Chapter 14: Geology and Water Environment

Figures

Appendices

Glossary of Terms

Abstraction	The removal or diversion of water from the natural water environment.
Alluvium	A deposit of clay, silt, and sand left by flowing floodwater in a river valley or delta, typically producing fertile soil.
ALTBAR	Mean catchment altitude (metres above sea level).
AOD(Above Ordnance Datum)	The system used by Ordnance Survey in Great Britain as the basis for deriving altitude on maps.
Aquifer	An underground layer of water-bearing rock.
BGS (British Geological Survey)	Public sector organisation responsible for advising government on all aspects of geoscience and providing impartial geological advice to industry, academia and the public
Catchment	An area of land within which water flows to a particular location.
CAR	The Water Environmental (Controlled Activities) (Scotland) Regulations 2011 (as amended).
CAR licence	A licence for activities affecting the water environment, issued by SEPA under The Water Environmental (Controlled Activities) (Scotland) Regulations 2011 (as amended).
Construction Environmental Management Plan (CEMP)	A document detailing measures to be followed during construction of a development to ensure that it is built in an environmentally sensitive manner.
CIRIA (Construction Industry Research and Information Association)	A neutral, independent and not-for-profit body who facilitate a range of collaborative activities that help improve the construction industry.
Compensation Flow / Compensation release	Water released from a dam to maintain a flow of water down a watercourse.
Discharge	The release of water or other substances into the natural water environment.
DPSBAR	Index of catchment steepness.
Esker	A long ridge of gravel and other sediment, typically having a winding course, deposited by meltwater from a retreating glacier or ice sheet.
Fault	A planar fracture or discontinuity in a volume of rock, across which there has been significant displacement as a result of rock-mass movement.
FEH (Flood Estimation Handbook)	FEH and its related software offer guidance on rainfall and river flood frequency estimation in the UK and is the industry standard used to estimate local flood risk and develop resilient infrastructure.
Glacial deposits	Landform, created by rock deposited in the landscape by a retreating glacier.
Glaciofluvial deposits	Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice.
Gley	A sticky waterlogged soil lacking in oxygen, typically grey to blue in colour.
GPP (Guidance for Pollution prevention)	Replacement guidance for PPGs on environmental good practice produced by SEPA, the Environment Agency and Northern Ireland Environment Agency.
GWDTE (Ground Water dependent Terrestrial Ecosystem)	Wetlands which critically depend on groundwater flows or chemistries. They are safeguarded by the Water Framework Directive and are sensitive to hydrological and ecological changes caused by developments.
Humus	The organic component of soil, formed by the decomposition of leaves and other plant material by soil microorganisms.
Hydromorphology	The hydrological and geomorphological processes and attributes of rivers, lakes, estuaries and coastal waters.
Intrusive rocks	Rock formed from magma forced into older rocks at depths within the Earth's crust, which then slowly solidifies below the Earth's surface, though it may later be exposed by erosion.

LDP	Longest drainage path.
LFT (Lochaber Fisheries Trust)	Charitable organisation undertaking monitoring and protection of populations of native wild fish in Lochaber region.
Lochaber District Salmon Fishing Board (DSFB)	Statutory body with responsibility for salmon and sea-trout fishery protection and enhancement in the Lochaber region.
Meta-sedimentary	Type of metamorphic rock formed through deposition and solidification of sediment.
NVC (National Vegetation Classification)	A recognised system of classification and description of plant communities of Britain.
Planning Advice Notes (PANs)	Notes produced by Scottish Government which provide advice on good practice and other relevant information.
Peat probing	Penetration of organic soils by a probe to ascertain depth.
Peat slide	The movement of peat down a slope
Podzol	An infertile acidic soil having an ash-like subsurface layer (from which minerals have been leached) and a lower dark stratum, occurring typically under temperate coniferous woodland.
PMP (Peat Management Plan)	A document detailing the quantities and locations of peat to be excavated, stored and re-used and methods for doing this.
PPG (Pollution Prevention Guidelines)	Guidance on environmental good practice produced by SEPA, the Environment Agency and Northern Ireland Environment Agency.
Professional Judgement	The informed view of a qualified and experienced professional.
PWS (Private Water Supply)	Water supply obtained from a source not connected to the mains.
SAAR (standard-period average annual rainfall)	Annual rainfall statistics produced by the met office based on 30 year data.
Scoping Opinion	The written opinion of the determining authority as to the scope and level of detail of information to be provided in an EIA report.
SDD (Small Domestic Discharge)	In relation to the CAR Regulations.
SEPA (Scottish Environment Protection Agency)	A non-departmental public body tasked with the protection of the environment and human health in Scotland.
Scottish Canals	The British Waterways Board, operating as Scottish Canals – Public body with statutory duty for the operation and maintenance of waterways in Scotland.
SNH (Scottish Natural Heritage)	The body responsible for promoting, caring for and improving natural heritage in Scotland, and advising Government on natural heritage issues.
SNIFFER (Scotland and Northern Ireland Forum for Environmental Research)	Independent charity commissioning scientific research on the protection and enhancement of the natural environment.
SSSI (Site of Special Scientific Interest)	Nationally designated areas of land and water considered to best represent the natural heritage in terms of their flora, fauna, geology, geomorphology or a mix of these features.
Stakeholders	Organisations and individuals who can affect or may be affected by The Proposed Development.
Sustainable Drainage Systems (SuDS)	A method of treating run-off from a development by encouraging natural filtration and dissipation of dirty water through vegetation and into the ground, rather than directly into sewers.
SW (Scottish Water)	Publically-owned company responsible for water supply and treatment of waste water in Scotland.
THC (The Highland Council)	The Local and Planning Authority.
Water Framework Directive	Directive 2000/60/EC establishing a framework for the Community action in the field of water policy.
WEWS Act	Water Environment and Water Services (WEWS) (Scotland) Act 2003

WTW	Water Treatment Works maintained by Scottish Water.

14 Geology and Water Environment

14.1 Executive Summary

14.1.1 This Chapter assesses the impacts of the Revised Coire Glas Pumped Storage Scheme (The Proposed Development) in relation to the potential effects on the geology (including soils and peat), and the water environment (hydrology and hydrogeology), during the construction and operational phases. An assessment of water levels and fluctuation in Loch Lochy and of required compensation flow water releases as a consequence of operation of The Proposed Development is given in Chapter 6: Water Management.

14.1.2 Information on the study area was compiled using baseline information from a desk study and was verified by field work prior to completion of the assessment. A comprehensive programme of peat probing has been completed which has been used to assess peat slide risk and peat management proposals. A borrow pit screening assessment has also been completed and a schedule of watercourse crossings prepared. Details of private water supplies have also been obtained and assessed.

14.1.3 The assessment was undertaken considering the sensitivity of any receptors identified, and considering mitigation measures incorporated as part of the development design (embedded mitigation).

14.1.4 Mitigation measures have been identified, either through the development design or in accordance with good practice guidance. Examples include no direct discharge of water into watercourses and the specification of Sustainable Drainage Systems (SuDS) to limit the rate of runoff from the development site and allow the quality of water to be managed at source prior to any discharge being made.

14.1.5 These measures have been shown to eliminate any significant residual effects associated with the construction and operation of The Proposed Development on soils, geology and the water environment. In addition it is concluded that The Proposed Development would not result in a cumulative effect on soils, geology or the water environment.

14.1.6 A programme of confirmatory monitoring has been proposed that would be used to further characterise baseline conditions and water quality during and following construction.

14.2 Introduction

14.2.1 This Chapter assesses the impacts of The Proposed Development on geology (including soils and peat) and the water environment (hydrology and hydrogeology). The assessment of impacts has been made on the basis of the Scheme Overview layout as fully described in Chapter 3: Description of Development.

14.2.2 This Chapter outlines the embedded good practice methods which have been incorporated into the development design, and would be used during the construction and operation of The Proposed Development to prevent or reduce identified effects and risks.

14.2.3 Further mitigation methods to address any potential effects are proposed, where appropriate, and residual effects assessed.

14.2.4 The assessment uses information and findings presented in Chapter 6: Water Management, Chapter 10: Terrestrial Ecology, Chapter 12: Aquatic Ecology and Chapter 13: Fish to inform the assessment of potential effects on water quality and on possible areas of Groundwater Dependent Terrestrial Ecosystems (GWDTE) presented in this Chapter.

14.2.5 The assessment has been undertaken by SLR Consulting.

14.3 Scope of Assessment

Study Area

14.3.1 This assessment considers surface water including streams, rivers and lochs; groundwater within a 2 km buffer of the Site (as defined by the site boundary, shown on Figure 14.1); and the soils, superficial and bedrock geology within the Site (shown on Figures 14.2 – 14.4).

14.3.2 The study area for potential cumulative effects uses the catchments within the study area, with a maximum downstream distance of 2 km from The Proposed Development. Beyond this 2 km distance, any effect is considered to be so diminished as to be undetectable and therefore not significant.

Scoping and Consultation

14.3.3 The scope of the assessment has been determined through a combination of professional judgement, reference to relevant guidance documents and consultation with stakeholders. A scoping exercise was conducted as part of this Application and a Scoping Opinion was received from Scottish Ministers in July 2017.

14.3.4 Scoping responses received relevant to Geology and Water Environment are summarised in Table 14.1.

Table 14.1: Key Issues From Consultation

Consultee	Summary Response	Comment/Action Taken
Scottish Environment Protection Agency (SEPA)	Consider that the following key issues should be addressed: • map showing engineering works within and near the water environment; • map showing impacts on GWDTE; • peat depth survey map and re-use proposals; • map and table detailing forest removal; • map and layout of significant excavation, borrow pit areas and re-use proposals; and • schedule of mitigation including pollution prevention measures.	Addressed in Chapter 10: Terrestrial Ecology and this Chapter (and supporting Technical Appendices). The removal of forest is considered in Chapter 21: Forestry. A schedule of mitigation measures is included in Appendix 3.2.

Consultee	Summary Response	Comment/Action Taken
Scottish Natural Heritage (SNH)	An assessment should be made of the impacts of the proposal on carbon rich soils, deep peat and priority peatland habitat. Assessment of whether the development footprint contains any of the following: • an abundance of Sphagnum-rich ridges; • ridges of Sphagnum – *Betula nana*; • Hummocks of *S.fuscum* or *S. austinii;* • Peat mounds; and • hollows of Sphagnum or bare peat.	Addressed in Chapter 10: Terrestrial Ecology and this Chapter. A comprehensive programme of site investigation has been completed including National Vegetation Classification mapping (see Chapter 10) and peat depth probing (see Appendix 14.1: Peat Landslide and Hazard Risk Assessment). The presence of deep peat and sensitive habitats informed the developing site design.
Scottish Water (SW)	The EIA should include an assessment of the potential impacts on water abstraction locations within the vicinity.	Assessed in Confidential Appendix 14.7.
AM Geomorphology	Localised peat has been identified within areas proposed for infrastructure. Given the proximity of the Allt a' Choire Ghlais and the connectivity of the watercourse to Loch Lochy the risks associated with peat instability should be assessed.	Addressed in Appendix 14.1: Peat Landslide and Hazard Risk Assessment.
Lochaber Fisheries Trust (LFT)	The effect of fluctuating water levels in Loch Lochy on fish spawning and foraging activity and impact of the scheme's operation on water flows in the River Lochy should be addressed. The construction phase of the project also has the potential to affect water quality.	Effects on water fluctuation in Loch Lochy are addressed in Chapter 6: Water Management and Chapter 13: Fish. The potential effects on water quality associated with the construction phase are within this Chapter.

14.3.5 In addition to the written scoping responses presented above, further pre-application consultation and discussions were organised with key stakeholders, including SEPA, SNH and The Highland Council to discuss how the EIA assessment would approach peat management, borrow pits, Groundwater Dependent Terrestrial Ecosystems (GWDTE). Further details are set out in Chapter 4: EIA Approach, Scoping and Consultation.

Potential Effects Assessed in Full

14.3.6 The following potential effects have been assessed in full:

- pollution risk, including potential effects on surface water and groundwater quality and public and private water supplies during construction and operation of The Proposed Development;
- erosion and sedimentation which could give rise to potential effects on surface water and groundwater quality and public and private water supplies during construction and operation of The Proposed Development;
- potential effects upon the linkage between groundwater and surface water during construction and operation of The Proposed Development;
- potential effects on areas of peat during construction and operation;
- potential effects on areas of possible GWDTE during construction and operation; and

- potential cumulative effects during construction and operation.

14.3.7 The potential effects on water resources, water levels in Loch Lochy and operation of the scheme are considered in Chapter 6: Water Management.

Effects Scoped Out

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

- increased flood risk caused by blockages to flow in watercourses during operation and maintenance of The Proposed Development as these crossings would be subject to maintenance requirements under CAR. Flood risk onsite is negligible and The Proposed Development design ensures that no critical infrastructure is located near (within 50m) watercourses;
- changes to public/private water supply yield as a consequence of changes to runoff rates and volumes during operation and maintenance of The Proposed Development as no significant alterations to runoff rates/infiltration or drawdown of the water table are anticipated during or as a consequence of operation and maintenance; and
- potential cumulative effects in relation to public/private water supply yields during the operational phase as water requirements are low during operation and any change would not be discernible at the catchment level.

14.4 Legislation, Policy & Guidance

14.4.1 This assessment has been undertaken with regard to environmental legislation, planning policy and general guidance, including the following.

Legislation

- The Water Environment (Controlled Activities) (Scotland) Amendment Regulations, 2013 (Controlled Activities Regulations (CAR));
- European Union (EU) Water Framework Directive (2000/60/European Commission (EC));
- EU Drinking Water Directive (98/83/EC);
- The Water Supply (Water Quality) (Scotland) Regulations, 2001;
- The Flood Risk Management (Scotland) Act 2009;
- Water Environment and Water Services (WEWS) (Scotland) Act 2003 (WEWS Act); and
- Private Water Supplies (Scotland) Regulations 2006.

Planning Policy

14.4.2 Planning policies of relevance to this assessment are outlined in Chapter 5: Planning Policy.

Guidance

Planning Advice Notes (PAN)

- PAN 50 Controlling the Environmental Effects of Surface Mineral Workings;
- PAN 61 Planning and Sustainable Urban Drainage Systems; and
- PAN 69 Planning and Building Standards Advice on Flooding.

SEPA Pollution Prevention Guidance Note (PPG) and Guidance for Pollution Prevention (GPP):

- PPG01 General Guide to the Prevention of Pollution;
- GPP02 Above Ground Oil Storage Tanks;
- PPG03 Use and Design of Oil Separators in Surface Water Drainage Systems;
- GPP05 Works and Maintenance in or near Water;
- PPG06 Working at Construction and Demolition Sites;
- PPG07 Safe Storage - The Safe Operation of Refuelling Facilities;
- GPP08 Safe Storage and Disposal of Used Oils;
- GPP13 Vehicle Washing and Cleaning;
- GPP21 Pollution Incident Response Planning; and
- PPG22 Incident Response – Dealing with Spills.

Construction Industry Research and Information Association (CIRIA) Publications:

- C532 Control of Water Pollution From Construction Sites (2001);
- C648 Control of Water Pollution from Linear Construction Projects – Technical Guidance (2006);
- C741 Environmental Good Practice on Site (2015); and
- C753 The Sustainable Urban Drainage Systems (SUDS) Manual (2015).

SEPA Publications:

- Engineering in the Water Environment: Good Practice Guide – River Crossings (2010).
- Engineering in the Water Environment: Good Practice Guide – Sediment Management (2010);
- Groundwater Protection Policy for Scotland, Version 3 (2009);
- Land Use Planning System SEPA Guidance Note 31, Version 2 (October 2014) – Guidance on assessing proposals on groundwater abstractions and GWDTE's;
- Position Statement – Culverting of Watercourses (2006); and
- Regulatory Position Statement – Developments on Peat (2010).

Other Guidance:

- SNH, 2nd Edition June 2013 - Constructed Tracks in Scottish Uplands;
- Good Practice during Windfarm Construction, Version 3, a joint publication by Scottish Renewables, SNH, SEPA, Forestry Commission Scotland (FCS) and Historic Environment Scotland (HES) (2015); and
- Scottish Renewables and SEPA - Developments on Peatland: Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste (2012).

14.5 Methodology

14.5.1 The assessments of both the construction and operational phases of The Proposed Development have been structured around the consideration of the following potential effects on receptors:

- pollution risk: potential effects on surface water and groundwater quality; public and private water supplies;
- erosion and sedimentation: potential effects on surface water and groundwater quality; public and private water supplies;
- fluvial flood risk: potential effects on flood risk both to the proposed development and offsite effects during the operational phase only;
- infrastructure and man-made drainage: potential effects on surface and sub-surface drainage patterns (which could also directly feed GWDTE); and
- cumulative effects: potential effects of the proposed development in combination with those from other developments within the hydrological study area.

14.5.2 The contamination of surface water and groundwater caused by leakage and spills of chemicals, vehicle use and construction and operational activities has the potential to lead to a pollution event. Deterioration of the quality of either surface water or groundwater could cause a potential effect on the status of the receiving water bodies and any public or private water supply. The effects have been assessed, using professional judgement, in terms of the frequency and duration of activities that have the potential to cause pollution together with the nature of the potential pathways linking the source of pollution to a receptor(s). The length of the pathway is a key factor in determining the risk of contamination with particular attention given to the potential occurrence of direct pollution to water bodies.

14.5.3 The potential for erosion and sedimentation mainly occurs during the construction phase of The Proposed Development. Potential causes include the transfer of sediment during rainfall events from areas of exposed ground or stockpiled materials, which could enter the watercourses. This can cause blockages in watercourses as well as a deterioration of water quality. The effects have been assessed in the same way as for contamination events. The potential for an activity to cause erosion or sedimentation is based on a combination of the type of land cover, the nature of the activity, experience from other relevant projects, professional judgement and relevant guidance.

14.5.4 Increases in the potential flood risk to a receptor would be localised, resulting from increased runoff from areas of hardstanding, compacted ground or due to the under-sizing

of water crossings. The effects have been assessed using the good practice techniques and professional judgement.

14.5.5 Water abstraction could potentially be required during the construction phase of The Proposed Development. This could affect the quantitative status of waterbodies (either surface water or groundwater). The effect has been assessed primarily on the proposed quantities of water required for abstraction as well as the duration of abstraction and management of abstracted water.

14.5.6 Identification of potential GWDTE provides a visual means of assessing the nature of the underlying groundwater in the absence of extensive field investigation. Consequently, they are a valuable tool in assessing potential changes in groundwater flow. However, while GWDTE play a role in the interpretation of groundwater movement, the ecosystems themselves are subject to protection due to their ecological value. Given their various roles, effects on GWDTE are considered in both this and the Terrestrial Ecology Chapter (see Chapter 10). This Chapter assesses the potential effect of The Proposed Development upon the quality and quantity of groundwater supporting the GWDTE due to potential effects on sub-surface drainage patterns.

Desk Study

14.5.7 An initial desk study has been undertaken to determine and confirm the baseline characteristics by reviewing available information on soils, geology, hydrology and hydrogeology. The following sources of information have been consulted in order to characterise the baseline conditions of the area within and surrounding the Site (Table 14.2).

Table 14.2: Information and Data Sources

Topic	Source of Data and Information
Topography; and Elevation, Relief and Climate.	Ordnance Survey (OS) mapping: 1:10 000; OS Terrain 50 digital terrain model (DTM) and Flood Estimation Handbook (FEH) web service.
Soils and Geology	Online British Geological Survey (BGS) drift and solid geology mapping; Online Soil Survey for Scotland mapping; BGS DigMapGB-50 Vector Mapping: • Bedrock (1:50,000); • Superficial (1:50,000); and • Features (1:50,000). James Hutton Institute: • The Soil map of Scotland (1:250,000).

Topic	Source of Data and Information
Surface Water; Flooding; Groundwater; Water Quality; Abstractions and Discharges; Private Water Supplies; and Statutory Designated Sites.	THC for details of private water supplies and recorded instances of flooding; SEPA for details of water use, abstractions, discharge and quality; SEPA Groundwater Vulnerability Map of Scotland, 2003; SEPA Interactive Maps: • Water Environment HUB; and • Flood Maps. Ness District Salmon Fishery Board; Lochaber District Salmon Fishery Boards; BGS Hydrogeology of Scotland, 1988; SNH SiteLink Online Information Service; and BGS Groundwater Vulnerability Mapping of Scotland (1:625,000).

Field Survey

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

14.5.9 Detailed site visits and walkover surveys have been undertaken by the authors of this assessment on:

- 6th September 2017;
- 20-22nd September 2017;
- 25th-27th September 2017;
- 17-20th October 2017; and
- 30th November 2017.

14.5.10 The field work has been undertaken in order to:

- verify the information collected during this desk and baseline study;
- allow appreciation of the Site, determine gradients, access routes, ground conditions, etc., and to assess the relative location of all the components of The Proposed Development;
- undertake a visual assessment of the main surface waters and identify and verify private water supplies;
- identify drainage patterns, areas vulnerable to erosion or sediment deposition, and any pollution risks;
- assess areas of potential GWDTE;
- undertake a comprehensive peat depth probing investigation; and
- prepare a schedule of watercourse crossings.

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

14.5.12 The data obtained as part of the desk study and collected as part of the field work has been processed and interpreted to complete the impact assessment and to recommend mitigation measures where appropriate.

Assessment of Effects

14.5.13 The significance of the potential effects from The Proposed Development has been assessed by considering two factors: the sensitivity of the receiving environment and the potential magnitude of impact, should that effect occur.

14.5.14 The assessment methodology has also been informed by experience of carrying out such assessments for a range of developments in upland settings, knowledge of the water environment characteristics in Scotland and cognisance of good practice.

14.5.15 This approach provides a mechanism for identifying the areas where mitigation measures are required and for identifying mitigation measures appropriate to the significance of potential effects presented by The Proposed Development.

14.5.16 Criteria for determining the significance of effect are provided in Table 14.3, Table 14.4 and Table 14.5.

Sensitivity/Importance

14.5.17 The sensitivity of the receiving environment (i.e. the baseline quality of the receiving environment) is defined as its ability to absorb an effect without a detectable change. It can be considered through a combination of professional judgement and a set of pre-defined criteria which are set out in Table 14.3. Receptors in the receiving environment only need to meet one of the defined criteria to be categorised at that associated level of sensitivity.

Table 14.3: Criteria for Assessing Sensitivity of a Receptor

Sensitivity	Definition
High	• SEPA Water Framework Directive Water Body Classification: High-Good or is close to the boundary of a classification Moderate to Good or Good to High; • receptor is of high ecological importance or national or international value (e.g. Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC), habitat for protected species) which may be dependent upon the hydrology of the proposed development area; • receptor is at high risk from flooding above 0.5% Annual Exceedance Probability (AEP) and/or water body acts as an active floodplain or flood defence; • receptor is used for public and/or private water supply (including Drinking Water Protected Areas (DWPA); • groundwater vulnerability is classified as high; and • if a GWDTE is present and identified as being of high sensitivity.
Moderate	• SEPA Water Framework Directive Water Body Classification Moderate or is close to the boundary of a classification Low to Moderate; • receptor is at moderate risk from flooding (0.1% AEP to 0.5% AEP) but does not act as an active floodplain or flood defence; and • moderate classification of groundwater aquifer vulnerability.

Sensitivity	Definition
Low	• SEPA Water Framework Directive Water Body Classification Poor or Bad; • receptor is at low risk from flooding (less than 0.1% AEP); and • receptor not used for water supplies (public or private).
Not Sensitive	Receptor would not be affected by the proposed development, e.g. lies within different and unconnected hydrological/hydrogeological catchments.

Magnitude of Effect

14.5.18 The potential magnitude of an impact would depend upon whether the potential effect would cause a fundamental, material or detectable change. In addition the timing, scale, size and duration of the potential effect resulting from The Proposed Development are also determining factors. The criteria that have been used to assess the magnitude of impact are defined in Table 14.4.

Table 14.4: Criteria for Assessing Magnitude of Impact

Magnitude	Criteria	Definition
Major	Results in loss of attribute.	Fundamental (long term or permanent) changes to the baseline hydrology, hydrogeology and geology such as: wholesale changes to watercourse channel, route, hydrology or hydrodynamics; changes to the Site resulting in an increase in runoff with flood potential and also significant changes to erosion and sedimentation patterns; major changes to the water chemistry; and major changes to groundwater levels, flow regime and risk of groundwater flooding.
Medium	Results in impact on integrity of attribute or loss of part of attribute.	Material but non-fundamental and short to medium term changes to baseline hydrology, hydrogeology and water quality, such as: some fundamental changes to watercourses, hydrology or hydrodynamics. Changes to Site resulting in an increase in runoff within system capacity; moderate changes to erosion and sedimentation patterns; moderate changes to the water chemistry of surface runoff and groundwater; and moderate changes to groundwater levels, flow regime and risk of groundwater flooding.
Low	Results in minor impact on attribute.	Detectable but non-material and transitory changes to the baseline hydrology, hydrogeology and water quality, such as: minor or slight changes to the watercourse, hydrology or hydrodynamics; changes to Site resulting in slight increase in runoff well within the drainage system capacity; minor changes to erosion and sedimentation patterns; minor changes to the water chemistry of surface runoff and groundwater; and minor changes to groundwater levels, flow regime and risk of groundwater flooding.

Magnitude	Criteria	Definition
Negligible	Results in an impact on attribute but of insufficient magnitude to affect the use/integrity.	No perceptible changes to the baseline hydrology, hydrogeology and water quality such as: no alteration or very minor changes with no impact to watercourses, hydrology, hydrodynamics, erosion and sedimentation patterns; no pollution or change in water chemistry to either groundwater or surface water; and no alteration to groundwater recharge or flow mechanisms.

Significance of Effect

14.5.19 The sensitivity of the receptor together with the magnitude of impact determines the significance of the effect, which can be categorised into a level of significance as identified in Table 14.5. This also takes into account good practice measures implemented and embedded as part of the design and construction of The Proposed Development and the use of professional judgement where appropriate. Good practice measures (i.e. embedded mitigation) are discussed later in the chapter.

14.5.20 The significance of a potential effect provides a guide to assist in decision making. However, it should not be considered as a substitute for professional judgment and interpretation. In some cases, the potential sensitivity of the receiving environment or the magnitude of potential impact cannot be quantified with certainty and therefore professional judgement remains the most robust method for identifying the predicted significance of a potential effect.

Table 14.5: Significance of Effect

Magnitude of Impact	Sensitivity of Receptor			
	High	Moderate	Low	Not Sensitive
Major	**Major**	**Major**	**Moderate**	Negligible
Medium	**Moderate**	**Moderate**	Minor	Negligible
Low	**Moderate**	Minor	Minor	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

14.5.21 The assessment concludes with a Statement of Significance associated with The Proposed Development. Effects of **Major and Moderate** significance are considered to be 'significant' in terms of the EIA Regulations and would require mitigation.

Limitations to the Assessment

14.5.22 This assessment has been completed using recent data and resources in addition to data and information provided for The Consented Development[1], and supporting Technical Appendices prepared as part of that application. All data has been reviewed critically and best judgement has guided the information and interpretation made in this Chapter.

[1] Coire Glas Environmental Statement (2012) and supporting information.

14.6 Baseline Conditions

14.6.1 The Site location, geological and hydrological setting is presented on Figures 14.1 to 14.7 and discussed in detail as follows.

Climate and Topography

14.6.2 The standard-period average annual rainfall (SAAR) for the two principal surface water catchments that serve the Site (Allt a' Choire Ghlais and Allt na Cailliche) is 2,000 mm based on data obtained from the Flood Estimation Handbook (FEH) Web Service (FEH, 2017).

14.6.3 The proposed crossing of the River Garry at White Bridge is approximately 60 m above ordnance datum (AOD). The proposed site access route then rises steadily southwards following the valleys of Allt Ruighe Bhlair and Allt na Cailliche watercourses towards the eastern slope of Meall nan Rudhag (445 m AOD). The route then traverses the eastern slopes of Ben Tee (901 m AOD) towards the horseshoe of Coire Glas, bound to the north by Meal a' Choire Ghlais (900 m AOD) and south by Sron a' Choire Ghairbh (935 m AOD), Sean Mheall (887 m AOD) and Meall nan Dearcag (689 m AOD) eastwards (see Plate 14.1).

Plate 14.1: Coire Glas Looking West Towards Mheall a' Choire Ghlais (Right) and Sron a' Choire Ghairbh and Sean Mheall (Left)

14.6.4 The location of the Lower Reservoir Works and the access route to it, are all located along the western shore of Loch Lochy at approximately 30 m AOD (Plate 14.2).

14.6.5 Access tracks are also proposed between the Lower Reservoir Works and the Dam, and to the surge shaft. The access track to the surge shaft rises to an elevation of 700 m AOD.

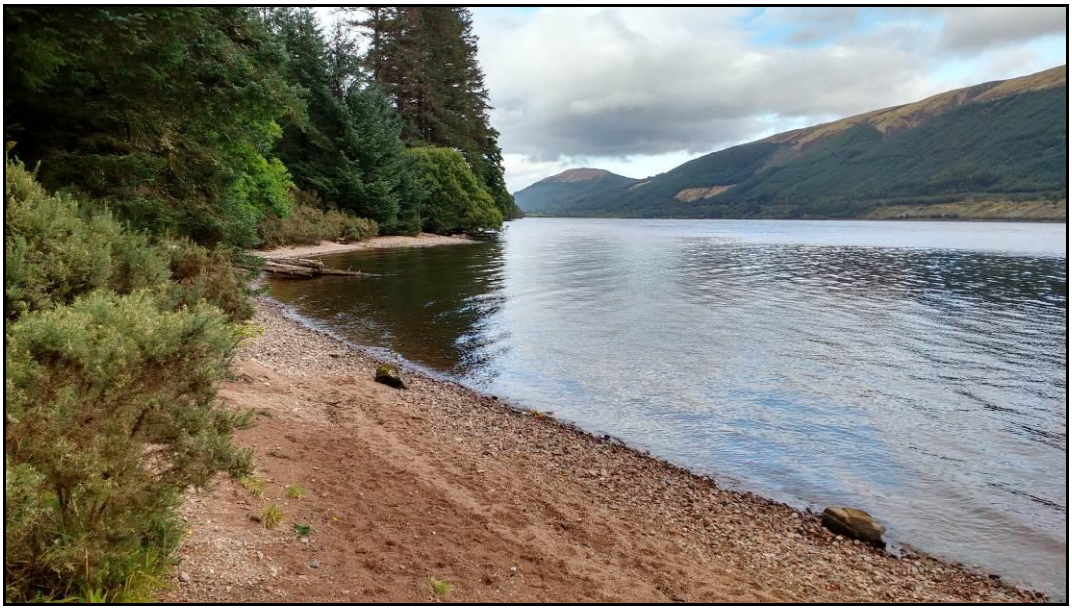

Plate 14.2: Loch Lochy looking East Towards Proposed Location of Tailrace

Designations

14.6.6 Review of the SNH online SiteLink service (SNH, 2017) confirms that there are no statutory designated sites present within the site boundary. Within 5 km of The Proposed Development are four statutory designated sites (see Figure 14.1); those relevant to Geology and the Water Environment are listed below.

West Inverness-shire Lochs

14.6.7 West Inverness-shire Lochs Site of Special Scientific Interest (SSSI) comprises a grouping of eight freshwater lochs that include Lochs Affric, Bad an Losguinn, Blair, Cluanie, Garry, Loyne, Lundie and Poulary, together with a short stretch of the River Garry which links Lochs Poulary and Garry. Qualifying features include breeding populations of bird species:

- Black-throated diver (*Gavia arctica*); and
- Common scoter (*Melanitta nigra*).

14.6.8 The SSSI boundary is coincident with that of West Inverness-shire Lochs Special Protection Area (SPA), which is classified for the same two species.

Garry Falls (SSSI)

14.6.9 The Garry Falls site is an area of ancient semi-natural woodland on the west side of a gorge cut by the River Garry and has been designated a SSSI for qualifying features including:

- Bryophyte assemblage; and
- Upland mixed ash woodland.

14.6.10 The presence of rhododendron and non-native conifers within the SSSI resulted in the woodland and bryophyte features being in unfavourable condition. However, with

rhododendron control carried out across the SSSI in 2008 the site's condition is expected to improve in the medium to long term.

South Laggan Fen (SSSI)

14.6.11 The majority of the site supports fen and swamp vegetation with associated open water, grassland and woodland. It is one of a very small number of species rich, lowland fens with moderate nutrient levels found within Lochaber and is notable for its size, naturalness, diversity of vegetation types and range of plant species.

14.6.12 The permanently wet reed bed lies between the southern tip of Loch Oich and the Great Glen Water Park access road. The drier fen meadow, found to the south and east of the access road, is subject to seasonal flooding and water seepage from adjacent areas. SSSI qualifying features include:

- Fen, Marsh, Swamp – Transitional Fen

Parallel Roads of Lochaber (SSSI)

14.6.13 Glens Roy, Spean and Gloy together form an area of outstanding importance for their landforms and sediments. The landforms within these glens are unique in Britain: not only the glacial lake shorelines, but also the associated collection of remarkable depositional landforms. SSSI qualifying features include:

- Fluvial Geomorphology of Scotland; and
- Quaternary of Scotland.

14.6.14 The designated sites are not in hydraulic continuity with The Proposed Development, and therefore are not considered further in this assessment.

Soils, Peat and Geology

14.6.15 A detailed review of the soils, superficial and solid geology at the Site is given within Appendices 14.1: Peat Landslide and Hazard Risk Assessment, Appendix 14.2: Borrow Pit Screening Assessment, Appendix 14.3: Hydromorphology Interim Report and Appendix 14.4: Hydromorphology Coire Glas and Kilfinnan Burn; these have been reviewed and verified as part of this assessment.

14.6.16 Potential impacts pertinent to soil and rock excavations are considered in detail within Appendix 14.5: Draft Peat Management Plan and Chapter 7: Spoil Management respectively.

Soil

14.6.17 An extract of Soil Survey of Scotland mapping is presented as Figure 14.2: Soil Plan. The mapping indicates that five soil types are identified with the Site Boundary:

- Montaine soils following the horseshoe ridgeline of Ben Tee, Meal a' Choire Ghlais, Sron a' Choire Ghairbh, Sean Mheall and Meall nan Dearcag;
- Peaty podzols generally following the river valleys of Allt a' Choire Ghlais and Allt na Cailliche;

- Brown earths along the shore of Loch Lochy;
- Peaty gleys between the river Allt na Cailliche and summit of Meall nan Rudhag; and
- Humus-iron podzols along the valley of Allt Glas Dhoire, between Loch Lochy and Loch Oich, and the alluvial fan of Kilfinnan Burn.

Peat

14.6.18 A programme of peat probing was competed in support of The Consented Development, and a further comprehensive peat probing exercise was conducted in 2017 (see Appendix 14.1).

14.6.19 Review of the peat data in relation to The Proposed Development confirms:

- soils greater than 0.5 m in depth are largely absent within the Site;
- three small discrete areas of deeper peat (>3 m) have been identified at the north-western edge of Loch a' Choire Ghlais (Plate 14.3), east of the proposed dam on the opposite side of Allt a' Choire Ghlais near the outlet of the indicative spillway channel; and the north-eastern shoulder of Meall nan Dearcag near Lochan na Corra (Plate 14.4); and
- no peat is recorded on the public road and forestry track along the western shore of Loch Lochy.

Plate 14.3: Area of Deep Peat (>3m) on the North-western end of Loch a' Choire Ghlais

Plate 14.4: Area of Deep Peat (>3m) on the north-eastern shoulder of Meall nan Dearcag

Superficial Geology

14.6.20 An extract of the regional superficial geological mapping is presented as Figure 14.3 (Superficial Geology) and indicates that superficial geology is largely absent within the Site with bedrock at or near the surface (Plate 14.5).

Plate 14.5: Bedrock exposures along valley sides of the Allt a' Choire Ghlais, looking towards Sean Mheall

14.6.21 Hummocky glacial deposits, where present are generally confined to the lower lying areas of the Site. Peat has been identified by the BGS as follows:

- along Loch a' Choire Ghlais and the north-east of the corrie;
- between the summits of Meall a' Choire Ghlais and Ben Tee;
- along the north-east slopes of Meall nan Dearcag; and
- around Lochan Diota.

14.6.22 Alluvium, consisting of clay, silt and gravel is shown to bound the River Garry at the proposed site entrance at White Bridge. Glaciofluvial deposits are present along the Caledonian Canal between North Laggan and Kilfinnan Farm while alluvial fan deposits of gravel, sand, silt and clay are present at the mouths of Kilfinnan Burn and Allt Glas Dhoire on Loch Lochy (Plate 14.6).

Plate 14.6: Alluvial fan deposits along the shoreline of Loch Lochy at mouth of Allt Glas Dhoire at NGR NN 25423 93403

14.6.23 An esker crestline has been mapped by BGS on the north-eastern slope of Mheall nan Dearcag, corresponding to a linear ridge of glaciofluvial deposits.

Bedrock and Solid Geological Features

14.6.24 An extract of the regional bedrock geological mapping is presented on Figure 14.4 (Solid Geology).

14.6.25 The BGS records the solid geology underlying the Site to comprise almost entirely of the meta-sedimentary unit of Upper Garry Psammite Formation – Psammite (Plate 14.7). A unit of the Upper Garry Psammite Formation – Psammite and Semipelite also exists between the summits of Sean Mheall and Meall nan Dearcag with a unit of cataclasite belonging to the Great Glen Fault Zone existing along Loch Lochy.

Plate 14.7: Psammite Bedrock Exposure in existing small Borrow Pit at NGR NH 27409 01052

14.6.26 There are several minor discrete units of intrusive rocks throughout the Site.

14.6.27 Several fault lines are present within the Site, the largest of which include faults which:

- follow the watercourse Allt a' Choire Ghlais (recognised downstream as Kilfinnan Burn by OS) to Sron a' Choire Ghairbh through the proposed dam;
- follow the approximate forest line of Kilfinnan Wood;
- follow Allt Ruighe Bhlair watercourse; and
- between the summits of Sean Mheall and Meall nan Dearcag.

Hydrogeology

14.6.28 An extract of the Hydrogeological Map for Scotland (1:625,000 scale) is presented as Figure 14.5: Regional Hydrogeology and Scotland and Northern Ireland Forum for Environmental Research (SNIFFER) groundwater vulnerability map as Figure 14.6: Groundwater Vulnerability.

14.6.29 Review of the regional Hydrogeological Map for Scotland confirms that the Site is underlain by impermeable rocks (Precambrian), generally without groundwater except at shallow depth indicating an aquifer of limited potential. Any groundwater flow is likely to occur in the upper weathered surface of the rock and follow local surface water gradients.

14.6.30 Some groundwater flow and storage may also be expected in deposits of Alluvium, River Terrace and Glacial deposits as the sand and gravels in these units will be able to transmit water. Water in these units is likely to be shallow and locally in hydraulic continuity with surface water features (e.g. streams and lochs). The peat and Till, as a consequence of their low bulk permeability are not considered to be groundwater bearing.

14.6.31 Review of the groundwater vulnerability mapping confirms the following for the Site:

- Superficial Aquifer: Where present, predominantly intergranular flow of low productivity with rare areas of moderate to high productivity at lower altitudes and along Loch Lochy and the site entrance at the River Garry;
- Bedrock Aquifer: Exclusively fracture flow mechanism with very low to low productivity; and
- Vulnerability Class 4 (a-d) to 5 with vulnerability generally increasing with altitude.

14.6.32 Vulnerability classes range from 1 to 5, with 5 being most vulnerable. Class 4 is subdivided. It is the hydrogeological characteristics within the pathway rather than the 'importance' of a particular aquifer that results in the final vulnerability classification. Large parts of Scotland show areas of Classes 4 and 5, reflecting the widespread occurrence of igneous and metamorphic rocks where the potential for the attenuation of contaminants in the pathway is very limited.

14.6.33 However, the meta-sedimentary and intrusive rocks underlying the Site are likely to contain very small volumes of groundwater, mainly within fracture zones, due to their composition. The relatively high groundwater vulnerability classification at site represents the vulnerability to pollution on account of the dominance of fracture flow and generally thin and superficial cover. The methodology behind the classification assumes that where contaminants move through unsaturated fractured bedrock, no attenuation of pollutants can take place.

14.6.34 Under its responsibilities of the Water Framework Directive (WFD), SEPA has classified groundwater bodies that underlay the Site as presented in Table 14.6 (SEPA 2017).

Table 14.6: SEPA Groundwater Body Classification (2016)

Waterbody Name	Area (km^2)	Overall Status	Water Balance	Chemical Status
Fort William (ID: 150696)	2274.7	Good	Good	Good
Northern Highlands (ID: 9382.3)	9382.3	Good	Good	Good

14.6.35 SEPA has confirmed that there are no groundwater level or water quality monitoring sites within a 7 km radius of the Site.

Local Hydrology

14.6.36 Within the Site Boundary, proposed infrastructure is located within two principal surface water catchments, Allt na Cailliche and Allt a' Choire Glas (recognised downstream as Kilfinnan Burn by OS). Details of each are given below.

Allt na Cailliche

14.6.37 The Allt na Cailliche (Plate 14.8) catchment serves the permanent northern access track from the A87 at White Bridge up to the eastern slopes of Ben Tee and comprises many upstream tributaries including:

- Allt Ruighe Bhlair and its upstream tributary Allt Coire Bo Chailein and Lochan na Beinne Brice;
- Allt Bac nan Laogh;

- Allt Ruadh;
- Fuaran na Sguabaich; and
- Allt nan Seileach and Lochan Diota.

Plate 14.8: Allt na Cailliche Looking South towards Ben Tee (Right) and Meall nan Dearcag (Left)

14.6.38 It is noted that the site access at the crossing of the River Garry from the A87 at White Bridge is served by a minor catchment with no defined watercourses, where surface water runoff discharges directly to the River Garry.

14.6.39 The River Garry discharges to Loch Oich. Loch Oich flows northwards through the Caledonian Canal, Loch Ness and River Ness, ultimately discharging to the Moray Firth.

Allt a' Choire Ghlais (Kilfinnan Burn downstream)

14.6.40 The Allt a' Choire Ghlais (Plate 14.9) catchment begins at Loch a' Choire Ghlais (Plate 14.10) and is within this catchment most of the upper reservoir works will take place. The watercourse has many small unnamed and the following larger named tributaries including:

- Allt na Feadaige; and
- Allt a' Choire Bhuidhe.

Plate 14.9: Allt a' Choire Ghlais at NGR NN 25735 96394

Plate 14.10: Loch a' Choire Ghlais, looking towards Sron a' Choire Ghairbh

14.6.41 The hydromorphology of Allt a' Choire Ghlais is discussed in detail within Appendix 14.3 and 14.4.

14.6.42 It is noted that the public road and forestry track along the western shore of Loch Lochy is served by many small unnamed and named watercourses that discharge directly to Loch Lochy (see Appendix 14.6: Schedule of Watercourse Crossings) including:

- Allt Cruinneachaidh;
- Allt an Oighre;
- Allt na h-Atha;

- Allt an Fhuarain; and
- Allt na Bruaich.

14.6.43 Loch Lochy flows south towards the Caledonian Canal and River Lochy to Loch Linnhe.

14.6.44 Table 14.7 shows catchment descriptors from the FEH database for the two principal surface water catchments that drain the Site and which the majority of the development is proposed. The descriptors can be used to characterise the catchments anticipated response to precipitation.

Table 14.7: Catchment Descriptors for Principal Watercourses

Catchment	Downstream point NGR	Area (km^2)	SAAR (mm)	ALTBAR (m ASL)	DPSBAR (m/km)	LDP (km)
Allt na Cailliche	NH 28300 00700	11.4	1,856	318	184.3	7.17
Allt a' Choire Ghlais	NN 28150 95700	10.7	2,142	541	340.6	7.85

Grid reference of downstream maximum extent of catchment as denoted by either the site boundary or confluence with another watercourse

SAAR – surface average annual rainfall between 1961 and 1990

ALTBAR – mean catchment altitude (metres above sea level (ASL))

DPSBAR – index of catchment steepness

LDP – longest drainage path

Flood Risk

14.6.45 SEPA have developed national flood maps (SEPA, 2017) that present modelled flood extents for river, coastal, surface water and groundwater flooding which were developed using a consistent methodology to produce outputs for the whole of Scotland, supplemented with more detailed, local assessments where available and suitable for use. Flood extents are presented in three likelihoods:

- High likelihood: A flood event is likely to occur in the defined area on average more than once in every ten years (1:10). Or a 10% chance of happening in any one year;
- Medium likelihood: A flood event is likely to occur in the defined area on average more than once in every two hundred years (1:200). Or a 0.5% chance of happening in any one year; and
- Low likelihood: A flood event is likely to occur in the defined area on average more than once in every thousand years (1:1000). Or a 0.1% chance of happening in any one year.

14.6.46 The flood risk from each of these potential sources is discussed below. Consultation with THC and SEPA has also been conducted and used to inform the assessment of flood risk.

14.6.47 The Site is distant from all coastal flooding extents. The lowest elevations within The Proposed Development are approximately 30 m AOD and therefore not considered a development constraint.

14.6.48 As discussed above, little groundwater is present at site and groundwater flooding is not considered to pose a development constraint.

14.6.49 The SEPA river flood map was developed using a nationally consistent approach to produce flood hazard information, such as depth of water and speed of flow arising from river flooding. It is based on a two dimensional flood modelling method applied across Scotland to all catchments greater than 3 km^2. The river flood map includes hydraulic structures and defences such as bridges, culverts and flood storage areas where appropriate information was available.

14.6.50 Review of the SEPA river flood map confirms that flood extents are constrained by the incised channels of the River Garry, Allt a' Choire Ghlais and Allt na Cailliche. River flooding is not, therefore, considered to pose a development constraint.

14.6.51 No areas of potential significant surface water flooding are shown within the site boundary by SEPA mapping.

14.6.52 It was noted during the site visit on 17/10/2017 that after a period of heavy rain, surface water ponding, typically at watercourse crossings, and drainage ditch overflow was noted on sections of the minor public road between North Laggan and Kilfinnan Farm as illustrated in Plates 14.11 and 14.12. The areas of surface water flooding are small and discrete.

14.6.53 Surface water flooding, therefore, is not considered to pose a development constraint.

Plate 14.11: Surface Water Ponding on Public Road along the West of Loch Lochy

Plate 14.12: Road Drainage Ditch Overflow on Public Road Along the West of Loch Lochy

14.6.54 SEPA Natural Flood Management data for Sediment Management within their flood maps has highlighted that the Allt na Cailliche watercourse has been identified with a moderate and high erosion regime whilst the River Garry, immediately downstream of its confluence with Allt na Cailliche, has been identified as a high deposition regime, developing further to a moderate deposition regime where the river passes through Invergarry, downstream of the confluence with Aldernaig Burn.

14.6.55 SEPA has confirmed that they do not have any record of existing or proposed flood defence measures in the study area.

14.6.56 SEPA have provided records for two historical flood events within 7 km of the Site:

- 1920 – railway at Letterfinlay was blocked due to downwash of debris from the eastern slopes above Loch Lochy; and
- 2015 – A82 closed between Inverglory and Letterfinlay due to a landslide and flooding on the road from the eastern slopes above Loch Lochy.

14.6.57 It is concluded, therefore, that existing flooding extents do not preclude development at site. Measures to manage flood risk during construction and operation of The Proposed Development are considered in the following sections.

Surface Water Quality

14.6.58 Two watercourses within the site boundary have been classified by SEPA as part of its responsibilities under the WFD. Watercourses and waterbodies which receive water drained from The Proposed Development have the following SEPA classifications shown in Table 14.8.

Table 14.8: SEPA Surface Water Classification (2016)

Regional Catchment	Watercourse	Overall Status	Overall Ecology	Fish Barrier	Morphology	Overall Hydrology
Loch Oich to Moray Firth	Allt na Cailliche (ID: 20297	Good	Good	High	Good	High
	River Garry – Loch Oich to Loch Garry (ID:20254)	Good Ecological Potential	Moderate	High	High	Moderate
	Loch Oich (ID: 100188)	Good	Good	High	Good	High
Loch Lochy to Loch Linnhe	Allt a Choire Ghlais (ID: 20341)	Moderate	Moderate	High	High	Moderate
	Caledonian Canal Loch Oich to catchment boundary (ID: 20250)	Good Ecological Potential	-	-	-	-
	Caledonian Canal Loch Lochy to Ness catchment boundary (ID: 20250)	Good Ecological Potential	-	-	-	-
	Loch Lochy (ID: 100194)	Good Ecological Potential	Poor	High	Moderate	Poor

14.6.59 SEPA have identified pressures on Allt a' Choire Ghlais that include modifications to the waterbody, allowed as part of a hydroelectricity scheme development (CAR licence number CAR/L/1108419) (see Licenced Abstractions/Discharges). It is noted that this licence applies to The Consented Development and that these pressures have been applied to the watercourse by SEPA in advance of any development.

Private Water Supplies

14.6.60 Private water supplies are regulated by the Private Water Supplies (Scotland) Regulations 2006. The Regulatory objective is to ensure the provision of clean and wholesome drinking water and the delivery of significant health benefits to those using such supplies.

14.6.61 As part of this assessment, data requests were made to THC regarding details of PWS within 7 km of the Site, supplemented with information gathered during the site visit in October 2017.

14.6.62 Owing to the low permeability of the underlying superficial and bedrock aquifers and the shallow nature of groundwater flow within these aquifers, the hydrogeological "catchment areas" to any groundwater or spring PWS is likely to be similar to their surface water catchment areas. Only PWS sources within the catchments presented on Figure 14.1, and discussed above, are therefore considered to be in immediate hydraulic connection to the Site.

14.6.63 Properties were visited by an SLR Hydrologist during the field visit in October 2017 to gather further detailed information for properties identified by THC to be served by a PWS within the surface water catchments connected to the Site. The results of this investigation are presented in Table 14.9. The location of the PWS and the source of their water are shown on Figure 14.1.

Table 14.9: Private Water Supplies

Property ID (Figure 14.1)	Source NGR	Waterbody	Relation to Infrastructure
PWS01 (Glenluie)	NH 27100 01100	Spring	Source is outside of catchments connected to The Proposed Development.
PWS02 (Forest gate)	NH 27942 00457	Unnamed watercourse	Source located on opposite side of river valley to The Proposed Development infrastructure with pipe route passing beneath the proposed existing forestry track upgrade.
PWS03 (Laggan Bridge Cottage)	NN 30044 98331)	Borehole	Source located adjacent to property on opposite side of Loch Oich valley.
PWS04 PWS05 PWS06 PWS07 PWS08 PWS09 PWS10 PWS11 PWS12 PWS13 (North Laggan)	NN 29458 98124	Allt Cruinneachaidh	Source upstream of pubic road proposed for upgrade with pipeline crossing at an unknown location serving all of the properties at North Laggan.
PWS14 (Unknown)	NN 29518 98071	Unnamed watercourse	Temporary water abstraction equipment set aside sheep run, suggesting infrequent abstraction for livestock.
PWS15 (North Laggan Farm)	Unknown	Unknown	Unknown
PWS16 (Mogwy Cottage)	NN 29186 97680	Unnamed watercourse	Source upstream of pubic road proposed for upgrade with pipeline crossing at an unknown location serving property.
PWS17 (Stoneyfield)	NN 28563 96955	Allt na h-Atha	Source upstream of pubic road proposed for upgrade with pipeline crossing at an unknown location serving property.
PWS18 (Linden Tree Cottage)	NN 28419 96932	Unnamed watercourse	Source upstream of pubic road proposed for upgrade with pipeline crossing at an unknown location serving property.

Property ID (Figure 14.1)	Source NGR	Waterbody	Relation to Infrastructure
PWS19 (2 Balmaglast)	NN 28399 96712 NN 28420 96821 NN 28465 96836	Allt an Fhuarain and two unnamed watercourse	Three sources upstream of pubic road proposed for upgrade with pipeline crossing at unknown locations serving property.
PWS20 (Kelly's View)	NN 28284 96525	Unnamed watercourse	Source upstream of pubic road proposed for upgrade with pipeline crossing at an unknown location serving property.
PWS21 (Glengarry Lodges)	NN 28346 96372	Borehole	Borehole on the banks of Loch Lochy, pumped to holding tank above holiday homes. Pipeline does not cross public road proposed for upgrade.
PWS22 (Laggan Lock)	NN 28629 96468	Borehole	Borehole on the banks of Loch Lochy. Pipeline does not cross public road proposed for upgrade.
PWS23 (Kilfinnan Farm)	NN 27434 95972	Kilfinnan Burn	Source downstream of proposed dam and upstream of pubic road proposed for upgrade. Pipeline crossing public road at an unknown location serving property.
PWS24 (Highland Lodges) PWS25 (Great Glen Lodge) PWS26 (Kilfinnan Lodges)	NN 27093 95247	Unnamed watercourse	Source upstream of existing forestry track proposed for upgrade with pipeline crossing at an unknown location serving all three properties.

14.6.64 A questionnaire was left for the residents of PWS15 who were not available during the field visit however no response has been received to date.

14.6.65 Of the PWS sources identified only those belonging to PWS23 and PWS24-PWS26 are downgradient of proposed infrastructure; however it is noted that all surface water sourced PWS have pipelines supplying their property that lie beneath roads and tracks proposed to be upgraded.

Licenced Abstractions/Discharges

14.6.66 SEPA holds records for CAR authorisations within the study area. It is understood that the majority are for private septic tank effluent discharges (small domestic discharge (SDD)). Licences for those hydraulically connected and within 2 km of the Site are summarised in Table 14.10 and shown on Figure 14.1.

Table 14.10: Abstraction/Impoundment CAR Licences Hydraulically Connected to Site within 2 km

CAR Licence No.	Name	NGR	Distance to Infrastructure (km)
CAR/R/1103499	Forest Gate House Invergarry	NH 28168 00918	0.000
CAR/L/1108419	Coire Glas Hydro Scheme, Kilfinnan	NN 25441 93328	0.175

CAR Licence No.	Name	NGR	Distance to Infrastructure (km)
CAR/S/1040437	Kilfinnan Lodges, by Spean Bridge	NN 27101 95225	0.000
CAR/R/1089636	New House @ Highland Holiday Lodges Kilfinnan	NN 27234 95303	0.025
CAR/R/1091354	Kelly's View, Balmaglaster, Spean Bridge	NN 28380 96460	0.080
CAR/R/1078466	Facility Block, Laggan Locks, By Spean Bridge	NN 28599 96342	0.325
CAR/S/1136075	Laggan Locks, Spean Bridge	NN 28610 96250	0.375
CAR/R/1083368	Stoneyfield, Balmaglaster, Spean Bridge	NN 28707 96962	0.030
CAR/R/1124453	Mogwy Cottage, Spean Bridge	NN 29240 97650	0.000
CAR/R/1078463	Laggan Bridge Bothy, By Spean Bridge	NN 30052 98321	0.250

14.6.67 Scottish Water maintain two Water Treatment Works (WTW) abstractions, in the vicinity of the Site, one of which, while located more than 10km from the Site is in hydraulically continuity with the Site. The potential impacts on flows and water levels at this abstraction are considered in confidential Appendix 14.7.

14.6.68 As the other Scottish Water abstraction is not in hydraulic continuity with the site it is not considered further.

Watercourse Crossings

14.6.69 A schedule of potential watercourse crossing is provided in Appendix 14.6. The majority of the watercourse crossings are associated with the proposed upgrade of the public road that runs along the west of Loch Lochy between North Laggan and Kilfinnan Farm e.g. are existing watercourse crossings.

Groundwater Dependant Terrestrial Ecosystems

14.6.70 SEPAs wind farm planning guidance which applies to all developments where there may be Groundwater Dependent Terrestrial Ecosystems (GWDTE), states a National Vegetation Classification (NVC) survey should be undertaken to identify wetland areas that might be dependent on groundwater.

14.6.71 If potential GWDTE are identified within (a) 100 m of proposed excavations less than 1 m deep (e.g. roads, tracks and trenches), or (b) within 250 m of excavations deeper than 1 m (e.g. excavated tracks, borrow pits and foundations), then it is necessary to assess how the potential GWDTE may be affected by The Proposed Development.

14.6.72 A summary of the habitat survey completed at the Site is provided in Chapter 10: Terrestrial Ecology along with a detailed NVC habitat plan (Figure 10.3a to 10.3l). This plan has been used to assess for the potential presence of moderate and high GWDTE in accordance with SEPA guidance – see Figure 14.7 (Groundwater Dependent Terrestrial Ecosystems), which shows:

- the majority of the land within the Site Boundary does not feature habitat that might be considered to be supported by groundwater;
- areas of potentially high and moderate GWDTE in the north of the Site are generally associated with forest rides and tracks;
- larger areas of potentially high and moderate GWDTE are recorded around Loch a' Choire Ghlais and Allt a' Choire Ghlais and with reference to Figure 14.2 and 14.3 are shown to be underlain by Peaty podzols and Hummocky glacial deposits;
- a complex mosaic of potentially high and moderate GWDTE has been identified near to the Kilfinnan Burn west of Lochan na Corra;
- northwest of Lochan Diota a larger area of potentially high and moderate GWDTE exists around the Fuaran na Sguabaich (spring), extending northwards towards Allt na Cailliche; and
- following the channel of Allt Ruighe Bhlair a discrete area of potentially high GWDTE has been identified.

14.6.73 The assessment presented in Chapter 10: Terrestrial Ecology states that none of the potential GWDTE has been classed as of High or Very High Sensitivity.

14.6.74 Following the site visits and review of baseline conditions it is considered that the majority of potential area of moderate and high GWDTE are not sustained by groundwater for the following reasons:

- little groundwater is present at the Site and where present will follow surface gradients and be readily shed in the upper surface of the weathered bedrock to the valley bottoms; and
- hummocky glacial deposits underlie the soils in the valleys and will hinder the infiltration of incident rainfall-runoff allowing surface water to pond and saturate soils, and sustain habitats that otherwise might be considered groundwater dependent.

14.6.75 It is concluded that the areas identified as being potentially moderately or highly groundwater dependent are likely to be sustained by incident rainfall and local surface water runoff rather than by groundwater. Accordingly, the buffers proposed in SEPAs GWDTE guidance need not apply. Mitigation measures, to sustain existing surface water flow paths at site, which can be used to sustain these habitats, are discussed later in this Chapter.

Receptor Sensitivity

14.6.76 Table 14.11 outlines the receptors identified as part of the baseline study, and their sensitivity based upon the criteria contained in Table 14.3. These receptors form the basis of the assessment and are used in conjunction with an estimate of the magnitude of an effect to determine the significance of any potential effect.

Table 14.11: Sensitivity of Receptors

Receptor(s)	Sensitivity	Comment	Effects Assessed for Construction and Operation
Water Dependent Statutory Designated Sites	High	No designated sites recorded in direct hydraulic connectivity downstream to the Site.	None.
Soils, Peat and Geology	High	There are no significant areas of deep peat although owing to the scale of the development, volumes of excavated peat are significant. No geologically designated sites would be disturbed by The Proposed Development.	Peat management and reuse.
Hydrogeology	High	Groundwater in the bedrock is regionally of Good water quality. Shallow groundwater beneath the Site is vulnerable to pollution and likely to be in hydraulic continuity with surface waters in the valleys.	Pollution, drainage and groundwater-surface water interactions.
Hydrology	High	Surface water catchments draining the Site have been classified with Moderate-Good water quality.	Pollution, erosion and sedimentation, drainage and groundwater-surface water interactions.
Flooding	Moderate	Minor flooding has been recorded downstream of the Site at the public road along the west of Loch Lochy between North Laggan and Kilfinnan Farm.	Changes in runoff rate and volume due to changes in vegetation cover.
Private Water Supplies	High	Two private water supply sources have been recorded at PWS22 and PWS23-PWS25, which lie in a surface water catchment in which development is proposed. All surface water sourced PWS have pipelines connecting sources to the properties that lie beneath roads and tracks for proposed upgrade.	Pollution, erosion, sedimentation and changes in yield.

Receptor(s)	Sensitivity	Comment	Effects Assessed for Construction and Operation
Licenced Abstractions / Discharges and Impoundments	High	Scottish Water maintains two abstractions in the vicinity of the site. One abstraction is not hydraulically connected to the Site. The other which is remote from the Site is in hydraulic connection to the Site and is assessed in confidential Appendix 14.7. Discharges relate to septic tank discharges only that would not be affected by The Proposed Development.	Pollution, erosion and sedimentation, drainage and groundwater-surface water interactions.
Groundwater Dependent Terrestrial Ecosystems	High	No habitat is sustained by groundwater, but rather it is sustained by incident rainfall and surface water runoff.	Changes in runoff rate and volume due to changes in vegetation cover.

Modifying Influences

14.6.77 Climate change predictions indicate that greater extremities in rainfall may be witnessed (Kay, A.L, et al, 2011). In times of rainfall, greater rainfall intensities and durations may be evident, which could result in greater volumes of runoff, increases in the rate and velocity of runoff, and thus increased flooding, erosion and sediment transport.

14.6.78 Periods of drought may be more pronounced and be characterised by higher temperatures, and longer dry periods.

14.6.79 It is considered, however, that these potential changes, would not significantly affect or alter the baseline conditions assessed at the Site. Mitigation measures have been included in the development design to allow for the effects of greater climate variability; details are provided in the sections that follow.

14.6.80 Similarly, the existing regulatory regime controls PWS, new water abstractions, discharges and impoundments, and this regime would ensure no significant change in future geological and hydrological baseline conditions.

14.7 Potential Effects

14.7.1 Construction activities, as set out in Chapter 3: Description of Development, have the potential to affect hydrological receptors and these are assessed below.

14.7.2 The assessment assumes that good practice (see Section 14.8 - Good Practice Measures) would be applied throughout construction and the levels of predicted magnitude are based on this assumption.

Pollution Risk

14.7.3 During the construction phase, there is the potential for a pollution event to affect surface water bodies and subsequently impact on their water quality. This would have a negative effect on the receptor and any resultant degradation of the water quality would impact on any aquatic life and private and public water supplies abstracting from the watercourses.

14.7.4 Pollution could occur from excavated and stockpiled materials during Site preparation. Contamination of surface water runoff from machinery, leakage and spills of chemicals from vehicle use and the construction of infrastructure also have the potential to affect surface water bodies. Potential pollutants include sediment, oil, fuels and cement.

14.7.5 The risk of a pollution incident occurring would be managed using good practice measures. Many of these practices are concerned with undertaking construction activities away from watercourses and identifying safe areas for stockpiling or storage of potential pollutants that could otherwise lead to the pollution of watercourses.

14.7.6 The baseline assessment has shown that The Proposed Development lies within the River Lochy and River Ness catchments, and that their tributaries are recognised as high sensitivity receptors as a consequence of existing good water quality, the presence of high value fisheries and private and public water abstractions.

14.7.7 The magnitude of a pollution event within the surface water sub-catchments has been considered negligible following adherence to good practice measures set out in Section 14.8. The potential effect of a negligible magnitude event on watercourses of high sensitivity would be of **negligible** significance and not significant in relation to the EIA Regulations. No further mitigation measures would therefore be required.

14.7.8 The groundwater bodies extending beyond the study area are very large when compared to the area of proposed development, and any effects are judged not to be detectable beyond the study area. Potential pollution events occurring during construction would be of negligible magnitude as they would be controlled by good practice measures. Should pollutants reach the groundwater, the scale of the effect would be low in relation to the overall size of the groundwater body. The effect to groundwater, which has been assigned a high sensitivity, has therefore been assessed as being of negligible significance and not significant. No further mitigation measures would be required.

Erosion and Sedimentation

14.7.9 Site traffic during the construction phase has the potential to cause erosion and an increase in sedimentation loading during earthworks. Due to the increased areas of hard-standing and features such as stockpiles, tracks and excavations etc., which could be washed by rainfall or inappropriate site practices, increased sediment could enter into surface water features. This has the potential to reduce the surface water quality, increase turbidity levels, reduce light and oxygen levels and effect ecology including fish populations. After consideration of good practice measures, the magnitude of impact to the receptors has been assessed as negligible and therefore with the high sensitivity receptors described above, the significance of effect without mitigation has been assessed as **negligible**. No further mitigation measures would be required.

14.7.10 Excavations (inc. cut-and-fill tracks and borrow pits), construction of hardstanding and diversion of drainage channels are key sources of sediment generation. Adherence to good practice measures would ensure that any material generated would not be transported into nearby watercourses.

14.7.11 'Location specific' good practice measures would be specified in the final CEMP and would be managed by the appointed Contractor and monitored by the site ECoW to control the amount of fine sediment that could potentially enter a watercourse if it were not managed appropriately. These measures would potentially include cut-off drainage, sediment traps and sumps, as detailed in Appendix 3.3: Draft Construction Environmental Management Plan.

Fluvial Flood Risk

14.7.12 Construction of hardstanding including the tracks, tarmac roads, dam, lower control works and site establishment areas would create impermeable surface areas. This would lead to a relatively small increase in the total impermeable surface area of the Site causing negligible increases in runoff rates and volumes.

14.7.13 Adherence to good practice measures including appropriate drainage design and compliance with the final CEMP would limit any potential effects to being local and of short duration and so would be of negligible magnitude.

14.7.14 It is proposed that any rainwater and limited groundwater ingress which collects in the excavations and borrow pits during construction would be stored and/or attenuated prior to controlled discharge to ground adjacent to the excavation.

14.7.15 Attenuation of runoff generated within the proposed excavations and borrow pits would allow settlement of suspended solids within the runoff prior to discharge in accordance with the 'Site control' component of the SuDS 'management train' (CIRIA, 2015).

14.7.16 The potential effect on flood risk, which is considered to be a receptor of moderate sensitivity, is therefore assessed as being of **negligible** significance and not significant. No further mitigation would therefore be required.

14.7.17 The magnitude of the increase in impermeable area would not be sufficient to have a measurable effect on groundwater levels, as the extent of the impermeable area would insignificant compared to the extent of the underlying geology and groundwater.

Soils, Drainage and Groundwater

14.7.18 During the construction period, drainage would be required to ensure construction areas are workable and not saturated. In particular, drainage, some of which would be temporary, would be required around the dam working area, the site establishment areas and lower control works to manage surface flows. Excavations might require temporary de-watering for the period of the foundation build. These drainage activities could lead to temporary changes, in the water table surrounding these construction activities (where de-watering is required below the level of the natural water-table).

14.7.19 As the areas of potential GWDTE are considered to be sustained by surface water rather than groundwater, surface water drainage paths to these habitats would be maintained.

14.7.20 The potential effect of The Proposed Development on groundwater and areas of potential GWDTE is considered unlikely to change during the operation of The Proposed Development and therefore has not been considered under operational effects.

14.7.21 Excavations associated with construction works (e.g. cut tracks, inlet / outlet structures and dam foundations etc.) can result in local lowering of the water table. This is important in areas upgradient of peat and PWS sources that are derived from groundwater sources (springs and boreholes).

14.7.22 The design of The Proposed Development has avoided areas of ecological or habitat interest wherever possible. Furthermore, the underlying bedrock has little groundwater and therefore limited or little dewatering is likely to be required. There remains potential, however, for local dewatering of soils near dam foundations, without incorporation of mitigation measures.

14.7.23 Development of the proposed temporary access track in the east of the Site could affect the quantity and quality of water that drains to the source of PWS24-26. The magnitude of potential effect has been assessed as medium as the area of The Proposed Development in the surface water catchment that drains to the downgradient PWS is relatively small and best practice measures would be used to maintain existing surface water flow paths. Given that the PWS is a high sensitivity receptor the potential effect is considered to be of **moderate** significance and therefore significant with respect to the EIA Regulations. Further mitigation would therefore be required.

14.7.24 The sensitivity of the groundwater (and habitat that may be dependent on groundwater) receptor has been assessed as being high. However, as discussed above and as a consequence of the Site geology, the extent of any dewatering would be very small. Without mitigation the magnitude of the impact has been assessed as negligible and therefore the potential significance of effect of changing groundwater levels and flow due to dewatering is considered to be of **negligible** significance and would require no further mitigation.

Water Abstraction

14.7.25 Specific consideration of the potential impacts of the impoundment of water behind the dam is provided within Chapter 6: Water Management.

14.7.26 During the construction of The Proposed Development, water might be abstracted for uses such as concrete batching plant, dust suppression, vehicle washing and welfare facilities. The volume of water and mitigation required would be regulated through a CAR abstraction licence and therefore the magnitude of an effect on groundwater and surface, which are considered to be of high sensitivity, has been considered to be negligible. The significance of effect would therefore be **negligible** and not significant.

14.8 Mitigation

14.8.1 Any potential effects of The Proposed Development on the water environment or geology identified by the assessment have been addressed and mitigated by the design (embedded mitigation) and the application of good practice guidance to be implemented as standard during construction and operation to prevent, reduce or offset effects where possible. As such a number of measures would form an integral part of the construction process and

these have been taken into account prior to assessing the likely effects of The Proposed Development. Where appropriate, further more tailored mitigation measures have been identified prior to determining the likely significance of residual effects.

14.8.2 Good practice measures would be applied in relation to pollution risk, sediment management, peat management and management of surface runoff rates and volumes. This would form part of the CEMP (see draft included as Appendix 3.3) to be implemented for The Proposed Development and would be prepared prior to construction.

14.8.3 The final CEMP would include details and responsibilities for environmental management onsite for environmental aspects and would outline the necessary surface water management, oil and chemical delivery and storage requirements, waste management, traffic and transport management and would specify monitoring requirements for waste water, water supply including an Environmental Incident Response Plan (EIRP) and all appropriate method statements and risk assessments for the construction of The Proposed Development.

14.8.4 With the exception of the private water supply sources of PWS23 and 24-26, there are no predicted significant effects under the terms of the EIA Regulations in relation to The Proposed Development. Other than the good practice measures that would be implemented as standard (and as described above), no specific mitigation, during construction, has therefore been identified as being required.

Site Specific Mitigation

Private Water Supplies

14.8.5 Prior to construction of The Proposed Development upgradient of the sources of private water supplies PWS22 and PWS24-26, a programme of baseline water monitoring would be completed (specified within the final CEMP) to confirm baseline water quantities and quality. The baseline monitoring would be carried out at least 12 months prior to construction to establish where fluctuations occur naturally. This data would be used to assess the suitability of the water source and provide a monitoring record against which monitoring data collected during construction and operation could be assessed. The CEMP would also specify trigger levels and an action plan, should a variance of water be recorded compared to the baseline conditions.

14.8.6 With this mitigation in place, which could be expected to be secured by an appropriately worded planning condition, the magnitude of impact has been assessed as negligible and therefore the potential significance of effect on the private water supplies PWS22 and PWS24-26 have been considered to be **negligible** and would require no further mitigation.

Development Design

14.8.7 The Proposed Development has undergone design iterations and evolution in response to the geological (including soils and peat) and water environment (including hydrogeological and hydrological constraints) identified as part of the baseline studies and field studies so as to avoid and/or minimise potential effects on receptors where possible. This has included watercourse locations, areas of peat, potential flooding and GWDTE.

Buffer to Watercourses and Watercourse Crossings

14.8.8 With the exception of watercourse crossings at the Upper Reservoir and Lower Control Works, a 50 m buffer has been applied between watercourses and any proposed construction activities or infrastructure within the Site, in accordance with construction best practice guidelines (see Section 14.4).

14.8.9 The layout of the access track was designed to minimise the requirement for watercourse crossings. In accordance with best practice guidance new and/or upgraded crossings will be sized to pass at the 0.5% Annual Probability Flood (the 200-yr flood) and be installed in accordance with CAR.

Groundwater Dependent Terrestrial Habitats

14.8.10 Measures, such as permeable access tracks and regular cross track drains, have been proposed to safeguard existing water flow paths and maintain existing water quality. It is considered therefore that the water dependent habitats identified by the NVC mapping can be sustained. This would be confirmed, in accordance with good practice, by the ECoW at the time of the construction of The Proposed Development and the ECoW would advise the contractor to ensure that existing surface water flow paths are maintained.

Borrow Pits

14.8.11 An assessment of potential borrow pit locations has been undertaken and is presented as Appendix 14.2: Borrow Pit Screening Assessment. Drainage of water from the borrow pits would be manged using sustainable and passive techniques so as to ensure the borrow pit does not locally impair water quality or increase flood risk.

Good Practice Measures

14.8.12 Key good practice measures are stated below and the assessment incorporates these measures as part of The Proposed Development. Any further specific mitigation which might be required to reduce the significance of a potential effect has been identified in the assessment of likely effects during the construction and operation phases.

General Measures

14.8.13 As a principle, preventing the release of any pollution/sediment is preferable to dealing with the consequences of any release. There are several general measures which cover all effects assessed within this Chapter, details are given below.

14.8.14 Prior to construction, section specific drainage plans would be produced. These would take into account any existing local drainage which may not be mapped and incorporate any section specific mitigation measures identified during the assessment.

14.8.15 Measures would be included in the final CEMP for dealing with pollution/sedimentation/flood risk incidents and would be developed prior to construction. This would be adhered to should any incident occur, reducing the effect as far as practicable.

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

14.8.17 Roles would be assigned to different engineering/construction/supervising personnel and the inspection and maintenance regimes of sediment and runoff control measures would be adopted during these periods. In extreme cases, the above protocol would dictate that work onsite might have to be temporarily suspended until weather/ground conditions allow.

Water Quality Monitoring

14.8.18 Water quality monitoring during the construction phase would be undertaken for the surface water catchments that serve the Site, to ensure that none of the tributaries of the main channels are carrying pollutants or suspended solids, resulting from construction activities. Monitoring would be carried out at a specified frequency (depending upon the construction phase) on these catchments.

14.8.19 Monitoring of the quality of water at the water supply to Kilfinnan Farm (PWS23), Highland Lodges (PWS24), Great Glen Lodges (PWS25) and Kilfinnan Lodges (PWS2) would also be specified. An emergency response plan would be developed, and included in the final CEMP should the water source be impaired. The response plan would include provision to secure an alternative water source.

14.8.20 This monitoring would commence at least 12 months prior to construction and continue throughout the construction phase and immediately post construction. Monitoring would be used to allow a rapid response to any pollution incident as well as assess the impact of good practice or remedial measures. Monitoring frequency would increase during the construction phase if remedial measures to improve water quality were implemented. Detailed water quality monitoring plans would be developed during detailed design (THC and SEPA) would be consulted on the plan and would be contained within the final CEMP.

14.8.21 The performance of the good practice measures would be kept under constant review by the water monitoring schedule, based on a comparison of data taken during the construction phase with a baseline data set, sampled prior to the construction period.

Pollution Risk

14.8.22 Good practice measures in relation to pollution prevention are contained within the CEMP and include the following:

- refuelling would take place at least 50 m from watercourses;
- foul water generated onsite would be managed in accordance with best practice and would be drained to a sealed tank and routinely removed from Site;
- areas would be designated for washout of vehicles which would be a minimum distance of 50 m from a watercourse;
- if any water is contaminated with silt or chemicals, runoff would not be allowed to enter a watercourse directly or indirectly without treatment;

- procedures would be adhered to for the storage of fuels and other potentially contaminative materials in line with the Water Environment (Oil Storage) (Scotland) Regulations 2006, to minimise the potential for accidental spillage (e.g. stored in 110% bunded storage facilities); and
- a plan for dealing with spillage incidents would be designed prior to construction, and this would be adhered to should any incident occur, reducing the effect as far as practicable. This would be included in the final CEMP.

14.8.23 Site investigation (e.g. trial pitting and/or boreholes) would be undertaken prior to any construction works where excavation would be required to establish the development, and it would inform the detailed design and construction methods to ensure pollution risk is considered prior to construction.

Erosion and Sedimentation

14.8.24 Good practice measures for the management of erosion and sedimentation would include the following:

- all stockpiled materials would be located out with a 50 m buffer from watercourses and battered to limit instability and erosion;
- stockpiled material would either be seeded or appropriately covered, minimising the area of exposed bare ground;
- monitoring of stockpiles/excavation areas would occur during and following heavy rainfall/snowmelt events;
- the amount of ground exposed, and time period during which it is exposed, would be kept to a minimum and appropriate drainage would be in place to prevent surface water entering deep excavations;
- water would be prevented as far as possible, from entering excavations through the use of appropriate cut-off drainage;
- where the above is not possible, water that enters excavations would pass through a number of settlement lagoons and silt/sediment traps to remove silt prior to discharge into the surrounding drainage system. Detailed assessment of ground conditions would be required to identify locations where settlement lagoons would be feasible;
- clean and dirty water onsite would be separated and dirty water would be filtered before entering the stream network;
- a design of drainage systems and associated measures to minimise sedimentation into natural watercourses would be developed. This could include silt traps, check dams and/or diffuse drainage;
- silt/sediment traps, single size aggregate, geotextiles or straw bales would be used to filter any coarse material and prevent increased levels of sediment. Further to this, activities involving the movement or use of fine sediment would avoid periods of heavy rainfall where possible; and
- construction personnel and the Principal Contractor would carry out regular visual inspections of watercourses to check for suspended solids.

Fluvial Flood Risk

14.8.25 SuDS would be incorporated as part of The Proposed Development.

14.8.26 SuDS techniques aim to mimic pre-development runoff conditions and balance or throttle flows to the rate of runoff that might have been experienced at the Site prior to development. Good practice in relation to the management of surface water runoff rates and volumes and potential for localised fluvial flood risk would include the following:

- drainage systems would be designed to ensure that any sediment, pollutants or foreign materials which may cause blockages are removed before water is discharged into a watercourse;
- onsite drainage would be subject to routine checks to ensure that there is no build-up of sediment or foreign materials which may reduce the efficiency of the original drainage design causing localised flooding;
- appropriate drainage would attenuate runoff rates and reduce runoff volumes to ensure minimal effect upon flood risk; and
- as per good practice for pollution and sediment management, prior to construction, section specific drainage plans would be developed and construction personnel would be made familiar with the implementation of these.

14.8.27 Further information on ground conditions and drainage designs would be provided in the final CEMP.

Water Abstractions

14.8.28 Abstraction of water for construction activities may be required and would be determined as part of the detailed design.

14.8.29 Any water abstraction would only be made in accordance with the Controlled Activity Regulations, and be authorised/regulated by SEPA.

Watercourse Crossings

14.8.30 The locations of the required watercourse are summarised in Appendix 14.6: Schedule of Watercourse Crossings.

14.8.31 The crossings would be designed and constructed in accordance with CAR and best practice guidance(see Section 14.4), and be designed to pass at least the 200 year (yr) storm water flow.

Peat Management

14.8.32 Peat would be managed in accordance with best practice and the site specific Peat Management Plan (PMP). Principles for the management of peat at site are presented in Appendix 14.5: Draft Peat Management Plan. The PMP will be updated further following site investigation prior to construction, and in consultation with SEPA and THC.

14.9 Monitoring

14.9.1 With the exception of baseline water quality monitoring prior to and during construction, no further survey requirements have been identified.

14.10 Residual Effects

14.10.1 No significant residual effects on geology and water environment receptors have been predicted during the construction and operational phase of The Proposed Development.

14.11 Cumulative Effects

14.11.1 It is understood that there are no other proposed or consented developments within the same surface water (and therefore groundwater) catchments as The Proposed Development.

14.11.2 No cumulative effects are therefore identified.

14.12 Conclusions

14.12.1 A thorough assessment of the existing soils, geology and water environment and has been completed.

14.12.2 It has been shown, as a result of the embedded mitigation included in the development design, and as a consequence of the best practice techniques and site specific mitigation that would be deployed at the Site, that no significant effects on soils (inc. peat), geology or the water environment are predicted.

14.12.3 In particular, it has been shown that The Proposed Development would not affect the wholesomeness of water or alter the rate of runoff from site so as to increase flood risk. To confirm this, a programme of water monitoring has been proposed. It is concluded, therefore, that with respect to the water environment The Proposed Development would have no negative effects.

14.13 Statement of Significance

14.13.1 This Chapter has assessed the likely significance of effects of The Proposed Development on the geology (including soils and peat) and water environment.

14.13.2 As a consequence of the development design, The Proposed Development has been assessed as having no significant effects following adoption of good practice measures and site specific mitigation measures.

14.14 References

ASH Design and Assessment Ltd (2012) Coire Glas Pumped Storage Hydro Scheme Environmental Statement.

CIRIA (2015). The SuDS Manual C753.

FEH Web Service, available at https://fehweb.ceh.ac.uk/GB/map [accessed 15/11/2017]

Kay, A.L., Crooks, S.M., Davies, H.N. and Reynard, N.S. (2011). Centre for Ecology and Hydrology An assessment of the vulnerability of Scotland's river catchments and coasts to the impacts of climate change Work Package 1 Report.

SEPA flood maps, available at http://map.sepa.org.uk/floodmap/map.htm [accessed 17/11/2017]

SEPA Water Classification Hub, available at https://www.sepa.org.uk/data-visualisation/water-classification-hub [accessed 20/11/2017]

SHN SiteLink, available at http://www.snh.gov.uk/publications-data-and-research/snhi-information-service/sitelink/ [accessed 17/11/2017]