20 to T22A	0.9

⁶ Card Geotechnics (2019) Scottish & Southern Electricity Networks Creag Dhubh 275/13skV Substation Ground Investigation Report.

⁷ Scotland Carbon and Peatland 2016 Map. Available online: <https://soils.environment.gov.scot/maps/thematic-maps/carbon-and-peatland-2016-map/>. [Last accessed January 2022].

Table 10.6: Areas of Deep Peat (>0.5m depth)			
Tower/Infrastructure	Maximum Peat Depth (m)	Tower/Infrastructure	Maximum Peat Depth (m)
Tower 19	1.8	Permanent Track T23 to T24	0.6
Tower 20	3.4	Permanent Track T24 to T25	1.3
Tower 21A	0.8	Temporary Track T26 to T27	0.6
Tower 22A	0.7	Temporary Track T30B to T31A	1.3
Tower T23	1.0	Permanent Track T31A to T32	2.8
Tower 24	0.6	Permanent Track T32A to T33A	1.8
Tower 25	1.8	Permanent Track to T33A	4.3
Tower 26	1.0	Temporary Track to T34A	3.3
Tower 28	1.3	Temporary Track to T37A	2.0
Tower 29	0.7	Temporary Track T37A to T39A	2.7
Tower 30B	1.3	Permanent Track to T40A	1.2

Hydrogeology

- 10.4.18 The site is underlain by the Oban and Kintyre groundwater body. According to the SEPA Water Classification Hub⁸ the Oban and Kintyre groundwater body is assessed to be of 'Good' overall status, 'Good' Quantitative Status and 'Good' chemical status under the WFD classification scheme.
- 10.4.19 According to BGS 1:625,000 scale hydrogeological mapping (Figure 10.6), the OHL route overlies aquifers assessed to be of Low Productivity, within which small amounts of groundwater may be present the near surface weathered zone and fractures.

Water Resources

- 10.4.20 The Proposed Development passes through a Surface Water Drinking Water Protected Area (DWPA)⁹, which comprises the catchment of a small watercourse and associated headwaters (three unnamed tributaries) to the location of a Scottish Water intake situated on the stream at GR 209680, 721112 (**Figure 10.3**). Water abstracted at this location serves properties in Cladich situated approximately 600 m north of the point of abstraction. Four tower locations are situated within the DWPA: T04 (113 m to the west of the upper extent of the watercourse headwater), T05B (46 m from a contributing stream), T06A (50 m north and 72 m of two contributing streams) and T07 (23 m south of the watercourse leading to the Scottish Water intake, and 250 m south west of the intake itself). An existing access track to which upgrading is proposed crosses a tributary at upper extent of the catchment at GR 208999, 720409. The intake membranes at the point of abstraction are sensitive to changes in pH and silt.

⁸ SEPA Water Classification Hub. Available online: <https://www.sepa.org.uk/data-visualisation/water-classification-hub/> [Last Accessed January 2022].

10.4.21 The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017 came into force in October 2017, and are regulated and enforced by Local Authorities. Following a request for information by Ramboll, Argyll and Bute Council provided mapping of Private Water Supply (PWS) locations within 2 km of the site, based on the Council's register.

10.4.22 According to the Council's register, there are no PWS locations recorded within 250 m of the Proposed Development (**Figure 10.7, EIAR Volume 3a**), including proposed access tracks and tower locations. In line with SEPA guidance¹⁰ groundwater abstractions outside of a 250 m buffer site specific qualitative and/or quantitative risk assessment is not required.

10.4.23 Three PWS locations are situated in close proximity to a watercourse, downstream and therefore in potential hydrological connection to the Proposed Development. These locations are summarised below:

Table 10.7: Argyll and Bute PWS Locations				
Private Water Supply Name	Source Type	Easting	Northing	Distance From Infrastructure
Bovuy	Surface	210400	722500	595 m
Millside Cottage	Groundwater (Well)	211300	723400	455 m
Achlilan	Groundwater (Well)	212200	724200	435 m

10.4.24 Site assessment carried out by Balfour Beatty on behalf of SSE indicates that further PWS are present within 250 m of the proposed alignment (**Figure 10.7, EIAR Volume 3a**), to the south east of Cladich Farm and in proximity to a sheep wash to the south east of Achlian Farm, the source and name of these supplies is not available. Locations of PWS identified by Balfour Beatty are summarised below:

Table 10.8: Balfour Beatty PWS Locations						
Ramboll ID	Private Water Description	Easting	Northing	Distance From Infrastructure	Notes	
BB_PWS_1	Cladich Farm area (Bovuy), stream within forestry	210820	722296	114 m	Stream location (assumed surface water supply), downslope of T14	
BB_PWS_2	Cladich Farm area (Bovuy), stream on grazed land	211069	722839	230 m	Stream location (assumed surface water supply), downslope of T16	
BB_PWS_3	Achlilan, to south east of sheep dip area	212584	723815	90 m	Field boundary / drain, type of abstraction not specified, upslope of proposed route / track	

¹⁰ LUPS SEPA Guidance Note 31. Available online:

https://www.sepa.org.uk/media/143868/lupsgu31_planning_guidance_on_groundwater_abstractions.pdf [Last accessed November 2021]

Ramboll ID	Private Water Description	Easting	Northing	Distance From Infrastructure	Notes
BB_PWS_4	Achlian, to north east of sheep dip area	212634	723887	66 m	Located on stream / surface water flow path, grazed land, type of abstraction not specified, upslope of proposed route / track

10.4.25 A natural spring is reported to be located between T43 and T44 (NN17926 26188) which provides Brackley Farm with a water supply. According to the landowner this spring flows north from this point to a water settlement tank just south of Brackley Farm. This location is approximately 50 m north east of tower location T43 and is downslope of a proposed track route.

GWDTE

10.4.26 Surveying of vegetation communities (**TA 6.1, EIAR Volume 4**) identified habitats that could have a potential to be groundwater dependent, according to NVC vegetation classification only. Further assessment of potential hydrogeological impacts of the Proposed Development on these potential GWDTE areas, considering the potential for them to be groundwater dependent based on local hydrogeological and hydrological conditions, is provided in **TA 10.8: GWDTE Assessment, EIAR Volume 4**.

Future Baseline

10.4.27 In the absence of the Proposed Development, the morphology of the hydrological regime identified directly under the proposed OHL and proposed wayleave¹¹ either side of the OHL (the 'operational corridor') are likely to continue to be present in their current form.

10.4.28 It is assumed that forestry felling shall continue in line with the Long Term Felling Plans (LTFP) in place along the proposed OHL route. Existing management proposals for forestry felling within the study area are taken into account in the **TA 10.5: Forestry and Hydrology Assessment (EIAR Volume 4)**, and as such felling would be phased such that alteration to physico-chemical conditions of watercourses is avoided.

10.4.29 There is potential for climate change to impact future baseline conditions. Climate change studies predict a decrease in summer precipitation and an increase in winter precipitation alongside slightly higher average temperatures. This suggests that there may be greater pressures on PWS's in summer months in the future.

10.4.30 Summer storms are predicted to be of greater intensity. Therefore, peak fluvial flows associated with extreme storm events may also increase in volume and velocity. Such changes could lead to an expansion of areas assessed by SEPA to be at risk of flooding and increased surface water runoff rates. These climate change factors have been taken into account when considering the potential for likely significant effects.

¹¹ An average corridor of 80 m required (40 m either side of the tower centre line).

Sensitive Receptors

10.4.31 **Table 10.9** provides a summary of baseline receptor sensitivity.

Table 10.9 Hydrological Receptors Scoped-In		
Feature	Nature Conservation Value	Justification
Salmonid spawning and nurseries (Teatle Water, Allt Fearnna and the Cladich River)	County	Salmon and trout spawning and nursery habitats are present in the Teatle Water, Allt Fearnna and the Cladich River, crossed by the Proposed Development. Migratory salmonids, their spawn and downstream migrating 'smolts' are afforded protection under the Salmon and Freshwater Fisheries (Consolidation) (Scotland) (Act 2003). Salmonid spawning and nursery habitats are in connection to downstream surface waterbodies and support fish populations within migratory connection.
Watercourses	Local	The conditions of watercourses along the OHL Route are assessed to be generally moderate or good, although the River Cladich is classified as a Heavily Modified waterbody ⁸ . This feature has been assessed to be of local level importance, because of the intrinsic connectivity through the various catchments and the provision of habitat for otter, water vole, amphibians, fish and invertebrates. As a result, this feature is considered to be of local importance.
Wetlands (potential GWDTE and marshy grassland)	County	GWDTEs are sensitive to changes in hydrology and hydrogeology and are a priority under the Water Environment and Water Services (Scotland) Act ¹² . The GWDTE Assessment (TA10.8, EIAR Volume 4) shows that potential GWDTE habitats within the study area are unlikely to be dependent of groundwater supplies and are supported by surface water accumulation and direct precipitation. The examples of potential GWDTE and marshy grassland in the field survey area are generally in good condition, with increased diversity and naturalness compared to the surrounding habitats, such as coniferous woodland plantation. Due to the small and fragmented areas present in the ecology field survey area, with larger expanses present in the wider area, this feature is considered to be of county importance.
Peatlands (blanket bog, wet modified bog, wet and dry heath, and flushes)	Regional (blanket bog and flushes)	These habitat types are included in Annex 1 of the EC Habitats Directive ¹³ and are sensitive to environmental change, such as changes to hydrology.

¹² Water Environment and Water Services (Scotland) Act (2003): <https://www.legislation.gov.uk/asp/2003/3/contents> [7th October 2021].

¹³ EC Directive on the Conservation of Natural Habitats and Wild Flora and Fauna (1992): http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm [17th August 2021].

Table 10.9 Hydrological Receptors Scoped-In		
Feature	Nature Conservation Value	Justification
	County (wet modified bog, and wet and dry heath)	While peatland habitats are found to be of varying quality and depth across the study area, and examples of bog and heath habitats are found across the Argyll and Bute area, such habitats represent a significant water store and distinctive hydrological regime. As such these areas are considered to be of Regional importance.
Private Water Supplies	Local	PWS within 250 m of the Proposed Development serve individual properties and are considered to be of Local importance.
Public Water Supply	Local	An unnamed tributary to the Cladich River is within a Drinking Water Protected Area (DWPAs). Records indicate that water is piped from the abstraction point to the north to a small number of residences in Cladich. Public water supply from this resource is considered to be of local significance.
Groundwater	Local	The Site is underlain by a low productivity aquifer, which is considered likely to support water supply only at a local scale.

10.5 Issues Scoped Out

- 10.5.1 A detailed flood risk assessment of the Proposed Development has been scoped out of the EIA as limited areas of the study area are considered by SEPA to be at risk of fluvial flooding. The Proposed Development infrastructure (except for sections of access track crossing watercourses) has deliberately been located outwith the indicative flood extent of watercourses and their 30 m watercourse buffer. Therefore, further detailed assessment of potential vulnerability to flood risk has been scoped-out of this assessment.
- 10.5.2 Flow calculations applicable to watercourse crossings would be carried out by an appointed contractor at the detailed design stage, such that crossings would be designed to the 1 in 200 (0.5%) design standard, inclusive of a suitable allowance for climate change as specified in **TA10.4: Watercourse Crossing Assessment (EIAR Volume 4)**.
- 10.5.3 An increase in the area of impermeable surface area during construction could lead to higher runoff rates and therefore higher risk of peak flows downslope from the Proposed Development. However, as the development is not considered to have a significant potential to increase flood risk to downstream receptors due to the low percentage change of hardstanding surface relative to the site area, the potential for an increase in flood risk due to the Proposed Development is negligible.

10.6 Assessment of Effects, Mitigation and Residual Effects

Mitigation by Design

- 10.6.1 The Proposed Development has been designed to maintain a 30 m buffer from watercourses and such that the number of watercourse crossings required is minimised. The proposed watercourse crossing points have been aligned to be perpendicular to minimise disruption to bank sides. **TA10.4: Watercourse Crossing Assessment (EIAR Volume 4)** sets out principles of best practice for watercourse crossing design.
- 10.6.2 The design of access tracks shall be carried out in line with best practice measures 14,15 and as detailed in the CEMP to be prepared by the contractor such that track construction shall not significantly alter habitat drainage regimes. Drainage measures incorporated into track design would ensure the continued hydrological connectivity of habitats and prevent increases in surface water runoff rates from track surfaces.

Potential Impacts

Construction Phase

Chemical Pollution

- 10.6.3 There is the potential for the accidental release of stored fuels, oils and materials (e.g. cement and grout) used on-site during construction works to negatively impact surface waters and underlying groundwater. Potential effects include degradation of water quality, downstream migration of pollution and indirect effects on aquatic habitats and species.
- 10.6.4 Were such a release to occur, there is the potential for a negative impact to surface water resources and to shallow groundwater (if present) in near-surface peat and superficial deposits, with a subsequent impact on biodiversity. Potential effects include degradation of water quality, direct effects on aquatic ecology and indirect effects on the ecology of downstream receptors. Surface water features are assessed to be of a medium to high sensitivity to chemical pollution (based on the varying chemical and ecological status of watercourses and downstream receptors). Were an accidental release of potentially harmful materials to occur, such an event could be of a Small magnitude (based on the limited volumes of such materials that would be held on site). Therefore, there is the potential for a Moderate impact to receiving waters.

Sedimentation and Erosion

- 10.6.5 There is potential for the discharge of increased sediment loads due to construction activity and erosion, to negatively impact on aquatic ecology or fluvial morphology of receptors downstream from the Proposed Development. There is also potential for surface water run-off with relatively high sediment loads to be discharged over or into soil, which may in turn impact on local infiltration capacity. Increased sediment loads may be the result of excavation and surface disturbance, excavation and dewatering of foundation excavations or the mobilisation of stockpiled material.

¹⁴ Scottish Natural Heritage, 2015. Constructed tracks in the Scottish Uplands. 2nd Edition Updated September 2015.

¹⁵ Forestry and Land Scotland (FLS) 2019 Forest Road Specification. Available online: <https://forestryandland.gov.scot/> [last accessed January 2022].

- 10.6.6 There is the potential for hardstanding and compacted surfaces to increase rates of surface runoff on the area of the Proposed Development and for infrastructure to create preferential drainage pathways. Increases in surface runoff may in turn lead to higher risks of erosion and sedimentation and have the potential to increase flood risk downstream. Surface water features are assessed to be of a medium to high sensitivity to sedimentation/erosion (based on the varying chemical and ecological status of watercourses and downstream receptors). Due to the limited extent of excavations and the design of the layout which takes in to account potential impact to surface waters, such an event could be of a Small magnitude. Therefore, there is the potential for a Moderate impact to receiving waters.

Alteration to Surface Water Flows and Runoff

- 10.6.7 The construction of access tracks could lead to the restriction of surface water flows and near-surface flows downslope across the site. This leads to the potential for a reduction in the water supply to down slope mire habitats and the risk of peat soils becoming dry or eventually desiccated due to a lowering of the water table and alterations to the drainage pattern.
- 10.6.8 The construction of tracks and associated drainage features could also lead to the creation of preferential drainage pathways which could drain natural wetland areas. Were increased runoff rates to occur at such locations, increased erosion rates could lead to increased sediment loads as discussed above. Surrounding peatland habitats are potentially sensitive to alterations in surface water runoff. Although it is noted that the quality of such habitats in the study area is varied, assessment of NVC communities identified as potentially groundwater dependent (**TA 10.8, GWDTE Assessment, EIAR Volume 4**) indicates that some habitats could be of a High sensitivity to changes in supply of surface water runoff. Due to the implementation of best practice measures in track construction (Mitigation by Design, Paragraph 10.5.1), potential impacts on the surface water regime could be of a Small magnitude. Therefore, there is the potential for a Minor impact.

Impact on GWDTE

- 10.6.9 An assessment of potential effects to GWDTE areas is provided in **TA 10.8 (EIAR Volume 4)**. This assessment shows that it is unlikely that such areas are fed by the groundwater aquifer and that the majority of potentially GWDTE areas are in direct connection to surface water features and are therefore not sensitive to changes in the groundwater regime. Potential impacts to peatland habitats and proposed habitat restoration are specified in **Chapter 6: Biodiversity (EIAR Volume 2)** and **TA10.2: Outline Peat Management Plan (EIAR Volume 4)**.
- 10.6.10 This assessment indicates that the vegetation communities are sensitive to alterations in the quality and quantity of surface and near-surface water supply. There is potential for direct loss of peatland habitat and indirect impacts as a result of chemical or physical alterations to surface runoff during the construction phase.
- 10.6.11 As impacts to habitats identified by NVC surveying as potentially groundwater dependent would be limited to either temporary or permanent direct loss, with indirect losses not anticipated as the habitats are not considered sensitive to changes in the groundwater regime, the impact of the Proposed Development would be highly localised and therefore small in the context of the surrounding area and habitats. The importance of potential GWDTE habitats including mire, wet heath and grassland habitats is assessed in **Chapter 6: Biodiversity** to be varied (local-regional). Wherever possible the most sensitive habitats (peat forming flush habitats, as set out in **Chapter 6: Biodiversity**, and GWDTE areas on which groundwater dependency is not ruled out, as set out in **TA10.8**) would be avoided through the use of micro-siting of construction work and installation of infrastructure. Therefore, the impact on potential GWDTE habitats would be very localised and of a low magnitude impact in the context of the habitat study area. On this basis, effects on the potential GWDTEs would not be significant.

Impact on Peat and Carbon Rich Soils

10.6.12 In addition to the indirect effects on GWDTE, changes to local soils and peat habitats could occur as a result of:

- Compaction of soils;
- Potential for increased erosion of peat soils through disturbance, either through direct disturbance or localised drying caused by infrastructure; and
- Loss of peatland habitats and carbon rich soils through excavations for infrastructure.

10.6.13 An Outline PMP has been prepared for the Proposed Development (see **TA 10.2, EIAR Volume 4**) which documents measures to mitigate potential impacts, as listed above, on peat and carbon rich soils through the construction phase. This is a working document that will be updated as the project progresses through detailed design, construction and operation. Peat habitats are considered to be of Medium or High sensitivity. Loss and degradation of peat can result in the release of carbon dioxide and result in habitat loss. The PMP would seek to ensure that any impacts on peat and carbon rich soils are reduced to a Low or Negligible magnitude, particularly with regard to any areas of deeper peat, such that no significant effects are predicted.

Watercourse Crossings

10.6.14 Desk based assessment and field surveying has identified 16 locations at which watercourse crossings are proposed. **TA 10.4: Watercourse Crossing Assessment (EIAR Volume 4)** details the locations of proposed crossings and provides site specific assessment of watercourse conditions, the anticipated crossing type at each location, likely levels of CAR authorisation that would be required, and best practice measures that would be implemented in the construction of watercourse crossings.

10.6.15 During the construction of watercourse crossings there is potential for activities to negatively impact both water quality and the natural morphology. SEPA good practice guidance¹⁶ identifies that where proper care is not taken during the construction phase disturbance of river bed and banks can lead to the direct loss of aquatic flora and fauna and the release of fine sediments and other pollutants resulting in the smothering of plants, animals or the habitats they depend on.

10.6.16 Crossings (and culverts) will be designed to ensure protection of the existing fluvial morphology and aquatic flora and fauna. Based on the implementation of best practice measures as detailed in **TA10.4** and to be set out in the CEMP, GEMPs and SPPs (see **TAs 2.2-2.4, EIAR Volume 4**) the potential impact of the construction of watercourse crossings is assessed to be of a small magnitude, and therefore potential impacts would be minor and not significant.

Water Resources

10.6.17 There is potential that construction work carried out within DWPA upstream of a Scottish Water intake present at GR 209680, 721112 (**Figure 10.3, EIAR Volume 3a**) could lead to a reduction on water quality for users of the supply or, were sedimentation of the tributary to occur, that operation of the intake could be negatively affected, and that Scottish water should be notified of works within the DWPA. The public water supply is considered to be of a High sensitivity. Were the supply impacted, water supply and associated infrastructure serving several properties forming the Claddich settlement could be affected, leading to impacts of a Moderate magnitude. Therefore there is the potential for a Major impact.

¹⁶ Engineering in the water environment: River crossings (Natural Scotland and SEPA, 2010).

- 10.6.18 As identified in **TA10.5: Private Water Supplies Assessment (EIAR Volume 4)** there are no PWS locations identified by ABC recorded within 250 m of the Proposed Development, including proposed access tracks and tower locations. In line with SEPA guidance¹⁷ site specific qualitative and/or quantitative risk assessment is not required of groundwater abstractions outside of a 250 m buffer as alteration to groundwater supplies is unlikely where this buffer is achieved. A total of three ABC PWS locations are situated in close proximity to a watercourse, downstream and therefore in potential hydrological connection to the Proposed Development (at a distance of between 435 m and 595 m).
- 10.6.19 Site assessment carried out by Balfour Beatty on behalf of SSE indicates that further PWS are present within 250 m of the Proposed Development (**TA10.5: Private Water Supplies Assessment**), to the south east of Cladich Farm and in proximity to a sheep wash to the south east of Achlian Farm, the source and name of these supplies is not available. Two supplies are downslope of the Proposed Development (Cladich Farm 114 m north of T14 and 230 m north of T16).
- 10.6.20 A natural spring is also reported to be located between T43 and T44 (GR 217926, 726188) which provides Brackley Farm with a water supply. According to the landowner this spring flows north from this point to a water settlement tank just south of Brackley Farm. This PWS location is approximately 50 m north east of tower location T43
- 10.6.21 Private water supplies are considered to be of a High sensitivity. Assessment of PWS provided in TA10.5: Private Water Supplies Assessment indicates that the supplies identified are associated with single properties. Were a supply impacted it is likely that a single property could be affected, leading to impacts of a Small magnitude. Therefore there is the potential for a Minor impact.

Operational Phase

- 10.6.22 The potential risk of the release of pollutants or sediment from the activities relating to the operational phase of the Proposed Development is substantially lower than during construction because of the decreased levels of ground disturbance.
- 10.6.23 There is the potential for hardstanding surfaces and compacted tracks and infrastructure to lead to increased rates of surface runoff, in turn leading to the potential for increased risk of surface erosion and downstream flood risk. There is also the potential for tracks and associated drainage infrastructure to lead to preferential drainage pathways and the alteration of drainage patterns potentially adversely affecting the quality of peat habitats. Taking in to account the varied quality of peatland habitats as identified in **TA10.1: Peat Survey Results Report (EIAR Volume 4)**, and the implementation of best practice measures in track design¹⁸, it is unlikely that significant impacts would occur in the operational phase. Furthermore temporary access tracks would be removed and reinstated at the operational phase such that the potential for adverse impacts to occur would be reduced.
- 10.6.24 There is the potential for site infrastructure to present a barrier to near surface flows during the operational phase. Were cross drainage measures not appropriately installed, there is the potential for tracks to impede the movement of surface waters leading to the drying out or desiccation of areas dependent on water supply or retention. The installation of drainage measures designed to ensure the continued conveyance of surface water across the study area during the construction phase and the removal of temporary access tracks would ensure a reduced risk of adverse effects during the operational phase. Furthermore, tower foundations would be of impermeable construction such that the Proposed Development would not lead to preferential drainage pathways or resultant drying of habitats during the operational phase.

¹⁷ LUPS SEPA Guidance Note 31. Available online:
https://www.sepa.org.uk/media/143868/lupsgu31_planning_guidance_on_groundwater_abstractions.pdf [Last accessed November 2021].

10.6.25 Watercourses and habitats dependent on the distribution of surface water are assessed to be of a High sensitivity. The potential for impacts during the operational phase of the Proposed Development would be limited through measures listed above that would be installed at the construction phase, in line with the CEMP and best practice guidance¹⁸. The potential magnitude of impacts would be Small, and therefore the significance of such changes would be Minor and not significant.

10.6.26 No potential operational phase impacts on peat and carbon rich soils are anticipated.

Mitigation

10.6.27 The key measures to prevent impacts to watercourses and surface water resources in the area will be set out in a Construction Environmental Management Plan (CEMP, see **TA 2.2: OCEMP, EIAR Volume 4**) and detailed PMP (see **TA10.2: Outline PMP, EIAR Volume 4**), which will be prepared by the Principal Contractor following the determination of the Application for s37 consent.

10.6.28 The CEMP would include construction methods and environmental protection measures applying best practice guidance as set out in applicable SEPA PPGs, listed in **Table 10.10**, and applicable SSEN GEMPS, as listed in **Table 10.11** and presented in **TA2.3: SSEN Transmission GEMPs (EIAR Volume 4)**. Implementation of these measures during all aspects of the construction phase would ensure construction activity would not cause adverse effects to sensitive receptors.

Table 10.10: Applicable Best Practice Guidance and Advice

Document Reference	Title
PPG 1	General guide to the prevention of pollution
GPP 5	Works and maintenance in or near water (January 2017)
PPG 6	Working at construction and demolition sites (2012)
PPG 22	Incident response - dealing with spills (October 2018)
PAN 79	Water and Drainage (September 2006)
WAT-SG-25	Good Practice Guide - River Crossings (November 2010)
WAT-SG-26	Good Practice Guide - Sediment Management (September 2010)
WAT-SG-29	Good Practice Guide - Temporary Construction Methods (March 2009)
WAT-PS-06-02	Culverting of Watercourses (June 2015)
WAT-SG-75	Sector Specific Guidance: Construction Sites
CIRIA (2005) C650	Environmental Good Practice On Site (2nd Edition)
CIRIA Report C532	Control of Water Pollution from Construction Sites

Table 10.11: Applicable SSEN GEMPs

Document Reference	Title
TG-NET-ENV-510	Oil Storage and Refuelling (June 2020)
TG-NET-ENV-518	Private Water Supplies (May 2020)
TG-NET-ENV-511	Soil Management (May 2020)

¹⁸ Scottish Natural Heritage, 2015. Constructed tracks in the Scottish Uplands. 2nd Edition Updated September 2015.

Forestry and Land Scotland (FLS) 2019 Forest Road Specification. Available online: <https://forestryandland.gov.scot/> [last accessed January 2022].

Table 10.11: Applicable SSEN GEMPs	
Document Reference	Title
TG-NET-ENV-515	Watercourse Crossings (May 2020)
TG-NET-ENV-512	Working Near Water (May 2020)
TG-NET-ENV-513	Working in Sensitive Habitats (May 2020)

10.6.29 It is anticipated that the Site would be subject to a Construction Site License and as such detailed design of proposed drainage works would be subject to licensing requirements set out under CAR regulations¹⁹ and compliance with regulations would be agreed in consultation with the LPA and SEPA and set out in the Construction Site License application.

Chemical Pollution

10.6.30 Measures to prevent Chemical pollution will be implemented through application of the CEMP, SSEN GEMP TG-NET-ENV-510 (Oil Storage and Refuelling); TG-NET-ENV-512 (Working Near Water); and TG-NET-ENV-513 (Working in Sensitive Habitats). Specific measures to be adopted would include, but not be limited to, the following:

- All refuelling would be carried out in designated locations, 30 m away from water courses. Irrespective of the buffer distance and location of refuelling, drip trays and spill kits will be available in accordance with standard best practice;
- Fuel, oils and chemicals will be stored on an impervious base within a suitably drained bund able to contain at least 110 % of the volume stored (and in compliance with compliance with General Binding Rule 28 of the Controlled Activity Regulations);
- Plant parking areas would be situated at least 30 m from watercourses and plant nappies placed under plant onsite when parked up for extended durations;
- A personnel Site Induction will make specific reference to required pollution prevention measures; and
- In the event of a pollutant spillage on site, the material will be contained (using an absorbent material such as sand or soil or commercially available booms) and were an event to occur affecting a watercourse, SEPA would be notified immediately.

Sedimentation and Erosion

10.6.31 Measures to prevent sedimentation and erosion will be set out in the CEMP (as outlined in **TA2.2: OCEMP, EIAR Volume 4**). The CEMP would include measures to minimise potential adverse effects related to surface water and groundwater discharge, including impacts associated with dewatering which may arise from the excavation of tower foundations. Therefore, the contractor shall be required to meet regulatory requirements and implement best practice measures as set out in SEPA planning guidance and CAR regulations. Specific measures to be adopted would include, but not be limited to, the following:

- The area of soils disturbed or excavated shall be minimised and where disturbance is necessary management of materials shall be carried out in accordance with SSEN GEMP TG-NET-ENV-511: Soil Management;

¹⁹ Scottish Government (2011, 2013, 2017) Water Environment (Controlled Activities) (Regulations) Scotland 2011 (CAR) and their further amendments of 2013 and 2017 Available at: <https://www.sepa.org.uk/regulations/water/>.

- Clean runoff (i.e. non-silty surface water flow, including that which has not passed over any disturbed construction areas) would be kept separate from construction areas as far as possible, and subsequently distributed to suitable downslope vegetated area;
- Sediment laden runoff shall be directed to settlement ponds suitable for the containment of volumes of water and sediment as appropriate to the area of disturbed or excavated ground (taking in to account the potential for rainfall events). Water discharged from settlement ponds shall be directed to vegetated areas and measures such as silt fences shall ensure sediment loads are fully entrained;
- Where drains are installed, either temporarily during the construction phase or in association with the installation of site infrastructure, check dams would be installed at suitable intervals (as defined by the gradient of the drain) to reduce flow velocity and allow the settlement of sediment loads prior to discharge to watercourses; and
- Following construction activity any disturbed land and vegetation shall be restored to pre-construction conditions (including temporary access tracks) in line with SSEN GEMP TG-NET-ENV-522: Restoration.

Alteration to Surface Water Flows and Runoff

10.6.32 Details of any necessary drainage measures would be included in the final CEMP and the design and installation of such measures would mitigate potential adverse impacts on the hydrology of the Site and surrounding areas during the construction phase of the Proposed Development. Measures would ensure that pre-development runoff rates are maintained and that rates of runoff to watercourses are not increased.

10.6.33 At the limited number of locations where a track is required to cross a watercourse, or where other infrastructure is necessary within 50 m of a surface watercourse, either as described in this Chapter or as identified by the ECoW, the installation of drainage measures shall be supervised by the ECoW during the construction phase of works. The requirement for monitoring of water quality (prior to and during construction) within watercourses downstream of the Proposed Development would be agreed with SEPA and Marine Scotland. Procedures for this would be detailed in the CEMP.

Water Resources

10.6.34 Where works are to take place within the identified Cladich DWPA, Scottish Water shall be contacted prior to the commencement of works and works shall be carried out in line with their requirements. Works within the DWPA shall be supervised by the ECoW and visual inspection of the watercourse and intake point shall be carried out on a daily basis to ensure sediment loads are not increased. Water quality sampling shall be carried out prior to construction work to determine physico-chemical baseline conditions and subsequent monitoring will be conducted during the construction phase of the Proposed Development to identify deviation from baseline conditions, under the supervision of the ECoW.

10.6.35 Construction works situated within the Cladich DWPA would be subject to additional measures to ensure that the release of sediment laden water or pollutants to the watercourse resulting from the Proposed Development would be mitigated:

- A detailed pre-construction risk assessment will be completed by the contractor in consultation with Scottish Water;

- A silt barrier (silt fencing or a fibre roll) would be installed downslope of the proposed construction tower locations, following best practice guidance²⁰, prior to the commencement of construction and would remain in situ until the construction phase is completed and permanent drainage measures that shall serve the track are operational;
- If dewatering is carried out at the foundation of proposed tower locations, sediment laden water would be pumped to suitably sized settlement ponds (or purpose built sediment tanks), discharge from which would be to a vegetated area at least 10 m from a watercourse or subject to mechanical filtration through the use of de-watering bags, pipe-end filters or passing water through a suitable filter medium;
- The use of semi-permeable silt curtains situated at a downstream location within the watercourse (at which flow velocities would allow suitable installation) could be considered;
- No storage of fuels or potentially contaminative materials (including cements), refuelling of plant or extended laydown of plant shall take place within the DWPA;
- One watercourse crossing is proposed within the DWPA. At this location a silt barrier shall be installed to a 30 m buffer from the watercourse and splash guards installed at the approach to and on the crossing; and
- Measures to mitigate the potential for the release of sediment laden water from this area during construction would be overseen by the ECoW, who would carry out and record daily inspection of the watercourse and sediment control measures during construction work to ensure no visible increase in sediment load occurs.

10.6.36 Detailed risk assessment shall be carried out by the appointed contractor, prior to the commencement of construction work, at four locations identified in **TA10.5: Private Water Supplies Assessment (EIAR Volume 4)**; Bovuy PWS, BB_PWS_1 and BB_PWS_2 and at the Brackley Farm PWS (subject to confirmation of the PWS location identified by the landowner). These locations are downstream of the Proposed Development and as such potentially sensitive to alterations in the quality and quantity of surface water supply.

10.6.37 Standard procedures will be applied by the Principal Contractor and set out in the CEMP to protect PWS water quality and supply during construction works. To ensure that all drainage measures employed during the construction phase of the Proposed Development are maintained appropriately and remain effective, the performance of the drainage measures would be monitored, and drainage management works would be supervised by the ECoW.

10.6.38 Works in proximity to PWS identified above shall be carried out in accordance with SSEN General Environmental Management Plan (GEMP) TG-NET-ENV-518 – Private Water Supplies, as detailed further in **TA10.5: Private Water Supplies Assessment (EIAR Volume 4)**.

Peat and Carbon Rich Soils

10.6.39 Key measures to minimise and prevent impacts to peat and carbon rich soils are included within the outline PMP (**TA10.2: Outline Peat Management Plan**) and PLHRA (**TA10.3: Peat Landslide Hazard Risk Assessment, EIAR Volume 4**). These set out good practice measures and specific mitigation measures to minimise the potential effects on peat and carbon rich soils. Specific mitigation to be included to minimise and reduce potential impacts on peat and carbon rich soils include:

²⁰ SEPA, WAT_SG_29: Engineering in the Water Environment Good practice Guide, 2008. Available online: https://www.sepa.org.uk/media/150997/wat_sg_29.pdf [last accessed January 2022].

- Proposed access tracks located over deep peat (>1 m in depth) would be 'floated' to minimise the volume of excavated peat. If required, bog mats would be used to cross waterlogged areas or minor watercourses without causing damage to bank integrity or compaction of soils;
- Towers located over deep peat would be constructed using a piled foundation solution where practicable to minimise the peat excavation and disturbance required. Working areas will be constructed using a layer of geotextile and stone over the peat, which can be reinstated on completion;
- Avoid cutting trenches or aligning excavations across slopes (which may act as incipient back scars for peat failures) unless appropriate mitigation has been put in place;
- Awareness of peat instability and pre-failure indicators would be incorporated in site induction, tool box talks, and training to enable all site personnel to recognise ground disturbances and features indicative of incipient instability;
- Peat and carbon rich soils would be stored temporarily on site during the works in accordance with the outline PMP to avoid desiccation and creation of run-off; and
- Peat and carbon rich soils excavated during the works would be used for the reinstatement of infrastructure such as track verges/shoulders and tower locations. Surplus excavated peat would be used to backfill drainage ditches and depressions in three habitat restoration areas located along the Proposed Development (**TA 10.2: PMP - Figure 10.2.1: Proposed Peatland Restoration Areas, EIAR Volume 4**).

Residual Effects

10.6.40 No significant residual effects to hydrology, hydrogeology, geology and soils as a result of the construction and operation of the Proposed Development have been identified. On this basis, no further mitigation beyond the good practice measures outlined in this chapter and through the detailed CEMP that shall be prepared by the appointed contractor will be required.

Cumulative Effects

10.6.41 There is potential for the cumulative effect of forestry operations to affect water quality in watercourses and downstream receptors. Ramboll have prepared a Forestry Hydrology Assessment (**TA10.5 (EIAR Volume 4)**). This demonstrates that for the river catchments within which felling is proposed for the Proposed Development, clearance of the proposed Operational Corridor and associated access infrastructure, combined with plans for commercial felling shall be within UK Forestry Standards Guidelines (UKFSD) (5th edition). UK Forestry Standards Guidelines state that '*effects of harvesting on surface water acidity are difficult to discern when 20% or less of a catchment is felled within any three-year period*'. Whilst the total potential felling for the OHL corridor amounts to less than 20 % of the Cladich DWPA (which is a Scottish Water Notice Area) within a three-year period, it is noted that if the felling for the OHL corridor considered in conjunction with that for the new access tracks and the wider area of potential management felling, the total area could reach 20 % of the Cladich DWPA. However, the total area of management felling represents all land where much management felling could occur, and not the total area which would be felled. The felling of these areas is subject to Landowner agreement and by method of Scottish Forestry felling licence approval or Long Term Forest Plan formal amendment. This additional 'management felling' would be subject to a requirement for separate felling licence approval from Scottish Forestry. The final selection of management felling areas would take account of downstream water quality in consultation with Scottish Water. The felling licence would ensure no impact on the water quality at the downstream abstraction.

10.6.42 Other cumulative schemes within 2 km of the Proposed Development (shown in **Figure 14.1, EIAR Volume 3a**) would also be required to mitigate against impacts on downstream hydrological, hydrogeological and geological receptors and, as such, would individually not result in significant effects. Although, in-combination localised effects could arise where the Proposed Development would connect to the Blarghour Wind Farm Connection, Creag Dhubh Substation, Creag Dhubh to Inveraray OHL and ITE/ITW Tie-In Connection, these are unlikely to exceed a threshold for significant effects and furthermore given SSEN Transmission is the Applicant for all four developments, the impacts during the construction would be managed collectively through the implementation of measures set out in the CEMP. Accordingly, no significant cumulative effects are considered to occur to hydrological or hydrogeological receptors.

10.7 Summary

- 10.7.1 This chapter has considered potential impacts and their associated effects on hydrological, hydrogeological, soils and peatland features, such as watercourses, surface water distribution, potentially groundwater dependent habitats, groundwater resources and water resources for both public and private supply, and carbon rich soils.
- 10.7.2 Without the application of mitigation, significant effects could occur to sensitive receptors such as surface water quality, aquatics habitats, and peatland soil. Following the application of mitigation, and the implementation of a CEMP and PMP to protect water supplies and peat, no significant residual effects are predicted.