Chapter 10

Hydrology, Hydrogeology, Geology and Soils

SCOTTISHPOWER RENEWABLES

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10.1 Executive Summary

1. Earraghail Renewable Energy Development ('the proposed Development') has been assessed in relation to the potential impacts on hydrology, hydrogeology, geology and soils during the construction and operational phases.

2. Information on the study area was compiled using data gathered through a desk study and verified by an extensive programme of fieldwork. The assessment was undertaken through consideration of the sensitivity of receptors identified during the baseline study, the potential magnitude of effect and the likelihood of that effect occurring, and taking into consideration any mitigation measures incorporated as part of the proposed Development's design.

3. A detailed programme of peat depth and condition surveying has been completed and the results used to inform design. A Peat Slide Risk Assessment (PSRA) and Peat Management Plan (PMP) have been produced for the proposed Development, which show that areas of deep peat can be avoided where topography and engineering constraints allow, and peat resources can be safeguarded.

4. The Site lies outwith any floodplain areas and no private water supplies (PWS) or drinking water protected areas have been identified within the Site, however several PWS have been identified within 2 km of the Site. Designated sites that are near, or have a hydrological connection to, the Site have been assessed individually and appropriate mitigation measures set out where linkages have been identified.

5. Sustainable Drainage Systems (SuDS) have been proposed to ensure that the rate of runoff from the Site post-development would be no greater than that prior to development and would not therefore increase flood risk downstream. The proposed SuDS allow the quality of water to be managed at source, prior to any discharge, thereby helping to prevent any reduction in water quality downstream of the Site.

6. Potential groundwater-dependent terrestrial ecosystems (GWDTE) have been identified within the Site and assessed on a case-by-case basis to determine their level of groundwater dependency and potential impacts from development. Location-specific mitigation measures are provided to manage potential impacts arising from construction where it has not been possible to avoid these areas.

7. Mitigation measures have been identified for all potential impacts, either through the design process or in accordance with good practice guidance.

8. It has been shown, as a consequence of design and embedded mitigation, that the proposed Development would not result in any significant impacts on hydrology, hydrogeology, geology and soils.

10.2 Introduction

9. This Section of the Environmental Impact Assessment (EIA) Report describes the existing hydrological, hydrogeological, geological and soil conditions within the study area, including peatland, and identifies and assesses the potential impacts that may be caused by the proposed Development. This includes site preparation, construction works, restoration of construction works and site operation. Mitigation measures that may be employed to alleviate any adverse effects are set out (see **Section 10.7.7.2**).

10. Key findings are summarised within this Chapter.

10.3 Scope and Methodology

11. The assessment was undertaken through a desk study and site inspection of existing hydrological, hydrogeological, geological and soils-related features within and surrounding the study area. The existing conditions were described and potential risks that may be associated with the proposed Development were identified and assessed. The following effects were assessed:

- physical changes to overland drainage and surface water flows;
- particulates and suspended solids;
- water contamination from fuels, soils, concrete batching or foul drainage;
- changes in or contamination of water supply to vulnerable receptors;
- increased flood risk;
- physical removal of bedrock;
- modification to groundwater flow paths;
- soil erosion and compaction; and
- peat instability.

12. No potential effects were scoped out of the assessment.

13. Within this Chapter, the study area is considered to include the application boundary (see **Figure 1.2**) and an area up to 2 km from this boundary. For hydrological concerns, areas downstream of the application boundary are considered at a distance up to 5 km as it is possible for effects to be transmitted downstream further than 2 km.

14. The initial desk studies were undertaken to determine and verify the baseline conditions through review and collation of available and relevant information relating to hydrology, hydrogeology, geology and soils. This included a review of published mapping, including OS topographical mapping, BGS geological mapping and Scotland's Soils soil and peatland mapping, aerial photographs and site-specific data such as available site investigation data, geological and hydrogeological reports, digital terrain models (DTM; to provide slope data) and geological literature.

15. Private water supply (PWS) data was requested from Argyll and Bute Council's Environmental Health Officer. Potential PWS located downstream of the site were verified by DTM data and local information to determine their level of risk.

16. Two site visits and walkover surveys were undertaken to:

- verify the information collected during the baseline desk study;
- undertake a visual assessment of the main surface waters and verify PWS, including intakes that could be affected by the proposed Development;
- identify drainage patterns, areas vulnerable to erosion or sediment deposition, and any pollution risks;
- visit any identified GWDTE (in consultation with the project ecology team);
- prepare a schedule of potential watercourse crossings and existing crossings that would require upgrading;
- inspect rock exposures and establish by probing an estimate of overburden thickness and confirmation of likely substrate;

- allow appreciation of the site including awareness of gradients, possible borrow pit sites, access route options and prevailing ground conditions, and to assess the relative location of all the components of the proposed Development;
- collection of peat and substrate information where exposures are present, e.g. in watercourse channels and alongside existing track cuttings

17. Reconnaissance surveys were undertaken on 19th February 2020 and 11th March 2021. In February 2020, the weather was cloudy and overcast with showers, becoming misty later in the day. In March 2021, the weather was overcast with showers and generally good visibility.

18. In parallel with the site visit and walkover survey, a peat probing exercise was undertaken. This involved undertaking a peat depth survey with a hand-held probe on a 100 m grid across the proposed Development area, to identify areas of deeper peat and natural variation in the peat substrate across the area. These surveys were undertaken in March and May 2020.

19. Following the field surveys, a geomorphological mapping exercise was undertaken to link the topographic features with the underlying geology, and to identify areas of the Site that may be potentially at risk from peat landslide. This made use of collected field data, DTM, topographical mapping and aerial photography.

20. Following finalisation of the infrastructure design, a second phase of peat survey work was scheduled. This included peat probing at 50 m centres along all proposed new access tracks and 25 m crosshair probing at turbine locations. Additional probing was undertaken as required in areas where existing tracks would require widening or modification to corners or junctions, and at all other infrastructure locations, to ensure that there was sufficient peat depth information to support the infrastructure design process and related studies on peat instability and peat excavation and reuse. These surveys were undertaken in August 2020 and April 2021.

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

22. A peat slide risk assessment (PSRA) was undertaken in accordance with the Scottish Government's Peat Landslide Hazard & Risk Assessments: Best Practice Guide for Proposed Electricity Developments (The Scottish Government, 2017). The PSRA was informed by the peat depth model, site walkover and peat depth surveys, detailed geomorphological mapping and terrain classification. The assessment used a combined qualitative (contributory factor) and quantitative (factor of safety) approach to determine the likelihood of peat landslides. Areas with the highest likelihoods were compared with identified receptors to identify risks and determine appropriate mitigation measures. The assessment is provided in **Technical Appendix 10.1**.

23. A peat management plan (PMP) was prepared in accordance with the Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste (Scottish Renewables & SEPA, 2012). The PMP was informed by the collated peat depth probing described above, combined with a full site appraisal of potential reuse opportunities e.g. reinstatement and landscaping requirements associated with infrastructure, mapping of drainage ditches and peat hagging. Where opportunities were identified to integrate the PMP with wider environmental enhancement measures, such as peatland restoration, the PMP identifies the volume and type of peat to be used for this activity.

24. An assessment of bedrock suitability for track and hardstanding construction was undertaken, together with a mapping exercise to identify potentially suitable locations for use as borrow pits for the proposed Development. The assessment is provided in **Technical Appendix 10.3**.

25. An assessment of groundwater-dependent terrestrial ecosystems (GWDTE) was undertaken based on the NVC mapping undertaken by the ecology team. Where areas of potentially moderate or highly GWDTE were identified in proximity to proposed infrastructure, additional investigation was undertaken to identify if the wetland areas are truly groundwater-dependent, refine their mapped extent, conceptualise the hydrogeology and assess any potential effects on these areas. The assessment is provided in **Technical Appendix 10.4**.

26. An assessment of drainage requirements to manage surface runoff and potential downstream flood risk was undertaken for the proposed Development. The assessment also includes an inventory of all proposed watercourse crossings, both for new structures and for existing crossings that may require upgrading. The assessment is provided in **Technical Appendix 10.5**.

27. A number of data sources were considered in writing this Chapter; the main sources are detailed below:

- Ordnance Survey topographical mapping, current and historical;
- British Geological Survey geological mapping, superficial and bedrock;
- British Geological Survey online borehole database;
- Centre for Ecology and Hydrology Flood Estimation Handbook Web Service;
- Argyll and Bute Council Environmental Health Department PWS records;
- Scotland's Soils mapping; and
- Scottish Environment Protection Agency's A functional wetland typology for Scotland.

10.3.1 Effects Evaluation

28. The significance of potential effects has been classified taking into account three principal factors: the **sensitivity** of the receiving environment, the potential **magnitude** of the effect and the **likelihood** of that effect occurring. This approach is based on guidance contained within the joint NatureScot/Historic Environment Scotland publication *Environmental Impact Assessment Handbook v5* (Nature Scot/HES, 2018).

10.3.1.1 Receptor Sensitivity

29. The sensitivity of a receptor represents its ability to absorb the anticipated effect without resulting perceptible change. Four levels of sensitivity have been used, as defined in **Table 10.1**.

30. In the context of EIA, there is a requirement to consider any potentially significant effects. Receptors that are not sensitive have no potentially significant effects, as their lack of sensitivity prevents this from occurring, and are therefore not included for consideration. Only receptors that have a level of sensitivity need to be covered by the assessment process.

Table 10.1 Sensitivity Ratings

Sensitivity	Definition
Very high	The receptor has very limited ability to absorb change without fundamentally altering its present character, is of very high environmental value and/or is of international importance e.g. Special Areas of Conservation, RAMSAR sites.
High	The receptor has limited ability to absorb change without significantly altering its present character, is of high environmental value and/or is of national importance e.g. National Nature Reserves, Sites of Special Scientific Interest.
Medium	The receptor has medium capacity to absorb change without significantly altering its present character, has medium environmental value and/or is of regional importance e.g. Geological Conservation Review sites.
Low	The receptor is tolerant of change without detriment to its present character, is of low environmental value and/or of local importance e.g. Local Nature Reserves, Local Geodiversity Sites.

10.3.1.2 Effect Magnitude

31. The magnitude of effects includes the timing, scale, size and duration of the potential effect. Four levels of magnitude have been used, as defined in **Table 10.2**.

Table 10.2 Magnitude Rating

Magnitude	Definition
Substantial	Significant changes, over a significant area, to key characteristics or to the geological/hydrogeological/peatland classification or status for more than 2 years.
Moderate	Noticeable but not significant changes for more than 2 years or significant changes for more than 6 months but less than 2 years, over a significant area, to key characteristics or to the geological/hydrogeological/peatland classification or status.
Slight	Noticeable changes for less than 2 years, significant changes for less than 6 months, or barely discernible changes for any length of time.
Negligible	Any change would be negligible, unnoticeable or there are no predicted changes.

10.3.1.3 Likelihood of Effect

32. The likelihood of an effect occurring is evaluated to three levels: **unlikely**, **possible** or **likely**.

10.3.2 Effects Significance

33. The findings in relation to the three criteria discussed above – Receptor Sensitivity, Effect Magnitude and Likelihood of Effect – have been brought together to provide an assessment of significance for each potential effect (**Table 10.3**). Potential effects are concluded to be of **major**, **moderate**, **minor** or **negligible** significance. Potential effects are assessed taking into account the proposed mitigation measures. The assessment concludes with a review of various effects to determine if they would be significant in terms of the *Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017*. Effects assessed as **major** or **moderate** are deemed to be significant; those assessed as **minor** or **negligible** are deemed to be not significant.

Table 10.3 Effects Significance Matrix

Sensitivity	Magnitude	Likelihood	Significance
Very High	Substantial	Likely	**Major**
		Possible	**Major**
		Unlikely	**Moderate**
	Moderate	Likely	**Major**
		Possible	**Moderate**
		Unlikely	**Moderate**
	Slight	Likely	**Moderate**
		Possible	Minor
		Unlikely	Minor
	Negligible	Likely	Minor
		Possible	Negligible
		Unlikely	Negligible
High	Substantial	Likely	**Major**
		Possible	**Major**
		Unlikely	**Moderate**
	Moderate	Likely	**Moderate**
		Possible	**Moderate**
		Unlikely	Minor
	Slight	Likely	Minor
		Possible	Minor
		Unlikely	Minor
	Negligible	Likely	Minor
		Possible	Negligible
		Unlikely	Negligible
Medium	Substantial	Likely	**Major**
		Possible	**Moderate**
		Unlikely	Minor
	Moderate	Likely	**Moderate**
		Possible	Minor
		Unlikely	Minor
	Slight	Likely	Minor
		Possible	Minor
		Unlikely	Negligible
	Negligible	Likely	Negligible
		Possible	Negligible
		Unlikely	Negligible

Sensitivity	Magnitude	Likelihood	Significance
Low	Substantial	Likely	**Moderate**
		Possible	Minor
		Unlikely	Negligible
	Moderate	Likely	Minor
		Possible	Minor
		Unlikely	Minor
	Slight	Likely	Minor
		Possible	Negligible
		Unlikely	Negligible
	Negligible	Likely	Negligible
		Possible	Negligible
		Unlikely	Negligible

34. In addition to the **Sensitivity, Magnitude** and **Likelihood** of an effect, effects can be **Adverse** or **Beneficial**, **Temporary** or **Long-Term**, **Direct** or **Indirect, Single** or **Cumulative**. Definitions of these terms are provided in **Table 10.4.**

Table 10.4 Definitions for Types of Effect Used in Impact Assessment

Type of Effect	Definition
Adverse	Having a negative, harmful or unfavourable effect on the receptor
Beneficial	Having a positive, enhancing or favourable effect on the receptor
Temporary	Short-term, lasting for only a limited period of time e.g. may be present only through construction; recovery may take a period of months or a small number of years in comparison with the lifespan of the proposed Development
Long-term	Anticipated to be required for the duration of the proposed Development
Direct	A change made directly to a receptor e.g. excavation has a direct effect on soils
Indirect	Effects arising as a result of change made to a different receptor e.g. loss of fish habitat resulting from release of sediment to a watercourse
Single	Effects arising from this proposed Development alone
Cumulative	Effects arising as a combination of works on this proposed Development and other nearby developments. 'Nearby' can have different meanings depending on the receptor being considered e.g. effects on geology and soils are mainly very localised; effects on hydrology can travel with the water movement.

10.3.3 Limitations and Uncertainties

35. The site visits followed a standard 'reconnaissance level' walkover survey to obtain an overview of site conditions at the time of the visit. A reconnaissance level survey involves walking through and around an area to gather visual information concerning elements such as slope, rock outcrop, ground wetness and bogginess, nature and type of watercourses, and the presence or absence of groundwater seepages or spring points. No ground investigation was undertaken as part of the site visits. As a result, information is limited to detail that can be gathered from a visual survey of this kind. Uncertainties may arise as a result of preceding weather conditions; e.g. very wet preceding conditions may cause an over-estimation of the watercourse nature or ground bogginess than would be considered 'normal' for the area.

36. The information gathered has been combined with information from site visits for other disciplines, including site surveys to map peat depths and vegetation classes, and available photography to give as full a picture of site conditions as possible. All reasonable attempts were made to ensure that good coverage of the site was included. However, it is possible as a result of the type of survey undertaken that some information was not collected as a result of access restrictions (ornithology exclusion zones, active forestry works, unsafe ground), the lack of intrusive investigation or the areas visited during the surveys.

10.4 Consultation Undertaken

37. Consultation was undertaken with a number of statutory and non-statutory consultees and interested parties, including the Scottish Government, Argyll and Bute Council, the Scottish Environment Protection Agency, NatureScot, Scottish Water and local stakeholders (please refer to **Chapter 6**). Responses with relevance to hydrology, hydrogeology, geology and peat are provided in **Table 10.5**.

Table 10.5 Consultee Responses Relevant to Geology, Hydrogeology, Peat and Hydrology

Name of Stakeholder/ Consultee	Key concerns	Response
Argyll and Bute Council	The location of the borrow pits in relation to peat and water courses will need to be identified and should be accompanied by an outline of the extraction area and a restoration plan for the borrow pit. Further details will be required for the water courses and crossings, how are they to be protected and the construction of access routes over same. The proposed Development is in an area where residential properties are served by PWS. The applicants should identify all properties served by a private water supply, to determine the source of those supplies that may be affected (e.g. surface supply, borehole etc.) and, where appropriate, should outline the proposed measures to avoid causing contamination during the construction phase.	Borrow pits are assessed in **Section 10.7.2.6** and **10.7.3.6**, and **Technical Appendix 10.3** Watercourse crossings are assessed in **Section 10.7.2** and **Technical Appendix 10.5**. PWS are identified in **Section 10.5.9** and assessed in **Section 10.7.2.4**.
Scottish Water	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.	**Section 10.7.2.3**, foul drainage provision will be private treatment options
SEPA	The site layout must be designed to avoid impacts upon the water environment. Where activities such as watercourse crossings, watercourse diversions or other engineering activities in or impacting on the water environment All tracks should be a minimum of 50 m from waterbodies and watercourses, with scope for minor changes for layout. Detailed layout of all proposed mitigation including all cut off drains, location, number and size of settlement ponds	Hydrology is discussed in **Sections 10.5.6** and **10.5.7**, and assessed in **Sections 10.7.2** and **10.7.3**. Watercourse crossings are assessed in **Technical Appendix 10.5**.
	Demonstrate how the layout has been designed to minimise disturbance of peat and consequential release of CO_2 and outline the preventative/mitigation measures to avoid significant drying or oxidation of peat through, for example, the construction of access tracks, drainage channels, cable trenches, or the storage and re-use of excavated peat. A detailed map and quantities of peat to be excavated with re-use/re-instatement plans outlined.	Peat is assessed in **Technical Appendix 10.1** and **10.2**. Mitigation of peat is outlined in **Section 10.7.6.2**.
	A map demonstrating that all GWDTE are outwith a 100m radius of all excavations shallower than 1m and outwith 250m of all excavations deeper than 1m and proposed groundwater abstractions.	GWDTE is assessed in **Technical Appendix 10.4**.
	A map demonstrating that all existing groundwater abstractions are outwith a 100m radius of all excavations shallower than 1m and outwith 250m of all excavations deeper than 1m and proposed groundwater abstractions.	PWS are identified in **Section 10.5.9** and assessed in **Section 10.7.2.4**. **Figure 10.6** maps PWS.

Name of Stakeholder/ Consultee	Key concerns	Response
	Each borrow pit should have a map showing locations and depths, alongside a full assessment with justification of site, drainage plans and mitigation.	Borrow pits are assessed in **Section 10.7.2.6** and **10.7.3.6**, and **Technical Appendix 10.3**.
NatureScot	An assessment of the impacts on the features of the Tarbert to Skipness Coast SSSI and Tarbert Woods SAC.	Designated sites are identified in **Section 10.5.10** and assessed in **Section 10.7.2.4**.
Marine Scotland	Recommends the developer to carry out and present the following in the EIA Report: Water quality; Provide appropriate site-specific mitigation measures; and Establish an integrated water quality and fish monitoring programme before, during and after construction.	Water quality has been identified in **Section 10.5.8**.

10.4.1 Legislation, Policy and Guidance

38. In preparing this section of the EIA Report, consideration has been given to relevant planning guidance at all levels. Planning policies of relevance are outlined in **Chapter 4**. Legislation and guidance of specific relevance to this Chapter include, but are not limited to, the following:

- The European Water Framework Directive (2000/60/EC) and associated daughter Directives including the Groundwater Directive (2006/118/EC);
- The European Mining Waste Directive (2006/21/EC);
- The Environmental Protection Act 1990 (as amended);
- The Water Environment and Water Services (Scotland) Act 2003;
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 as amended;
- The Pollution Prevention and Control (Scotland) Regulations 2012;
- The Water Environment (Oil Storage) (Scotland) Regulations 2006;
- Scottish Planning Policy 2014;
- Scottish Government's Planning Advice Note 51: planning, environmental protection and regulation (2006);
- SEPA's Position Statement WAT-PS-10-01: Assigning Groundwater Assessment Criteria for Pollutant Inputs (2014); and
- SEPA's Guidance for Pollution Prevention, with particular reference to:
  - GPP 1: Understanding your environmental responsibilities – good environmental practices;
  - GPP 5: Works and maintenance in or near water; and
  - PPG 6: Working at construction and demolition sites.

39. The EU Directives, although no longer directly applicable to UK situations, are still considered to represent best practice and are therefore taken into account as relevant guidance rather than legislation.

10.5 Baseline Conditions

10.5.1 Meteorology and Climate

40. The proposed Development is located on the Kintyre peninsula on the west coast of Scotland, within the UK Meteorological Office's Western Scotland regional climatic area (UK Met Office, 2021). Much of Western Scotland is exposed to the rain-bearing westerly winds, particularly areas along the west coast. Although in the more western part of the region, the proposed Development lies to the east of the islands of Islay and Jura, affording it a limited amount of ground-level protection from the rain-bearing westerly winds.

41. The Western Scotland climatic area includes part of the West Highlands, in the northern part of the region. This is one of the wettest areas in Scotland, with annual rainfall over 3,500 mm in the areas of higher ground. In contrast, the upper Clyde valley and the coastal sections of Ayrshire and Dumfries and Galloway receive annual rainfall of less than 1,000 mm.

42. Average annual rainfall for the Site catchments varies between 1,707 mm and 2,015 mm (CEH, 2021), reflecting the elevation and slope aspect of the catchments. Average annual rainfall for the climate monitoring station at Campbeltown Airport, Machrihanish, is 1,226.2 mm, and for the monitoring station at Rothesay, Isle of Bute, is 1,455.2 mm. **Figure 10.A** shows the average rainfall distribution through the year from these monitoring stations.

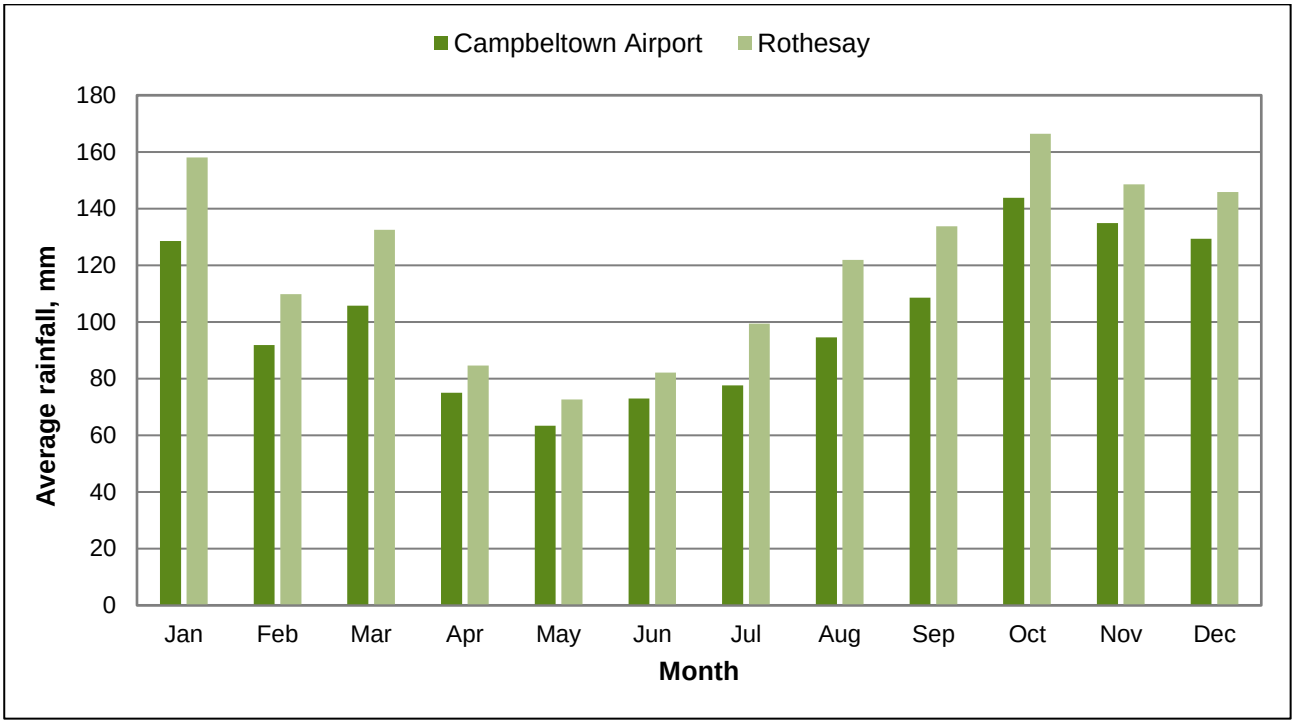

Figure 10.A Monthly rainfall averages for monitoring stations at Campbeltown Airport (Machrihanish, Kintyre) and Rothesay (Isle of Bute). Averages cover the period 1981-2010 for both stations. Met. Office (2020).

10.5.2 Geology

43. Geological information is derived from the BGS GeoIndex online geological mapping (BGS, 2021) and BGS map sheets Sound of Gigha (Sheet 20 and part of 21W) and Kilfinan (Sheet 29W and part of 21W) (BGS, 1996; 2000).

10.5.2.1 Bedrock Geology

44. The Site is underlain by bedrock from the Beinn Bheula Schist Formation, part of the Southern Highland Group of the Dalradian Supergroup, of Pre-Cambrian age. This formation is described as 'psammite, quartzose to micaceous, locally gritty, with phyllitic semipelite'. Bedrock and superficial geology mapping are provided in **Figure 10.1**.

45. Two sets of dykes are mapped within the Site. The oldest trends roughly east-west through the central part of the Site and consists of quartz microgabbro of the Central Scotland Late Carboniferous Tholeiitic Dyke Swarm. The younger dykes are shown to be olivine microgabbro of the Mull Dyke Swarm, part of the North Britain Palaeogene Dyke Suite. These dykes follow either a north west to south east or north east to south west orientation and are generally limited in extent.

46. The Site lies across the Cowal Antiform, a major regional up-fold structure. The fold axis crosses the Site with a north east to south west orientation.

47. A number of minor inferred faults and slides are indicated on the geological mapping. These form two sets, oriented north east to south west and north west to south east. The area is largely without significant fault displacement.

48. One minor earthquake has been recorded within the Site (BGS, 2021). This was recorded in September 2008, with a Richter local magnitude (R_{ML}) of 1.8. Two further events have been recorded just outwith the Site, both of smaller magnitude (R_{ML} 1.4 in 2009 and R_{ML} 1.1 in 2015; BGS, 2021). All recorded events in this region are of very minor significance.

10.5.2.2 Mineral Extraction

49. There is no evidence of mining within the area (BGS, 2021; Coal Authority, 2021).

50. Parts of all the Site lie within Mineral Assessment Areas for silica sand and silica rock, limestone, hard rock aggregate, limestone and dolomite (BGS, 2021). A Mineral Reconnaissance Programme report from the BGS covers part of the northern Site; the report is 'Gold mineralisation in the Dalradian rocks of Knapdale-Kintyre, south west Highlands, Scotland' (Gunn *et al.*, 1996).

51. A number of existing borrow pits are present within the Site. It is understood that these are all related to the forestry works within the active forest areas.

10.5.2.3 Superficial Geology

52. Superficial geology information is derived from the BGS GeoIndex online geological mapping superficial deposits 1:50,000 map (BGS, 2021).

53. The Site has limited superficial deposits. The Skipness River valley is indicated to have deposits of diamicton till. This is a highly variable glacial sediment consisting of unsorted material ranging in size from clay to boulders, usually with a matrix of clay to sand. Some alluvium is also indicated along the Skipness River valley. Alluvium is variably formed from mixed clay, silt, sand and gravel and is typically associated with watercourses.Some coastal sections are indicated to have raised marine deposits formed from sand and gravel. These are confined to isolated very narrow strips along the eastern coast.

10.5.3 Soils and Peat

54. The Soil Survey of Scotland digital soils mapping shows four soil types within the Site (James Hutton Institute, 1981). Details on soils within the Site are provided in **Table 10.6**. Soils and peat mapping are provided on **Figure 10.2a** and **Figure 10.2b**.

Table 10.6 Soil Types within the Site

Soil Assoc.	Parent Material	Component Soils	Landforms	Vegetation	Area %
Strichen	Drifts derived from arenaceous schists & strongly metamorphosed argillaceous schists of the Dalradian Series	Brown forest soils, humus-iron podzols, humic gleys	Hill & valley sides with strong to very steep slopes; slightly & moderately rocky	Bent-fescue grassland; broadleaved woodland; rush pastures & sedge mires	10.3
		Peaty gleys, peat; some peaty podzols & peaty rankers	Hill sides with gentle & strong slopes; moderately rocky	Bog heather moor & blanket bog; Atlantic & Boreal heather moor; heath-rush – fescue grassland	38.7
		Peaty gleys, peaty rankers, peat; some peaty podzols	Rugged hills with gentle to strong slopes; very rocky	Atlantic, Boreal & bog heather moor; blanket bog; heath-rush – fescue grassland	47.2
Kintyre	Drifts derived from Dalradian schists & red sandstones, often water-modified	Peaty gleys; some peat	Undulating foothills with gentle slopes; slightly rocky	Flying bent grassland & bog; heath-grass – white bent grassland; rush pastures	3.8

55. The Soil Survey mapping does not identify extensive blanket peat within the Site, although almost all the Site is overlain by peaty gleys with peat and peaty podzols as secondary soils. Brown forest soils are present along the eastern coastal section.

56. The Carbon and Peatland 2016 map has been consulted to understand the carbon-rich soils, deep peat and priority peatland habitat within the Site (Scotland's Soils, 2016). The peatland classes present within the Site are outlined in **Table 10.7**.

Table 10.7 Carbon and Peatland Classes Present within the Site

Peatland Class	Description	Area %
Class 0	Mineral soils; peatland habitats are not typically found on such soils	5.19
Class 1	All vegetation cover is priority peatland habitat; all soils are carbon-rich soils and deep peat	0.23
Class 2	Vegetation cover is priority peatland habitat or areas with high potential to be restored; soils are carbon-rich soils, deep peat or peaty soils	2.18
Class 3	Dominant vegetation cover is not priority peatland habitat but is associated with wet and acidic type; occasional peatland habitats can be found. Most soils are carbon-rich soils, with some areas of deep peat	4.40
Class 5	Peat soil; soil information takes precedence over vegetation data; no peatland habitat recorded; may also show bare soil; all soils are carbon-rich and deep peat (defined within the document as 0.5 m or deeper)	88.00

57. The majority of the Site is underlain by Class 5 soils; these represent areas of commercial forestry plantation on peat soils and have a lack of peatland vegetation. Part of the northern section of the Site, north and west of the proposed turbine area, is underlain by Classes 1 and 2, which are considered to be nationally important carbon-rich soils, deep peat and priority peatland habitat. These areas are deemed likely to be of high conservation value. Part of the southern-most Site is underlain by Class 3, indicating that occasional peatland habitats can be found here. Mineral soils have been identified along the eastern edge of the Site.

58. Peat depth surveys were undertaken in March and May 2020 across the application boundary area and in August 2020 and April 2021 for areas of proposed infrastructure. The peat depth and reconnaissance surveys all confirm that peat is present in the area but is patchy and irregular in its distribution across the Site. The peat survey also confirmed that within the Site, peatland has been significantly modified for commercial forestry with extensive drainage systems present in many areas.

59. Much of the recorded peat is relatively shallow (<1.5 m), although some areas of deep peat (>1.5 m) are present. Areas of deep peat are patchy in distribution across the Site and usually form small basins between hill crests and around the headwater areas of some watercourses. Two main areas of deep peat were found approximately 60 m north of Turbine 9 and 120 m west of Loch na Machrach Mòire. There are also small areas of deep peat 170 m north west of Turbine 7, 100 m west of Turbine 1, 240 m north east of Turbine 13 and 60 m south of Turbine 5. Areas of very deep peat (>2.5 m) were infrequent within the Site; a notable area of very deep was located approximately 300 m north east of Turbine 9. More details of peat depth and peat depth variation are provided in **Technical Appendices 10.1** and **10.2**. An overview map of the peat depth distribution within the Site is provided in **Figure 10.3**.

10.5.4 Geomorphology

60. Local geomorphology is variable and undulating, with cliffs along the north east coast of the Kintyre peninsula. The Site lies on relatively high ground, with elevations reaching more than 300 m above Ordnance Datum (AOD). Across the Site, elevations range from sea level along the coast to 377 m AOD towards the middle of the Site at Cruach Doire Lèithe.

61. The Site is located across a dissected plateau surrounded by sloping ground to lower areas and the coast. The main plateau area is characterised by a series of notable hills with summits between 237 and 377 m AOD, and a large number of smaller rocky hills, with a distinctive north-east to south-west lineation visible in aerial imagery. Between the hills, the land is generally less than 14% slope, with the exception of some land in the north Corranbuie forest area and throughout the south west of the Skipness forest area.

62. The north eastern margin of the plateau area falls off steeply to the coastline. The slope is relatively smooth with numerous small watercourses providing drainage to this section. Slopes in the north western and southern margins are comparatively steep.

63. The south western margin of the Site is less clearly defined, as the plateau area continues beyond this area. Part of the south western margin, in the southern part of the Site, contains steep slopes in the section around the Skipness River valley.

10.5.5 Hydrogeology

64. Bedrock and superficial aquifers are classified on the basis of the type of flow and level of productivity (**Table 10.8**),

Table 10.8 Aquifer Classification (Scottish Government, 2021)

Aquifer class	Flow type	Level of productivity
1A	Significant intergranular flow	Highly productive aquifer
1B	Significant intergranular flow	Moderately productive aquifer
1C	Significant intergranular flow	Low productivity aquifer
2A	Flow is virtually all through fractures and discontinuities	Highly productive aquifer
2B	Flow is virtually all through fractures and discontinuities	Moderately productive aquifer
2C	Flow is virtually all through fractures and discontinuities	Low productivity aquifer
3	None	Rocks with essentially no groundwater

65. The Site is underlain by bedrock forming part of the Oban and Kintyre groundwater body, classed as a 2C low productivity aquifer with flow virtually all through factures and other discontinuities, comprising Dalradian schists, psammites and semi-pelites (Scottish Government, 2021; BGS, 2021). Groundwater flow is concentrated principally within the near-surface weathered zone, which typically extends to around 1-2 m below ground surface. Groundwater storage and flow at deeper levels requires the presence of a network of fractures within the bedrock, which are infrequent and often isolated in these strata.

66. Regional groundwater flow will tend to mimic the natural topography, flowing north and east in the northern part of the Site and south and east in the southern part. It is likely that natural groundwater discharges will be partly via small flows to springs and streams on the hill slope, but principally to the sea.

67. There are no groundwater bodies within superficial geological deposits present within the application boundary.

68. The peat bodies will also hold some groundwater, although peaty gleys are known to have poor and impeded drainage. Flow within peat is extremely slow, although it can contribute some limited baseflow to local burns.

10.5.5.1 Groundwater Vulnerability

69. Groundwater vulnerability is divided into five main categories (**Table 10.9**).

Table 10.9 Groundwater Vulnerability Classifications and Their Interpretation (Dochartaigh *et al*., 2011)

Vulnerability class	Description	Frequency of activity	Travel time
5	Vulnerable to most pollutants, with rapid impacts in many scenarios	Vulnerable to individual events ↓ Vulnerable only to persistent activity	Rapid ↓ Very slow
4	Vulnerable to those pollutants not readily adsorbed or transformed		
	4a: May have low permeability soil; less likely to have clay present in superficial deposits		
	4b: More likely to have clay present in superficial deposits		
3	Vulnerable to some pollutants; many others significantly attenuated		
2	Vulnerable to some pollutants, but only when they are continuously discharged/leached		
1	Only vulnerable to conservative pollutants in the long term when continuously and widely discharged/leached		
0	Not sufficient data to classify vulnerability		

70. The groundwater in the Site has mainly been assigned vulnerability class 5, likely to be a reflection of the lack of superficial deposits across most of the Site leading to a high vulnerability classification. A small area around the Skipness River has

been assigned vulnerability classes 3, 4a and 4b; these are lower vulnerability classes that reflect the presence of low permeability soils and clay in superficial deposits in this area.

10.5.5.2 GWDTE

71. A habitat mapping exercise was completed as part of the ecology baseline assessment, which was used to identify potential GWDTE within the Site. The results of the habitat mapping exercise are discussed in detail within **Chapter 8**.

72. GWDTE are defined by UKTAG (2004) as:

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

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

74. National Vegetation Classification (NVC) communities identified by SEPA as potentially highly or moderately groundwater dependent, depending on the hydrogeological setting, are listed in SEPA's publication "*Planning guidance on on-shore windfarm developments*" (SEPA, 2017). The potentially groundwater-dependent NVC communities identified within the Site are:

- M23 – *Juncus effusus/acutiflorus – Galium palustre* rush-pasture;
- M25 – *Molinia caerulea – Potentilla erecta* mire.

75. M23 is described as having a potentially high groundwater dependency, and M25 is described as having a potentially moderate groundwater dependency in Scottish situations (SEPA, 2017). NVC mapping for the Site is shown on **Figure 8.5** and discussed further in **Chapter 8**.

76. An assessment of the GWDTE has been undertaken separately and details are provided in **Technical Appendix 10.4**.

77. Ten areas of M25 mire and three areas of M23 rush-pasture were identified within the infrastructure buffer. The potentially groundwater-dependent habitats have been assessed specifically within the context of the proposed Development, taking into account the local geology, hydrogeology, peat distribution and site observations. Mapped superficial deposits were absent within the vicinity of the identified communities; however, significant thicknesses of peat were generally present in areas around the watercourse channels. The underlying bedrock is a low productivity aquifer, and the small amounts of groundwater are likely to be insulated from the surface by the peat present. The peat itself is likely to contain some water; however, flow will be slow, limiting the amount of water available and likely only to form a partial source of water during prolonged dry periods.

78. All of the identified areas of M23 rush-pasture are closely associated with watercourses and are restricted to the immediate area of the channel or associated surface drainage.

79. It is determined as a result that neither of the two potentially groundwater-dependent communities within the Site are actually groundwater-dependent in this area but rely on a mix of surface water, shallow throughflow in surface vegetation and rainwater. Hydrology

80. The proposed Development is located across the catchment areas for three main watercourses, plus approximately 20 smaller watercourses which provide drainage along the eastern side of the Site. The minor watercourses all drain east directly to sea. Most have no identified name; named watercourses (from north to south) include the Allt a' Bhacain, Allt Beithe, Allt Airigh nan Cuilean, Allt Oamhna, Allt Coire Laraich, Allt Airigh Fhuair and Allt Uinnsinn. The catchment areas are shown on **Figure 10.4.**

81. The three main watercourses that provide drainage to the Site are the Skipness River, the Bardaravine River and the Allt Achachoish. All watercourse catchments are shown on **Figure 10.4**.

82. The Catchment Wetness Index, PROPWET, for the three main Site catchments are all 0.660, indicating the soils within the Site are wet for 66% of the time. The area has a relatively low Baseflow Index, indicating that groundwater contribution is of limited importance to Site watercourses. The Standard Percentage Runoff is relatively high, indicating that 50-55% of Site rainfall is converted into surface runoff from rainfall events. Catchment statistics are derived from the Flood Estimation Handbook Web Service (CEH, 2021).

83. Catchment statistics are derived from the Flood Estimation Handbook Web Service (CEH, 2021). Full catchment statistics are provided in **Table 10.10**. Catchment statistics have only been provided for the main catchments within the Site.

Table 10.10 Site Catchment Statistics

Catchment Name	Catchment Wetness Index (PROPWET)	Base Flow Index (BFI HOST19)	Standard Percentage Runoff (SPR HOST)	% of Site within catchment
Skipness River	0.660	0.276	54.80 %	56.8
Bardaravine River	0.660	0.272	54.10 %	1.9
Abhainn Achachoish	0.660	0.304	50.84 %	5.0
Allt a' Chnoic Ghlais	0.660	0.282	54.01 %	2.1
Morrison's Mill Burn	0.660	0.278	55.04 %	4.0
Allt Beithe	Not available			2.4
Unnamed catchment 1	Not available			1.4
Unnamed catchment 2	Not available			1.4
Unnamed catchment 3	Not available			1.3
Unnamed catchment 4	Not available			3.3

10.5.6 Watercourse Catchments

10.5.6.1 Skipness River

84. The Skipness River drains the southern part of the Site and the vast majority of the proposed Development, flowing broadly south-south west into the Kilbrannan Sound at Skipness. The catchment covers an area of 14.7 km^2 and includes one small waterbody, Loch na Machradh Mòire, which is within the application boundary. The catchment lies at elevations between 422 m AOD at Cnoc a' Bhaile-shios, just west of the Site, and sea level at Skipness. The highest point within the Site is Cruach na Machrach, at 346 m AOD.

85. The catchment is primarily commercial forestry, with some peatland and some agricultural land near the coast. Within the Site, the catchment land use consists primarily of commercial forestry. In areas outwith the Site, land use consists of moorland with some commercial forestry and agricultural land.

10.5.6.2 Bardaravine River

86. The Bardaravine River drains the north-central part of the Site and flows mainly west into West Loch Tarbert. Its catchment covers an area of 7.6 km^2. The catchment lies at an elevation between 422 m AOD at Cnoc a' Bhaile-shios and sea level. The highest point within the Site is Cruach an t-Sorchain, at 343 m AOD.

87. This catchment is a mix of commercial forestry, peat moorland, agricultural land and native forestry. Within the Site, this catchment comprises commercial forestry and peat moorland.

10.5.6.3 Abhainn Achachoish

88. The Abhainn Achachoish drains the north westernmost part of the Site and flows broadly south-west into West Loch Tarbert at Corranbuie. Its catchment covers an area of 4.0 km^2. The catchment lies at an elevation between 237 m AOD at Cnoc an Fhreacadain and sea level.

89. This catchment is a mix of commercial forestry, native forestry and peat moorland. Within the Site the catchment is primarily commercial forestry.

10.5.6.4 Allt a' Chnoic Ghlais

90. The Allt a' Chnoic Ghlais drains part of the north eastern section of the Site and flows north-east into Loch Fyne, just south of Mealdarroch Point. Its catchment covers an area of 1.8 km^2. The catchment lies at an elevation between 340 m AOD and sea level. The catchment is a mix of coniferous and non-coniferous forestry, with the majority of the catchment area being commercial forestry.

10.5.6.5 Morrison's Mill Burn

91. The Morrison's Mill Burn drains from a small, unnamed lochan in the north eastern section of the Site. It flows in a north easterly direction into Loch Fyne, entering the loch at Morrison's Mill. Its catchment covers an area of 1.2 km^2. The catchment lies at an elevation between 355 m AOD and sea level. The catchment is a mixture of commercial and non-commercial forestry.

10.5.6.6 Allt Beithe

92. The Allt Beithe drains from the north eastern section of the Site. It flows in a north easterly direction into Loch Fyne, entering the sea loch between Mealdarroch Point and Rubha Clach an Tràghaidh. The catchment lies at an elevation between 340 m AOD and sea level. The catchment is a mixture of commercial and non-commercial forestry, with the majority of the catchment area being commercial forestry.

10.5.6.7 Unnamed Catchments

93. The first unnamed catchment drains the furthest north part of the Site, near Tarbert. It flows broadly north and enters Loch Fyne between Tarbert Pier and Rubha Loisgte. Its catchment area is 0.6 km^2. The catchment lies at an elevation of 260 m AOD and sea level, and the majority of the area is commercial forestry.

94. The second unnamed catchment drains the south-eastern section of the Site. It flows from west to east into Loch Fyne, entering the sea loch approximately 500 m north of Sgolaig. Its catchment area is 0.3 km^2. The catchment lies at an elevation of 300 m AOD and sea level. The catchment is a mixture of commercial and non-commercial forestry. The section of the catchment that lies within the Site is entirely commercial forestry.

95. The third unnamed catchment drains the south-eastern section of the Site. It flows from south west to north east into Loch Fyne, entering the loch 100 m further south from unnamed catchment two. The catchment area for unnamed catchment three is also 0.3 km^2, and it lies at an elevation between 260 m AOD and sea level. The catchment is a mixture of commercial and non-commercial forestry, and the section within the Site is entirely commercial forestry.

96. The fourth unnamed catchment drains the southernmost section of the south-eastern edge of the Site. It flows broadly from west to east and drains into Loch Fyne 300 m south of Rubha Leathan. The catchment area is 0.7 km^2. It lies at an elevation between 240 m AOD and sea level. The catchment is a mixture of commercial and non-commercial forestry, the section within the Site is entirely commercial forestry.

10.5.7 Water Quality

10.5.7.1 Surface Waterbodies

97. SEPA's Water Classification (SEPA, 2021a) and Water Environment Hubs (SEPA, 2021b) have been consulted to determine the existing baseline water quality for the main watercourses and waterbodies within the Site. The Skipness River is the only classified watercourse within the Site, details are summarised in **Table 10.11**.

Table 10.11 Baseline Surface Water Quality Status, Summarised

Waterbody Name and ID	Status		Pressures
Skipness River (ID 10250)	**Condition in 2014**	Overall: Good Water flows & levels: High Physical condition: High Water quality: Good	None
	Classification in 2018	Overall: Good ecological potential Biology (fish): Good Hydromorphology: High	

10.5.7.2 Groundwater

98. Scotland's environment groundwater classification map (2021) was also consulted for groundwater quality information. The Oban and Kintyre groundwater body has been classified as 'Good'.

10.5.7.3 Receiving Waterbodies

99. SEPA's Water Classification (SEPA, 2021a) and Water Environment Hubs (SEPA, 2021b) have also been consulted to determine the existing baseline water quality for the Site's receiving waterbodies.

100. The Skipness catchment drains south-south-west into the Kilbrannan Sound coastal waterbody. The Bardaravine River and Abhainn Achachoish drain west into the West Loch Tarbert coastal water body. Tributaries along the eastern Site drain east into the Loch Fyne coastal waterbody. The Alltan Uinnsinn in the south east Site drains south-east into the Sound of Bute coastal waterbody. The receiving waterbody details are summarised in **Table 10.12**.

Table 10.12 Receiving Waterbody Quality Status, Summarised

Waterbody Name and ID	Status		Pressures
Loch Fyne – Outer Basin (ID 200042)	**Condition in 2014**	Overall: Good Physical condition: High Water quality: Good	None
	Classification in 2018	Overall: Good ecological potential Biological elements: Good Hydromorphology: High	
Sound of Bute (ID 200027)	**Condition in 2014**	Overall: Moderate Physical condition: High Water quality: Moderate	None
	Classification in 2018	Overall: Good Biological elements: Good Hydromorphology: High	
Kilbrannan Sound (ID 200025)	**Condition in 2014**	Overall: Good Physical condition: High Water quality: Good	Unknown pressures on water quality
	Classification in 2018	Overall: Good Biological elements: Good Hydromorphology: High	
West Loch Tarbert (Kintyre) (ID 200307)	**Condition in 2014**	Overall: Good Physical condition: High Water quality: Good	None
	Classification in 2018	Overall: Good Biological elements: Good Hydromorphology: High	

10.5.8 PWS

101. No PWS are known to be present within the Site. Details of identified PWS within 2 km of the application boundary are provided in **Table 10.13** and locations are shown on **Figure 10.5**. Information in this Section has been obtained from Argyll & Bute Council's Environmental Health Department.

102. Two classes of private water supply exist: A1, which serve commercial premises such as bed and breakfasts, holiday cottages or chalet parks; and B, which serve private homes. B supplies usually only serve one property.

103. PWS form two main clusters: around Skipness, near the southern region of the application boundary, and around Corranbuie, where the access route leaves the A83, near the north western region of the application boundary.

Table 10.13 Details of PWS near the Site

ID	Supply Name (class)	Source Location	Source Type	Properties Served	Distance from Application Boundary	Linkage?
Skipness Cluster						
1	Culindrach/MOD Skipness (A1)	NR 9141 5951	Surface water	4	0.4 km south	Potential, surface water source located downstream of Site
2	Lilypond (A1)	NR 9047 5888	Surface water	2	0.5 km east	Potential, surface water source located downstream of Site
3	Coalfin (A1)	NR 8966 5807	Groundwater	1	0.8 km south	None, source is located in a separate sub-catchment
4	Crowglen (A1)	NR 8961 5778	Surface water	14	1.1 km south	None, source is located in a separate catchment
5	Glebe House (B)	NR 8980 5761	Unknown	1	1.2 km south	None, source is located in a separate catchment
6	Campbells Cottage (B)	NR 9017 5767	Groundwater	1	1.2 km south	None, source is located in a separate sub-catchment
7	Glenbuie (B)	NR 8868 5736	Unknown	1	1.9 km south-west	None, source is located in a separate catchment
Corranbuie Cluster						
8	West Loch Shores Tarbert Holiday Park (A1)	NR 8453 6645	Surface water	10	1.1 km north-west	None, source is located in a separate catchment
9	Escart (B)	NR 8462 6680	Unknown	1	1.2 km north-west	None, source is located in a separate catchment
10	Corranbuie (B)	NR 8429 6590	Surface water?	1	1.2 km west	Potential, surface water source likely to be located downstream of access track
11	Sunnyside (B)	NR 8352 6536	Unknown	1	1. 6 km west	None, source is located in a separate catchment
12	Bardaravine (B)	NR 8368 6488	Surface water	1	1.6 km west	Potential, surface water source located downstream of Site
13	Woodhouse West Loch (B)	NR 8357 6516	Unknown	1	1.8 km west	None, source is located in a separate catchment

10.5.9 Flood Risk

104. SEPA's Indicative Flood Map (SEPA, 2021c) was consulted to gain an overview of the likelihood of flooding within the Site. Flood risk within the Site is shown to be minimal, with some localised regions of river (fluvial) and surface water (pluvial) flood risk.

105. No elements of the proposed Development are indicated to be at risk from flooding from any source.

106. River flooding is confined to the main channels of the Bardaravine River and the Skipness River near the edges of the application boundary. Additionally, there are some very small localised regions of surface water (pluvial) flooding, largely along already defined watercourse channels and within or near water bodies near the central Site.

10.5.10 Designated Sites

107. Designated sites of relevance to hydrology, hydrogeology and geology that are located within 5 km of the application boundary were reviewed; data was collated from NatureScot (2021). Designated sites reviewed include Sites of Special Scientific Interest (SSSI), Special Areas of Conservation (SAC) and Ramsar sites (internationally recognised wetlands). Geological Conservation Review (GCR) sites have also been included for completeness; these do not have a statutory designation but are considered to be important for geological understanding and many are also protected as SSSI.

108. The area containing the Tarbert woods and cliffs is designated as both an SSSI and SAC for features relating to hydrology. It is present along the full extent of the eastern section of the Site where most development is proposed. The two site names for this area are detailed in **Table 10.14**. The location of this designated site is provided in **Chapter 8**, **Figure 8.1**.

Table 10.14 Designated Sites Relevant to Hydrology, Hydrogeology, Geology and Soils.

Site Name	Qualifying Features Relating to Hydrology	Distance From Site	Linkage?
Tarbert Woods SAC	No direct hydrological qualifying features. Western acidic oak woodland habitat; Bryophyte plant assemblage.	Immediately adjacent to application boundary, 340 m west of nearest infrastructure.	Watercourses flowing from proposed Development area to designated site.
Tarbert to Skipness Coast SSSI			

10.6 Influence on Design

109. The importance of hydrology, hydrogeology, geology and peat has been recognised throughout the proposed Development design process. Key constraints that have had a considerable influence on design are:

- peatland and peat depth;
- watercourses and waterbodies;
- designated areas with a hydrological linkage; and
- potential GWDTE.

110. Other constraints that were considered but have not been required for the proposed Development include PWS and public water supply infrastructure.

111. The scoping layout of turbines was identified as requiring changes following the first phase of peat depth surveys, as a number of the turbines were located in areas of deep peat (**Figure 10.6**). Subsequent phases of design have made use of the detailed local peat depth data collected through the peat depth surveys to ensure that significant infrastructure (turbines, crane pads, compounds etc.) is located in areas with peat preferably less than 1.0 m and in no location with peat depth greater than 1.5 m. Tracks have for the most part been confined to areas of peat less than 1.2 m in depth, with a few small areas of new floating track where crossing peat deeper than 1.2 m was necessitated by the balance of other environmental constraints (please refer to **Figure 10.8**).

112. The existing forestry track has been used as much as possible to minimise the requirement for new track. Where existing track is understood to use floating construction, any track widening would also be of floating construction (**Figure 10.8**).

113. Watercourse crossings have been kept to a practical minimum, with sixteen regulated crossings and eight minor crossings required for the Development (**Technical Appendix 10.5, Figure 10.5.2,**). Most of these are on relatively small headwater channels, and most are existing crossings on the existing forestry track. Only three are completely new crossings, two are regulated crossings and one is a minor crossing.

114. The nearby designated site with a hydrological linkage has been avoided for any proposed infrastructure. Monitoring requirements to ensure protection for this designated area downstream of the proposed Development are set out in **Table 10.16**.

115. Potentially sensitive wetland habitats have been avoided where possible. Other constraints including ecology, forestry felling and visual impact were important considerations that required balancing with peatland, hydrology and wetland habitats.

116. Key infrastructure design iterations are shown on **Figure 10.6**.

10.7 Assessment of Effects

10.7.1 Development Characteristics

117. The construction phase of the proposed Development would involve a number of different elements. **Chapter 3** of the EIA Report describes the scheme elements in detail. The elements with particular relevance to hydrology, hydrogeology, geology and soils are as follows:

- construction of access routes and watercourse crossings;
- excavation and construction of turbine foundations and associated crane pads;
- creation of construction compounds, laydown areas and a substation;
- excavation of borrow pits and processing of excavated rock;
- installation of permanent met masts;
- installation of drainage features around permanent infrastructure;
- batching of concrete (if required);
- temporary welfare facilities and site utilities including water supply and foul water disposal; and
- removal, handling and temporary storage of peat and soils.

118. During operation of the proposed Development, activities with particular relevance to hydrology, hydrogeology, geology and soils are as follows:
- Surface water drainage, including treatment and discharge of surface drainage;
- Maintenance of tracks and trackside drainage;
- Long term drainage around permanent infrastructure; and
- Additional extraction and processing of rock for necessary maintenance.

10.7.2 Effects During Construction

10.7.2.1 Physical Changes to Overland Drainage and Surface Water Flows

119. Changes to overland drainage patterns would arise principally from construction of new access track and upgrades to existing access track, with subsidiary effects from construction of the turbine foundations, crane pads and ancillary infrastructure.

120. The new access track would require installation of trackside drainage and cross-drains to protect the track from water damage. Modifications to the existing access track would require modifications and possibly expansion of trackside drainage and cross-drains. Constructed drains would be no longer and deeper than necessary to provide the required track drainage. Cross-drains would be installed at an appropriate frequency to minimise concentration of flows from above the track, where cross-slopes are present, and to prevent diversion of flows between sub-catchment areas, to minimise changes to the hydrological regime. All drainage infrastructure would be designed with suitable capacity for a rainfall intensity of a 1-in-200 year storm event, plus allowance for climate change (Scottish Government, 2014; SUDSWP, 2016).

121. A number of watercourses would be crossed by the access track. Sixteen crossings of regulated watercourses have been identified and details are provided in **Technical Appendix 10.5**. Only two of these crossings would be new structures.

122. Eight minor, unregulated watercourses would also require a crossing to be installed. Seven are existing crossings to be upgraded, with one new crossing being required. These crossings would be designed with sufficient capacity for a rainfall intensity of a 1-in-200 year storm event, plus allowance for climate change (Scottish Government, 2014; SUDSWP, 2016).

123. All necessary permissions required for watercourse crossing works would be obtained prior to commencement of associated works.

124. The receptor, surface watercourses within the Site, is considered to be of **Medium** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be of **Slight** magnitude. The likelihood of effect is considered to be **Likely**.

125. The effect of physical changes to overland drainage from construction works is assessed as **Minor**, long-term and adverse.

10.7.2.2 Particulates and Suspended Solids

126. All development work involving earthmoving operations would generate loose sediment, which could potentially gain access to surface watercourses and waterbodies through entrainment in surface runoff. This could potentially have an adverse effect on the downstream watercourses through damage to fish spawning habitat and changes to dissolved oxygen and nutrient levels in watercourses and waterbodies.

127. Surface water from the areas surrounding the turbine bases, all hardstanding areas (including crane pads, substation, construction compounds and laydown areas) and borrow pits would be prevented from entering the working areas by appropriate use of peripheral bunding and cut-off drains. These would help to divert clean water around and away from the working areas.

128. During excavation works for turbine foundations, cut sections of track, cut areas for hardstandings and borrow pits, silt fencing or appropriate alternative sediment control protection would be installed on the downhill side of the excavation to prevent inadvertent discharge of silty water into any site watercourse.

129. All engineering work adjacent to watercourses, including track construction and installation of watercourse crossings, would have appropriate sediment control measures established prior to any groundworks. Vegetation would be retained along watercourse banks to act as additional protection.

130. In-stream works are likely to be required during upgrading works for existing watercourse crossings. It is anticipated that this work would be undertaken using a temporary dam, alongside over-pumping if required, depending on flow conditions. The two new crossings are not anticipated to require in-stream works.

131. Minor in-stream works would be required for the crossings of the minor watercourses noted above. This work would be undertaken using a temporary dam to control flow whilst the culvert pipes are installed. Over-pumping would only be used if flow conditions require this.

132. For areas of larger excavation, such as turbine bases and crane pads or borrow pit excavations, temporary water control measures will be used. These may include use of temporary settlement ponds or the use of proprietary treatment systems such as Siltbusters, as appropriate.

133. Construction activities would be restricted during periods of wet weather, particularly for any work occurring within 20 m of a watercourse or within areas of identified deeper peat, to minimise mobilisation of sediment in heavy rainfall. The 'stop' conditions in **Table 10.15** are recommended to guide construction activity (CH2M & Fairhurst, 2018):

Table 10.15 Recommended 'Stop' Conditions for Earthmoving Activities

'Stop' rule	Requirements
High intensity rainfall	Rainfall during construction greater than 10 mm per hour
Long duration rainfall	Rainfall in the preceding 24 hours greater than 25 mm
7-day cumulative rainfall (1)	Preceding 7 days of rainfall greater than 50 % of the monthly average
7-day cumulative rainfall (2)	Preceding 7 days of rainfall greater than 50 mm

134. Any water collecting within excavations would be pumped out prior to further work in the excavation. This water may require treatment to remove suspended solids prior to discharge to ground.

135. Vegetation cover would be re-established as quickly as possible on track verges, screening bunds and cut slopes, by re-laying of excavated soil turves and peat acrotelm, to improve slope stability and provide erosion protection. Additional methods, including hydroseeding and/or use of a biodegradeable geotextile, would be considered, if necessary, in specific areas and areas of particular sensitivity as identified on site by the Environmental Clerk of Works (ECoW)

136. All necessary permissions relating to construction works, plus accompanying pollution prevention plans, would be obtained prior to any construction work beginning within the Site.

137. A water quality monitoring programme would be established at key locations around the proposed Development (see **Table 10.18** and **Figure 10.7**). Monitoring would begin prior to any construction works, to allow pre-construction baseline quality to be determined. Details would be agreed with SEPA, but are anticipated to include at least the following:

- visual checks for entrained sediment; and
- in-situ measurements of pH, temperature, specific conductivity.

138. Monitoring during the construction phase would be undertaken by the ECoW or suitably experienced alternative individual. Any change from baseline conditions of pH and/or specific conductivity would potentially indicate an incident and additional investigation would be required in order to identify the origin of the change. Control locations (WQ2, 5, 7, 8 and 10) are intended to help differentiate between incidents arising from and those unrelated to, the proposed Development. Details are provided in **Table 10.16** and shown on **Figure 10.7**.

Table 10.16 Water Quality Monitoring Locations and Recommended Monitoring Frequency by Phase of Development

ID	Location	Monitoring schedule
WQ1	Abhainn Achachoish watercourse, close to the site entrance downstream from WC01.	**Baseline**: Monthly, min. 3 months **Construction**: Twice daily during all construction work on the access track and site entrance compound; weekly during all BP1 operations; otherwise monthly.
WQ2	Allt Airigh nan Eun watercourse, tributary to the Abhainn Achachoish watercourse. Upstream from the track, 200 m south west of Borrow Pit 1 (Control).	
WQ3	Garbh Allt watercourse, 250 m west of Turbine 1 and south of Turbine 7.	**Baseline:** Monthly, min. 3 months **Construction:** Twice daily during all construction work at the construction compounds, Turbine 1, 7, 13 & 14; weekly during all Borrow Pit 2 operations (see **Technical Appendix 10.3**); otherwise monthly.
WQ4	Garbh Allt watercourse, 150 m south of Turbine 14.	
WQ5	Tributary of Garbh Allt watercourse, upstream of track 350 m of west of Turbine 7 (Control).	
WQ6	Allt Carn Chaluim watercourse, 600 m west of Turbine 4 and 1 km north along the track from Glenskible.	**Baseline:** Monthly, min. 3 months **Construction:** Twice daily during all construction work at Turbine 2, 9, 11 and 12; weekly during all Borrow Pit 3 operations (see **Technical Appendix 10.3**); otherwise monthly.
WQ7	Allt Carn Chaluim watercourse, upstream between Turbine 8 and 9, 400 m south east of Loch na Machrach Mòire (Control).	
WQ8	Tributary to Allt Carn Chaluim watercourse, upstream between Turbine 9 and 11, 150 m north from the bend in the track to Turbine 9 (Control).	
WQ9	Eas a' Chromain watercourse, 530 m west of Turbine 4 and 1 km north along the track from Glenskible.	**Baseline:** Monthly, min. 3 months **Construction:** Twice daily during all construction work at the solar area, Turbine 2, 3, 4, 5, 6 & 10; weekly during all Borrow Pit 3 operations; otherwise monthly.
WQ10	Tributary to Eas a' Chromain watercourse, upstream between Turbine 5 and 10 (Control).	

139. The receptor, surface watercourses within the Site, is considered to be of **Medium** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be **Slight**. The likelihood of effect is considered to be **Likely**.

140. The effect of particulates and suspended solids from construction works is assessed as **Minor**, temporary and adverse.

10.7.2.3 Water Contamination from Fuels, Oils, Concrete Batching or Foul Drainage

141. Spillage of fuels, oils, wet concrete or concrete washout water could have an adverse effect on surface water quality, and major spillages could have a potential influence on the Skipness River system, with smaller potential influences on the Bardaravine River and Abhainn Achachoish systems as a result of the smaller infrastructure footprint in these catchments.

142. Oil and fuel storage and handling within the Site would be undertaken following published guidance, in particular *Guidance on Pollution Prevention 2 – Above ground oil storage tanks* (SEPA, 2018) and in compliance with the *Water Environment (Oil Storage) (Scotland) Regulations 2006*. The details are as follows:

- risk assessments would be undertaken and all Hazardous Substances and Non-Hazardous Pollutants that would be used and/or stored within the Site would be identified. Hazardous substances likely to be within the Site include oils, fuels, hydraulic fluids and anti-freeze. No non-hazardous pollutants have been identified as likely to be used within the Site. Herbicides would not be used;
- all deliveries of oils and fuels would be supervised by the Site Manager or appointed deputy;
- all storage tanks would be located within impermeable, bunded containers where the bund is sufficient to contain 110% of the tank's capacity. For areas containing more than one tank, the bund would be sufficient to contain 110% of the largest tank's capacity or 25% of the total capacity, whichever is the greater;
- any valve, filter, sight gauge, vent pipe or other ancillary equipment would be located within the containment area;
- waste oil would not be stored within the Site but would be removed to dedicated storage or disposal facilities;
- management procedures and physical measures would be put in place to deal with spillages, such as spill kits and booms;
- maintenance procedures and checks would ensure the minimisation of leakage of fuels or oils from plant;
- refuelling and servicing would be undertaken in a designated area or location with adequate precautions in place, such as a dedicated impermeable surface with lipped edges to contain any contaminants;
- where vehicle maintenance is necessary in the field, owing to breakdown, additional precautions would be taken to contain contaminants, such as spill trays or absorbent mattresses;
- the access track would be designed and constructed to promote good visibility where possible and two-way access where visibility is restricted, to minimise risk of vehicle collisions; and
- if concrete batching within the Site is required, this would take place in one designated location within the Site construction compound. This location would be at least 250 m from the nearest watercourse. Protective bunding would be installed around the batching area to ensure that contaminated runoff is contained. Dedicated drainage would be installed to ensure that water from the batching area can be suitably treated to reduce alkalinity and suspended sediment load prior to discharge, or removed from the Site by tanker for treatment and disposal offsite.

Foul Drainage Provision

143. There are no sewerage facilities available near the Site. The site welfare facilities would include either a suitably sized holding tank, which would be emptied by tanker and removed from the proposed Development on an appropriate timescale for disposal at a suitably licensed facility, or would make use of waterless composting toilet facilities with bottled water provided for drinking and washing.

Spillage and Emergency Procedures

144. The Spillage and Emergency Procedures would be prominently displayed at the Site and staff would be trained in their application. The Procedures document would incorporate guidance from the relevant SEPA Guidance Notes.

145. In the event of any spillage or discharge that has the potential to be harmful to or to pollute the water environment, all necessary measures would be taken to remedy the situation. These measures would include:

- identifying and stopping the source of the spillage;
- containing the spillage to prevent it spreading or entering watercourses, by means of suitable material and equipment;
- absorbent materials, including materials capable of absorbing oils, would be available within the Site to mop up spillages. These would be in the form of oil booms and pads and, for smaller spillages, quantities of proprietary absorbent materials. Sandbags would also be readily available for use to prevent spread of spillages and create dams if appropriate;
- where an oil/fuel spillage may have soaked into the ground, the contaminated ground would be excavated and removed from the Site by a licensed waste carrier to a suitable landfill facility;

- the emergency contact telephone number of a specialist oil pollution control company would be displayed within the Site; and
- sub-contractors would be made aware of the guidelines for handling of oils and fuels and of the spillage procedures at the Site.

146. SEPA would be informed of any discharge or spillage that may be harmful or polluting to the water environment. Written details of the incident would be forwarded to SEPA no later than 14 days after the incident.

147. A water quality monitoring programme would be established at key locations around the Site. Monitoring would begin prior to any construction works, to allow pre-construction baseline quality to be determined. Details are provided in **Table 10.16**.

148. The receptor, surface watercourses within the Site, is considered to be of **Medium** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be **Moderate**. The likelihood of effect is considered to be **Unlikely**.

149. The effect of water contamination from fuels, oils, concrete batching or foul drainage from construction works is assessed as **Minor**, temporary and adverse.

10.7.2.4 Changes In or Contamination of Water Supply to Vulnerable Receptors

150. Vulnerable receptors that have the potential to be affected by development works have been identified. These include two designated sites and a number of potential GWDTE. Thirteen PWS have also been identified as needing assessment (**Table 10.13** and **Figure 10.5**).

Designated Sites

151. Two designated sites have potential links to the Site and proposed works.

152. Both the Tarbert to Skipness Coast SSSI and Tarbert Woods SAC are located along the eastern side of the proposed Development. Neither site is designated for aspects directly linked to hydrology or soil conditions, and there is no proposed infrastructure within the SSSI/SAC boundary.

153. Precautions would be taken during construction to ensure that any potentially contaminating materials would not be permitted to enter any project area watercourses, particularly those that drain through the SSSI/SAC. These precautions are set out in **Sections 10.7.2.2** and **10.7.2.3.** All works that have potential to affect the SSSI/SAC would be supervised by the ECoW and additional levels of protection would be installed if advised by the ECoW during site works.

154. Water monitoring locations at key points downstream of proposed works would be included in the project water quality monitoring programme. No new or upgraded watercourse crossings will be required at watercourses that flow through the SSSI/SAC.

155. The designated sites with hydrological linkage are considered to be of **High** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be **Slight**. The likelihood of effect is considered to be **Unlikely**.

GWDTE

156. A detailed assessment of the interaction between the proposed Development and potential GWDTE has been undertaken. Two potentially groundwater-dependent NVC communities have been identified within the Site: M23 rush-pasture and M25 mire. M25 mire has potential moderate groundwater dependency and M23 rush-pasture has potential high groundwater dependency.

157. Ten areas of potentially groundwater-dependent M25 mire wetland habitat have been identified within the open area between Skipness and Corranbuie forest areas, wholly or partially inside the 100 m buffer around the access track. Three areas of potentially groundwater-dependent M23 rush-pasture wetland habitat have been identified within the 100m buffer around the access track or 250 m buffer around the proposed turbine foundations.

158. It is determined as a result that neither of the two potentially groundwater-dependent communities within the Site are actually groundwater-dependent in this area but rely on a mix of surface water, shallow throughflow in surface vegetation and rainwater.

159. Specific mitigation measures, to avoid changes to the watercourse hydrochemistry through 'flushing' of excavated soil in surface runoff, have been set out and would be adhered to during all site works. Careful construction to ensure suitable continuity of flow across site tracks would help to minimise any potential impacts to the wetland habitats present within the Site.

160. All works through and adjacent to wetland areas would be supervised by the ECoW.

161. Details of the GWDTE assessment are provided in **Technical Appendix 10.4**.

162. The potential GWDTE within the Site are considered to be of **Low** sensitivity as a result of the absence of any hydrogeological linkage and the low quality of the habitats. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be **Moderate**. The likelihood of effect is considered to be **Likely**.

PWS

163. A number of properties are known to be reliant on PWS in the area near to and downstream of the proposed Development. All individual PWS have been assessed using the source-pathway-receptor method, in line with current best practice guidance.

164. An initial screening assessment of potential pathways is provided in **Table 10.13**. The supplies identified through the screening process as potentially at risk from the proposed Development are considered in more detail in **Table 10.17**.

Table 10.17 PWS Risk Assessment

ID	Supply Name (class)	Source Type	Distance from Application Boundary	Assessment	At Risk
Skipness Cluster					
1	Culindrach/MOD Skipness (A1)	Surface water	0.43 km south	Source is located in separate sub-catchment from the proposed Development infrastructure, with surface and groundwater flows away from the source	No
2	Lilypond (A1)	Surface water	0.48 km east	Source is located in separate sub-catchment from the proposed Development infrastructure, with surface and groundwater flows away from the source	No
3	Coalfin (A1)	Groundwater	0.79 km south	Source is uphill and 160 m from the Skipness River which has tributaries draining areas of proposed Development infrastructure 3.5 km upstream. Limited risk through groundwater abstraction that is hydraulically connected to the river via alluvial deposits	Very low risk
4	Crowglen (A1)	Surface water	1.09 km south	Source is located in a separate catchment	No
5	Glebe House (B)	Groundwater	1.23 km south	Source is located in a separate catchment	No
6	Campbells Cottage (B)	Groundwater	1.24 km south	Source is 40 m from the Skipness River which has tributaries draining areas of proposed Development infrastructure 4.5 km upstream. Limited risk through groundwater abstraction that is hydraulically connected to the river via alluvial deposits	Very low risk

ID	Supply Name (class)	Source Type	Distance from Application Boundary	Assessment	At Risk
7	Glenbuie (B)	Unknown	1.85 km south west	Source is located in a separate catchment	No
Corranbuie Cluster					
8	West Loch Shores Tarbert Holiday Park (A1)	Surface water	1.1 km north west	Source is located in a separate catchment	No
9	Escart (B)	Unknown	1.2 km north west	Source is located in a separate catchment	No
10	Corranbuie (A1)	Surface water	1.19 km west	Source is 170 m downstream from the Construction compound and access track, potential pollution risk	Potential risk
11	Sunnyside (B)	Surface water	1.56 km west	Source is located in a separate catchment	No
12	Bardaravine (B)	Surface water	1.62 km west	Source is downstream from the Bardaravine River's tributaries which drain the proposed Development area access track 5.5 km upstream	Low risk
13	Woodhouse West Loch (B)	Unknown	1.75 km west	Source is located in a separate catchment	No

165. The surface water supply at Corranbuie has been assessed as potentially at risk due to it being close to the access track and construction compound, although the exact source location is unknown. It is possible that the source is from the mainstem of the Abhainn Achachoish or from one of its lower tributaries. Consultation with the property owner/resident would be required to identify the location source and what protection measures may be required if it sources the Abhainn Achachoish mainstem downstream of any works. Information was requested with relation to this PWS source, but no response was received.

166. The groundwater sources of Coalfin and Campbells Cottage are assessed as very low risk due to the distance downstream from the proposed Development and distance between the Skipness River and the groundwater abstraction points, reducing the potential for pollution. The Bardaravine surface water source has been assessed as low risk due to the distance from the proposed Development and the construction works that could affect the watercourse being limited to the access track.

167. The following mitigation would be applied to all works directly uphill from the surface water and groundwater supplies:

- no excavation works would begin until cut-off drains and sediment protection (silt fencing and/or pegged straw bales, as appropriate) have been installed between the construction works and the direct flow paths towards the supply sources; These would require sign-off by the ECoW prior to ground works beginning;
- early installation of permanent drainage infrastructure for the construction compound close to Corranbuie would be required, such that its effectiveness can be tested during the construction phase to ensure that drainage is not directed towards the PWS source;
- visual and in-situ water quality monitoring of the watercourses upstream from the PWS, at their closest points downstream of the ground works, would be undertaken on a twice-daily basis (morning and afternoon) while works are ongoing in the area of these watercourses;
- visual and in situ water quality monitoring at a location near to, and upstream of, the Corranbuie PWS intake would be taken twice daily while works are ongoing along the access route within the Abhainn Achachoish catchment. Any signs of siltation or suspended sediment, changes in pH or electrical conductivity in the water would be recorded and reported immediately to the ECoW for further investigation;
- no maintenance or refuelling activities would take place within 500 m of the PWS except as required within the designated area of the proposed construction compound;
- sediment protection measures would remain in place, with regular checks to ensure their continued effective operation, until all ground works are completed and vegetation has re-established on exposed soil areas;

- should any concerns regarding the water quality be raised by site staff or occupants at the PWS sites, ongoing activity within 500 m would be restricted as far as possible to allow further investigation to be undertaken to identify the cause of the concerns and their validity. Works would remain restricted until the investigation has demonstrated that it was a false alarm and/or not related to the proposed Development works, or until additional protection measures are installed to prevent a recurrence, to the ECoW's satisfaction. Provision of an alternative source of water, such as a water bowser, would be considered until concerns can be fully investigated; and
- no pouring of concrete would be carried out within 500 m of any PWS source.

168. The PWS with hydrological linkage are considered to be of **High** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be **Slight**. The likelihood of effect is considered to be **Unlikely**.

169. The effect of changes in or contamination of water supply to vulnerable receptors from construction works is assessed as **Minor**, temporary and adverse.

10.7.2.5 Increased Flood Risk

170. The proposed Development infrastructure is not at risk of flooding from any source.

171. The drainage infrastructure installed around long-term infrastructure would be designed to minimise concentration of flows. This would be achieved by:

- use of cut-off drains to divert runoff around necessary 'hard' infrastructure such as turbine bases and hardstanding areas;
- use of regular cross-drains underneath access tracks. These would be installed in line with the natural terrain, making use of low points where runoff would naturally be focused; and
- use of a slight gradient on installed 'hard' infrastructure to encourage drainage into a filter drain or swale, for infiltration into vegetated areas and as shallow through-flow.

172. Long-term drainage would be installed ahead of related construction works or excavations taking place, to ensure that site drainage can be controlled appropriately. For tracks, the required trackside drainage would be put in place ahead of access track construction, on a rolling basis as the track development progresses.

173. Any areas which have to be left unvegetated during the construction phase, such as turbine foundations, hardstanding areas and borrow pits, would have settlement ponds put in place to attenuate flow until vegetation can be re-established at the end of the construction period.

174. In line with best practice guidance, site runoff would not be greater than natural pre-development runoff (SUDSWP, 2016). Details are provided in **Technical Appendix 10.5**.

175. The receptors, infrastructure and property downstream of the proposed Development, are considered to be of **High** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be **Negligible**. The likelihood of effect is considered to be **Unlikely**.

176. The effect of increased flood risk resulting from the construction works is assessed as **Negligible**.

10.7.2.6 Physical Removal of Bedrock

177. Bedrock and superficial materials would require to be removed from turbine foundations, platforms for construction of hardstanding areas and, particularly, to facilitate development of borrow pits in order to provide aggregate for the proposed Development construction works.

178. These works would require permanent modification to the natural geology at the Site. As the footprint of the works within the Site is small, overall changes to the geological character of the area would be limited. There are no areas designated for geological characteristics within or adjacent to the proposed Development.

179. Rock testing would be undertaken on appropriate samples from the three proposed borrow pit areas to determine their suitability for unbound track and hardstanding construction. This would include testing to determine likely degradation patterns during the lifespan of the proposed Development. Should the tests identify problems with parts of the rock within the

borrow pit footprints, care would be taken to ensure that unsuitable material is not used for construction but would be retained for use in borrow pit restoration.

180. The Site bedrock receptor is considered to be of **Low** sensitivity. The magnitude of effect is considered to be **Slight**. The likelihood of effect is considered to be **Likely**.

181. The effect of physical removal of bedrock from construction works is assessed as **Minor**, long-term and adverse.

10.7.2.7 Modification to Groundwater Flow Paths

182. Physical changes to the shallow subsurface as a result of all excavation work have potential to interrupt shallow groundwater flow paths. This would include cut-and-fill track sections, turbine foundations, hardstanding areas, met masts, substation, laydown area, construction compounds and cable trenches.

183. Physical changes to the deeper subsurface (>5 m below ground surface) have potential to interrupt deeper groundwater flow paths. This would include borrow pit excavations and some turbine foundation areas.

184. The superficial deposits are noted to be largely without groundwater, although some groundwater would be present within the peat bodies and occasionally in parts of the glacial till. There is likely to be some groundwater flow via fracture networks within the bedrock.

185. Groundwater monitoring boreholes would be established within the three main borrow pit areas prior to any construction work beginning, to a depth at least 1 m below the deepest expected excavation. Groundwater level monitoring would be undertaken to determine whether groundwater is present within the borrow pit areas and, if it is, at what level the seasonally highest groundwater table stands. Any groundwater within the borrow pit area would be managed in line with best practice (SEPA, 2017), with discharge via a settlement pond to allow any entrained sediment to be removed prior to discharge. Any required discharge licence would be obtained prior to excavation commencing.

186. Excavation of cable trenches could lead to groundwater flow between catchments if the trenches act as preferential flow paths. This can be avoided by laying cables in disturbed ground adjacent to access tracks. In areas where cable routes cross up or down notable slopes, clay bunds or alternative impermeable barrier would be placed for every 0.5 m change in elevation along the length of the trench to minimise in-trench groundwater flow.

187. The Site groundwater receptor is considered to be of **Medium** sensitivity. With appropriate design constraints and mitigation measures in place, as described, the magnitude of the works is considered to be **Slight**. The likelihood of effect is considered to be **Likely**.

188. The effect of modification to groundwater flow paths from construction works is assessed as **Minor**, long-term and adverse.

10.7.2.8 Soil Erosion and Compaction

189. Construction activity (particularly plant and vehicle movements), soil stripping and stockpiling, would affect the nature of the Site soils. Plant movements would act to compact soils through movements over unstripped ground. All activity requiring removal, transport and stockpiling of soils would have potential to lead to soil erosion and loss of structure, resulting in overall soil degradation.

190. All traffic routes would be clearly demarcated and vehicles would not be permitted access outwith these areas.

191. Only tracked or low ground pressure vehicles would be permitted access to unstripped ground. Existing tracks have been incorporated into the proposed Development as far as possible and use of these would help to keep additional soil disturbance to a minimum.

192. Soil stripping would be undertaken with care and would be restricted to as small a working area as practicable. Topsoil would be removed and laid in a storage bund, up to 2 m in height, on unstripped ground adjacent to the working area. It would be attempted to retain the turf layer vegetation-side-up where possible, although ground conditions may make this challenging. Subsoils and superficial geological deposits would be removed subsequently and laid in storage bunds, also up to 2 m in height, clearly separated from the topsoil bund. Care would be taken to maintain separate stockpiles for separate soil types in order to preserve the soil quality.

193. For work within areas of peat, acrotelmic peat (the uppermost 0.5 m) would be removed as for the topsoil. It would be attempted to retain the acrotelm vegetation-side-up where possible, although ground conditions may make this challenging. The underlying catotelmic peat would be stored in bunds up to 1 m in height. Catotelmic peat is sensitive to handling, and loses its internal structure easily, so would be transported as short a distance as possible to its storage location. Excavation of catotelmic peat has been limited by careful infrastructure design and use of floating road construction on areas of deeper peat.

194. Limited smoothing or 'blading' of stockpiled soils and catotelmic peat would be undertaken to help shed rainwater and prevent ponding of water on the stockpile. Stockpiles on notably sloping ground would have sediment control measures installed near the base, on the downslope side, to collect and retain any sediment mobilised by rainfall. Stockpiles would be located on flat or nearly flat ground where possible.

195. Excavated soil and peat would be used in site restoration and rehabilitation at the end of the construction period, in order to promote fast re-establishment of vegetation cover on worked areas and areas of bare soil or peat that are not required for the operational phase of the proposed Development. Some of the excavated peat would be reserved for peatland restoration in parts of the Site. Soils and peat would be stored for as short a time as practicable, in order to minimise degradation through erosion and desiccation.

196. Should prolonged periods of dry weather occur, a damping spray would be employed to maintain surface moisture on the soil and peat stockpiles. This would help to maintain vegetation growth in the turves and to retain the soil structure.

197. The receptor, Site soils and peat, is considered to be of **Medium** sensitivity. The magnitude of effect is considered to be **Slight**. The likelihood of effect is considered to be **Likely**.

198. The effect of soil erosion and compaction from construction works is considered to be **Minor**, temporary and adverse.

10.7.2.9 Peat Instability

199. Construction activity on peatland can affect the natural stability of the peat deposits in areas near to or associated with construction works. Particular risk areas are associated with works at or near breaks in slope, areas where natural peat instability has been recorded and locations where the peat has degraded through, for example, erosion processes, drying out or overgrazing.

200. A detailed Peat Slide Risk Assessment (PSRA) has been undertaken for the Earraghail RED and is provided in **Technical Appendix 10.1**. The key effects assessment findings are provided below.

201. The PRSA found that the majority of the Site has a negligible or low risk of natural or induced peat landslide. Five individual single cells located close to proposed infrastructure have been identified as having a moderate risk of peat instability. Four additional areas within the wider application boundary have been identified as potentially having a moderate or high risk of peat instability. These areas were appraised in greater detail, taking into account location-specific details including information gathered from the reconnaissance surveys and peat surveys. Mitigation measures have been recommended to control the peat landslide hazard. For these areas, the peat landslide hazard can be controlled by use of good construction practice and micrositing. For all locations, the residual risk ranking is **Low** or **Negligible**.

202. A risk management system, such as a geotechnical risk register, would be compiled and maintained at all stages of the proposed Development and, should the proposed Development be consented, developed as part of the post-consent detailed design works. The document would be updated as necessary as new information becomes available.

203. The receptors for peat landslide hazard are the peatland habitat, the water environment including surface water and groundwater, the development infrastructure, and the construction personnel.

204. The peatland habitat, water environment and Development infrastructure receptors are considered to be of **High** sensitivity. Construction personnel are considered to be a **Very High** sensitivity receptor.

205. With appropriate design constraints and mitigation measures in place, as described in **Technical Appendix 9.1** of this EIA Report, the magnitude of effect is considered to be **Slight**. The likelihood of effect is considered to be **Unlikely**.

206. For all receptors, the effect of peat instability is assessed as **Minor**, long-term and adverse.

10.7.3 Effects During Operation

10.7.3.1 Physical Changes to Overland Drainage and Surface Water Flows

207. No additional changes to overland drainage and surface water flows are anticipated during the operational phase. Trackside and infrastructure drainage would remain in place during operation of the proposed Development. A monitoring and maintenance programme would be put in place for the drainage infrastructure, to include regular visual inspection of drainage ditches, crossing structures and cross-drains to check for blockages, debris or damage that might impede water flow. Any identified blockage, including build-up of sediment that may lead to future blockage, or damage to structures would be remediated immediately. Where practicable, routine maintenance would be undertaken during dry weather; where this is not practicable, additional sediment control measures may need to be established to manage silty water arising from the work.

208. The receptor, Site surface watercourses, is considered to be of **Medium** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be **Negligible**. The likelihood of effect is considered to be **Unlikely**.

209. The effect of physical changes to overland drainage from operational works is assessed as **Negligible**.

10.7.3.2 Particulates and Suspended Solids

210. The main operational phase work would involve track and hardstanding maintenance and repair. Regular monitoring of the track and hardstanding condition would be undertaken, particularly following periods of heavy or prolonged rainfall and after snowfall and clearance, if relevant. Any sections of the track showing signs of excessive wear would be repaired as necessary with suitable rock from on-site borrow pits or external sources.

211. The drainage network would also be subject to regular monitoring to ensure that it remains fully operational, as water build-up can cause considerable damage to unbound track construction.

212. All bridge structures would have appropriate splash control measures as part of their design, to prevent silty water splashing into the watercourse from vehicle movements. These splash controls would be monitored regularly to ensure they remain effective and have not become damaged in any way.

213. The receptor, Site surface watercourses, is considered to be of **Medium** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be **Slight**. The likelihood of effect is considered to be **Possible**.

214. The effect of particulates or suspended solids from operational works is assessed as **Minor**, temporary and adverse.

10.7.3.3 Water Contamination from Fuels, Oils or Foul Drainage

215. The risk of water contamination from fuels or oils is considerably lower during operation than during construction as there are significantly decreased levels of activity on site. The majority of potential pollutants would no longer be present on site. Lubricants for turbine gearboxes, transformer oils and maintenance vehicle fuels would remain present in small quantities.

216. The pollution prevention plan and site spillage and emergency procedures, as set out above, would remain in force throughout the operational phase. It is anticipated that there would be no concrete batching on site. The Site welfare facilities would include either a suitably sized holding tank, which would be emptied by tanker and removed from the Site on an appropriate timescale for disposal at a suitably licensed facility, or would make use of waterless composting toilet facilities with bottled water provided for washing and drinking.

217. The receptor, Site surface watercourses, is considered to be of **Medium** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be **Negligible**. The likelihood of effect is considered to be **Unlikely**.

218. The effect of water contamination from fuels or oils from operational works is assessed as **Negligible**.

10.7.3.4 Changes In or Contamination of Water Supply to Vulnerable Receptors

219. Only minor works would take place within the Site during the operational phase, to allow necessary maintenance activities for the proposed Development. No additional works would be expected in or near the watercourses which flow through the Tarbert to Skipness Coast SSSI and Tarbert Woods SAC.

220. Additional works affecting the identified wetland habitats would also be of minor scale.

221. Additional works with potential to affect PWS with potential linkages to the Site would be of minor scale. Should concerns arise during the construction phase, additional monitoring during any required operational phase maintenance works would be put in place to provide a safety check for the PWS intakes.

222. The designated sites and PWS intakes are considered to be of **High** sensitivity. The potential GWDTE within the Site are considered to be of **Low** sensitivity. The magnitude of effect is considered to be **Negligible.** The likelihood of effect is considered to be **Unlikely**.

223. The effect of changes in or contamination of water supply to vulnerable receptors from operational works is assessed as **Negligible**.

10.7.3.5 Increased Flood Risk

224. Infrastructure drainage would remain in place during the proposed Development's operational phase. A regular monitoring and maintenance programme for the drainage infrastructure would be implemented by the proposed Development operator to ensure that it remains fully operational and in good condition. Where practicable, routine maintenance would be undertaken during dry weather, to help ensure that drainage operation during wet weather is fully functional.

225. Post-development runoff would be designed such that there is no change from natural pre-development runoff.

226. The receptors, infrastructure and property downstream of the proposed Development, are considered to be of **High** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effectis considered to be **Negligible**. The likelihood of effect is considered to be **Unlikely**.

227. The effect of increase in flood risk resulting from the operational works is assessed as **Negligible**.

10.7.3.6 Physical Removal of Bedrock

228. Although most physical removal of bedrock would have occurred during construction, the ongoing requirement for track and hardstanding maintenance would require some extraction of rock from the borrow pit sites during the operational phase of the proposed Development. These operations would be very limited in nature.

229. The bedrock receptor is considered to be of **Low** sensitivity. The magnitude of effect is considered to be **Negligible**. The likelihood of effect is considered to be **Likely**.

230. The effect of physical removal of bedrock from operational works is assessed as **Negligible**.

10.7.3.7 Modification to Groundwater Flow Paths

231. There is a minor ongoing requirement for additional rock extraction at the borrow pit sites during operation, for track and hardstanding maintenance. These operations would be limited in nature.

232. The Site groundwater receptor is considered to be of **Medium** sensitivity. The magnitude of effect is considered to be **Negligible**, the likelihood of effect is assessed as **Likely**.

233. The effect of modification to groundwater flow paths from operational works is assessed as **Negligible**, long-term and adverse.

10.7.3.8 Soil Erosion and Compaction

234. There are no soil stripping or stockpiling activities planned for the operational phase.

235. Ongoing monitoring and maintenance work for the proposed Development would require vehicle activity on site. This would be much reduced from the construction phase and would mostly involve significantly lighter vehicles than heavy construction plant. The ongoing vehicle activity would have some effect on soil and peat compaction below access tracks, although at a significantly lower level than during construction.

236. The receptor, Site soils and peat, is considered to be of **Medium** sensitivity. The magnitude of effect is considered to be **Slight**. The likelihood of effect is considered to be **Possible**.

237. The effect of soil erosion and compaction from operational works is considered to be **Minor**, temporary and adverse.

10.7.3.9 Peat Instability

238. No changes to the infrastructure are anticipated during the operational phase of works. Therefore, the effect of natural or induced peat instability during the operational works is assessed as **Negligible**.

10.7.4 Effects During Decommissioning

10.7.4.1 Physical Changes to Overland Drainage and Surface Water Flows

239. It is anticipated that new tracks constructed specifically for access to development infrastructure would be removed and fully reinstated at the end of the Development's lifetime. Existing forestry tracks would be returned to the condition required by FLS but would remain in place. Any associated drainage infrastructure would be fully reinstated, including removal of any cross-drainage culverts under the track sections.

240. Any long-term drainage infrastructure associated with turbine foundations, crane pads and ancillary infrastructure would also be removed and fully reinstated as part of the decommissioning works.

241. No changes to watercourse crossings are anticipated as part of decommissioning. Upgraded crossings would remain in place for future forestry access.

242. The receptor, surface watercourses within the Site, is considered to be of **Medium** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be of **Slight** magnitude. The likelihood of effect is considered to be **Likely**.

243. The effect of physical changes to overland drainage from decommissioning works is assessed as **Minor**, long-term and beneficial.

10.7.4.2 Particulates and Suspended Solids

244. All decommissioning work involving earthmoving operations would generate loose sediment, which could potentially gain access to surface watercourses and waterbodies through entrainment in surface runoff. This could potentially have an adverse effect on the downstream watercourses through damage to fish spawning habitat and changes to dissolved oxygen and nutrient levels in watercourses and waterbodies.

245. All areas where excavation works for decommissioning would be required would have water control measures put in place in advance of any works. This would involve use of peripheral bunding or cut-off drains to divert clean water around the working areas.

246. During decommissioning works, areas of excavation would have appropriate sediment control measures installed on the downslope side of the works area prior to groundworks commencing, to prevent inadvertend discharge of silty water into any site watercourse. These would include use of silt fencing, bunding, settlement ponds, sumps or proprietary treatment systems such as SiltBusters as appropriate to the situation. Where possible, vegetation would be retained to act as additional protection, particularly for any works adjacent to watercourses or waterbodies.

247. It is not anticipated that any in-stream works would be required as part of the decommissioning process.

248. Decommissioning works involving significant earthmoving activity would be restricted during periods of wet weather, particularly for any work occurring within 20 m of a watercourse or within areas of deeper peat, to minimise mobilisation of sediment in heavy rainfall. The 'stop' conditions in **Table 10.15** are recommended to guide decommissioning activity.

249. Any water collecting within excavations would be pumped out prior to backfilling and reinstatement. This water may require treatment to remove suspended solids prior to discharge to ground.

250. Vegetation cover would be re-established as quickly as possible on reinstated areas including former turbine foundations, crane pads and access track sections. These would make use of excavated soil turves and peat acrotelm, where available, and may also require use of heather brash or alternative mulch, hydroseeding or biodegradeable geotextile where vegetated turf material is not available. This would be informed on site by the ECoW appointed for the decommissioning process.

251. Any necessary permissions relating to decommissioning works, plus any requirement for pollution prevention plans or similar documentation, would be obtained prior to any decommissioning work beginning within the Site.

252. A water quality monitoring programme would be established at key locations around the proposed Development (see **Table 10.16** and **Figure 10.7**). Monitoring would begin prior to any decommissioning works, to allow the existing operational-phase baseline to be determined. Details would be agreed with SEPA, but are anticipated to be similar to requirements for construction-phase monitoring (please refer to **Section 10.7.2.2**).

253. The receptor, surface watercourses within the Site, is considered to be of **Medium** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be **Slight**. The likelihood of effect is considered to be **Likely**.

254. The effect of particulates and suspended solids from decommissioning works is assessed as **Minor**, temporary and adverse.

10.7.4.3 Water Contamination from Fuels, Oils or Foul Drainage

255. Spillage of fuels and oils could have an adverse effect on surface water quality, and major spillages could have a potential influence on the Skipness River system, with smaller potential influences on the Bardaravine River and Abhainn Achachoish systems as a result of the smaller infrastructure footprint in these catchments.

256. Although no wet concrete would be on site during decommissioning, removal of concrete foundations has potential to release concrete dust which could cause damage to watercourses as a result of its high alkalinity.

257. The pollution prevention plan and site spillage and emergency procedures, as set out in **Section 10.7.2.3** above, would remain in force throughout the decommissioning phase. The Site welfare facilities would include either a suitably sized holidng tank, which would be emptied by tanker and removed from the Site on an appropriate timescale for disposal at a suitably licensed facility, or would make use of waterless composting toilet facilities with bottled water provided for washing and drinking.

258. Where concrete foundations require removal to below-ground prior to reinstatement, appropriate dust suppression equipment would be in place to minimise the risk of concrete dust dispersal into watercourses. Dust suppression sprays would be used in dry or windy weather to minimise airborne dust. Appropriate water management protections, such as settlement ponds, sumps, cut-off drains and/or silt fencing, would be established prior to concrete removal to ensure that water contaminated with concrete dust is captured for appropriate treatment. It is likely that any such contaminated water would require removal for treatment and disposal offsite. This process would be under the supervision of the EcoW appointed for the decommissioning process and would be agreed with SEPA prior to the start of decommissioning works.

259. A water quality monitoring programme would be established at key locations around the Site. Monitoring would begin prior to any construction works, to allow pre-construction baseline quality to be determined. Details are provided in **Table 10.16**.

260. The receptor, surface watercourses within the Site, is considered to be of **Medium** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be **Moderate**. The likelihood of effect is considered to be **Unlikely**.

261. The effect of water contamination from fuels, oils or foul drainage from decommissioning works is assessed as **Minor**, temporary and adverse.

10.7.4.4 Changes in or Contamination of Water Supply to Vulnerable Receptors

262. It is possible that vulnerable receptors would be affected by works required for decommissioning the proposed Development.

Designated Sites

263. The Tarbert to Skipness Coast SSSI and Tarbert Woods SAC remain potentially at risk from decommissioning works in the hydrological catchment areas immediately upslope from the designated areas.

264. Precautions would be taken during decommissioning to ensure that any potentially contaminating materials would not be permitted to enter any project area watercourses, particularly those that drain through the SSSI/SAC. These precautions are set out in **Sections 10.7.2.2** and **10.7.2.3.** All works that have potential to affect the SSSI/SAC would be supervised by the ECoW and additional levels of protection would be installed if advised by the ECoW during site works.

265. Water monitoring locations at key points downstream of proposed works would be included in the project water quality monitoring programme. No new or upgraded watercourse crossings will be required at watercourses that flow through the SSSI/SAC.

266. The designated sites with hydrological linkage are considered to be of **High** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be **Slight**. The likelihood of effect is considered to be **Unlikely**.

GWDTE

267. The footprint of works within and adjacent to wetland areas would be reduced from the construction phase. The mitigation measures identified in **Technical Appendix 10.4** would be put in place to avoid changes to the watercourse hydrochemistry through 'flushing' of excavated soil in surface runoff. Reinstatement of trackside and cross-drainage would help to return the areas to near-natural flow pathways as close to pre-development conditions as practicable.

268. All works through and adjacent to wetland areas would be supervised by the ECoW.

269. The potential GWDTE within the Site are considered to be of **Low** sensitivity as a result of the absence of any hydrogeological linkage and the low quality of the habitats. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be **Slight**. The likelihood of effect is considered to be **Likely**.

PWS

270. Any works with potential to affect PWS with potential linkages to the Site would be of minor scale. Should concerns have been noted during the construction phase, additional monitoring would be put in place for the duration of any decommissioning works active within the PWS catchment area. This would be under the supervision and direction of the ECoW.

271. The PWS with hydrological linkage are considered to be of **High** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be **Slight**. The likelihood of effect is considered to be **Unlikely**.

272. The effect of changes in or contamination of water supply to vulnerable receptors from construction works is assessed as **Minor**, temporary and adverse. Reinstatement of drainage associated with infrastructure adjacent to wetland areas is assessed as **Minor**, long-term and beneficial.

10.7.4.5 Increased Flood Risk

273. Decommissioning and reinstatement of the proposed Development would help to return the Site to near-natural conditions. Once fully reinstated, site runoff would revert to pre-development levels or better. Long-term drainage features would be left in place for as much of the decommissioning phase as possible, to ensure that any increased runoff arising from groundworks associated with decommissioning is managed appropriately within the Site.

274. Long-term drainage features such as settlement ponds that have become habitat features (e.g. wetland areas or small ponds) may be left in situ if agreed with FLS and SEPA. This would be discussed prior to decommissioning works.

275. The receptors, infrastructure and property downstream of the proposed Development, are considered to be of **High** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be **Negligible**. The likelihood of effect is considered to be **Unlikely**.

276. The effect of increased flood risk resulting from the construction works is assessed as **Negligible**.

10.7.4.6 Physical Removal of Bedrock

277. It is not anticipated that any additional bedrock removal would be required as part of decommissioning works.

278. The effect of physical removal of bedrock from decommissioning works is assessed as **Negligible**.

10.7.4.7 Modification to Groundwater Flow Paths

279. Additional physical changes to the shallow subsurface as a result of decommissioning works are considered to be limited and confined to areas previously disrupted during the construction phase. Removal and reinstatement of turbine foundations, crane pads, new access tracks and other Development infrastructure would help to restore shallow subsurface conditions to as near-natural a state as possible.

280. Underground cables would be left in situ and foundations would be removed to a depth of 0.5 m below ground level to minimise further disruption to consolidated sediments and soil and avoid the environmental impacts associated with deeper removal.

281. The Site groundwater receptor is considered to be of **Medium** sensitivity. With appropriate design constraints and mitigation measures in place, as described, the magnitude of the works is considered to be **Slight**. The likelihood of effect is considered to be **Possible**.

282. The effect of modification to groundwater flow paths from decommissioning works is assessed as **Minor** and long-term. Some effects may be beneficial in allowing near-natural flow paths to re-establish.

10.7.4.8 Soil Erosion and Compaction

283. Decommissioning activity involving excavation work, soil stripping and stockpiling would affect the nature of the Site soils. Plant movement would add to soil compaction in working areas.

284. Plant would not be permitted on unstripped ground. All traffic routes would be clearly demarcated and vehicles would not be permitted access outwith these areas.

285. Soil stripping would be minimised and only undertaken in areas where access is required to allow decommissioning activity. Soil stripping and stockpiling would be undertaken in line with the method outlined in **Section 10.7.2.8**. Any excavated soil material would be used in site restoration and reinstatement at the end of the decommissioning period.

286. Soils underlying access tracks and aggregate hardstanding that are removed as part of the decommissioning process would be ripped following removal of the aggregate material to loosen the soil and promote its re-establishment as active soil. If vegetated turf material is not available, heather brash or other suitable mulch, hydroseeding or a biodegradeable geotextile may be used to protect the soil layer from erosion and promote revegetation.

287. The receptor, Site soils and peat, is considered to be of **Medium** sensitivity. The magnitude of effect is considered to be **Slight**. The likelihood of effect is considered to be **Likely**.

288. The effect of soil erosion and compaction from decommissioning works is considered to be **Minor**, temporary and beneficial.

10.7.4.9 Peat Instability

289. Decommissioning activity would be less extensive than construction activity, and would be focused on areas of existing infrastructure. No additional works on or in areas of peatland are anticipated.

290. It is recommended that the risk management system, such as a geotechnical risk register, put in place for the construction and operational phases continues to be maintained throughout the decommissioning phase to ensure that the Developer and all site personnel are aware of the potential risks and warning signs of peat instability.

291. The receptors for peat landslide hazard are the peatland habitat, the water environment including surface water and groundwater and the decommissioning personnel.

292. The peatland habitat and water environment and Development infrastructure receptors are considered to be of **High** sensitivity. Decommissioning personnel are considered to be a **Very High** sensitivity receptor.

293. With appropriate design constraints and mitigation measures in place, as described in **Technical Appendix 9.1** of this EIA Report, the magnitude of effect is considered to be **Negligible**. The likelihood of effect is considered to be **Unlikely**.

294. For all receptors, the effect of peat instability is assessed as **Negligible**.

10.7.5 Indirect and Secondary Effects

295. No indirect or secondary effects relating to site hydrology, hydrogeology, geology or peat have been identified.

10.7.6 Cumulative Effects

296. There are several planned and operational Windfarms and wind turbine developments along the Kintyre Peninsula that have been considered for cumulative effects in relation to hydrology, hydrogeology, geology or peat. Within 7.5 km of the application boundary, seven developments have been considered for cumulative effects (**Table 10.18**).

10.7.6.1 Geology and Soils

297. Effects on geology and soils are very localised. As no developments lie within 1 km of the proposed Development, there are no cumulative effects relating to geology or soils.

10.7.6.2 Peat

298. Effects on peat need to be considered more widely, as peatland is classified as a national resource and its contribution as a carbon sink or carbon source is relevant to Scotland as a whole (Scottish Government, 2018; Scotland's Soils, 2021). Assuming that all the works at all the identified cumulative developments follow best practice in design and construction, in relation to avoidance of peat where possible, minimising of works directly affecting peat where it cannot be avoided, careful handling and storage of peat where excavation is required, and use of peatland restoration techniques where these can be applied, cumulative effects relating to the peat resource are considered to be **Negligible**.

10.7.6.3 Hydrogeology

299. Effects on hydrogeology are confined to shallow groundwater found within the same hydrological catchments as the proposed Development. Within 7.5 km of the Site, no developments share the same hydrological catchment areas with the Site. The Freasdail Windfarm, to the south west, is the closest development; this lies within the Claonaig Water catchment, a neighbouring surface water catchment to the Skipness River. Within these two catchments, groundwater flow would be expected to follow the local topography and would be in different directions for each development. As a result, there are no cumulative effects relating to hydrogeology from the proposed Development.

10.7.6.4 Hydrology

300. Effects on hydrology are generally confined to developments located within the same hydrological catchments as the proposed Development or that drain into the same receiving waterbodies. Within 7.5 km of the Site, no developments share the same hydrological catchment areas with the Site. The Freasdail Windfarm, to the south west, is the closest development; this lies within the Claonaig Water catchment, a neighbouring surface water catchment to the Skipness River.

301. Within 7.5 km of the Site, six developments drain into same receiving waterbodies as the proposed Development. These are summarised in **Table 10.18**.

Table 10.18 Developments Considered in the Cumulative Assessment

Development	Status	Distance from Site (km)	Receiving Waterbodies
Freasdail Windfarm	Operational	5.0	Kilbrannan Sound
Sheirdrim Windfarm	Planning	5.8	Kilbrannan Sound, West Loch Tarbert (Kintyre)
Kilchamaig Farm	Consented	6.0	West Loch Tarbert (Kintyre)
Gartnagrenach Farm	Operational	6.8	West Loch Tarbert (Kintyre)
Eascairt Windfarm	Consented	7.0	Kilbrannan Sound
Kilberry Windfarm	Scoping	4.2	West Loch Tarbert (Kintyre)

302. It is assumed that best practice construction methods would be used for all developments.

303. Both the proposed Development and the six surrounding developments drain into the Kilbrannan Sound and the West Loch Tarbert (Kintyre) waterbodies. However, the Freasdail Windfarm and Gartnagrenach Farm are already operational, and therefore construction effects are **Negligible**.

304. It is possible that construction works for one or more of the four other developments may be undertaken in parallel with construction for the proposed Development. The distances separating the four developments from the proposed Development are substantial, with a minimum distance of 4.2 km to Kilberry Windfarm as the nearest. In all cases, the receiving waterbody is a marine area, subject to tidal activity and natural transport of suspended sediment within the water column. Assuming that all developments employ appropriate sediment and pollution management controls, cumulative effects on these receiving waterbodies are considered to be **Minor**, temporary and adverse during construction; **Negligible** during operation; and **Negligible** during decommissioning.

10.7.7 Mitigation

305. In addition to the mitigation commitments set out above, mitigation through careful design provides an important control measure for the proposed Development. A detailed summary is provided below.

10.7.7.1 Mitigation by Design

306. All excavation works requiring removal of bedrock or superficial deposits have been kept to a practical minimum through good site design.

307. Careful and informed infrastructure design forms a key measure for prevention of induced instability in peat. The collated peat depth information has been used to inform the proposed infrastructure layout throughout the design process. Incursion into areas of deeper peat has been kept to a practical minimum by careful design and would be further reduced by local micrositing, should it be required, in order to minimise disruption to peatland ecosystems and hydrology, and to avoid the risk of induced peat instability. Where incursion into deeper peat has been required, floating road construction is proposed for these areas (**Figure 3.10**).

308. Access tracks are anticipated to be constructed using established cut-and-fill and floating road construction methods. Any peat present along the route would be excavated and stored for use in reinstatement of elements of project infrastructure where appropriate.

10.7.7.2 Mitigation Commitments

309. This section provides a summary of mitigation measures covered in **Section 10.7**, such that all proposed mitigation measures are provided in one place.

Soils and Peat

310. Soil stripping would be undertaken with care and would be restricted to as small a working area as practicable. Topsoil would be removed and laid in a storage bund, up to 2 m in height, on unstripped ground adjacent to the working area. It would be attempted to retain the turf layer vegetation-side-up where possible, although ground conditions may make this challenging. Subsoils and superficial geological deposits would be removed subsequently and laid in storage bunds, also up to 2 m in height, clearly separated from the topsoil bund. Care would be taken to maintain separate bunds for separate soil types in order to preserve the soil quality.

311. For work within areas of peat, acrotelmic peat (the uppermost 0.5 m) would be removed as for the topsoil. It would be attempted to retain the acrotelm vegetation-side-up where possible, although ground conditions may make this challenging. The underlying catotelmic peat would be stored in stockpiles up to 1 m in height. Catotelmic peat is sensitive to handling, and loses its internal structure easily, so would be transported as short a distance as possible to its storage location. Excavation of catotelmic peat has been limited by careful infrastructure design.

312. Limited smoothing or ‘blading’ of stockpiled soils and catotelmic peat would be undertaken to shed rainwater and prevent ponding of water on the stockpile. Bunds on sloping ground would have sediment control measures installed near the base, on the downslope side, to collect and retain any sediment mobilised by rainfall. Stockpiles would be located on flat or nearly flat ground where possible.

313. Excavated soil and peat would be used in site restoration and rehabilitation at the end of the construction period, in order to promote fast re-establishment of vegetation cover on worked areas and areas of bare soil or peat that are not required for the

operational phase of the development. Soils and peat would be stored for as short a time as practicable, in order to minimise degradation through erosion and desiccation.

314. Should prolonged periods of dry weather occur, a damping spray would be employed to maintain surface moisture on the soil and peat bunds. This would help to maintain vegetation growth in the turves and to retain the soil structure.

315. Construction work would make use of current best practice guidance relating to developments in peatland areas (Scottish Renewables *et al*., 2019). A risk management system, such as a geotechnical risk register, would be compiled and maintained at all stages of the proposed Development and, should the proposed Development be consented, developed as part of the post-consent detailed design works, and would be updated as new information becomes available.

316. Micrositing would be used to avoid possible problem areas identified, where possible, during ground investigation or other detailed design works. This would be assisted by additional verification of peat depths, to full depth, in any highlighted areas where construction work is required. Track drainage would be installed in accordance with published good practice documentation and would be minimised in terms of length and depth in order to minimise concentration of flows.

317. Construction activities would be restricted during periods of wet weather, particularly for any work occurring within 20 m of a watercourse or within areas of identified deeper peat. Careful track design would ensure that the volume and storage timescale for excavated materials would be minimised as far as practicable during construction works.

318. Vegetation cover would be re-established as quickly as possible on track and infrastructure verges and cut slopes, by re-laying of excavated peat acrotelm and soil turves, to improve slope stability and provide erosion protection. Additional methods, including hydroseeding and/or use of a biodegradable geotextile, would be considered, if necessary, in specific areas.

319. During construction, members of the proposed Development's construction staff would undertake advance inspections and carry out regular monitoring for signs of peat landslide indicators. A geotechnical specialist would be on call to provide advice should any peat landslide indicators be identified.

320. Construction staff would be made aware of peat slide indicators and emergency procedures. Emergency procedures would include measures to be taken in the event that an incipient peat slide is detected.

Surface Watercourses and Groundwater

321. Silt fencing or appropriate alternative sediment control protection would be installed on the downhill side of excavations to prevent inadvertent discharge of silty water into or towards any site watercourse within the Site.

322. All engineering works adjacent to watercourses, including access tracks and watercourse crossing structures, would have appropriate sediment control measures established prior to any groundworks.

323. Vegetation would be retained along watercourse banks to act as additional protection to the watercourses.

324. A water quality monitoring programme would be established. Details would be agreed with SEPA but are anticipated to include at least the following:

- visual checks for entrained sediment; and
- in-situ measurements of pH, temperature, specific conductivity.

325. In-situ measurement of turbidity and dissolved oxygen may be recommended for locations with particular sensitivity, such as upstream of PWS intakes, if relevant.

326. Pre-construction monitoring would be undertaken on a monthly basis for a period of three months prior to any work taking place within the Site.

327. During construction, the monitoring would be undertaken by the ECoW or suitably experienced alternative individual. Any change from baseline conditions of pH and/or specific conductivity would potentially indicate an incident and additional

investigation would be required in order to identify the origin of the change. Control locations (WQ2, 5, 8 and 9) are intended to help differentiate between incidents arising from, and those unrelated to, the proposed Development.

328. Recommended frequency of monitoring for the different locations are provided in below. Monitoring locations are identified in **Table 10.16** and shown in **Figure 10.8**.

329. Groundwater monitoring boreholes would be established within the borrow pit areas prior to any construction work beginning, to a depth at least 1 m below the deepest expected excavation. Groundwater level monitoring would be undertaken to determine whether groundwater is present within the borrow pit areas and, if it is, at what level the seasonally highest groundwater table stands. Any groundwater within the borrow pit area would be managed in line with best practice, with discharge via a settlement pond to allow any entrained sediment to be removed prior to discharge. If required, an appropriate discharge licence would be obtained prior to excavations commencing.

330. All works through and adjacent to wetland areas will be supervised by the ECoW.

Drainage Infrastructure

331. Trackside drainage would be no longer or deeper than necessary to provide the required track drainage.

332. Cross-drains under tracks would be installed at an appropriate frequency to mimic natural drainage patterns and to minimise concentration of flows.

333. All drainage infrastructure would be designed with a capacity suitable for a rainfall intensity of a 1-in-200 year storm event plus allowance for climate change.

334. Where track sections cross wetland or bog areas, cross-drainage would be provided within the track construction to ensure continuity of flow. This may take the form of a drainage layer within the track, suitably closely-spaced drainage pipes, or both as appropriate. These will be determined on a case-by-case basis to suit each individual area.

335. All required licences for watercourse crossings and construction site works would be in place prior to works on site beginning.

336. All long-term and temporary drainage infrastructure would be established on a running-basis ahead of excavation works. This includes temporary bunding and cut-off drains around turbine bases, hardstanding areas and borrow pits. Where possible, trackside drainage would laid up to 100 m ahead of track construction works on a running basis.

337. Temporary water control measures would be implemented, as necessary, adjacent to areas of larger excavation. These would include borrow pit sites and may also include turbine base excavations and hardstanding areas. These measures would take the form of temporary settlement ponds, filter drains or proprietary treatment measures such as Silt Busters. Detail would be provided within the Pollution Prevention Plan(s) required for the Construction Site Licence and suitability would be determined following appropriate on-site soil tests.

338. All earthmoving activity would be restricted during periods of wet weather, particularly for work occurring within 20 m of a watercourse or within areas of peat deeper than 1.5 m, to minimise mobilisation of sediment in heavy rainfall. The ‘stop’ conditions provided in are recommended to guide all earthmoving activity at all stages of the proposed Development.

339. Long-term drainage infrastructure would have a monitoring and maintenance programme established, to include regular visual inspection of drainage infrastructure to check for blockages, debris or damage that may impede flow. Remediation would be undertaken immediately. Routine maintenance would be scheduled, where possible, on dry weather days.

Excavations

340. Any water collecting within excavations would be pumped out prior to further work within the excavation. The water is likely to require treatment to remove suspended solids prior to discharge to ground.

341. Cable trenches would be laid in disturbed trackside material. In areas where cable routes cross up or down notable slopes, clay bunds or alternative impermeable barrier would be placed for every 0.5 m change in elevation along the length of the trench to minimise in-trench groundwater flow.

342. Vegetation cover would be re-established as quickly as possible on all areas of stripped ground, once activity involving these areas is complete. This would include track verges, screening bunds, cut slopes and much of the Site during decommissioning and restoration works. Where possible, this would be achieved using excavated peat acrotelm and soil turves. Additional measures including hydroseeding and/or use of a biodegradable geotextile would be considered if insufficient peat and soil turf is available, and for areas of particular sensitivity that require immediate protection.

343. Rock testing would be undertaken on appropriate samples from the borrow pit areas to determine its suitability for unbound track and hardstanding construction. This would include testing to determine likely degradation patterns throughout the lifespan of the proposed Development. Should the tests identify problems with parts of the rock within the borrow pit footprints, care would be taken to ensure that unsuitable material is not used for construction but would be retained for use in borrow pit restoration.

344. Any unused or remaining unsuitable aggregate material, plus any spare rock material arising from hardstanding or track reinstatement, may be used to reinstate the borrow pits to a suitable profile, and capped with soil or turf to promote re-establishment of natural vegetation cover.

345. Only tracked or low ground pressure vehicles would be permitted access to unstripped ground.

Site Traffic

346. Tracks and hardstanding areas would be monitored on a regular basis, particularly following periods of heavy or prolonged rainfall or after snow clearance. Any sections of track or hardstanding showing signs of excessive wear would be repaired as necessary with suitable rock from the borrow pit or external sources.

347. All bridge structures would have appropriate splash control measures as part of their design, to prevent silty water splashing into the watercourse from vehicle movements. The splash controls would be monitored regularly to ensure they remain effective and have not become damaged in any way.

348. Routine monitoring checks of project infrastructure, including track and hardstanding surfaces and all drainage infrastructure, would be undertaken on a quarterly basis throughout project operation. Monitoring would involve visiting all aspects of the infrastructure and undertaking a visual inspection to identify the following:

- areas where track surfaces or hardstanding areas were showing evidence of erosion or surface damage;
- any areas where surface water was ponding or collecting on tracks or hardstanding areas; and
- any areas where drainage infrastructure was damaged, blocked or inadequate.

349. Any areas of track or hardstanding surface showing signs of damage, erosion or excessive wear would be repaired as necessary. Drainage features would be repaired, reinstated or replaced as necessary to ensure continued efficient operation.

350. Site-specific mitigation, including track drainage segregation to avoid ‘flushing’ from excavation works, and micrositing to avoid specific higher sensitivity areas, will be identified and established where appropriate.

351. All traffic routes would be clearly demarcated and vehicles would not be permitted access outwith these areas.

Pollution Prevention

352. Oil and fuel storage and handling on site would be undertaken in compliance with SEPA’s Guidance on Pollution Prevention 2 – Above ground oil storage tanks and with the Water Environment (Oil Storage) (Scotland) Regulations 2006.

353. Risk assessments would be undertaken and all Hazardous Substances and Non-Hazardous Pollutants that would be used and/or stored on site would be identified. Hazardous substances likely to be on site include oils, fuels, hydraulic fluids and anti-freeze. No non-hazardous pollutants have been identified as likely to be used on site. Herbicides would not be used.

354. All deliveries of oils and fuels would be supervised by the Site Manager or appointed deputy.

355. All storage tanks would be located within impermeable, bunded containers where the bund is sufficient to contain 110% of the tank’s capacity. For areas containing more than one tank, the bund would be sufficient to contain 110% of the largest tank’s capacity or 25% of the total capacity, whichever is the greater.

356. Any valve, filter, sight gauge, vent pipe or other ancillary equipment would be located within the containment area.

357. Waste oil would not be stored on site but would be removed to dedicated storage or disposal facilities.

358. Management procedures and physical measures would be put in place to deal with spillages, such as spill kits and booms.

359. Maintenance procedures and checks would ensure the minimisation of leakage of fuels or oils from plant.

360. Refuelling and servicing would be undertaken in a designated area or location with adequate precautions in place, such as a dedicated impermeable surface with lipped edges to contain any contaminants.

361. Where vehicle maintenance is necessary in the field, owing to breakdown, additional precautions would be taken to contain contaminants, such as spill trays or absorbent mattresses.

362. The access track would be designed and constructed to promote good visibility where possible and two-way access where visibility is restricted, to minimise risk of vehicle collisions.

363. If absolutely required, concrete batching would take place in one designated location within the site construction compound. This location would be at least 250 m from the nearest watercourse. Protective bunding would be installed around the batching area to ensure that contaminated runoff is contained. Dedicated drainage would be installed to ensure that water from the batching area can be suitably treated to reduce alkalinity and suspended sediment load prior to discharge, or removed from site by tanker for treatment and disposal offsite.

364. Site welfare facilities would include a suitably sized holding tank, which would be emptied by tanker and removed from site on an appropriate timescale for disposal at a suitably licensed facility, or composting toilet facilities with bottled water provided for washing and drinking.

365. The Site Spillage and Emergency Procedures would be prominently displayed at the Site and staff would be trained in their application. The Procedures document would incorporate guidance from the relevant SEPA Guidance Notes.

366. In the event of any spillage or discharge that has the potential to be harmful to or to pollute the water environment, all necessary measures would be taken to remedy the situation. These measures would include:

- identifying and stopping the source of the spillage;
- containing the spillage to prevent it spreading or entering watercourses by means of suitable material and equipment;
- absorbent materials, including materials capable of absorbing oils, would be available on site to mop up spillages. These would be in the form of oil booms and pads and, for smaller spillages, quantities of proprietary absorbent materials; and.
- sandbags would also be readily available for use to prevent spread of spillages and create dams if appropriate.

367. Where an oil/fuel spillage may have soaked into the ground, the contaminated ground would be excavated and removed from site by a licensed waste carrier to a suitable landfill facility.

368. The emergency contact telephone number of a specialist oil pollution control company would be displayed on site and sub-contractors would be made aware of the guidelines for handling of oils and fuels and of the spillage procedures at the Site.

369. SEPA would be informed of any discharge or spillage that may be harmful or polluting to the water environment. Written details of the incident would be forwarded to SEPA no later than 14 days after the incident, in line with their requirements.

10.8 Summary of Effects

370. This assessment is based on a site-specific risk assessment method following recommended environmental impact assessment techniques. Potential effects, both positive and negative, long-term or temporary, adverse or beneficial, single or cumulative, to the geological, hydrogeological and hydrological regime have been considered. These effects are summarised in **Table 10.19**.

Table 10.19 Summary of Effects

Effect	Phase	Assessment consequence	Effect significance
Physical changes to overland drainage and surface water flows	Construction	Minor, long-term, adverse	Not significant
	Operation	Negligible	Not significant
	Decommissioning	Minor, long-term, beneficial	Not significant
Particulates and suspended solids	Construction	Minor, temporary, adverse	Not significant
	Operation	Minor, temporary, adverse	Not significant
	Decommissioning	Minor, temporary, adverse	Not significant
Water contamination from fuels, oils, concrete batching or foul drainage	Construction	Minor, temporary, adverse	Not significant
	Operation	Negligible	Not significant
	Decommissioning	Minor, temporary, adverse	Not significant
Changes in or contamination of water supply to vulnerable receptors	Construction	Minor, temporary, adverse	Not significant
	Operation	Negligible	Not significant
	Decommissioning	Minor, temporary, adverse Minor, long-term, beneficial	Not significant
Increased flood risk	Construction	Negligible	Not significant
	Operation	Negligible	Not significant
	Decommissioning	Negligible	Not significant
Physical removal of bedrock	Construction	Minor, long-term, adverse	Not significant
	Operation	Negligible	Not significant
	Decommissioning	Negligible	Not significant
Modification to groundwater flow paths	Construction	Minor, long-term, adverse	Not significant
	Operation	Negligible	Not significant
	Decommissioning	Minor, long-term, adverse or benficial	Not significant
Soil erosion and compaction	Construction	Minor, temporary, adverse	Not significant
	Operation	Minor, temporary, adverse	Not significant
	Decommissioning	Minor, temporary, beneficial	Not significant
Peat instability	Construction	Minor, long-term, adverse	Not significant
	Operation	Negligible	Not significant
	Decommissioning	Negligible	Not significant
Hydrological cumulative effects	Construction	Minor, temporary, adverse	Not significant
	Operation	Negligible	Not significant
	Decommissioning	Negligible	Not significant

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