VOLUME 2: CHAPTER 12 HYDROLOGY, HYDROGEOLOGY, GEOLOGY AND SOILS

Figures and Visualisations (Volume 3a and 3b of this EIA Report)

Appendices (Volume 4 of this EIA Report)

12. HYDROLOGY, HYDROGEOLOGY, GEOLOGY AND SOILS

12.1 Introduction

This chapter assesses the significant effects of the construction and operation of the Proposed Development, which is detailed in **Volume 2, Chapter 3 Description of the Proposed Development**, on surface water, groundwater, flood risk, geology, peat, and soils.

The chapter includes;

- policy context for hydrology,
- consultation feedback,
- assessment methodology and criteria,
- current baseline conditions at the Proposed Development site and surrounding area,
- future baseline conditions at the Proposed Development site and surrounding area,
- significance of effects,
- potential cumulative effects, and proposed mitigation.

Supporting documentation to this chapter is provided in **Volume 3** and **Volume 4** and referenced accordingly throughout the text.

Figures used in this Chapter and provided in **Volume 3** are as follows:

- Figure 12.1 Water Study Areas
- Figure 12.2 Surface Water Features
- Figure 12.3 Hydrogeology
- Figure 12.4 Bedrock Geology
- Figure 12.5 Superficial Soils
- Figure 12.6 National Scottish Soils
- Figure 12.7 Carbon and Peatland
- Figure 9.2a UK Habitat Classification
- Figure 9.2b GWDTE

Appendices used in this Chapter and provided in **Volume 4** are as follows:

- Appendix 3.1 General Environmental Management Plans;
- Appendix 12.1 Earthworks Strategy;
- Appendix 12.2 Outline Surface Water Drainage Strategy;
- Appendix 12.3 Flood Risk Assessment; and
- Appendix 12.4 Ground Investigation Report.

12.2 Legislation, Policy, and Guidance

The following legislation, policy, guidance, and information sources have been considered in carrying out the assessment of water resources, flood risk, and ground conditions.

12.2.1 Legislative Background

The Water Framework Directive (WFD) (2000/60/EC)[1] establishes a framework for the protection, improvement, and sustainable use of all water environments. It is transposed within Scotland by The Water Environment and Water Services (Scotland) Act 2003[2] and subsidiary Regulations. The WFD protects the UK's water environments by preventing their deterioration and improving their quality. This is achieved through

[1] Water Environment and Water Services (Scotland) Act 2003 [Online] Available at: http://www.legislation.gov.uk/asp/2003/3/. Date accessed 14/10/2024

[2] Scottish Government. (2017) The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (the EIA Regulations). [Online] Available at: https://www.legislation.gov.uk/ssi/2017/101/made. Date accessed 14/10/2024

setting ecological targets and environmental objectives to ensure the protection, improvement, and sustainable use of all water environments.

The Water Environment and Water Services (Scotland) Act 2003 provides a legal framework for sustainable water use, protection of the water environment, and flood risk management through guidelines and legal obligations to assess and mitigate potential impacts on water resources and flooding and incorporating public consultation and adaptive management into the EIA process.

The assessment has been completed in accordance with the principles detailed within the following legislation:

- The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017[3];
- The Water Environment (Controlled Activities) (Scotland)[4];
- The Flood Risk Management (Scotland) Act 2009[5];
- The Reservoirs (Scotland) Act 2011[6];
- The Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003[7];
- The Private Water Supplies (Scotland) Regulations 2006[8];
- The Water Environment and Water Services (Scotland) Act 2003[9];
- The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017[10];
- The Public and Private Water Supplies (Miscellaneous Amendments) (Scotland) Regulations 2015[11]; and,
- The Bathing Waters (Scotland) Regulations 2008[12].

12.2.2 National Policy

Consideration was given to the National Planning Framework 4 (NPF4)[13] which sets out the Scottish Government's principles and policies which direct development and infrastructure planning in Scotland. Policy 22 within this document details the overall approach to flood risk and water management in Scotland, intending to strengthen resilience to flood risk, ensure water resources are used efficiently and sustainably, and that wider use of natural flood risk management benefits people and nature.

NPF4 states that: *"Development proposals at risk of flooding or in a flood risk area will only be supported if they are for:*

- *Essential infrastructure where the location is required for operational reasons;*
- *Water compatible uses;*
- *Redevelopment of an existing building or site for an equal or less vulnerable use; or,*

[3] Scottish Government. (2017) The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017). [Online] Available at: https://www.legislation.gov.uk/ssi/2017/102/contents. Date accessed 14/10/2024

[4] Scottish Government (2011) The Water Environment (Controlled Activities) (Scotland) Regulations 2011. [Online] Available at: https://www.legislation.gov.uk/ssi/2011/209/contents/made. Date accessed 14/10/2024

[5] Scottish Government (2009) Flood Risk Management (Scotland) Act 2009 [Online] Available at: https://www.legislation.gov.uk/asp/2009/6/contents. Date accessed 14/10/2024

[6] Scottish Government (2011) Reservoirs (Scotland) Act 2011 [Online] Available at: https://www.legislation.gov.uk/asp/2011/9/contents. Date accessed 14/10/2024

[7] Scottish Government (2003) Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003 [Online] Available at: http://www.opsi.gov.uk/legislation/scotland/acts2003/asp_20030015_en_1. Date accessed 14/10/2024

[8] Scottish Government (2006) The Private Water Supplies (Scotland) Regulations 2006 [Online] Available at: http://www.legislation.gov.uk/ssi/2006/209/contents/made. Date accessed 14/10/2024

[9] Scottish Government (2003) Water Environment and Water Services (Scotland) Act 2003 [Online] Available at: https://www.legislation.gov.uk/asp/2003/3/contents. Date accessed 14/10/2024

[10] Scottish Government (2017) The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017 [Online] Available at: https://www.legislation.gov.uk/ssi/2017/282/note/made. Date accessed 14/10/2024

[11] Scottish Government (2015) the Private and Public Water Supplies (Miscellaneous Amendments) (Scotland) Regulations 2015 [Online] Available at: https://www.legislation.gov.uk/ssi/2015/346/contents. Date accessed 14/10/2024

[12] Scottish Government (2008) The Bathing Waters (Scotland) Regulations 2008 [Online] Available at: https://www.legislation.gov.uk/ssi/2008/170/contents/made. Date accessed 14/10/2024

[13] The Scottish Government (2023) National Planning Framework 4 [Online] Available at: https://www.gov.scot/publications/national-planning-framework-4/. Date accessed 14/10/2024

- *Redevelopment of previously used sites in built up areas where the LDP has identified a need to bring these into positive use and where proposals demonstrate that long-term safety and resilience can be secured in accordance with relevant SEPA advice".*

Policy 5 of NPF4 details the approach to soils, and includes some of the following key points in relation to peatlands:

"Development proposals on peatland, carbon-rich soils and priority peatland habitat will only be supported for:

- *Essential infrastructure and where there is a specific locational need and no other suitable site;*
- *The generation of energy from renewable sources that optimises the contribution of the area to greenhouse gas emissions reductions targets;*
- *Small-scale development directly linked to a rural business, farm or croft;*
- *Supporting a fragile community in a rural or island area; or*
- *Restoration of peatland habitats.*

Where development on peatland, carbon-rich soils or priority peatland habitat is proposed, a detailed site-specific assessment will be required to identify:

- *The baseline depth, habitat condition, quality and stability of carbon-rich soils;*
- *The likely effects of the development on peatland, including on soil disturbance; and*
- *The likely net effects of the development on climate emissions and loss of carbon.*

This assessment should inform careful project design and ensure, in accordance with relevant guidance and the mitigation hierarchy, that adverse impacts are first avoided and then minimised through best practice. A peat management plan will be required to demonstrate that this approach has been followed, alongside other appropriate plans required for restoring and/or enhancing the site into a functioning peatland system capable of achieving carbon sequestration."

The River Basin Management Plan (RBMP) for Scotland[14] aims to protect and improve Scotland's water environment for the benefit of people, wildlife, and the economy. The RBMP set out a range of actions to address impacts on water quality, physical condition, water resources, and the migration of wild fish, summarising:

- The state of the water environment;
- Pressures affecting the quality of the water environment where it is in less than good condition;
- Actions to protect and improve the water environment; and,
- A summary of outcomes following implementation.

12.2.3 Local Policy

Local policy context is set out in **Chapter 7: Planning and Energy Policy Context**, with policy relevant to water resources, flood risk, and ground conditions listed below:

- River Basin Management Plan for Scotland 2021 – 2027[15];
- The Highland Council Flood Risk & Drainage Impact Supplementary Guidance[16];
- The Highland Council Wide Local Development Plan[17];
  - Safeguarding our Environment: Geodiversity;
  - Safeguarding our Environment: Water Environment;

[14] SEPA (2021) The River Basin Management Plan for Scotland 2021 – 2027. [Online] Available at: https://www.sepa.org.uk/media/594088/211222-final-rbmp3-scotland.pdf. Date accessed 14/10/2024

[15] SEPA (2021) The River Basin Management Plan for Scotland 2021 – 2027 [Online]. Available at: https://www.sepa.org.uk/environment/water/river-basin-management-planning/. Date accessed 14/10/2024

[16] The Highland Council (2013) Flood Risk & Drainage Impact Supplementary Guidance [Online]. Available at: https://www.highland.gov.uk/downloads/file/2954/flood_risk_and_drainage_impact_assessment_supplementary_guidance. Date accessed 14/10/2024

[17] The Highland Council (2012) Highland-wide Local Development Plan [Online]. Available at: https://www.highland.gov.uk/developmentplans. Date accessed 14/10/2024

- Safeguarding our Environment: Flooding; and
- Safeguarding our Environment: Surface Water Drainage.

12.2.4 Guidance

Pollution Prevention Guidelines (PPGs) and the replacement series Guidance for Pollution Prevention (GPPs) give advice on statutory responsibilities and good environmental practice[18]. Each PPG and GPP addresses a specific industrial sector or activity. The Scottish Environment Protection Agency (SEPA) is in the process of replacing the PPGs with GPPs. The following guidance is of relevance to surface water and groundwater and informs the principles of the embedded mitigation detailed within this chapter:

- GPP1 (2020): Understanding your environmental responsibilities – good environmental practices;
- GPP2 (2018): Above ground oil storage tanks;
- GPP4 (2017): Treatment and disposal of wastewater where there is no connection to the public foul sewer;
- GPP5 (2018): Works and maintenance in or near water;
- GPP6 (2023): Working at construction and demolition sites;
- GPP8 (2017): Safe storage and disposal of used oils;
- PPG18 (2000): Managing fire water and major spillages;
- GPP21 (2021): Pollution incident response planning; and
- GPP22 (2018): Dealing with spills.

Other relevant guidance includes:

- Planning Advice Note 61: Planning and Sustainable Urban Drainage Systems[19];
- Planning Advice Note 79: Water and Drainage[20];
- Control of Water Pollution from Construction Sites (C532)[21];
- Development and flood risk: guidance to the construction industry, C624D[22];
- British Standard Code of Practice for Earthworks BS 6031 2009[23];
- Engineering in the Water Environment Good Practice Guide: River Crossings[24];
- Land Use Planning System guidance Note 31, Version 2. Guidance on Assessing the Impacts of Windfarm Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems[25];
- The SuDS Manual (C753)[26];
- Environmental Good Practice on Site (C741)[27];

[18] SEPA (various) Pollution Prevention Guidelines and Guidance on Pollution Prevention [Online] Available at: http://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/. Date accessed 14/10/2024

[19] Scottish Government (2001) Planning Advice Note 61: Sustainable urban drainage systems. [Online] Available online at: https://www.gov.scot/publications/pan-61-sustainable-urban-drainage-systems/. Date accessed 14/10/2024

[20] Scottish Government (2006) Planning Advice Note 79: Water and Drainage. [Online] Available at: https://www.gov.scot/publications/planning-advice-note-pan-79-water-drainage/. Date accessed 14/10/2024

[21] Masters-Williams, H., Construction Industry Research And Information Association and Al, E. (2001). Control of water pollution from construction sites : guidance for consultants and contractors. London: Ciria.

[22] Lancaster, J.W., M Preene, Marshall, C.T. and Construction Industry Research And Information Association (2004). Development and flood risk : guidance for the construction industry. London: Ciria.

[23] BSI (2009) BS 6031:2009 Code of Practice for Earthworks. [Online] Available at: https://knowledge.bsigroup.com/products/code-of-practice-for-earthworks/standard. Date accessed 14/10/2024

[24] SEPA and Natural Scotland (2010) Engineering in the Water Environment Good Practice Guide: River Crossings, Second edition. [Online] Available at: https://www.sepa.org.uk/media/151036/wat-sg-25.pdf. Date accessed 14/10/2024

25 SEPA (2014) Land Use Planning System Guidance Note 31. Guidance on Assessing the Impacts of Windfarm Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems, Version 2. [Online] Available at: https://www.sepa.org.uk/media/143868/lupsgu31_planning_guidance_on_groundwater_abstractions.pdf. Date accessed 14/10/2024

26 CIRIA (2016). The SuDs Manual. London: Ciria.

27 Charles, P. and Connolly, S. (2005). Environmental Good Practice on Site.

- Highways Agency's Design Manual for Roads and Bridges (DMRB) LA 113 – Road drainage and the water environment, formerly HD45/09, Revision 1, 2020[28];
- SEPA Supporting Guidance (WAT-SG-75) Sector Specific Guidance: Water Runoff from Construction Sites[29];
- Peat Landslide Hazard and Risk Assessments – Best Practice Guide for Proposed Electricity Generation Developments[30];
- Peatland Survey: Guidance on Developments on Peatland, on-line version only[31];
- Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and Minimisation of Waste[32];
- Developments on Peat and Off-Site Uses of Waste Peat[33];
- Relevant SSEN GEMPs listed in **Volume 4 Appendix 3.1: GEMP**;
- The Scottish Soil Framework[34]; and
- Planning Advice Note 50 – Controlling the Environmental Effects of Surface Mineral Workings[35].

12.3 Assessment Methodology and Significance Criteria

12.3.1 Scope of the Assessment

The following effects on water resources, flood risk, and ground conditions related to the Proposed Development are considered due to the potential for significant effects, as agreed during the EIA scoping process.

The construction of the Proposed Development has the potential to cause the following effects:

- Impediments to near-surface water and drainage to all watercourses as a result of construction;
- Alterations and disturbance to surface water drainage patterns as a result of the diversion of the Achalone Tributary;
- Alterations to surface water drainage patterns and the characteristics of connected watercourses as a result of the excavations associated with the cut of the Proposed Development;
- Potential chemical pollution and sedimentation of surrounding waterbodies from general construction activities (spillage);
- Potential effects on Designated Sites in terms of decrease in condition of qualifying interests;

28 Highways Agency (2020) Design Manual for Roads and Bridges - LA 113: Road drainage and the water environment (formerly HD45/09), Revision 1. [Online] Available at: https://www.standardsforhighways.co.uk/tses/attachments/d6388f5f-2694-4986-ac46-b17b62c21727?inline=true. Date accessed 14/10/2024

29 SEPA (2021) Supporting Guidance (WAT-SG-75) Sector Specific Guidance: Water Runoff from Construction Sites. [Online] Available at: https://www.sepa.org.uk/media/340359/wat-sg-75.pdf. Date accessed 14/10/2024

30 Scottish Government. 2017. "Peat Landslide Hazard and Risk Assessments – Best Practice Guide for Proposed Electricity Generation Developments". Crown Copyright. [Online] Available at: Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (www.gov.scot). Date accessed 14/10/2024

31 Scottish Government et al. 2017. *"Peatland Survey – Guidance on Developments on Peatland"*. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2018/12/peatland-survey-guidance/documents/peatland-survey-guidance-2017/peatland-survey-guidance-2017/govscot%3Adocument/Guidance%2Bon%2Bdevelopments%2Bon%2Bpeatland%2B-%2Bpeatland%2Bsurvey%2B-%2B2017.pdfDate accessed 14/10/2024

32 SEPA and Scottish Renewables. 2012. *"Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and Minimisation of Waste"*. Crown Copyright. [Online] Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2014/07/assessment-of-peat-volumes-reuse-of-excavated-peat-and-minimisation-of-waste-guidance/documents/guidance-on-the-assessment-of-peat-volumes-reuse-of-excavated-peat-and-the-minimisation-of-waste/guidance-on-the-assessment-of-peat-volumes-reuse-of-excavated-peat-and-the-minimisation-of-waste/govscot%3Adocument/Guidance%2Bon%2Bthe%2Bassessment%2Bof%2Bpeat%2Bvolumes%252C%2Breuse%2Bof%2Bexcavated%2Bpeat%252C%2Band%2Bthe%2Bminimisation%2Bof%2Bwaste.pdf. Date accessed 14/10/2024

33 SEPA. 2017. *"Developments on Peat and Off-Site Uses of Waste Peat"*. [Online] Available at: https://www.sepa.org.uk/media/287064/wst-g-052-developments-on-peat-and-off-site-uses-of-waste-peat.pdf. Date accessed 14/10/2024

34 Scottish Government. 2009. *"The Scottish Soil Framework"*. Crown Copyright. [Online] Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2009/05/scottish-soil-framework/documents/0081576-pdf/0081576-pdf/govscot%3Adocument/0081576.pdf. Date accessed 14/10/2024

35 UK Government – The Scottish Office. 1996. *"Controlling the Environmental Effects of Surface Mineral Workings"*. Crown Copyright. [Online] Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/1996/10/planning-advice-note-pan-50-controlling-environmental-effects-surface-mineral/documents/0026467-pdf/0026467-pdf/govscot%3Adocument/0026467.pdf
Date accessed 14/10/2024

- Potential effects on the hydrological function of Groundwater Dependent Terrestrial Ecosystems (GWDTEs);
- Changes to groundwater interflow patterns from temporary works such as physical cut-offs or dewatering for foundations, affecting the hydrologically connected groundwater bodies, and leading to reduced function of, or severance of, flow to GWDTEs;
- Reduced quality, quantity, or continuity of supply for public or private water supplies and abstractions due to changes in groundwater, near-surface, or surface water flow;
- Increase in surface water runoff and flood risk due to increased impermeable hardstanding as part of the Proposed Development;
- The disturbance of deep peat through construction activities;
- The compaction of peat and soils through construction activities;
- The loss of peatland habitat throughout the construction phase;
- Peat slide events that occur as a result of construction activities;
- Potential for the loss of important geological minerals as a result of construction activities; and
- Cumulative effects from the above if the potential effects arising from the Proposed Development are in combination with other relevant projects or activities.

The operation and maintenance of the Proposed Development has the potential to cause the following effects:

- Increased runoff from increased hardstanding; and
- Potential chemical pollution and sedimentation of surrounding waterbodies from general operation and maintenance activities (spillage).

12.3.2 Extent of the Study Area

The following study areas will be considered for the water resources, flood risk, and ground conditions assessment, as shown in **Volume 3 Figure 12.1**:

- Core Study Area: outlined by the Site boundary; and,
- Wider Study Area: a 1 km buffer zone around the Core Study Area.

The Wider Study Area is based on the identification of surface water, groundwater, and geological receptors within 1 km of the Proposed Development, considering hydraulic connectivity, impact pathways to the wider environment, and high value receptors, such as designated sites. Where necessary, the Wider Study Area has been extended to include sensitive receptors which could be impacted by the Proposed Development.

12.3.3 Consultation Undertaken to Date

A scoping report was submitted to The Highland Council in December 2023. The scoping opinion received regarding water resources, flood risk, and ground conditions are shown in **Table 12.1**, alongside a response.

Table 12.1: Summary of Scoping Opinion

Consultee	Summary of Consultation Response	Response to Consultee	Section Addressed
The Highland Council	The EIAR should fully describe the likely significant effects of the development on the local geology including aspects such as earthworks, site restoration and the soil generally including direct effects and any indirect. Proposals should demonstrate construction practices that help to minimise the use of raw materials and maximise the use of secondary aggregates and recycled or renewable materials. EIAR should include a table detailing the volumes of soil and sand being excavated and where and how this will be reused within the site. The soils balance calculation should demonstrate whether additional material will be required or will be generated.	Potential effects relating to geology are assessed in **Section 12.6**. Construction mitigation measures relating to soil management are detailed in **Table 12-10** and **Volume 4 Appendix 3.1: GEMPs**. The cut and fill quantities are detailed in **Volume 4 Appendix 12.1 Earthworks Strategy.**	**Section 12.6, Table 12-10 Volume 4 Appendix 3.1: GEMPs.; Volume 4 Appendix 12.1 Earthworks Strategy.**
	The EIAR needs to address the nature of the hydrology and hydrogeology of the site, and of the potential impacts on water courses, water supplies including private supplies, water quality, water quantity and on aquatic flora and fauna. Impacts on watercourses, lochs, groundwater, other water features and sensitive receptors, such as water supplies, need to be assessed. Measures to prevent erosion, sedimentation or discolouration will be required, along with monitoring proposals and contingency plans. Assessment will need to recognise periods of high rainfall which will impact on any calculations of run-off, high flow in watercourses and hydrogeological matters. In this respect, you are directed to SEPA's consultation response on the Scoping Report.	The baseline water environment is detailed in **Section 12.4**. Aquatic flora and fauna is covered in **Chapter 9: Ecology, Ornithology, and Nature Conservation**. Measures to manage surface water runoff quality and quantity are detailed in **Volume 4 Appendix 12.2: Outline Surface Water Drainage Strategy**.	**Section 12.4;, Chapter 9;**
Scottish Environment Protection Agency (SEPA)	The EIA submission must contain a scaled plan of sensitivities, for example peat, GWDTE, proximity to watercourses, overlain with proposed development. This is necessary to ensure the EIA process has informed the layout of the development to firstly avoid, and then reduce then mitigate significant impacts on the environment.	This chapter is supported by figures which present the listed receptors alongside the Core Study Area.	**Volume 3 Figure 12.1 to Figure 12.7.**
	This site has a myriad of small watercourses draining it. We highlight we are likely to object to any culverting for land gain of a natural watercourse. Whilst it is accepted that some of the watercourses maybe historic agricultural drainage ditches, several appear to be modified natural watercourses which would require appropriate buffers and possible realignment. The surface water flooding impacts of these measures if undertaken would need to be very carefully considered. We also highlight no temporary or permanent SUDS proposals should be placed online with the two natural watercourses.	No culverting of natural watercourses for the purposes of land gain is proposed. Wherever practicable buffers around watercourses have been implemented. Where this is not practicable further detail on the watercourse and proposed infrastructure is provided. A Flood Risk Assessment is provided in **Volume 4 Appendix 12.3 Flood Risk Assessment** which accounts for the impacts of the Proposed Development on flood risk elsewhere. Any watercourse structures will be designed to accommodate a 1 in 200-year plus climate change flow.	Watercourse culverting and diversions – **Section 12.6**; Watercourse buffers and watercourse inventory – **Section 12.6**; **Volume 4 Appendix 12.3: Flood Risk Assessment**; and **Volume 4 Appendix 12.2: Outline Surface Water Drainage Strategy**.

	The Burn of Halkirk (the watercourse on the northeast boundary of the site) and its straightened tributaries (some within the site) will require appropriate buffers – we would request a 50m buffer where possible. The Burn and tributaries appear to have been historically straightened so we highlight there is potential scope for significant improvement of these and we would welcome consideration of this as part of the Biodiversity Net Gain (BNG) assessment even though the Burn itself may not be within the site boundary.	Wherever practicable buffers around watercourses have been implemented. Where this is not practicable further detail on the watercourse and proposed infrastructure is provided. Watercourse realignment and naturalisation is incorporated into the Proposed Development.	Watercourse buffers, naturalisation and diversions – Section 12.6
	All other watercourses within the red line boundary appear to be man-made drainage channels except for one to the southwest of the site that we will reference as the Achalone tributary. We attach a plan below highlighting it in magenta for clarity. The first edition OS map shows an obvious natural planform downstream from the A9 crossing and for a short distance upstream. Given the small catchment area upstream from the road and the relatively moderate slope of the land, we suspect that upstream from where the OS map shows a natural planform (sinuous channel) there probably was not a channel. It was probably more just wet ground in a depression in the land. It is difficult to tell without seeing it on the ground. We note there is a channel now, but it is very straight. This watercourse will be impacted by the proposed works and therefore we will require to know how and what mitigation will be in place. We highlight this could be an opportunity to revert some of the straight channel to wetland and/or create more natural channel where appropriate. This would presumably help with the BNG target.	As part of the Proposed Development the Achalone Tributary around the southern and eastern edges of the Site will be diverted, with naturalisation measures included to improve the realigned watercourse above its current condition.	Watercourse buffers, naturalisation and diversions – **Section 12.6**
	Our database indicates the site comprises Wet Heather Moorland which is likely to include GWDTE. What the impacts on these will need to be carefully considered in any future detailed planning of this site. Avoidance should be the first principle.	Avoidance of GWDTE is implemented as a first principle, with a GWDTE risk assessment conducted where required.	**Section 12.6**
	OS maps indicate the presence of wells to the north and west of the site. SEPA will require confirmation of the existing status of these and the nature of the water supplies to neighbouring properties, particularly properties around North Achalone, Achalone and Banniskirk House, in any final submission and confirmation, if required.	Details of wells and private water supplies have been obtained as part of the desk-based assessment which informs this chapter.	**Section 12.4** and **Section 12.6**
	Whilst the site is not adjacent to the SEPA Future Flood Map extent, as already highlighted, there are several small watercourses/drainage ditches within and adjacent to the site and a Flood Risk Assessment should be included in any planning submission which indicates how these will be managed in terms of flood risk should they be diverted. A baseline assessment of flood risk should be provided alongside the flood risk with the works as proposed to ensure there is no increase elsewhere as a result.	A Flood Risk Assessment has been provided as an Appendix to this chapter.	**Volume 4 Appendix 12.3: Flood Risk Assessment**
	We note from the Scoping Report a ground investigation (GI) has been undertaken but has not been included in the Report. We refer the applicant to section 3 of the Appendix for what information we expect to see submitted with a planning application	The Ground Investigation Report is provided as an Appendix to this chapter.	**Volume 3 Appendix 12.4: Ground Investigation Report.**

	where peat maybe present. If further detailed peat probing is not proposed the full GI report should be submitted with any future application to justify this.		
Scottish Water	A review of our records indicates that there are no Scottish Water drinking water catchments or water abstraction sources, which are designated as Drinking Water Protected Areas under the Water Framework Directive, in the area that may be affected by the proposed activity.	Baseline data, including public water supplies, is discussed in **Section 12.4**.	**Section 12.4**.
	For reasons of sustainability and to protect our customers from potential future sewer flooding, Scottish Water will not accept any surface water connections into our combined sewer system.	The proposed surface water drainage system for the Proposed Development will outfall to existing watercourses at the Site. During construction it is anticipated that there will be an onsite temporary foul drainage solution which will be taken off site by a licensed carrier. As detailed in **Volume 4 Appendix 12.2: Outline Surface Water Drainage Strategy** there are no public sewers within the vicinity of the Proposed Development and therefore foul discharge from the Proposed Development will be discharged to the surrounding water environment via a suitably designed onsite package treatment plant which will be designed in accordance with SEPA guidance on foul discharge. As such, no surface water will outfall to Scottish Waters combined sewer system.	**Volume 4 Appendix 12.2**: **Outline Surface Water Drainage Strategy**

Following the scoping opinion, consultation was held with the Highland Council (statutory bodies were also invited), during a design workshop in May 2024. They key points relating to water resources, flood risk, and ground conditions raised during the design workshop and where this is addressed is summarised in **Table 12.2**.

Table 12.2: Summary of Consultation Response

Comments Made by Consultee	Response to Consultee	Section Addressed
The diversion of watercourses and burns may offer opportunities to improve the western edge of the Site with a re-naturalised burn and riparian planting.	As part of the Proposed Development the Achalone Tributary around the southern and eastern edges of the Site will be diverted, with naturalisation measures included to improve the realigned watercourse above its current condition.	**Section 12.6**
Is there potential to move the Proposed Development further east towards Banniskirk Mains to avoid the need to divert watercourses?	The platforms were moved further east, as far as practicable in response to THC comments, including visual impact along the A9.	Not applicable
The cut of the Site may affect drainage and alter the characteristics of Burn of Halkirk and Achalone Tributary.	Potential impacts on drainage characteristics are included as a potential effect within this chapter.	**Section 12.6, Volume 4 Appendix 12.2 Outline Surface Water Drainage Strategy. Volume 4 Appendix 12.4 GI Report.**
The cut of the Site may act as a sump where water will collected, requiring a pumped drainage solution.	Potential impacts on drainage characteristics are included as a potential effect within this chapter.	**Section 12.6**

12.3.4 Method of Baseline Data Collation

A desk-based survey has been carried out to collate existing data to form an understanding of the water resources, flood risk, and ground conditions within the Core Study Area and Wider Study Area. The desk-based survey included:

- Identification of catchments, watercourses, springs and water features from publicly available desktop sources;
- Collation of data provided through consultations;
- Collation of floodplain information and water quality data; and
- Compilation of soils, geological and hydrogeological information.

A site walkover was undertaken to visually inspect surface water features, obtain an understanding of the local topography and drainage patterns and to ground-truth the information reviewed and collated in the desk-based assessment.

Ground Investigation (GI) was undertaken in July 2023 to determine the underlying soil and geological composition of the Site, including groundwater depths.

12.3.5 Determining Magnitude of Change and Sensitivity of Receptors

The sensitivity of the baseline conditions, including the importance of environmental features on or near to the Site or the sensitivity of potentially affected receptors, was assessed in line with best practice guidance, legislation, statutory designations and / or professional judgement.

Sensitivity of a receptor to a change in it or its surroundings caused by a development is a description of the amount the key attributes of a receptor are affected by a given level of change. For a given level of change, the key attributes of a high sensitivity receptor will be affected more than those of a low sensitivity receptor.

Table 12.3 details the framework for determining the sensitivity of receptors. Sensitivity can be classified as high, moderate, low or negligible. These classifications are dependent on factors such as the quality and

quantity of water within the receptor, their purpose (e.g. whether used for drinking, fisheries, etc.) and existing influences, such as land-use.

Table 12.3: Framework for Determining Sensitivity of Receptors – Hydrology and Hydrogeology

Sensitivity of Receptor	Definition
High	The receptor is of national importance with limited ability to absorb change without fundamentally altering its present character. The receptor is of local scale and of high environmental value and rarity, or is of national or regional scale and of moderate/medium environmental value and rarity.
Medium	The receptor is of regional importance with limited ability to absorb change without fundamentally altering its present character. The receptor is of local scale and of medium environmental value and rarity, or is of national or regional scale and of low environmental value and rarity.
Low	The receptor is of local importance and scale, tolerant of change without detriment to its character and is of low environmental value and rarity.
Negligible	The receptor is resistant to change and is of little environmental value.

For geology and peat, the receptor classification is determined by a series of factors, including: the nature and extent of peat, associated habitats, soil characteristics, geology and land use. Peat soils of a high moisture content, such as those found in blanket bog, are considered to be highly sensitive receptors.

Table 12.4 details the different classifications of receptor sensitivity that are used to inform the assessment of geology and peat within the Core Study Area.

Table 12.4: Framework for Determining Sensitivity of Receptors – Geology, Peat and Soils

Sensitivity of Receptor	Definition
High	• Soil type and associated land use are highly sensitive (e.g. peat/blanket bog); • Class 1 or 2 priority peatland, carbon-rich and peaty soils cover >20% of the Project area. • Deep peat (>1.0 m) is present in area of blanket bog. • Nationally important carbon rich soils are present. • Areas containing geological or geomorphological features considered to be of national importance (e.g. geological Sites of Special Scientific Interests (SSSIs)); • Receptor contains areas of regionally important economic mineral deposits.
Medium	• Soil type and associated land use are moderately sensitive (e.g. commercial forestry); • Class 1 or 2 priority peatland, carbon-rich and peaty soils cover <20% of the Development Area; • Class 3 to 5 peatland areas, carbon rich and peaty soils; • Deep peat (>1.0 m) is present out with blanket bog; • Receptor contains areas of locally important economic mineral deposits; • Areas containing geological features of designated regional importance including Regionally Important Geological/geomorphological Sites (RIGS), considered worthy of protection for their historic or aesthetic importance.
Low	• Geological features or geology not protected and not considered worthy of specific protection; • Soil type and associated land use not sensitive to change in hydrological regime (e.g. intensive grazing); • Receptor contains Class -2, -1, 0, and 4 non-peatland areas, with no carbon-rich and/or peaty soils.
Negligible	• The receptor is resistant to change and is of little environmental value.

The magnitude of potential change will be identified through consideration of the Proposed Development, the degree of change to baseline conditions predicted as a result of the Proposed Development, the duration and reversibility of an effect and professional judgement, best practice guidance and legislation. The magnitude of change is determined by the timing, scale, size, and duration of the potential change resulting from the Proposed Development. The criteria for assessing the magnitude of change are presented in **Table 12.5** and **Table 12.6**.

Table 12.5: Framework for Determining Magnitude of Change – Hydrology and Hydrogeology

Magnitude of Change	Definition
High	A fundamental change to the baseline condition of the asset, leading to total loss or major alteration of character: • A short or long term major shift in hydrochemistry or hydrological conditions sufficient to negatively change the ecology of the receptor. This change would equate to a downgrading of a watercourse classification by two classes e.g. from “High” to “Moderate”; • A sufficient material increase in the probability of flooding onsite and offsite, adding to the area of land which requires protection by flood prevention measures or affecting the ability of the functional flood plain to attenuate the effects of flooding by storing flood water; • Where there would be complete severance of a site such as to fundamentally affect the integrity of the site (e.g. blocking hydrological connectivity); • Major permanent or long-term negative change (i.e., degradation of quality) to groundwater quality or a reduction in the available yield; and / or • Changes to quality or water table level which will cause harm local ecology or will lead to flooding issues.
Medium	A material, partial loss or alteration of character: • A short or long term non-fundamental change to the hydrochemistry or hydrological environment, resulting in a change in ecological status. This change would equate to a downgrading of watercourse classification by one class e.g. from “Good” to “Moderate”; • A moderate increase in the probability of flooding onsite and offsite, adding to the area of land which requires protection by flood prevention measures or affecting the ability of the functional flood plain to attenuate the effects of flooding by storing flood water; • Major severance or major effects to a site which impacts its integrity as a feature, or disturbance such that the value of the site would be affected, but could still function; • Changes to the local groundwater regime may slightly affect the use of the receptor; • The yield of existing supplies may be reduced or quality slightly deteriorated; and / or • Fundamental degradation of local habitats may occur, resulting in impaired functionality.
Low	A slight, detectable, alteration of the baseline condition of the asset: • A detectable non-detrimental change to the baseline hydrochemistry or hydrological environment. This change would not reduce the watercourse quality classification; • A marginal increase in the probability of flooding onsite and offsite, adding to the area of land which requires protection by flood prevention measures or affecting the ability of the functional flood plain to attenuate the effects of flooding by storing flood water;

	• A detectable but non-material effect on the receptor or a moderate effect on its integrity as a feature or where there would be a minor severance or disturbance such that the functionality of the receptor would not be affected; and / or • Changes to groundwater quality, levels or yields that do not represent a risk to existing baseline conditions or ecology.
Negligible[36]	A barely distinguishable change from baseline conditions: • No perceptible changes to the baseline hydrochemistry or hydrological environment; • No change to the watercourse water quality classification; • No increase in the probability of flooding onsite and offsite; and / or • A slight or negligible change from baseline condition of l resources; change hardly discernible, approximating to a situation of 'no change' in condition.

Table 12.6: Framework for Determining Magnitude of Change – Geology and Peat

Magnitude of Change	Definition
High	• Major or total loss of or alteration to peatland resource such that post development characteristics or quality will be fundamentally or irreversibly changed. • Long term/permanent change to human or environmental health. • Catastrophic failure of site infrastructure due to ground instability. • Long term/permanent change to baseline resource; and • Major or total loss of a geological site or mineral deposit, where the value of the site would be severely affected.
Medium	• Loss of, or alteration to the baseline resource such that post development characteristics or quality will be partially changed. • Mid-term/permanent change to human or environmental health. • Ground failure that requires remediation but does not cause catastrophic failure of site infrastructure. • Mid-term/permanent change to baseline resource; and • Partial loss of a geological site or mineral deposit, with major effects to the settings, or where the value of the site would be affected.
Low	• Small loss of soils or peatland, or where soils will be disturbed but the value not impacted. • Short-term change to human or environmental health. • Ground settlement/subsidence that does not adversely affect site infrastructure or require remedial action. • Short-term change to baseline resource; and • Small effect on a geological site or mineral deposit, such that the value of the site would not be affected.
Negligible[37]	• Minimal or no change to soils or peatland deposits. • Minimal or no change to human or environmental health. • Minimal or no change to ground stability. • A very slight change from the baseline conditions. The change is barely distinguishable, and approximates to the 'no-change' situation; and • Minimal or no change to a geological site or mineral deposit.

[36] Negligible magnitude of change includes magnitude of effects that would be assessed as no change to the baseline scenario.

[37] Negligible magnitude of change includes magnitude of effects that would be assessed as no change to the baseline scenario.

The sensitivity of the asset and the magnitude of change will be used as a guide, in addition to professional judgement, to predict the significance of the likely effects. The matrix for determining the significance of effects is then used as outlined in **Chapter 5 Table 5-1.**

12.3.6 Limitations and Assumptions

All data considered necessary to identify and assess the potential significant effects resulting from the Proposed Development was available and used in the assessment reported in this chapter, and as such there are not considered to be any information gaps.

Should there be any PWS not known by THC, these will be identified as part of the construction planning conducted by the principal contractor.

The baseline conditions have been identified from a range of sources including historical and third-party data, however due to the dynamic nature of the Study Area certain aspects of the baseline conditions are likely to alter during the construction and operation of the Proposed Development.

The GI completed within the Core Study Area comprised 64 trial pits and 26 boreholes, to maximum depths of 15m for boreholes and 4.5m for trial pits. Given the comprehensive nature of the GI completed it is considered that peat probing was not required, and the baseline peat characteristics within the Core Study Area have been established from the results of the GI.

Prior to construction it is anticipated that additional information to that provided within this chapter would be required to inform the detailed design of crossings for flow conveyance and ecological provision which would be informed by consultation with SEPA and The Highland Council.

The assessment of effects within this chapter assumes that embedded mitigation measures are implemented. This includes the relevant SSEN Transmission General Environmental Management Plans (GEMPs) (that would inform a CEMP to be implemented by the Principal Contractor post submission). The relevant GEMPs include the following:

- Private Water Supplies;
- Working in or Near Water;
- Watercourse Crossings;
- Soil Management;
- Contaminated Land;
- Oil Storage and Refuelling;
- Forestry;
- Bad Weather; and
- Working with concrete.

12.4 Baseline Conditions

The Core Study Area is located on the north-western slope of Spittal Hill, approximately 520 m to the northeast of the existing Spittal Substation located on the opposite side of the A9. The Core Study Area lies within the hamlet of Banniskirk, in the Highland Council district of Scotland, centred on Ordnance Survey National Grid Reference (OSNGR) 316033 E, 956747 N.

Currently, the Core Study Area comprises mainly arable land, with areas of woodland to the east and northwest. Several surface water drainage ditches are present across the Core Study Area; generally, water drains in a north-westerly direction towards the Burn of Halkirk and west towards a tributary of Halkirk Burn.

Existing ground levels across the Core Study Area comprise an overall fall from approximately 90 metres Above Ordnance Datum (m AOD) in the southeast to approximately 65 m AOD in the northwest. A minor ridge is present across the centre of the Core Study Area, from southeast to northwest, with levels falling away towards the two burns.

12.4.1 Surface Hydrology

The Core Study Area is located within the Scotland WFD River Basin District (RBD), the main river catchment of the River Thurso, and the nested catchment of the Halkirk Burn.

The only WFD surface water body within the Wider Study Area is Halkirk Burn (SEPA ID: 20642), which is located approximately 786 m to the west of the Site boundary and has an overall WFD waterbody classification of "Moderate", a water quality classification of "High" and "Good" ecological potential. The Halkirk Burn has a 2027 and Long-Term objective to have an overall classification of "Good". The network of field drains located within the Core Study Area are assessed to act as tributaries to the Halkirk Burn.

Halkirk Burn is a tributary of the River Thurso which feeds into the River Thurso to Loch More to sea waterbody (SEPA ID: 20637) located approximately 2.8 km to the northwest of the Site, which has an overall WFD waterbody classification of "Good". There are no WFD surface water bodies within the Core Study Area.

The Core Study Area comprises a network of artificial field drainage ditches, particularly across the south of the Core Study Area. The artificial drainage ditches are generally located at the edges of the existing fields, draining surface water from the agricultural land to the northwest. A number of these drainage ditches are shown to drain under the A9 and ultimately into the main channel of Halkirk Burn.

The surface water baseline is presented in **Volume 3 Figure 12.2**.

12.4.2 Designated Hydrological Receptors

A review of NatureScot (formerly Scottish Natural Heritage) GIS datasets available through the Scotland's Environment mapping service[38] was used to identify statutory designated sites related to the water environment within the Wider Study Area. Statutory designations include those of international importance, e.g., Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Wetlands of International Importance (Ramsar); those of national importance, such as Sites of Special Scientific Interest (SSSIs) and National Nature Reserves (NNR); and those of local importance, i.e. Local Nature Reserves (LNR).

The only statutory designated site within the Wider Study Area is Banniskirk Quarry SSSI, located approximately 230m to the east of the Site boundary, and designated for earth sciences: Silurian - Devonian Chordata. Banniskirk Quarry is not hydrologically dependent and is hydrologically disconnected by topography and existing drainage within the Wider Study Area and therefore, has not been considered further within this chapter. There are no other hydrologically dependent or hydrologically connected designated sites within the Wider Study Area.

The Caithness and Sutherland Peatlands are a designated SPA and SAC, as well as a UNESCO World Heritage Site (WHS) and are located approximately 6.6 km northwest of the Core Study Area. The qualifying feature of the WHS is peatland habitat. Due to the distance from the Core Study Area, it is considered that the WHS is not in hydrological connection to the Core Study Area.

12.4.3 Flood Risk

The Indicative SEPA Flood Map[34] shows areas of Scotland with a 0.1% Annual Exceedance Probability (AEP) or greater chance of flooding. The indicated flood extents are classified into areas of river, surface water and coastal flooding with a risk rating of low (0.1% AEP) to high (10% AEP) applied. This mapping also shows areas which could have a 0.5% AEP chance of flooding from either rivers or the Sea by the 2080s.

SEPA's flood map indicates that the Site is not at risk of coastal flooding or river flooding both now and in the future, with a less than 0.1% AEP chance of flooding in any given year. Halkirk Burn to the west is shown to have a high risk (10% AEP) of river flooding, although this is not shown to impact the Site. However, as the upper Burn of Halkirk has a contributing catchment area of less than 3 km^2, the reach of the watercourse adjacent to the Site is not captured in the SEPA flood maps.

The SEPA flood map also indicated that the Site remains mostly free from surface water flooding, with no surface water flood flow paths indicated within the Site boundary. There are two isolated areas at medium risk

[38] NatureScot. (2023) SiteLink[Online], Available at: https://sitelink.nature.scot/map. Date accessed 14/10/2024

of surface water flooding within the Site boundary, associated with localised depressions at the head of artificial drainage channels. Land to the north of the Site, adjacent to the upper Halkirk Burn, is shown to be at low to high risk of surface water flooding. However, these areas are slight and do not encroach on the Proposed Development.

A site-specific FRA is provided in **Volume 4 Appendix 12.3: Flood Risk Assessment** which assesses the potential risk of flooding from a range of sources and the potential impact of the Proposed Development on flood risk elsewhere and concludes that the Core Study Area is at low risk of fluvial flooding and compliant with flood risk legislation, policies and guidance. The FRA recommends that where any existing watercourse crossings are upgraded this should be informed by hydraulic modelling at that stage to quantity potential impacts on flood risk downstream as a result of increases conveyance through crossings.

12.4.4 Hydrogeology

The BGS 1:625,000 hydrogeology map shows the bedrock unit is part of the Middle Old Red Sandstone rock unit, which is characterised as 'moderately productivity aquifers' whereby sandstones, in places flaggy, with siltstones, mudstones and conglomerates and interbedded lavas, locally yield small amounts of groundwater. The underlying hydrogeology is shown in **Volume 3 Figure 12.3**.

The Site is shown to be situated on the Caithness groundwater body (SEPA ID: 150692), which has an overall WFD classification of "Good".

The results from the GI conducted in the Core Study Area show that for most trial pits groundwater was not encountered before reaching probable rock. The depths and locations where groundwater was encountered is summarised in **Table 12.7**. The distribution of identified groundwater levels across the Core Study Area does not indicate there is a predominant direction of groundwater flows through the Core Study Area, with groundwater levels likely to vary depending on the localised groundwater connectivity. Full write up of the GI including the locations of trial pits and boreholes are shown in **Volume 4 Appendix 12.4: Ground Investigation Report**.

Table 12.7: Summary of Groundwater Levels Encountered During Ground Investigation

Trial Pit Number	Groundwater Depth (m)
02	0.80
03	1.10
03A	1.10
08	2.00
08A	2.00
11	1.70
13	2.00
13A	2.00
TP16	1.10
19	1.55
20	0.60
21	2.50
29	1.20
30	0.90
32	0.80
33	2.00
35	0.60

38	0.60
42	1.10
47	0.80
52	1.20
57	2.30
58	1.20
60	0.70
61	2.30
66	2.10 (rose to 2.05)
67	2.10
68	0.70
70	1.90

12.4.5 Groundwater Dependent Terrestrial Ecosystems

SEPA's database indicates that the Site comprises Wet Heather Moorland which is likely to include GWDTEs.

A UK Habitat (UKHab) survey was undertaken by ERM to identify potential GWDTEs that could be impacted. The survey was based on the methods described in the UK Habitat Classification User Manual[39]as extended for use in Environmental Assessment. Further details of the survey are detailed in **Chapter 9**, with results of the National Vegetation Classification (NVC) survey and GWDTEs shown in **Volume 3 Figure 9.2a** and **Figure 9.2b** respectively.

The groundwater dependency of the NVC communities are defined by Appendix 4 of SEPA LUPS-GU31[40] as moderately or highly groundwater dependent. Site specific desk and field-based assessment has been conducted to determine whether potential GWDTE habitats are truly groundwater dependent based on the following criteria based on the Botanaeco GWDTE decision tool[41]:

- Where the habitat is evidently dependent on and/or influenced by groundwater flow and discharge dependency is high. Key identifying characteristics include the presence of standing water in locations where there are no surface water features, the habitat being located at a spring head (e.g., NVC communities M31, M32, M33), diffuse source such as a flush (e.g., NVC communities M6, M23, M31, M32 and M33) or the presence of floristic indicators of base enrichment (e.g., NVC communities M10, M11, M37 or M38).
- Where the habitat is identified as being associated with surface water features or watercourse dependency will be no more than moderate and likely to be low. Key identifying characteristics include association with fractal, dendritic structure of seeps, rills & runnels leading to larger watercourses, location away from the likely emergence of groundwater (e.g. flat areas, upper slopes, etc) and location in or nearby to a watercourse, floodplain or topographic low point.
- Where the habitat is identified as being associated with ombrotrophic systems (i.e., rain-fed) dependency will be no more than moderate and likely to be low. Key identifying characteristics include the presence of M6 or M25 in association with M15 and/or M20, location on gentle slopes or flat areas above or beyond the potential emergence of groundwater, upstream or upslope presence of ombrotrophic bog or mire (e.g., wet heath or blanket bog), the presence of peat which is more than 0.5m in thickness or located away from groundwater rises (e.g., topographic high points, flat areas). Where habitats are located within artificial drainage ditches groundwater dependency will be low.

[39] UKHab (2023) The UK Habitat Classification Version 2.0. Available online: https://ukhab.org/ukhab-documentation/ Date accessed 22/10/2024

[40] SEPA (2017) Land Use Planning System SEPA Guidance Note 31. Available online: https://www.sepa.org.uk/media/144266/lups-gu31-guidance-on-assessing-the-impacts-of-development-proposals-on-groundwater-abstractions.pdf Date accessed 22/10/2024

[41] Botaneco, GWDTE Decision Tool. Available online at: https://botanaeco.co.uk/gwdte

The GWDTE identified during the NVC survey, the potential dependency, location with the Core Study Area and a summary of the observed dependency following a review of the localised hydrological and hydrogeological environment is detailed in **Table 12.8**.

Table 12.8: Groundwater Dependant Terrestrial Ecosystems Summary

NVC Community	Potential Groundwater Dependency (LUPS GU31)	Location Within the Core Study Area	Observed Groundwater Dependency
M15 Erica tetralix wet heath	Moderate to High	East of the Core Study Area in the location of the substation platform.	Low. The site walkover identified that the habitat is bounded by a network of linear surface water drains which are anticipated to be manmade on the upper edge of the slope of the wider topography.
M16 Sphagnum compactum wet heath	Moderate	Southeast of the Core Study Area in the location of the substation platform and cutoff ditch. North and centre of the Core Study Area in the location of the substation platform, bunding and cutoff ditch.	Low. In the north of the Core Study Area the site walkover identified that the watercourses are fractal in nature and land in the north is assumed to be surface water dependent. In the southeast of the Core Study Area the site walkover identified the presence of linear field drains which had standing water within the larger drain passing through the M16 habitat which has some saturated ground around the banks of the watercourse, however ground was no saturated away from the watercourse, indicating the habitat is surface water fed.
M23 Galium palustre rush-pasture	Moderate	Centre of the Core Study Area in the location of the substation platform.	Moderate. Whilst the habitat is a diffuse source the walkover survey identified manmade surface water drains within the habitat with topographic surface water flow routes evident within the habitat.
MG10 Juncus effusus rush-pasture	Moderate	South of the Core Study Area and spanning the eastern and western edges of the Core Study Area. In the location of the substation platform, operations depot, access tracks, bunding and detention basin.	Low. The habitat is located along the bank of the Burn of Halkirk and topography shows the habitat drains towards the watercourse.
U6 Festuca ovina grassland	Moderate	Centre of the Core Study Area in the location of the substation platform.	Low. The site walkover identified that the habitat is bounded by a network of linear surface water drains which are anticipated to be manmade on the upper edge of the slope of the wider topography.
M18 Blanket sphagnum bog	High	Centre of the Core Study Area in the location of the substation platform and cutoff ditch.	Low. The site walkover identified that the habitat is located on flat land and bounded by surface water field drains which are linear and appear to be man made.

12.4.6 Private Water Supplies

Publicly available mapping provided by the Highland Council indicates that there are no known private water supplies within 2 km of the Site.

SEPA's scoping response highlights the presence of wells on the Site in the first edition OS map[42] (1940s – 1880s). Questionnaires were issued by SSE to surrounding residents to confirm the nature of water supplies which have potential hydrological connectivity to the Proposed Development within the Wider Study Area. In total 17 questionnaires were issued, with 12 responses received. The results of these questionnaires indicate that there are no private water supplies within the Wider Study Area which are within connectivity to the Site and that the surrounding properties are served by Scottish Water mains. The locations of the wells shown on OS mapping correlate with the locations of properties which confirmed they are served by Scottish Water mains. Acknowledging the presence of Scottish Water mains, it is anticipated that the wells shown on OS mapping are no longer functional.

12.4.7 Public Water Supplies

The Site does not lie in a surface water Drinking Water Protected Area. This has been confirmed by Scottish Water, who in their scoping response stated that upon review of their records, there are no Scottish Water drinking water catchments or water abstraction sources, which are designated as Drinking Water Protected Areas under the Water Framework Directive, in the area that may be affected by the Proposed Development. The Site is however, within the Caithness groundwater Drinking Water Protected Area[43].

12.4.8 Geology

The British Geological Survey (BGS) GeoIndex Onshore mapping portal[35] includes general geological map data for the United Kingdom. The BGS 1:50,000 bedrock geology map shows that the Site is underlain by the Spittal Flagstone Formation comprising Siltstone, Mudstone, and Sandstone. The BGS 1:50,000 superficial deposits map indicates that the Site is situated on superficial deposits comprising Till, Devensian – Diamicton. The underlying bedrock geology is shown in **Volume 3 Figure 12.4**.

The portal also includes records of boreholes, shafts, and wells from all forms of drilling and ground investigation work. Two borehole logs are recorded approximately 85m to the north of the Site, at Georgemas Station, ND15NE1 and ND15NE2. Natural strata at ND15NE1 were recorded to comprise hard grey slatey rock overlain by stiff grey clay, then gravel, brown sandy clay & stones, and finally surface soils. Strata within borehole ND15NE2 was recorded to comprise of hard grey slatey rock overlain by stiff grey clay, then grey sandy clay & stone and surface soils. Onsite boreholes were conducted and the results of this are located in Appendix 12.4 GI Report.

12.4.9 Contaminated Land

Activities associated with the Site's use as agricultural land may have resulted in contamination associated with fuel, oils, and substances such as fertilisers. Construction of the A9, which runs along the western Site boundary, may have also resulted in contamination of the soils at the Site. However, it is considered unlikely that there will be significant levels of contamination present at the Site as a result of these activities.

The Coal Authority Interactive Map Viewer[36] indicates that the Site does not lie in an area that has been affected by coal mining, which can be a source of contamination.

No reference to contaminated land or soils are detailed in the GI trial pit and borehole logs and therefore is not considered further in this assessment.

[42] National Library of Scotland (2024) OS six-inch 1st Edition (1840s – 1880s) [Online]. Available at: https://maps.nls.uk/geo/explore/#zoom=16.3&lat=58.49304&lon=-3.45426&layers=257&b=1. Date accessed 14/10/2024

[43] Scottish Government (2014). Drinking Water Protected Areas. Available online at: https://www.gov.scot/publications/drinking-water-protected-areas-scotland-river-basin-district-maps/

12.4.10 Unexploded Ordnance (UXO)

The Zetica UXO (Unexploded Ordinance) Risk Map[37] indicates that the Site lies entirely within an area of low risk for UXO, indicating that UXO and associated contaminants are unlikely to be present.

12.4.11 Soils

The national soil map of Scotland[38] indicates that the Site is situated on component soils comprising noncalcareous gleys (soils which are part of the gleys major soil group and noncalcareous gleys major soil subgroup).

The Carbon and Peatland Map 2016[39] details that most of the Site is underlain by Mineral Soils, with substantial areas of Class 3 peat also present as well as two small areas of Class 4 peat. These are not designated as high priority peatland habitats and are classified as follows:

- Class 3 Peat: "*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.*";
- Class 4 Peat: *"Area unlikely to be associated with peatland habitats or wet and acidic type. Area unlikely to include carbon-rich soils."*; and
- Mineral Soils: *"Peatland habitats are not typically found on such soils"*.

The preliminary Ground Investigation (GI) report shows that the soil materials consist of topsoil and peat below the excavation area. The platform area shows peat, rockfill, topsoil, sandy clay, silt, made ground, and gravelly sandy silt. The southwest, west, east, and southeast areas of the Site show topsoil and isolated occurrences of peat. The north of the Site indicates topsoil and made ground.

The GI shows that peat depths in the boreholes range from 0.1m to 1.4m with an average peat depth of 0.6m. The type of peat was recorded as typically peat based topsoils and brown pseudo-fibrous peat described as H2 and H3 on the von Post scale (no to very slight decomposition) respectively. Peat was also recorded in 13 of the 70 trial pits with depths ranging from 0.2m to 0.55m averaging 0.3m.

The superficial soils and the national soil map of Scotland soils underlying the Core Study Area are shown in **Figure 12.5** and **Figure 12.6** respectively. The extracts of the Carbon and Peatland 2016 map within the Core Study Area are shown in **Figure 12.7**.

12.4.12 Sensitive Receptors

The sensitivities of the receptors identified as having the potential to be impacted by the Proposed Development based on the baseline conditions are detailed in **Table 12.9**.

Table 12.9: Hydrology, Geology and Soils Receptor Sensitivity

Receptor	Sensitivity	Sensitivity Description
Surface Hydrology (watercourses)	High	The surface water drains within the Core Study Area are of local importance, however they are hydrologically connected to the Halkirk Burn which is of local scale and high environmental value.
GWDTEs	Medium	GWDTEs are identified to have a low to moderate groundwater dependency, and will be of local scale and medium value.
Soils and Peat	Medium	GI investigations indicate there is no deep peat in the locations of the trial pits, however there are peaty soils within the Core Study Area.
Hydrogeology (groundwater)	Medium	The Proposed Development is underlain by a moderately productivity aquifer and the Caithness groundwater body which has an overall WFD classification of "Good", which is of local to regional scale and medium environmental value.

Downstream Flood Risk	High	There are properties, buildings and infrastructure located downstream of the Core Study Area which are shown to be at 'High' risk of flooding from the Burn of Halkirk and River Thurso.

12.5 Issues Scoped Out

As detailed in the Scoping Report the assessment of potential effects on the following receptors were scoped out:

- Designated receptors, surface water bodies and groundwater bodies not hydrologically connected to the Proposed Development, as there is no potential for effects on these receptors; and
- Receptors at distances greater than 1 km from the Proposed Development, as dilution and attenuation will mitigate pollution and sedimentation effects on the water environment.
- The Caithness and Sutherland Peatlands are a designated SPA and SAC, as well as a UNESCO World Heritage Site. The Core Study Area is located approximately 7 km northeast of the Caithness and Sutherland Peatlands and as such, there will be no impact on this sensitive receptor as a result of the Proposed Development and it is therefore scoped out.
- Impacts to PWS. The results of the PWS questionnaire and a review of the THC PWS database indicate that there are no PWS within 250m of the Proposed Development; 250m is the maximum buffer from excavations set out in LUPS31. The wells identified on OS mapping correlate with the location of properties now served by Scottish Water mains. As part of the pre-construction planning the appointed contractor will complete a screening study to identify any PWS in accordance with the PWS GEMP.

Activities associated with the Site's use as agricultural land may have resulted in contamination associated with fuel, oils, and substances such as fertilisers. Construction of the A9, which runs along the western Site boundary, may have also resulted in contamination of the soils at the Site. However, it is considered unlikely that there will be significant levels of contamination present at the Site as a result of these activities. Therefore contaminated land is scoped out of this assessment.

12.6 Assessment of Effects, Mitigation and Residual Effects

12.6.1 Mitigation by Design

The Proposed Development has been designed to reduce potential impacts as far as reasonably practicable. This includes mitigation that is *embedded* into the design in accordance with industry standard methods and procedures and from consideration of environmental constraints identified during the EIA process. A summary of the embedded mitigation incorporated into the project design to reduce to effects on geology, hydrology, hydrogeology, and soils in the study areas are presented in **Table 12.10**.

Table 12.10: Embedded Mitigation

Reference	Title	Description
HYD01	Watercourse Alterations and Diversions	A 5m to 10m buffer around watercourses during construction, within which no storage or construction works will take place in accordance with SEPA Good Practice Guidance WAT-SG-29[44]. The Proposed Development will utilise existing access tracks already in place where feasible, this will help to minimise ground disturbance and requirement for watercourse crossings. Any watercourse alterations will be subject to CAR authorisation. Where watercourses are altered, structures appropriate to the localised conditions will be installed and anticipated to be designed as appropriately sized culverts in line with SEPA's good practice guidance, SEPA CAR Practical Guidance (In particular the General Binding Rules) and the GEMPs. The adoption of good practice measures detailed in the GEMP would reduce the impact of modification to drainage flow patterns with artificial

[44] SEPA, Engineering in the Water Environment Good Practice Guidance. Temporary Construction Methods. Available online at: https://www.sepa.org.uk/media/150997/wat_sg_29.pdf

		drainage only installed where necessary and would where practicable be installed in advance of ground being cleared. All structures would be designed and construction following good practice techniques in accordance with the GEMPS and be of sufficient capacity to facilitate flows to a 1 in 200-year event with an appropriate allowance accounting for increases in flows due to climate change in accordance with SEPA guidance. The diversion of the Achalone Tributary will be subject to a SEPA Controlled Activities Regulations (CAR) Simple Licence (as the watercourse width is less than 3 m wide) and will be completed in accordance with the following diversions and realignments measures set out in CAR Flood Risk Standing Advice[45] and other relevant SEPA Good Practice Guidance (WAT-SG-29): • Minimising sharp bends and changes to slope which will affect velocity; • To minimise detrimental changes to the channel the proposed channel dimensions/ characteristics will be kept similar to existing channel dimensions, i.e. mimic existing channel plan form; • The proposed channel will not be located closer to infrastructure or property compared to the existing channel as it can increase the risk of flooding to existing infrastructure or property; • The channel will follow the natural topography of the land to ensure floodwater is returned to the watercourse thus limiting flooding elsewhere; and • Regular monitoring of the post engineering work will be undertaken.
HYD02	Pollution and Spillage	Construction good practice methods, outlined within the CEMP and based on the GEMPs, will limit the potential risk of spillages and contamination, to reduce the potential for chemical pollutants to be transferred to the water environment and protect watercourses from impacts related to construction works. Additional measures such as absorbent spill pads / kits and other measures highlighted within a CEMP will effectively limit the uncontained release of chemicals to minor fugitive releases. These would be minimised through best practice construction methods such as vehicle speed limits and regular vehicle and machine maintenance. Routine training practices such as staff inductions and toolbox talks will be conducted throughout construction.
HYD03	Erosion and Sedimentation	Good practice site environmental management measures set out in the Soil Management GEMP will reduce any potential effects of soil erosion and sedimentation. A 6m buffer around watercourses during construction, within which no storage or construction works will take place.
HYD04	Modifications to Hydrogeology and Groundwater	Prior to excavation works, further ground investigations will be conducted by an appointed contractor, which will include identifying groundwater levels within the areas of excavation. Where groundwater is identified dewatering or groundwater diversion will be conducted with mitigation and control measures in accordance with best practice guidance (e.g., CIRIA Groundwater Control). Measures relating to the identification and protection of groundwater will be detailed and secured within the CEMP.
HYD05	GWDTEs	Prior to access track construction, site operatives will identify flush areas, depressions or zones which may concentrate water flow. These sections will be spanned with plastic pipes or drainage matting to ensure hydraulic conductivity under the road and reduce water flow over the road surface during heavy precipitation.

[45] SEPA, CAR Flood Risk Standing Advice for Engineering, Discharge and Impoundment Activities. Available online at: https://www.sepa.org.uk/media/94134/car-flood-risk-standing-advice-for-engineering-discharge-and-impoundment-activities.pdf

		The following good practice construction and design measures will be implemented during construction and secured through the CEMP and GEMPs to ensure that effects on wetland habitats are minimised: • A Pollution Prevention Plan (PPP) is implemented to ensure good practice working methods are followed throughout construction works; • Silt traps will be deployed to trap and filter sediment-laden run-off throughout the construction phase of the Proposed Development; • Settlement lagoons will be constructed and actively managed to control water levels and ensure that any run-off is contained, especially during times of rainfall; • Foundations are constructed in holes in the ground that will be dewatered, and hence water flow is typically into the foundation area. This will prevent concrete leaching into groundwater or surface water in the event of shutter collapse; and • All excavations will be sufficiently dewatered before concrete pours begin and that dewatering continues while the concrete cures. However, construction good practice will be followed to ensure that fresh concrete is isolated from the dewatering system. In accordance with SEPA Land Use Planning System Guidance Note 31 as there will be excavations of >1m within 250m and <1m within 100m of GWDTEs monitoring of groundwater must take place to demonstrate that there is no degradation in the quality of groundwater and hydrological connectivity. Monitoring will be secured through an appropriately worded planning condition and completed in accordance with SEPA Land Use Planning System Guidance Note 31 and include the following: • Monitoring results will be presented to the planning authority in consultation with SEPA annually from the commence of development; • Monitoring will provide an evidence base which demonstrates that the construction and maintenance of infrastructure is proceeding as intended and not resulted in a statistically significant quantitative or qualitative change to groundwater flows; • The quality of identified GWDTEs will be measured every year (minimum of 1 fixed quadrat to the NVC level); • A minimum of 1 upgradient and 2 downgradient monitoring points will be implemented for each identified GWDTE; • Preconstruction monitoring will include a minimum of 10 samples equally spaced over a minimum of 6 months prior to construction (including at least 5 samples in the summer period); and • Post construction monitoring will include a minimum of 10 samples per year for a minimum of 3 years, with an annual monitoring report to be submitted to SEPA and the planning authority.
HYD06	PWS	The principial contractor will further assess PWS prior to construction to identify any PWS not identified in the EIA and verify the location of PWS source locations, types and uses. Further consultation would be held with the property/landowner as part of this process if any PWS were to be identified. The principal contractor will consider all construction activities and ensure they are aware of all PWS within the surrounding area that may be at risk as a result of the Proposed Development. Should this process identify any PWS which require protection an approach will be developed and agreed with SEPA. The principal contractor will complete construction works in accordance with the measures and approach set out in the Private Water Supplies GEMP.

HYD07	Soil Loss and Compaction	The measures set out in the Soil Management GEMP will limit potential impacts on soil compaction and quantities. Traffic routes will be clearly defined throughout construction with vehicles not permitted to route through ground outwith the defined access. Access to unstripped grounds will be limited to low weight and tracked vehicles. A defined working area, where soil stripping will take place, will be set for construction with the number of working areas planned for and managed to ensure that soil transportation within the site is limited. Stripping will be undertaken with care and in accordance with industry standard best practice measures with topsoil and sub-soils being removed and stored in clearly separated bunds on unstripped grounds.
HYD08	Peat and Soil Management	The following measures are considered sufficient, and sufficiently reliable, to avoid substantial alterations to the natural drainage regime: • Any peat and peaty soils will be reinstated on access track and infrastructure verges with turves placed on the upper horizons, encouraging revegetation; • All peat, soil and turves excavated from beneath infrastructure will be reinstated in the vicinity of its original location; • Any wet catotelmic peat will be placed at the bottom of any restoration profile, followed by semi-fibrous catotelmic peat and acrotelmic peat should be placed at the top; • Peatland restoration activities will be overseen by the Ecological Clerk of Works (ECoW) to ensure methods are properly adhered to; • The surface layer of peat (acrotelm) and vegetation will be stripped separately from the catotelmic peat. This will typically be an excavation depth of up to 0.5 m; • Acrotelmic material will be stored separately from catotelmic material; • Careful handling is essential to retain any existing structure and integrity of the excavated materials and thereby maximise the potential for excavated material to be re-used; • Less humified catotelmic peat which maintains its structure upon excavation should be kept separate from any highly humified amorphous or wet catotelmic peat; • Acrotelmic material will be replaced as intact as possible once construction progresses / as it is complete; • To minimise handling and transportation of peat, acrotelmic and catotelmic will be replaced, as far as is reasonably practicable, in the locality from which it was removed. Acrotelmic material is to be placed on the surface of reinstatement areas; • Temporary storage of peat will be minimised, with restoration occurring in parallel with other works; • Suitable storage areas should be sited in locations with lower ecological value, low stability risk and at a suitable distance from water courses; • Peat should be stored in stockpiles no greater than 2 m in height; • Reinstatement will, in all instances, be undertaken at the earliest opportunity to minimise storage of turves and other materials; • Managing the construction work as much as possible to avoid periods when peat materials are likely to be wetter i.e. high rainfall events; • Temporary storage and replacement of any peat excavated from the borrow pit should occur adjacent to and within the source pit; and • Transport of peat on Site from excavation to temporary storage and restoration site should be minimised.

HYD09	Flood Risk and Drainage	The surface water drainage measures set out in **Volume 4 Appendix 2.2: Outline Surface Water Drainage Strategy** will be implemented to prevent an increase in surface water runoff and flood risk downstream. The drainage system will attenuate surface water runoff from the Proposed Development to a 1 in 200-year plus climate change allowance whilst limiting discharge rates to the calculated greenfield runoff rate.

12.6.2 Construction Phase

Impediments to and Modification of Surface Water Drainage Patterns

Construction activities in or adjacent to watercourse channels, the location of watercourse crossings in constrained channels or inadequately designed crossings could impede flows within watercourses and causes blockages, resulting in flooding upstream.

The introduction of new or upgraded access tracks can disrupt the natural drainage regime by concentrating flows and altering the infiltration capacity of soils.

As part of the drainage regime of the Proposed Development, existing watercourses which have been identified as non-natural surface water field drains during the field survey, with many watercourses not conveying any flows or holding surface water at the time of the field survey, will be crossed, diverted or culverted. The non-natural watercourses will be culverted over as part of the substation platform and the Achalone Tributary around the southern and eastern edges of the Site will be diverted, with naturalisation measures included to improve the realigned watercourse above its current condition.

The diversion of the Achalone Tributary has the potential to displace surface water drainage patterns where appropriate compensatory drainage is not provided, whilst also interfering with drainage characterises through altering surface water flow routes across the Site. The watercourse diversion will implement a natural channel to replace the current linear routing of the watercourse, which includes no net loss in the total watercourse length within a water body. The designs will incorporate measures which enhance the in-channel and riparian habitat quality through the provision of a multistage channel and marginal planting using a natural routing.

Accounting for embedded mitigation HYD01 detailed in **Table 12.10** the magnitude of change on drainage patterns of surface hydrology (High sensitivity) is Negligible and therefore the significance of effect is **Negligible**.

A summary of the watercourse crossings associated with the access tracks are summarised in **Table 12.11**.

Table 12.11: Access Track Crossing Summary

ID	Easting, Northing	Approximate Width	Minor Watercourse?	Crossing Type	Description	Image
01	315587, 956458	1.5	Yes	New permanent crossing.	Slow moving ditch with very little water within channel and steep vegetated banks. Crossing will be from the site access to the A9 and along the watercourse.	
02	315640, 956688	2m	Yes	New permanent crossing.	Steep grassy banks with rock and gravel substrate. Moderate flows with bed width of approximately 30 cm.	
03	315778, 956581	2m	Yes	New permanent crossing.	Upstream of crossing 02 and therefore similar conditions.	

04	315819, 956568	2m	Yes	New permanent crossing.	Immediately upstream of crossing 03 and therefore similar conditions.	No image – similar to 03.
05	315846, 956555	1.2m	Yes	New permanent crossing.	Moderate flow, steep grassy banks.	
06	315824, 956328	2m	Yes	New permanent crossing.	Heavily vegetated banks along watercourse with limited flow.	

07	316138, 956445	3m	Yes	New temporary crossing.	Dry ditch, steep slopes, riparian vegetation on slopes.	
08	316355, 956674	1m (based on topographic data)	Yes	New temporary crossing.	Not available. Connected watercourses (including at the location of crossing 09) are artificial drainage channels with silt substrate and low flows. Anticipated to be similar in nature.	Not available.
09	316298, 956680	0.5m	Yes	New temporary crossing.	Artificial field drainage channel. Shallow, low flow, depth ~<5cm. Silt substrate.	
10	316225, 956749	Bogland rather than watercourse.	Yes.	New temporary crossing.	Location of the watercourse outline identified to be bog rather than a defined watercourse.	

11	316220, 956787	1m	Yes.	New temporary crossing.	Dry field drain which is heavily vegetated, with depths of approximately 0.5m.	

Pollution Incidents

During construction a number of potentially pollutting substances will be present onsite to facilitate construction activities including oil, fuels, chemicals, concrete and waste. Any pollution spillage or incident could have a detrimental effect on the water quality of nearby surface watercourses, groundwater and soils.

Accounting for embedded mitigation HYD02 detailed in **Table 12.10** the magnitude of change of pollution on surface watercourses, groundwater and soils (High and Medium sensitivity) is Negligible and therefore the Significance of Effect is **Negligible**.

Erosion and Sedimentation

Erosion and sedimentation can occur from excavations, stone winning, ground disturbance and overburden stockpiling. Sediment entering watercourses has the potential to affect water quality and flows of surface watercourses. This can have subsequent impacts on receptors hydrologically connected to an impacted watercourse, through either an increase or decrease in nutrients and flows.

Good practice site environmental management measures set out in SSEN's Soil Management GEMP will reduce any potential effects of soil erosion and sedimentation.

Accounting for embedded mitigation HYD03 detailed in **Table 12.10** the magnitude of change from erosion and sedimentation on surface watercourses (High sensitivity) is Negligible and therefore the Significance of Effect is **Negligible**.

Modifications to Hydrogeology and Groundwater

Cutting of ground at the Site will be required as part of the platform extension, access road and attenuation basin. Excavations, foundations and hardstanding areas 2m or deeper have the potential to divert shallow groundwater flows through de-watering if implemented or change sub-surface water flow by creating physical barriers within superficial deposits. Excavations which are more than 5m below the ground surface have the potential to divert and interrupt deeper groundwater flow paths and deposits.

Accounting for embedded mitigation HYD04 detailed in **Table 12.10** the magnitude of modifications to hydrogeology and groundwater (Medium sensitivity) is Negligible and therefore the significance of effect is **Negligible**.

Alterations to GWDTE

GWDTE have the potential to be at risk from a chemical pollution incident, sedimentation and erosion and impediments and alteration to flow patterns which can indirectly alter the habitat and plant species supported.

SEPA LUPS-GU31 guidance outlines the requirement for qualitative and / or quantitative assessment of effects of all infrastructure associated with the Proposed Development on GWDTE, if the GWDTE is located:

- Within 100 m radius of all excavations less than 1m in depth; and
- Within 250 m radius of all excavations deeper than 1m.

The SEPA classified 'Highly Groundwater Dependent' and 'Moderately Groundwater Dependent' GWDTE habitats within the Core Study Area are all within 250m of excavations which will exceed 1m in depth as part of the Proposed Development.

As detailed in **Table 12.10** groundwater must take place to demonstrate that there is no degradation in the quality of groundwater and hydrological connectivity. Monitoring will be secured through an appropriately worded planning condition and completed in accordance with SEPA Land Use Planning System Guidance Note 31.

With the implementation of embedded mitigation HYD05 detailed in **Table 12.10**, the magnitude of change from construction works is **Negligible**. Therefore with a minimal detectable effect on GWDTEs, which are a Medium sensitivity receptor, and no discernible effect on its integrity as a feature or hydrological functionality, the significance of effect is **Negligible**.

Reduction in the Quality and Quantity of Private Water Supplies

No PWS are located within 250 m of the Proposed Development and as such there is no requirement for a standalone detailed PWS Risk Assessment in accordance with SEPA LUPS Guidance 31. As part of the construction planning the principal contractor will further investigate the presence of any PWS, with further details provided in **Table 12.10**.

Loss and Compaction of Peat and Soils

Plant and vehicle movements and soil storage and stripping can impact the formation and nature of soils. The movement of vehicles and plant is likely to result in soil compaction. The stripping, transportation and storage of soils will have the potential to cause soil erosion and loss of soils leading to a degradation in the quality and storage capability of soils.

Accounting for embedded mitigation HTD07 detailed in **Table 12.10** the magnitude of the loss and erosion of soils (Medium sensitivity) is Negligible, and the magnitude of change is **Minor** and therefore the significance of effect is **Negligible**.

Disturbance of Peat

The GI conducted within the Core Study Area identified no deep peat (i.e., peat at depths greater than 1 m below ground level) at the location of trial pits and boreholes, however in the unlikely scenario that peat is encountered at locations in between trial pits then there is the potential for peat to be disturbed as a result of excavations.

Some excavations may need temporary sub-surface water controls, such as physical cut-offs or de-watering. These temporarily divert flows away from the excavation, and temporarily lower the local water table and sub-surface water levels in peat. Localised temporary changes to soil and peat interflow patterns may therefore arise. Substation foundations and hardstanding also have the potential to change sub-surface water flow by creating physical barriers within naturally occurring drainage macropores in soil or peat.

As a result of the lack of deep peat identified during GI and the measures set out in **Table 12.10**, peat is not expected to dry out, beyond what would be the case in the baseline scenario. No substantial impediments to near-surface water flow will be created as the detailed site drainage design will take into account any severance of saturated areas to ensure hydrological connectivity is maintained, in accordance with SEPA / NatureScot best practice.

In a scenario where peat is encountered in locations located in between trial pits, given the consideration that the losses of, or alteration to the baseline resource will be such that post development characteristics or quality of peat (Medium sensitivity) will only be partially changed, in the absence of mitigation, the Proposed Development will result in a potential moderate effect. With the application of embedded mitigation HYD08 detailed in **Table 12.10**, the effects will be **minor** which will be **not significant**.

Peat Stability

Construction activities have the potential to increase the likelihood of peat slides by way of locating proposed infrastructure including track networks on sloping ground where peat is present. All construction activities, involve the removal of surface vegetation and excavation of peat and other near surface soils from either the bedding surface of the underlying rock or the formation level within underlying soils, which naturally increases potential for slide.

During construction, care must be taken to ensure that the natural hydrological conditions of the surrounding peatland are maintained, as altering the surface or subsurface water flow and existing drainage patterns can increase the likelihood of bog burst. The peat management measures outlined in this chapter (within the Disturbance of Peat section) are sufficient so that the existing hydrological conditions at the Site will not be substantially altered as a result of the Proposed Development.

Given the increased potential for slide, low magnitude of effects and medium sensitivity of receptors, in the absence of mitigation, the Proposed Development will result in a potential **minor** effect and is therefore likely **not significant**.

12.6.3 Operational Phase

Increase in Surface Water Runoff and Flood Risk

The introduction of hardstanding surface on existing greenfield land as part of the Proposed Development has the potential to reduce the infiltration capacity of underlying soils and increase the rate of surface water runoff entering watercourses and drainage features.

The site-specific FRA provided in **Volume 4 Appendix 12.3: Flood Risk Assessment** concluded that the Core Study Area is at low risk of fluvial flooding and compliant with flood risk legislation, policies and guidance. The nine watercourse crossings implemented will feature culverts that are in accordance with CIRIA[46] and SEPA guidance so that a 0.5% AEP (200-year) fluvial flood event including an allowance for climate change and provision of appropriate freeboard is achieved. Where practicable, a 10m buffer has been provided between the Proposed Development and the boundary of the watercourse in accordance with SEPA guidance to reduce the impact on surface water runoff and flood risk during operation. Two watercourses that are diverted to construct the Proposed Development will be done so to maintain the riparian area of the watercourse and maintain its current channel capacity, 0.1% AEP (1000-year) plus climate change allowance, by featuring no abrupt changes in channel profile including planform and gradient.

A surface water drainage system design has been produced for the Proposed Development and is provided in **Volume 4 Appendix 12.2: Outline Surface Water Drainage Strategy.** The drainage system will attenuate surface wate runoff from the Proposed Development to a 1 in 200-year plus climate change allowance whilst limiting discharge rates to the calculated greenfield runoff rate.

Accounting for the implementation of a surface water drainage strategy which will limit discharge rates to the existing greenfield runoff rate the Proposed Development will not lead to an increase in surface water runoff. Implementing the mitigation identified in the flood risk assessment will reduce the impact of fluvial flows and there will not be an increase in flood risk. Therefore, accounting for the embedded mitigation, the magnitude of impact of an increase on surface water runoff and flood risk on downstream receptors (High sensitivity) is Negligible and the magnitude of change is **Minor** and therefore the significance of effect is **Negligible**.

Contamination from Foul Discharge

As detailed in **Volume 4 Appendix 12.2: Outline Surface Water Drainage Strategy** there are no public sewers within the vicinity of the Proposed Development and therefore foul discharge from the Proposed Development will be discharged to the surrounding water environment via a suitably designed onsite package treatment plant which will be designed in accordance with SEPA guidance on foul discharge, as further detailed in **Volume 4 Appendix 12.2: Outline Surface Water Drainage Strategy**. The package treatment plant will discharge to the diverted watercourse which will be located to the south and west of the Core Study Area.

The discharge of foul water into the water environment will therefore be managed in accordance with SEPA guidance and acknowledging the implementation of the treatment package detailed in **Volume 4 Appendix 12.2: Outline Surface Water Drainage Strategy** the magnitude of impact of foul water into the water environment on surface watercourses (High sensitivity) is Negligible and the magnitude of change is **Minor** and therefore the significance of effect is **Negligible**.

Contamination from Oil Storage

The Proposed Development includes oil-filled equipment which have the potential to lead to pollution of watercourses through entering the surface water drainage system during operation or through direct runoff into surrounding watercourses.

As detailed in **Volume 4 Appendix 12.2: Outline Surface Water Drainage Strategy** the surface water drainage strategy will incorporate a containment system which will bund the oil filled equipment that will be sized to accommodate 110% of the stored oil capacity. The drainage system includes an oil discriminating pump which will discharge to a treatment system before discharging into the water environment via sampling points to test the quality of runoff.

[46] CIRIA (2019) Culvert, screen and outfall manual (C786F)

Accounting for the implementation of the oil drainage interception and treatment detailed within **Volume 4 Appendix 12.2: Outline Surface Water Drainage Strategy** the magnitude of impact of oil contamination into the water environment on surface watercourses (High sensitivity) is Negligible and the magnitude of change is **Minor** and therefore the significance of effect is **Negligible**.

12.6.4 Residual Effects

No significant residual effects as a result of the construction and operation of the Proposed Development have been identified and no further mitigation beyond the good practice measures outlined in this chapter and through the detailed CEMP and GEMPs that shall be prepared by the Principal Contractor will be required.

12.6.5 Cumulative Effects

The greatest potential for cumulative effects arises when the construction phase of another development overlaps with the construction phase of the Proposed Development. These in-combination effects are considered to have the potential to be significant only where such an overlap may exist. The other reasonably foreseeable developments which have been identified to have potential in-combination cumulative effects in with the Proposed Development are detailed in **Table 5.2 in Chapter 5**.

Whilst other developments might present significant effects to Geology, Hydrology and Hydrogeology receptors in their own right, no significant effects have been identified associated with the Proposed Development and assuming other developments will employ effective controls and good practice measures no significant in-combination cumulative effects are anticipated. Furthermore, the construction programmes of each development would limit the probability of activities that have the potential to lead to significant effects coinciding across developments.

12.7 Summary

This Chapter has assessed the likely significance of effects of the Proposed Development on hydrology, hydrogeology, geology and soils. The Proposed Development has been assessed as having the potential to result in effects of negligible significance. Given that only effects of moderate significance or greater are considered significant in terms of the EIA Regulations, the potential effects on hydrology and hydrogeology are considered to be **not significant**.