10 Hydrology and Hydrogeology

10. Hydrology & Hydrogeology

10.1. Introduction

10.1.1. This Chapter presents a summary of the existing baseline conditions present at the site with respect to hydrology and hydrogeology (the water environment). It also details the embedded mitigation in the site design and best practice measures which would be implemented during construction and operation of the development. It then considers the likely potential impacts the Proposed Development may have on the water environment.

10.1.2. The assessment has been undertaken by SLR Consulting Limited under the supervision of a Technical Director who has more than 30 years' experience assessing similar developments with respect to potential impacts on the water environment. A site visit has also been undertaken by an experienced SLR hydrologist.

10.1.3. This Chapter is supported by **Appendix 10.1: Flood Risk Assessment and Drainage Impact Assessment** and the following figures:

- Figure 10.1a - b: Local Hydrology;
- Figure 10.2: Regional Hydrogeology; and
- Figure 10.3: Groundwater Vulnerability

10.2. Scope of Appraisal

10.2.1. This assessment is based on the description of the Proposed Development detailed in **Chapter 3: Description of the Proposed Development** and shown on **Figures 'Site Plan' and 'Site Plan Detail'**

10.2.2. It is noted that the Proposed Development will utilise existing access tracks which are part of the existing Limekiln Wind Farm and no upgrades or construction works are required to these access tracks.

Study Area

10.2.3. The study area is shown on **Figures 10.1** to **10.3** and includes a 500 m buffer to all elements of the Proposed Development including the proposed BESS, proposed Substation Extension and the proposed underground cable. Beyond this 500 m and with respect to water any effect is considered to be so diminished as to be undetectable.

Legislation, Policy and Guidance

10.2.4. The water environment in Scotland is afforded significant protection through key statutes and the regulatory activities of SEPA and the local authorities. The assessment has been undertaken with respect to environmental legislation, planning policy and general guidance, including the following which are relevant to the water environment.

Legislation

- European Union (EU) Water Framework Directive (2000/60/European Commission (EC));
- EU Drinking Water Directive (98/83/EC);
- Water Environment and Water Services (WEWS)(Scotland) Act 2003 (WEWS Act);
- The Environment Act 1995;
- Environment Protection Act 1990;
- The Flood Risk Management (Scotland) Act 2009;
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (Controlled Activities Regulations (CAR)) (as amended);
- The Water Supply (Water Quality) (Scotland) Regulations, 2001;
- Private Water Supplies (Scotland) Regulations 2006;
- The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017; and
- The Electricity Act 1989.

Planning Policy

10.2.5. National Planning Policy Framework 4 (NPF4) provides planning guidance and polices regarding sustainable development, tackling climate change and achieving net zero. Policies relevant to this Chapter include:

- Policy 2 (Climate Mitigation and Adaptation);
- Policy 20 (Blue and Green Infrastructure); and
- Policy 22 (Flood Risk and Water Management).

10.2.6. In addition, The Highland Council (THC) Highland-wide Development Plan (HwDP) provides planning guidance on the type and location of development that can take place in the region. The HwDP presents policies of which the following are relevant to this assessment:

- Policy 28 – Sustainable Design;
- Policy 60 – Other Important Habitats and Article 10 features;
- Policy 63 – Water Environment;
- Policy 64 – Flood Risk;
- Policy 66 – Surface Water Drainage; and
- Policy 72 – Pollution.

Guidance

10.2.7. The following guidance is also applicable to the assessment, and includes Planning Advice Notes (PANs) published by the Scottish Government, such as:

- PAN 61 Planning and Sustainable Urban Drainage Systems (SuDS); and
- Online Planning Advice on Flood Risk (which supersedes Pan 69).

10.2.8. Scottish Environment Protection Agency (SEPA) and NetRegs Guidance for Pollution Prevention (GPP):

- GPP01 Understanding your environmental responsibilities – good environmental practices;
- GPP02 Above Ground Oil Storage Tanks;
- GPP03 Use and Design of Oil Separators in Surface Water Drainage Systems;
- GPP05 Works and Maintenance in or near Water;
- GPP06 Working at Construction and Demolition Sites;
- GPP08 Safe Storage and Disposal of Used Oils;
- GPP13 Vehicle Washing and Cleaning;
- GPP18 Containing Major Spillages and Firewater at Industrial Sites;
- GPP21 Pollution Incident Response Plans; and
- GPP22 Dealing with Spills.

10.2.9. Construction Industry Research and Information Association (CIRIA) publications:

- C532 Control of Water Pollution from Construction Sites (2001);
- C624 Development and Flood Risk – Guidance for the Construction Industry (2004);
- C741 Environmental Good Practice on Site (2015); and

- C753 The SuDS Manual (2015).

10.2.10. SEPA Publications:

- Groundwater Protection Policy for Scotland, Version 3 (2009);
- Technical Flood Risk Guidance for Stakeholders (2022);
- Flood Risk and Land Use Vulnerability Guidance (2024);
- Climate Change Allowances for Flood Risk Assessment in Land Use Planning (2025);
- Guidance on Assessing the Impact of Developments on Groundwater Dependent Terrestrial Ecosystems (2024); and
- Guidance on Assessing the Impact of Development on Groundwater Abstractions (2024).

10.2.11. Other Guidance:

- THC, Flood Risk and Drainage Impact: Supplementary Guidance (2013);
- British Standards Institution, Assessing and Managing Flood Risk in Development – Code of Practice, Report BS-8533:2017 (2017); and
- Energy Network Association, Engineering Technical Report (2018).

10.3. Consultation

10.3.1. Data requests were issued to SEPA and THC to obtain information relating to water quality, groundwater level and flow, private water supplies and licenced water abstractions and discharges.

10.3.2. Pre-application advice was also sought from THC. **Table 10.1** summarises the key points relevant to hydrology and hydrogeology raised through consultation for the Proposed Development.

Table 10.1: Consultation Response

Consultee	Response	Comment
THC Pre-application report February 2025	The proposal is located around 2-3km to the east of the Caithness and Sutherland Special Area of Conservation (SAC) and East Halladale Special Site of Scientific Interest (SSSI), both of which are protected for blanket bog. NatureScot do not consider there is any hydrological connectivity between the application site and the SAC/SSSI. NatureScot advise there is no likely significant effect with regard to the SAC and no predicted impacts to the SSSI blanket bog.	Noted.
THC Pre-application report February 2025	The applicant will be required to carry out an investigation to identify any private water supplies, including pipework, which may be adversely affected by the development and to submit details of the measures proposed to prevent contamination or physical disruption. THC has some information on known supplies but it is not definitive. An on-site survey will be required.	As discussed in **Section 10.5**, no properties or private water supplies have been identified within 500m of the Proposed Development.
THC Pre-application report February 2025	Development or landraising within any floodplain should be avoided and proposals should generally follow SEPA's Standing Advice for Flood Risk. Should any permanent infrastructure be located within close proximity to a watercourse, a Flood Risk Assessment should be submitted to demonstrate that the development is not at risk from flooding and will not increase flooding elsewhere.	A site-specific Flood Risk Assessment is included as **Appendix 10.1**.
THC Pre-application report February 2025	Small watercourse crossings should be oversized and larger watercourse crossings should be demonstrated to be adequately designed to accommodate the 1 in 200 year flow (including an allowance for climate change and freeboard) to avoid increasing the risk of flooding, or information provided to justify smaller structures.	No track watercourse crossings are required. The proposed underground cable with pass beneath one watercourse.

THC Pre-application report February 2025	A minimum strip of 50 m should be kept free from development from the top of bank(s) of any watercourse or waterbody. Storage of materials within this area during construction is not permitted.	Noted. It is confirmed a 50 m buffer to mapped watercourses has been applied, except for one proposed watercourse crossing.
THC Pre-application report February 2025	A Drainage Impact Assessment (DIA) for the development is required. The DIA should include details relating to any existing field drains and the management of surface water drainage, which should be designed in line with general Sustainable Drainage Systems (SuDS) principles. The DIA shall demonstrate that surface water discharge from the site is limited to the equivalent pre-development rate for a range of storms up to and including a 1 in 200 year plus climate change event. The Applicant should demonstrate, within the proposals submitted, any mitigation measures to manage the residual risk of overland flow/pluvial flooding.	A site-specific outline DIA is included as **Appendix 10.1** which includes an outline drainage design using SuDS which will be developed further as part of the detailed drainage design stage.
THC Pre-application report February 2025	Natural flood management techniques should also be applied to reduce the rate of runoff where possible. Tracks should not act as preferential pathways for runoff and efforts should be made to retain the existing drainage network. Appropriate drainage is required to restrict runoff to pre-development rates and to minimise erosion to existing watercourses. The DIA should ensure that post development runoff rate is no greater than pre-development runoff rate (i.e. greenfield runoff) for all return periods up to the 1 in 200 year event including an allowance for climate change Runoff from all events up to and including the 1 in 200 year plus climate change event should be managed within the site boundary, with no flooding to critical roads or buildings, and evidence as to how this will be achieved should be included within the DIA.	A site-specific outline DIA is included as **Appendix 10.1** which confirms that surface water drainage will be managed up to the 1 in 200 year event including an appropriate allowance for climate change.

THC Pre-application report February 2025	The proposals should demonstrate how impacts on local hydrology have been minimised and the site layout designed to minimise watercourse crossings and avoid other direct impacts on water features. Measures should be put in place to protect any downstream sensitive receptors. The submission must include a set of drawings showing: • All proposed temporary or permanent infrastructure overlain with all lochs and watercourses; • A minimum buffer of 50m around each loch or watercourse. If this minimum buffer cannot be achieved each breach must be numbered on a plan with an associated photograph of the location, dimensions of the loch or watercourse and drawings of what is proposed in terms of engineering works; • A map showing the location, size, depths and dimensions of all borrow pits overlain with all lochs and watercourses within 250m and showing a site-specific buffer around each loch or watercourse proportionate to the depth of excavations. The information provided needs to demonstrate that a site specific proportionate buffer can be achieved.	Noted, please refer to **Figure 10.1**. A 50m watercourse buffer has been applied to mapped watercourses shown on the 1:10,000 scale Ordnance Survey (OS) mapping. No development is proposed within the 50m watercourse buffer, except for one proposed watercourse crossing. No borrow pits are proposed as part of the application.

THC Pre-application report February 2025	Groundwater Dependent Terrestrial Ecosystems (GWDTEs) are protected under the Water Framework Directive and therefore the layout and design of the development must avoid impact on such areas. Please refer to Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems for further generic advice and the minimum information SEPA requires to be submitted. The application should include proposals for habitat improvement or creation to mitigate any loss of GWDTE. Excavations and other construction works can disrupt groundwater flow and impact on existing groundwater abstractions. Please refer to the aforementioned guidance on assessing impacts on GWDTE for further advice on the minimum information SEPA requires to be submitted.	Potential effects to GWDTEs are considered within **Section 10.5** of this Chapter.
THC Pre-application report February 2025	You should be aware that in the event of a fire occur, the containment and discharge of potential polluted water resulting from firefighting back into the natural water cycle would be a relevant planning consideration. You should therefore ensure that in the event of a battery fire, sufficient storage for all firefighting water runoff so that it is contained onsite for testing of pollutants before discharge or removal, and that pollution control measures are implemented to protect the water and wider environment including any downstream designated sites. This protection should also prevent water naturally infiltrating into the ground from across the site. Reference should be made to the Council's adopted Flood Risk and Drainage Impact Assessment Supplementary Guidance. Consultation with SEPA in this regard might also be required.	Noted. Firewater containment and discharge are considered as part of the DIA, included as **Technical Appendix 10.1**.

10.4. Methodology

10.4.1. An initial desk study has been undertaken to determine and confirm the baseline characteristics of the study area by reviewing available information relating to hydrology and hydrogeology. This has been undertaken in order to prepare a contemporary assessment.

10.4.2. In addition to the Limekiln Wind Farm application[1], the following sources of information have been consulted in order to characterise the baseline conditions of the study area:

- OS 1:50,000, 1:25,000 and 1:10,000 scale mapping data;
- NatureScot SiteLink[2]
- James Hutton Institute, National Soil Map of Scotland (1:250,000)[3]
- British Geological Survey (BGS) Onshore Geoindex[4]
- BGS Hydrogeological Maps of Scotland[5]
- UK Centre for Ecology and Hydrology, Flood Estimation Handbook (FEH) Webservice[6]

[1] Limekiln Wind Farm Resubmission (2016) ECU Reference EC00005269
[2] NatureScot, SiteLink, available online at https://sitelink.nature.scot/map [Accessed June 2025]
[3] James Hutton Institute, National Soil Map of Scotland (1:250,000 scale), available online at https://soils.environment.gov.scot/ [Accessed June 2025]
[4] British Geological Survey, Onshore Geoindex, available online at https://mapapps2.bgs.ac.uk/geoindex/home.html [Accessed June 2025]
[5] British Geological Survey, Hydrogeological Maps of Scotland, available online at https://www.bgs.ac.uk/datasets/hydrogeological-maps-of-scotland/ [Accessed June 2025]
[6] UK Centre for Ecology and Hydrology, Flood Estimation Handbook (FEH) Webservice, available online at https://fehweb.ceh.ac.uk/ [Accessed June 2025]

- SEPA Flood Maps[7]; Rainfall data for Scotland[8]; Reservoir Inundation Flood Maps[9]; SEPA Environmental Data[10]; and
- THC Private Water Supply Map[11]

10.4.3. A hydrological walkover survey was undertaken by SLR in May 2025 to verify the information that was collected during the desk and baseline study and to allow an appreciation of the study area. This information was used to inform the emerging project design and to complete this assessment.

10.4.4. The assessment of potential impact to receptors identified by the baseline and field study has then been undertaken considering the safeguards incorporated into the site design and industry good practice that would be used during construction and operation of the Proposed Development.

10.5. Baseline Conditions

Site Setting

10.5.1. The site setting is shown on **Figure 10.1**.

10.5.2. The site is located on an existing wind farm and forestry site, with the site entrance located some 200 m east of Reay. The proposed BESS compound is located within an area of felled and unfelled commercial forestry, and the proposed Substation Extension site is presently comprised of felled forestry land to the north of the existing Limekiln Wind Farm Substation.

10.5.3. The site topography generally slopes from south to north, with a high point of approximately 105 m above Ordnance Datum (AOD) in the southwestern corner of the site, and a low of approximately 25 m AOD at the site access just east of Reay. The elevation of the proposed Substation Extension ranges from 71.7 m AOD in the southeastern corner to a low of 70.3 m

[7] Scottish Environment Protection Agency, Flood Maps, available online at https://beta.sepa.scot/flooding/flood-maps/ [Accessed June 2025]
[8] Scottish Environment Protection Agency, Rainfall data for Scotland, available online at https://www2.sepa.org.uk/rainfall/ [Accessed June 2025]
[9] Scottish Environment Protection Agency, Reservoir Inundation Flood Map, available online at https://map.sepa.org.uk/reservoirsfloodmap/Map.htm [Accessed June 2025]
[10] Scottish Environment Protection Agency, Environmental Data, available online at https://www.sepa.org.uk/environment/environmental-data/ [Accessed June 2025]
[11] The Highland Council, Private Water Supplies map, available online at https://map-highland.opendata.arcgis.com/maps/Highland::private-water-supplies [Accessed June 2025]

AOD in the western corner. The proposed BESS site elevation ranges from 90 m AOD in the southern corner to 81 m AOD in the northern corner.

10.5.4. SEPA precipitation data[8] for Strathy Bridge (station ID: 234319) rainfall gauge which is located approximately 14 km northwest of the Proposed Development indicates in 2024, the annual rainfall was recorded to be 872 mm.

Designations

10.5.5. Review of the NatureScot SiteLink website[2] confirms that there are no designated sites within the study area.

10.5.6. The Sandside Bay Site of Special Scientific Interest (SSSI) and North Caithness Cliffs Special Area of Protection (SPA) is located approximately 40 m north and 1.1 km northwest of the site access respectively. The SSSI is designated for important dune and links habitat whilst the SPA is designated for breeding bird assemblage. The designated sites are located downstream of the Proposed Development, however, they are located a significant distance (>2 km) from the Proposed Development and are not water dependent. The SSSI and SPA are not considered further in this assessment, however, potential effects on the designated features are discussed further in **Chapter 6: Ecology** and **Chapter 7: Ornithology**.

10.5.7. As noted by NatureScot in their pre-application advice the Proposed Development is located 2 – 3 km to the east of the Caithness and Sutherland Special Area of Conservation (SAC) and East Halladale SSSI, both of which are designated for their blanket bog habitats. NatureScot confirmed that there is no hydrological connectivity between the application site and the SAC/SSSI and therefore they are not considered in this assessment.

Geological Setting

10.5.8. Full description of the geological setting is described in **Chapter 9: Geology and Peat**.

10.5.9. An extract of 1:250,000 National Soil Map of Scotland[3] indicates that the Proposed Development is underlain by peat and peaty podzols.

10.5.10. The proposed Substation Extension location is shown on BGS[4] mapping to be underlain by igneous bedrock of the Strath Halladale Granite Formation, comprised of granite and biotite. The bedrock is shown to be overlain by superficial peat deposits.

10.5.11. The proposed BESS is shown to be underlain by bedrock of the Tobaireach Conglomerate Member, comprised of conglomerate sedimentary bedrock. The bedrock in this area is overlain by glacial till superficial deposits of the Thormaid Till Member. Areas of alluvium are also noted along the banks of the unnamed tributary of the Achvarasdal Burn to the north of the proposed BESS site.

10.5.12. As discussed in **Chapter 9: Geology and Peat** no peat deposits will be disturbed by the Proposed development.

Hydrogeology

Aquifer Characteristics

10.5.13. Extracts of the BGS 1:625,000 scale Hydrogeological Map of Scotland[4] and 1,100,000 scale Aquifer Productivity and Groundwater Vulnerability datasets[5] are presented in **Figure 10.2** and **Figure 10.3** respectively.

10.5.14. Review of **Figure 10.2** confirms that igneous bedrock, including that beneath the proposed substation extension, are classified as a low a productivity aquifer whereby small amounts of groundwater are expected in near surface weathered zones and secondary fractures. The sedimentary bedrock, including that beneath the proposed BESS is classified as a moderately productive aquifer, locally important, multi-layered aquifer.

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

10.5.16. Review of **Figure 10.3** confirms that the peat and glacial till superficial deposits are not considered a significant aquifer. Alluvium deposits are considered a moderate productivity aquifer with intergranular and fracture flow. Groundwater in the alluvium is likely to be shallow and in hydraulic continuity with adjacent watercourses.

10.5.17. The igneous bedrock aquifer is confirmed to be a very low productivity aquifer. Any groundwater that is present would be confined to shallow depths and found in the upper weathered surface of the rock or in secondary fractures. The sedimentary bedrocks are a moderately productive aquifer whereby flow is predominately through intergranular flow and fractures.

10.5.18. Groundwater vulnerability is divided into five classes (1 to 5) with 1 being least vulnerable and 5 being most vulnerable. The Proposed Development is shown to be underlain by groundwater vulnerability Class 4a and 4b which is considered vulnerable to pollution.

Groundwater Quality

10.5.19. All of Scotland's groundwater bodies have been designated as a Drinking Water Protected Area (DWPA) in accordance with the Water Environment (Drinking Water Protected Area) (Scotland) Order 2013 and require protection for their current use or future potential as drinking water resources.

SEPA has identified that the Proposed Development is underlain by two groundwater bodies, the Northern Highlands groundwater body (SEPA ID: 150701) and the Dounreay groundwater body (SEPA ID: 150487). Both groundwater bodies have been classified in 2023 (the latest reporting cycle) as having a Good overall groundwater quality with no pressures identified. SEPA have confirmed that they do not hold any specific groundwater quality data within the study areaA National Vegetation

Classification (NVC) habitat mapping exercise was conducted as part of the Limekiln Wind Farm EIA Resubmission project[1]. The assessment concluded that the majority of areas of potential Groundwater Dependent Terrestrial Ecosystem (GWDTE) are supported by rainfall, surface and/or near surface water flow controlled by local topography and drainage rather than emergent groundwater.

10.5.20. No development except for the proposed underground cable, will intersect any area of potential GWDTE mapped by the NVC survey.

10.5.21. Within the study area of this Proposed Development, areas of M15 and wet grasslands (defined as mostly M25 with small areas of MG9, MG10, M23, M27, M28 and CG10) are noted within the forest rides, along existing access tracks, areas of previously disturbed ground or along the banks of mapped watercourses. This distribution is not typical of that which is sustained by emerging groundwater, such as springs and/or seepage lines. The habitats are also underlain by low permeability peat/soils and glacial till deposits and no evidence of groundwater seepage was recorded during the site walkover. It is therefore considered that these areas of potential GWDTE are sustained by rainfall, surface water runoff and water ponding above the low permeability deposits and/or water logging of soils adjacent to watercourses rather than emergent groundwater. Buffers to areas of potential GWDTE specified in SEPA guidance therefore do not apply.

Hydrology

Local Hydrology

10.5.22. The site lies in the catchment of the Reay Burn to the west and the Achvarasdal Burn to the east, which both flow in a northerly direction before discharging into the North Sea at Sandside Bay (see **Figure 10.1**). The proposed substation extension location is approximately 80 m east of a tributary of the Reay Burn at its closest extent, and the proposed BESS site is approximately 85 m south of a tributary of the Achvarasdal Burn at its closest extent.

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

10.5.24. An existing surface water drainage ditch was observed during the site walkover within the proposed Substation Extension site, as shown on **Photograph 10.1.** The ditch is sourced from a culvert underneath the existing substation and was recorded to be approximately 0.5 m to 1 m wide and 0.2 m deep. It will require to be re-routed around or culverted beneath the proposed platform extension area to facilitate the Proposed Development and would assessed at the detailed design stage, as discussed in **Section 10.6**.

Photograph 10.1: Existing drainage ditch

Surface Water Quality

10.5.25. The larger watercourses within the study area or hydraulically connected to the study area are monitored by SEPA and have been classified in 2023. A summary of the SEPA classification is shown in **Table 10.2**. Smaller watercourses within the study area, including the Reay Burn are not monitored or classified by SEPA.

Table 10.2: SEPA Surface Water Classification (2023)

Waterbody (SEPA ID)	Overall Status	Overall Ecology	Physio-Chemical	Hydro-Morphology	Water Quality
Achvarasdal Burn (20623)	Good	Good	Good	Good	Good
Strathy Point to Dunnet Head (200224)	Good	Good	Not monitored	High	Good

Flood Risk

10.5.26. A Flood Risk Assessment is included as **Appendix 10.1**, which assesses the risk of flooding to the Proposed Development and confirms that it is not at flood risk for the NPF4 design event of 1 in 200 year plus an allowance for climate change or the Energy Network Association (ENA) design event of 1 in 1000 year plus an allowance for climate change for the proposed substation extension. It is understood that safe access/egress is to be afforded by the existing windfarm tracks and that no alterations to these routes are required.

10.5.27. Small discrete areas of surface water flooding of less than 300 mm depth are indicated to be located adjacent to the Proposed Development areas but are not expected to present a risk to the development as these can be managed locally as part of the development. Any direct rainfall on the BESS and Substation Extension platform will be managed through the SuDS design, as discussed in **Section 10.6** and **Technical Appendix 10.1**. No works are required to the existing site access tracks and surface water runoff from these will continue to be managed by the existing trackside drainage.

Watercourse Crossings

10.5.28. The Proposed Development has sought to use existing access tracks associated with the wind farm. No works to upgrade the existing access tracks or existing watercourse crossings are required.

10.5.29. One watercourse crossing is required for the proposed underground cable which will cross an unnamed tributary of the Achvarasdal Burn. The location of the watercourse crossing is shown on **Figure 10.1,** and a photograph of the proposed crossing point is shown on **Photograph 10.2**. The watercourse was recorded as dry during the site walkover however the channel was noted to be 0.1 m wide and 0.1 m deep. Good practice crossing techniques which will be adopted as part of the Proposed Development are discussed in **Section 10.6** of this report.

10.5.30. Upstream of the proposed crossing, silt traps / attenuation basins have been installed in accordance with good practice to attenuate water from the existing access track, as shown on **Photograph 10.3**.

Photograph 10.2: View of WX01, looking north (downstream)

Photograph 10.3: View of existing attenuation features upstream of WX01, looking north (downstream)

Private Water Supplies

10.5.31. THC private water supply database indicates that there are no private water supplies within 500 m of the Proposed Development. No private water supplies were identified within the

Limekiln Wind Farm Resubmission application. In addition, no properties were identified within 500 m of the Proposed Development during the site visit undertaken in May 2025.

10.5.32. Properties are noted within 500 m of the existing access track however no works are proposed to upgrade these access tracks as part of the Proposed Development.

10.5.33. Potential impacts on private water supplies are therefore not considered further in this assessment.

Licenced Sites (Abstractions, Discharges, and Waste)

10.5.34. Consultation with SEPA has confirmed there are no CAR authorisations within the Study Area.

10.6. Good Practice and Embedded Mitigation by Design

Embedded Mitigation

10.6.1. The Proposed Development has sought to use existing wind farm infrastructure (such as the site access track) or ground previously disturbed by commercial forest or by temporary constructions areas used by the wind farm.

10.6.2. A 50 m buffer of has been applied to watercourses (as shown on OS 1:10,000 mapping). All elements of the Proposed Development, including the proposed Substation Extension and proposed BESS, is located out width the 50 m watercourse buffer, except for the proposed watercourse crossing.

10.6.3. No areas of potential GWDTE have been identified within the proposed Substation Extension and proposed BESS sites and no private or licenced abstractions or water dependent designated sites are recorded within 500 m of the Proposed Development.

Good Practice Measures

10.6.4. The Proposed Development will be undertaken in accordance with industry good practice guidance including those detailed in **Section 10.2.** As a principle, preventing the release of any pollution or sediment is preferable to dealing with the consequences of any release. There are several general measures which cover all impacts assessed within this Chapter, details of which are given below.

Construction Environmental Management Plan

10.6.5. A contractual management requirement of the successful Principal Contractor would be the development and implementation of a comprehensive and site-specific Construction Environmental Management Plan (CEMP). This document would detail how the works would be managed in accordance with the commitments and mitigation detailed in the Environmental Appraisal, statutory consents and authorisations, and industry good practise and guidance.

10.6.6. It is anticipated that many of the principals agreed with consultees in the wind farm CEMP used during its construction remain wholly applicable and can be used again in the CEMP for this development.

10.6.7. The CEMP will outline measures to ensure that the works minimise the risk to the water environment. It is expected that the following will be included within the CEMP and would ensure the works are undertaken in accordance with good practice guidance, as detailed in **Section 10.2**:

- during construction there would be heavy plant and machinery required and as a result it is appropriate to adopt best working practices and measures to protect the water environment, including those set out in Pollution Prevention Guidance (GPP01);
- in accordance with GPP02 any above ground on-site fuel and chemical storage would be bunded;
- emergency spill response kits would be maintained during the construction works (GPP21);
- a vehicle management system would be put in place wherever possible to reduce the potential conflicts between vehicles and thereby reduce the risk of collision (GPP21);
- suitable access routes would be chosen which minimise the potential requirement for either new temporary access tracks or for tracking across open land which could contribute to the generation of suspended solids;
- a speed limit would be used to reduce the likelihood and significance of any collisions;
- plant nappies would be placed under stationary vehicles which could potentially leak fuel / oils;
- any temporary construction / storage compounds required would be located remote from any sensitive surface water receptors and will be constructed to manage surface water run-off in accordance with best practice;
- any water contaminated with silt or chemicals would not be discharged directly or indirectly to a watercourse without prior treatment; and
- water for temporary site welfare facilities would either be brought to site or a local surface water or groundwater abstraction would be identified. Any water abstraction would be made in accordance with General Binding Rules or an authorisation would be obtained from SEPA in accordance with the CAR; and
- foul water would either be collected in a tank and collected for offsite disposal at an appropriately licensed facility or discharge will be to a septic tank or soakaway in accordance with the CAR.

Environmental Clerk of Works (ECoW)

10.6.8. To ensure all reasonable precautions are taken to avoid negative effects on the water environment, a suitably qualified ECoW will be appointed prior to the commencement of construction to advise the Applicant and the Principal Contractor on all hydrological matters.

10.6.9. The ECoW will be required to be present onsite during the construction phase and will carry out monitoring of works and briefings with regards to any hydrological sensitivities at the site to the relevant staff of the Principal Contractor and subcontractors.

10.6.10. With respect to the water environment, the ECoW will also have responsibility for advising on the maintenance of surface water flow paths and ensuring the quality of surface water is maintained.

Pollution Risk

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

- refuelling would take place at least 50 m from watercourses;
- foul water generated onsite would be managed in accordance with GPP4;
- areas would be designated for production of concrete or washout of vehicles which are a minimum distance of 50 m from a watercourse;
- washout water would also be stored in the washout area before being treated and disposed of, or re-used in concrete production;
- if any water is contaminated with silt or chemicals, runoff would not enter a watercourse directly or indirectly prior to treatment;
- water would be prevented as far as possible, from entering excavations such as trenches and foundations;
- procedures would be adhered to for storage of fuels and other potentially contaminative materials in line with the CAR, to minimise the potential for accidental spillage; and
- a plan for dealing with spillage incidents would be designed prior to construction, and this would be adhered to should any incident occur, reducing the effect as far as practicable. This would be included in the final CEMP for the Proposed Development.

Erosion and Sedimentation

10.6.12. Good practice measures for the management or erosion and sedimentation would include the following:

- all stockpiled materials would be located out with a 50 m buffer from watercourses;
- water would be prevented as far as possible, from entering excavations such as trenches and foundations through the use of appropriate cut-off drainage;
- where the above is not possible, water would pass through silt/sediment traps to remove silt prior to discharge into the surrounding drainage system;
- clean and dirty water onsite would be separated, and dirty water would be filtered before entering the water environment;
- silt fences would be deployed as required to reduce sediment transport;
- the amount of ground exposed, and time period during which it is exposed, would be kept to a minimum;
- silt/sediment traps, single size aggregate, geotextiles or straw bales would be used to filter any coarse material and prevent increased levels of sediment. Further to this, activities involving the movement or use of fine sediment would avoid periods of heavy rainfall where possible; and
- the ECoW and the Principal Contractor would carry out regular visual inspections of watercourses to check for suspended solids in watercourses downstream of work areas.

Flood Risk

10.6.13. As detailed in **Appendix 10.1**, it is proposed to adopt SuDS as part of the Proposed Development. The Drainage Impact Assessment outlines a concept drainage design to show how surface water runoff from the proposed substation extension and proposed BESS site can be managed in accordance with current best practice. The concept design presented in **Appendix 10.1** will be developed further as part of the detailed design stage of the project and would be agreed with THC and SEPA prior to construction. It is anticipated that this will be secured by a planning condition.

Diversion of the Existing Drainage Ditch

10.6.14. As outlined in **Section 10.5**, an existing drainage ditch will require to be diverted to facilitate construction and use of the proposed substation extension. It has been confirmed by site investigations that the drainage ditch is small. As part of the detailed design stage, the final alignment of the diversion will be determined as well as the cross section, capacity and design of the diversion channel.

Installation of Underground Cables

10.6.15. The proposed underground cable would be installed progressively. The length of time the cable trench would remain open would be minimised. The cable trench would be opened using a tracked excavator. Arisings from the trench would be temporarily stored adjacent to the trench ready for use to restore the trench.

10.6.16. Arisings would be stored so that the potential for erosion and sedimentation is minimised (see above). Silt fences, cut-off drains and temporary cover of the stockpiles will be deployed as directed by the ECoW.

10.6.17. Vegetation turves would be stored separately to the spoil arisings. Once the cable has been installed in the cable trench arisings would be used to restore the trench and backfilled in the same order that the material was excavated from the trench. Turves would then be replaced on the backfilled trench.

10.6.18. If directed by the ECoW, low permeability barriers would be installed in the trench to prevent the trench forming a preferential water flow path. Where ground conditions are saturated a geotextile wrap would be used within the trench to ensure there is no loss of the sand or stone cable surround to adjacent ground.

10.6.19. Where required localised temporary pumping of water from the cable trench would be undertaken to maintain safe working conditions and to facilitate cable duct installation. Pumping arrangements would be agreed and supervised by the site ECoW. Pumping would cease once the cable duct has been installed.

10.6.20. Following completion of installation of a cable duct a cable team will install (pull) the cables through the ducts. Safeguards used to control pollution, runoff, erosion and sedimentation presented above would be deployed as required.

10.6.21. It is proposed that open cut techniques are used to install the trench at watercourse crossing WX01. Any water in the watercourse will be pumped over the working area to maintain the flow of water while the works are being undertaken. The cable trench would be constructed and completed as described above.

Fire Water Management

10.6.22. As detailed in **Appendix 10.1** provision has been made to collect and attenuate all runoff shed from the proposed BESS and proposed Substation Extension. Provision has been made for firewater containment in the BESS site. This is proposed to be provided by lining the proposed detention basin with a low permeability liner and provision of a penstock/shutoff valve on the outfall which can be used in the unlikely event of a fire to contain firewater in the basin, thus preventing a discharge from site. An outline estimate of the required volume for firewater containment, in accordance with GPP18, is detailed in **Appendix 10.1**.

Concrete Pouring

10.6.23. In relation to works involving concrete batching, transport and pouring, the following mitigation would be adopted:

- Where concrete transfers are required, measures would be adopted at the point of concrete transfer to prevent accidental spillage of liquid concrete and no transfers would be undertaken in proximity to watercourses or areas of standing water; and

- There would be no wash-out of concrete carrying vehicles (except the concrete chute). Chutes would be washed out to a suitable container, allowed to settle and disposed at suitably licensed facilities.

10.7. Assessment of Potential Impacts

10.7.1. The following have the potential to impair hydrology (surface water) and hydrogeology (groundwater):

- the use of and tracking of machinery has the potential to generate suspended solids in surface water runoff and/or introduce oils or hydrocarbons to the water environment;
- existing groundwater or surface water drainage paths could be disturbed or altered;
- fire water runoff from the BESS units has the potential to enter the water environment; and
- inadequate hardstanding drainage could increase or exacerbate local surface water ponding and flooding.

Surface and Ground Water Quality

Construction Phase

10.7.2. As stated in **Section 10.6**, the construction of the Proposed Development would be undertaken in accordance with relevant technical guidance, GPPs and other codes of best practice, to limit the potential for contamination of both ground and surface waters. In addition, a site-specific CEMP would be prepared by the Principal Contractor and include a surface and groundwater quality management plan.

10.7.3. The above measures would significantly reduce the likelihood of pollutants, including suspended solids, being discharged to nearby watercourses or groundwater.

Operational Phase

10.7.4. The risk of contamination from the Proposed Development is considered to be very low, as there would be no requirement for the storage of any potentially hazardous substances and runoff from the site would typically comprise of clean rainwater runoff from areas of hardstanding.

10.7.5. The transformers on site would require the use of insulating oils. Transformers would be installed within bunded areas so that in the unlikely event of a leak or damage there would be no release to the site surface water drainage system (see below). As an additional safeguard, surface water runoff would also be also routed through an oil interceptor before being discharged to the surface water drainage system.

10.7.6. The transformers would be subject to regular inspections and would have an automated warning system to alert if oil levels within the transformers suddenly drop. The construction and maintenance of the transformers would be undertaken in accordance with best practice

guidance, particularly “GPP02: Above Ground Storage Tanks” and “GPP08: Safe Storage and Disposal of used Oils”.

10.7.7. A surface water drainage strategy has been developed and is included in **Appendix 10.1**. The drainage strategy outlines how surface water runoff can be managed, utilising SuDS, to manage the quality and rate of surface water discharged from the hardstanding areas.

10.7.8. The drainage system at the BESS has also been sized to manage firewater, should, in the unlikely event of a fire, fire water and fire retardants be used to extinguish a fire. Details of the proposed firewater management strategy associated within the proposed BESS will again be developed as part of the detailed drainage design for the site, and sizing for the detention basin will accommodate flows as calculated in **Appendix 10.1**. It is anticipated that this will be secured by a planning condition.

10.7.9. As above, these measures would significantly reduce the likelihood of pollutants, including oils and suspended solids, being discharged to nearby watercourses or groundwater.

Groundwater Levels and Flow

10.7.10. As discussed in the baseline assessment, the Proposed Development will be constructed on bedrock deposits that contain little to moderate groundwater with overlying superficial deposits which inhibit throughflow and groundwater emergence. No significant deep or expansive earthworks are proposed when compared to the groundwater catchments so there will be no catchment scale impact on groundwater levels and flows.

10.7.11. The detailed design of the Proposed Development will be informed by further site investigation. The site investigation would be used to ensure appropriate safeguards are included in the construction works. No impact on groundwater levels and flow is therefore anticipated.

Surface Water Flow and Flood Risk

10.7.12. SuDS will be incorporated as part of the Proposed Development and a concept drainage design has been prepared (see **Appendix 10.1**). This will ensure that increase in surface water runoff, associated with the increase in impermeable areas required to facilitate the Proposed Development, are managed onsite up to and including the 1 in 200 year event plus an allowance for climate change.

10.7.13. With these safeguards and those outlined in Section 10.6, surface water flow and flood risk to the Proposed Development and downstream of the site can be mitigated.

10.8. Summary

10.8.1. Existing hydrological and hydrogeological conditions have been confirmed and used to assess the potential effects the Proposed Development might have on the water environment.

10.8.2. Many of the potential impacts associated with a development of this nature have been mitigated by its design. Further, good practice construction techniques that would safeguard the water environment have been committed. Subject to the adoption of the good practice construction techniques and the committed further works at the detailed design stage of the project no effects on hydrology or hydrogeology have been identified.