



Bhlaraidh Wind Farm Extension

Appendix 9.2 Flood Risk Assessment

Client: SSE Renewables
Project/Proposal No: 1571
Version: 2
Date: 2021-06-07





Document Information

Project Name:	Bhlaraidh Wind Farm Extension
Document Title:	Appendix 9.2 Flood Risk Assessment
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Date:	2021-06-07
Version	2
Project/Proposal Number:	1571
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Revision History

Version	Date	Authored	Reviewed	Approved	Notes
01	2021-05-24	K Brydie	S Donnan	S Donnan	First Issue
02	2021-06-07	K Brydie	S Tullie	S Tullie	Final version

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Drawings

- Drawing 001: Site Location Plan
- Drawing 002: Existing Hydrological Overview



1. Introduction

1.1 Context

ITPEnergised (ITP) has been appointed by SSE Renewables (The Client) to provide support and input to the Environmental Impact Assessment Report (EIAR) submission to support a planning application to extend the consented Bhlaraidh Wind Farm (hereafter referred to as the “Proposed Development”).

This FRA has been prepared as Technical Appendix 9.2 to Chapter 9: Hydrology and Hydrogeology within the EIAR. This report addresses potential flood risk to the proposed development from all potential sources.

The Site was visited by an experienced ITP Hydrologist and Civil Engineer in July 2020 to inform this assessment.

1.2 Policy and Guidance

This assessment has been completed in accordance with guidance presented within Scottish Planning Policy (SSP)¹, the National Planning Framework for Scotland 3 (NPF3)² and taking cognisance of the Flood Risk Management (Scotland) Act 2009.

The assessment also references and takes due consideration (where appropriate) of the following principal guidance and policy documents:

- CIRIA (2004) Development and Flood Risk – Guidance for the Construction Industry, Report C624;
- The Highland Wide Local Development Plan (HWLDP)
- The Highland Council Supplementary Guidance: Flood Risk and Drainage Impact Assessment (2013)
- Scottish Environment Protection Agency (2015) Flood Risk and Land Use Vulnerability Guidance (Reference: LUPS-GU24), Version 4, July 2018;
- Scottish Environment Protection Agency (2017) SEPA Development Plan Guidance Note 2a: Development Management Guidance: Flood Risk (Reference: LUPS-DM-GU2a), Version 2, July 2018; and
- Scottish Environment Protection Agency (2019) Technical Flood Risk Guidance for Stakeholders (Reference: SS-NFR-P-002) May 2019.

1.3 Site Location and Context

The Site is located on a relatively remote plateau approximately 20km southwest of Inverness and 8km west of Loch Ness, the main development area is centred around an approximate NGR: NH 39265 20931. The closest village is Invermoriston and the Site is within the jurisdiction of The Highland Council. The Site is accessed via a track exiting north of the A887 between Invermoriston and Bhlaraidh that is used for existing access to Bhlaraidh Windfarm (Operational Development), Livishie hydro-electric scheme and for Glemoriston Estate use. The main development area of the Site will also be accessed via existing Operational Development tracks and the continuation of the Livishie hydro-electric scheme track.

¹ The Scottish Government (2014) Scottish Planning Policy, 2020

² The Scottish Government (2014) National Planning Framework 3, June 2014



The Site comprises mostly of greenfield land and is located on a high rocky plateau. This open, undulating moorland features several rocky outcrops, small hills, many lochs, lochans, watercourses, areas of bog, tracks, hydroelectric and Operational Development infrastructure.

The surrounding area is a similar setting however areas of forestry and settlements are located to the south and east of the Site.

A site location plan is included as Drawing 001.

1.4 Proposed Development

The Proposed Development comprises up to 18 turbines and associate infrastructure including tracks, hardstanding, turning heads, a substation, a site entrance compound and borrow pits.

A copy of the proposed layout is included within Drawing 002.

1.5 Topography

The elevation of the main site area (i.e. where all proposed turbines are to be sited) ranges from 606mAOD in the northwest to 416mAOD in the southeast. The topography across this open, undulating moorland featuring rocky outcrops, small hill, many lochs and lochans varies, however generally the north of the main site has higher elevations than the south of the main site.

The proposed southern access route (an existing track) slopes downward from the main site to approximately 57mAOD at its most southern point by the A887.

Local high point, Meall a'Chrathaich, is located at the western edge of the Site boundary south of the existing windfarm at 678mAOD.

1.6 Geology and Hydrogeology

1.6.1 Geology

1.6.1.1 Superficial

Review of the British Geological Survey (BGS) online geology maps³ indicates that superficial cover is absent across the majority of the Site, suggesting that bedrock is at or close to the surface. This is supported by site reconnaissance survey work, during which bedrock outcrops were observed frequently across the Site. From BGS mapping and site reconnaissance, peat is indicated to be present in a number of localised areas across the Site, predominantly within depressions in the landscape or adjacent to water bodies. The areas in the south of the Site where the existing access track is located is covered in parts with Devensian Till, Devensian Hummocky Glacial Deposits consisting of Diamicton sand and gravel and Devensian Glaciofluvial Sheet Deposits consisting of sand, gravel and boulders.

1.6.1.2 Bedrock

Review of the BGS online geology maps indicates that the bedrock geology at the Site comprises Psammite and interbedded Psammite and Semipelite, the Loch Eli Group and Glenfinnan Group respectively.

1.6.2 Hydrogeology

Review of the BGS online hydrogeology maps indicates that the underlying bedrock that the Site is underlain by rocks of the following aquifer groups:

³ British Geological Survey (2020) Natural Environment Research Council – online Geology of Britain Viewer, available at: <http://mapapps.bgs.ac.uk/geologyofbritain/home.html> (accessed 14th January 2021)



- Loch Eil Group – recorded as a low productivity aquifer with small amounts of groundwater in near surface weathered zones and secondary fractures.
- Glenfinnan Group – recorded as a low productivity aquifer with small amounts of groundwater in near surface weathered zones and secondary fractures.

SEPA classifications identify the Site to be within the Northern Highlands groundwater body which has an overall status of Good.

1.7 Hydrological Context

The Site features numerous watercourses and water bodies. The largest water body is Loch a' Chrathaich adjacent to the western edge of the Site, into which the far western and south-western Site area extents drain. A series of smaller lochs and lochans are present across the rest of the Site, within complex topography meaning drainage will flow from various high points into these water bodies. The majority of the Site is anticipated to drain to the Allt Saigh, either directly or for the most part via the numerous smaller tributaries / sub-catchments to the Allt Saigh. The main watercourses within the study area are classed by SEPA as heavily modified water bodies (HMWB) and are discussed below.

Infrastructure of the Livishie hydro-electric scheme is located within the study area, including a dam at Loch a' Chrathaich and multiple intake locations. A dam is also located within the Allt Bhlaraidh but is located outwith the study area. A dam is located on the Allt Saigh, approximately 200m downstream of the Turbine Development area and within the study area. A dam and water outfall are also located at the Dundreggan Reservoir, upstream along the River Moriston outwith the study area.

1.7.1 Catchment Overview

All turbines and associated infrastructure (hardstandings and turning heads), new track, existing Livishie Hydro track (required to be upgraded), hydro borrow pit search areas, borrow pit search areas, the batching plant search area and the substation are located within the Allt Saigh catchment.

The construction compound at the site entrance, although not new, will require construction activities and the reinstatement of the western half of it (refer to EIAR Figure 1.3). This construction compound was utilised during construction of the Operational Development and is located within the catchment of the River Moriston.

The Satellite temporary construction compound is located within the Allt Bhlaraidh catchment. This compound is located on the site of the former batching plant for the Operational Development, allowing the platform that remains beneath the reinstated layer to be utilised. Further construction activities will be required to form the compound for use during the construction of the Proposed Development.

The access tracks via the existing wind farm track are located within each of the above discussed catchments (Allt Saigh catchment, River Moriston catchment and the Allt Bhlaraidh catchment). However no major works are required on these tracks. As discussed above, the existing Livishie hydro track will be upgraded as part of the Proposed Development and is located within the Allt Saigh catchment.

An existing hydrological overview is included as Drawing 002.

2. Planning and Guidance Context

2.1 Scottish Planning Policy



This report has been prepared in accordance with Scottish Planning Policy (SPP) relating to Managing Flood Risk and Drainage, which states that the planning system should promote:

- “a precautionary approach to flood risk from all sources, including coastal, water course (fluvial), surface water (pluvial), groundwater, reservoirs and drainage systems (sewers and culverts), taking account of the predicted effects of climate change;
- flood avoidance: by safeguarding flood storage and conveying capacity, and locating development away from functional flood plains and medium to high risk areas;
- flood reduction: assessing flood risk and, where appropriate, undertaking natural and structural flood management measures, including flood protection, restoring natural features and characteristics, enhancing flood storage capacity, avoiding the construction of new culverts and opening existing culverts where possible; and
- avoidance of increased surface water flooding through requirements for Sustainable Drainage Systems (SuDS) and minimising the area of impermeable surface”

and;

"To achieve this, the planning system should prevent development which would have a significant probability of being affected by flooding or would increase the probability of flooding elsewhere."

SPP presents a risk framework for planning decision making relating to flood risk. A summary of this risk framework is replicated in Table 1 below.

Table 1 SPP Flood Risk Framework

SPP Flood Risk Framework
<p>Little or No Risk – annual probability of coastal or watercourse flooding is less than 0.1% (1:1000 years):</p> <ul style="list-style-type: none">➤ No constraints due to watercourse, tidal or coastal flooding.
<p>Low to Medium Risk – annual probability of coastal or watercourse flooding is between 0.1% - 0.5% (1:1,000 – 1:200 years):</p> <ul style="list-style-type: none">➤ Suitable for most development. A flood risk assessment may be required at the upper end of the probability range (i.e. close to 0.5%), and for essential infrastructure and the most vulnerable uses. Water resistant materials and construction may be required.➤ Generally not suitable for civil infrastructure. Where civil infrastructure must be located in these areas or is being substantially extended, it should be designed to be capable of remaining operational and accessible during extreme flood events.
<p>Medium to High Risk – annual probability of coastal or watercourse flooding is greater than 0.5% (1:200 years):</p> <ul style="list-style-type: none">➤ May be suitable for:<ul style="list-style-type: none">○ residential, institutional, commercial and industrial development within built-up areas provided flood protection measures to the appropriate standard already exist and are maintained, are under construction, or are a planned measure in a current flood risk management plan;○ essential infrastructure within built-up areas, designed and constructed to remain operational during floods and not impede water flow;



SPP Flood Risk Framework

- some recreational, sport, amenity and nature conservation uses, provided appropriate evacuation procedures are in place; and
- job-related accommodation, e.g. for caretakers or operational staff.
- Generally not suitable for:
 - civil infrastructure and the most vulnerable uses;
 - additional development in undeveloped and sparsely developed areas, unless a location is essential for operational reasons, e.g. for navigation and water-based recreation, agriculture, transport or utilities infrastructure (which should be designed and constructed to be operational during floods and not impede water flow), and an alternative, lower risk location is not available; and
 - new caravan and camping sites.
- Where built development is permitted, measures to protect against or manage flood risk will be required and any loss of flood storage capacity mitigated to achieve a neutral or better outcome.
- Water-resistant materials and construction should be used where appropriate. Elevated buildings on structures such as stilts are unlikely to be acceptable.

Surface Water Flooding

- Infrastructure and buildings should generally be designed to be free from surface water flooding in rainfall events where the annual probability of occurrence is greater than 0.5% (1:200 years).
- Surface water drainage measures should have a neutral or better effect on the risk of flooding both on and off the site, taking account of rain falling on the site and runoff from adjacent areas.

The SPP Flood Risk Framework above uses the designations from SEPA's online indicative Flood Map to categorise the fluvial (and coastal) flood risk and these are defined as follows:

- **High Likelihood:** A flood event is likely to occur in the defined area on average once in every ten years (1:10) or a 10% chance of happening in any one year (i.e. Annual Exceedance Probability (AEP));
- **Medium likelihood:** A flood event is likely to occur in the defined area on average once in every two hundred years (1:200) or a 0.5% AEP chance of happening in any one year; and
- **Low likelihood:** A flood event is likely to occur in the defined area on average once in every thousand years (1:1000) or a 0.1% AEP chance of happening in any one year.

2.2 SEPA Flood Risk and Land Use Vulnerability Guidance

2.2.1 Context

This guidance outlines how SEPA assess the vulnerability to flooding of different land use with the following categories:



- Most Vulnerable Uses;
- Highly Vulnerable Uses;
- Least Vulnerable Uses;
- Essential Infrastructure; and
- Water Compatible uses.

The classification above is linked to the Flood Risk Framework in SPP (see Table 1 previously) by a matrix of flood risk. In producing this guidance, SEPA has sought to refine and enhance the vulnerability classification and definitions identified in the SPP risk framework.

The following paragraphs are extracted from the guidance for context:

“This guidance classifies land uses according to how they are impacted by flooding, i.e. their relative susceptibility and resilience to flooding, and any wider community impacts caused by their damage or loss.

The classification recognises that certain types of development, and the people who use and live in them, are more at risk from flooding than others (e.g. children, the elderly and people with mobility problems that may have more difficulty in escaping fast flowing water).

The term ‘land use vulnerability’ is used in this guidance to differentiate between a range of land uses, taking account of flooding impacts on land uses in terms of their relative susceptibility and resilience to flooding. It also reflects wider community impacts caused by their damage or loss. For example, a police station is not more likely to suffer damage (be susceptible) or less able to recover (be resilient) than a comparable office building. However, it is in a more vulnerable category than an office use because a higher value is placed upon the wider community impacts that would be caused by its potential loss or damage during a flood event. Similar considerations apply to the inclusion of hazardous waste facilities within the highly vulnerable category and other waste treatment facilities being within the less vulnerable category.”

2.2.2 Proposed Development Suitability

With reference to Table 1 (SEPA Land Use Vulnerability Classification)⁴ of the guidance the proposed developed is considered *Essential Infrastructure Uses* category.

With reference to Table 2 (SEPA Matrix of Flood Risk) of the guidance, the proposed Essential Infrastructure has no constraints in little or no risk (<0.1% AP), is generally suitable for development in low to medium risk (0.1% - 0.5% AP) and is suitable in medium to high risk (0.5% AP) where location is required for operational reasons, the development can be operational during floods and does not impede water flow.

2.2.3 Proposed Flood Design Criteria

With reference to the preceding sections, the proposed flood design criteria for the Proposed Development is that the Site is suitable in all flood risk scenarios (from all sources), providing that any development in medium to high risk locations is required for operational reasons, the development can be operational during floods and does not impeded water flow.

⁴ Scottish Environment Protection Agency (2018): Flood Risk and Land Use Vulnerability Guidance



3. Flood Risk Assessment

3.1 Sources of Information

3.1.1 National Floodplain Mapping and Risk Assessment

Strategic level information regarding the current flood risk at the Site has been obtained from SEPA via the online Indicative Flood map and National Flood Risk Assessment (NFRA) Portal⁵.

3.1.2 Mapping and Terrain Data

Ordnance Survey (OS) Mapping and satellite imagery have been used to set the context of the application site and its immediate surroundings.

3.2 Screening Assessment of Potential Source of Flood Risk

3.2.1 Overview

There are a number of potential sources of flooding which should be evaluated in accordance with best practice and SPP such as:

- Flooding from rivers or fluvial flooding;
- Flooding from the sea or tidal / coastal flooding;
- Flooding from land;
- Flooding from groundwater;
- Flooding from sewers; and
- Flooding from reservoirs, canals, and other artificial sources.

The flood risk from each of these potential sources is discussed in the following sections and a 'screening assessment' is presented in Section 3.2.8 which confirms any potential flood risk sources requiring a more detailed analysis and specification of bespoke mitigation measures.

Flood 'risk' definitions are based on a qualitative technical assessment taking into account the information reviewed, risk to site users and the development itself.

3.2.2 Fluvial Flooding

Review of SEPA's Fluvial Flood Map for the Site indicates high risk fluvial flooding of the banks of Allt Saigh in the south of the main site area. However, this flooding is localised to the river and connected lochs and lochans.

The majority of the Site is suitably distanced from this flooding extent with the exception of the track to Turbine 9 and Turbine 16 which lies approximately 30m from the flooding extent and the watercourse crossing on the approach to Turbine 14. Turbine 9 and hardstanding is approximately 5mAOD above the flooding extent and Turbine 16 and hardstanding is approximately 6mAOD above the flooding extent and are both located over 100m from the fluvial flooding extent. Taking account of the elevation of the proposed turbines and the distances between the flooding extent and tracks to the flooding extent, there is not considered to be a risk of flood waters impacting the turbines. To ensure that these risks are not exacerbated, drainage and water crossings will be designed to mimic greenfield conditions.

⁵ Scottish Environment Protection Agency (2020): NFRA data explorer tool, available at: <https://www.sepa.org.uk/data-visualisation/nfra2018/> (accessed 13th December 2020)



The online SEPA Flood Map shows high risk fluvial flooding of Allt Bhlaraidh along its banks however this risk is suitably out with the Site boundary.

The NFRA portal indicates that no fluvial flooding events have been recorded at or around the Site, with the closest event recorded located over 2km southeast of the Site in Invermoriston and over 4km east at Alltsigh.

Taking the above into account it is considered that there is a **'Low Risk'** of flooding to the Site from fluvial sources.

3.2.3 Tidal / Coastal Flooding

Review of SEPA's Flood Map confirms that the Site is not at risk of coastal / tidal flooding as it is located over 30km inland from any coastal flood risk areas and therefore, is designated as 'No Risk' to the Site.

Flooding from this source is therefore not considered further.

3.2.4 Flooding From Land (Pluvial or Surface Water Flooding)

Review of SEPA's Surface Water Flood Map shows highly localised areas of surface water flooding within the Site, however this flooding is generally located within lochans and watercourses. The turbine infrastructure is all located on areas of ground which are raised above or are suitably distanced from these areas.

Given the upland nature of the Site, overland flow routes from higher to lower ground will be common. However, given the extent of watercourses in the area, overland routes will for the most part, will have relatively short drainage paths. Track extents, turbine platforms and other infrastructure will be designed with appropriately sized cut-off drains on their upgradient extents and route these collected flows downstream at regular intervals. This approach will mimic the existing drainage conditions of the area and minimise any risk of overland flows impacting built infrastructure.

Taking the above into account it is considered that there is a **'Low Risk'** of flooding to the Site from land.

3.2.5 Groundwater Flooding

Review of SEPA's Groundwater Flood Map shows that the Site is not located in an area potentially at risk of groundwater flooding. Groundwater flooding areas are shown to be associated with Loch Ness however these are located over 2.5km from the Site boundary.

Flooding from this source is therefore not considered further

3.2.6 Flooding From Sewers / Drainage Systems

The proposed developed site area is not at material risk from any offsite drainage systems / sewers owing to its rural setting and site context.

Flooding from this source is therefore not considered further.

3.2.7 Flooding from Infrastructure Failure

Review of SEPA Reservoir inundation map indicates that there is a risk of flooding from Loch A' Chrathaich Reservoir. The area of flood risk is a suitable distance from the turbine locations and associated infrastructure however the existing access track located near Allt Loch a' Chrathaich lies within the flood risk area.

Taking the above into account it is considered that there is a **'Low Risk'** of flooding to the Site from infrastructure failure with respect to existing infrastructure to be utilised for the Proposed Development.



3.2.8 Flood Risk Screening Assessment Review

A summary of the potential flood risk to the Site from the sources reviewed is presented in 2 below.

This 'Screening Assessment' is used to identify if any sources of flood risk are required to be investigated in more detail i.e. a 'Technical' more detailed assessment which would include consideration / specification of bespoke flood mitigation measures for the Site development.

Table 2 Flood Risk Screening Assessment

Potential Flood Source	Screening Assessment of Flood Risk at Site ¹	Requiring Further Consideration i.e. Technical Assessment?
Fluvial flooding	Low Risk	No
Tidal flooding	No Risk	No
Flooding from land	Low Risk	No
Groundwater flooding	No Risk	No
Flooding from sewers / artificial drains	No risk	No
Flooding due to infrastructure failure / blockage	Low Risk	No

Notes: ¹only Flood Risks designated and screened as being 'medium' or 'high' warrant further investigation

No material flood risk to the Site is envisaged from the flood sources evaluated and thus no further consideration / specification of bespoke flood mitigation measures is required.

4. Conclusions

ITP Energised (ITPE) has carried out a Flood Risk Assessment in support of a EIAR submission in relation to the planning application for Proposed Development.

The FRA undertaken herein demonstrates that the proposed development site is at low fluvial flood risk from any nearby watercourse and low risk of flooding due to infrastructure failure and overland flows.

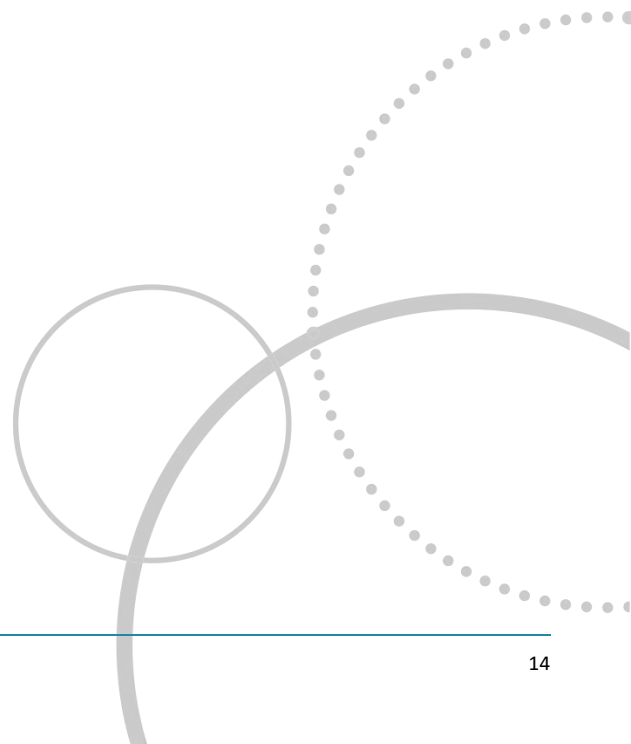
In accordance with Scottish Planning Policy and best practice / regulatory flood risk guidance, all other potential sources of flood risk have been evaluated (i.e. groundwater, sewer flooding etc) which confirms the development site is not at material flood risk from any other source.

The proposed development is considered to be 'Essential Infrastructure' and located in the 'little or no flood risk' category (<0.1% AEP), thus in accordance with SEPAs Guidance and Scottish Planning Policy and thus is considered entirely suitable in land use development terms.

As such it is considered that the proposed development is suitable in flood risk planning terms and there is no overriding impediment to the proposals being granted planning permission on the grounds of flood risk.

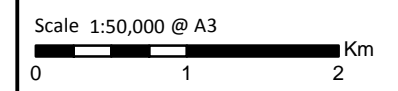
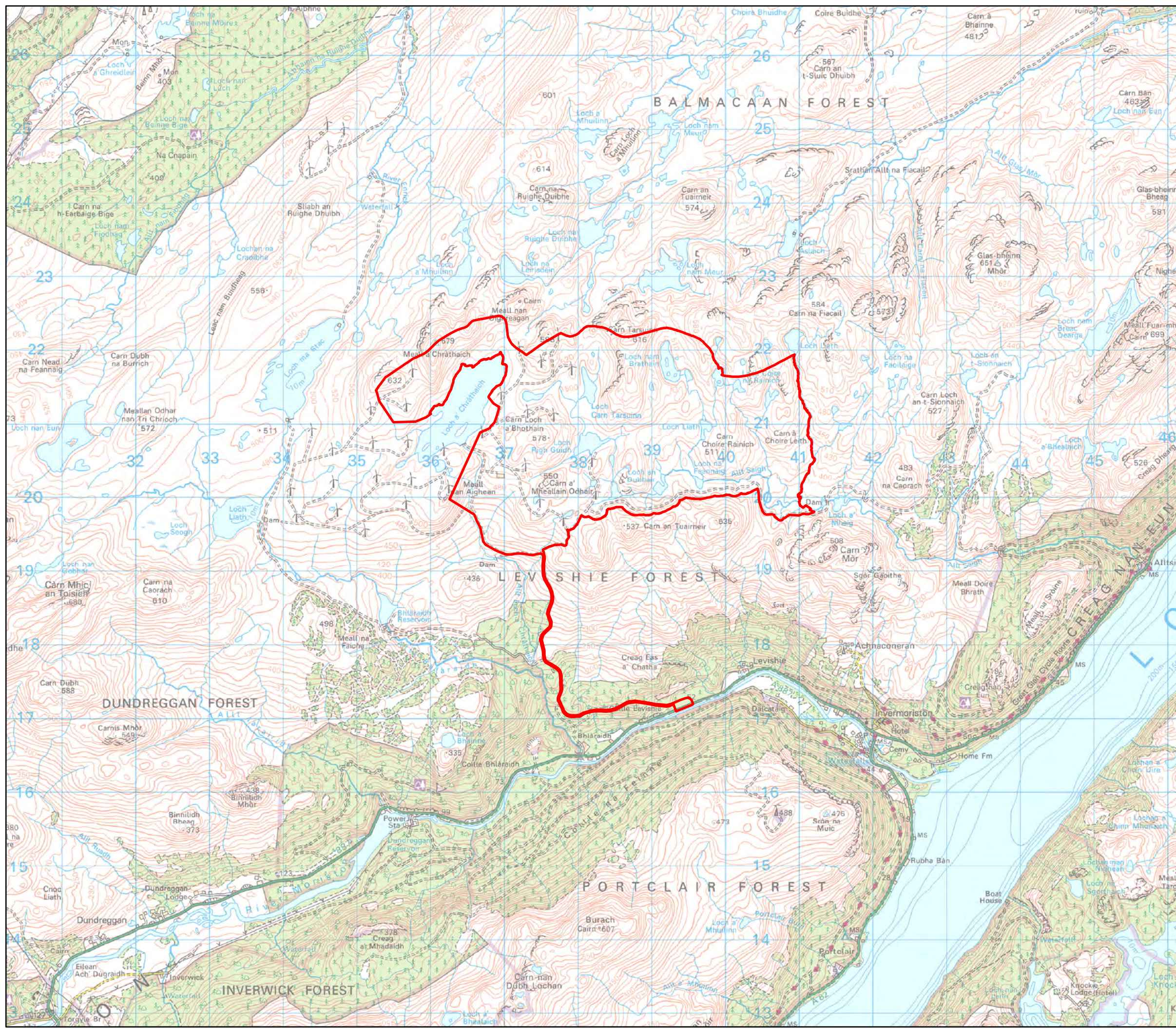


Drawings



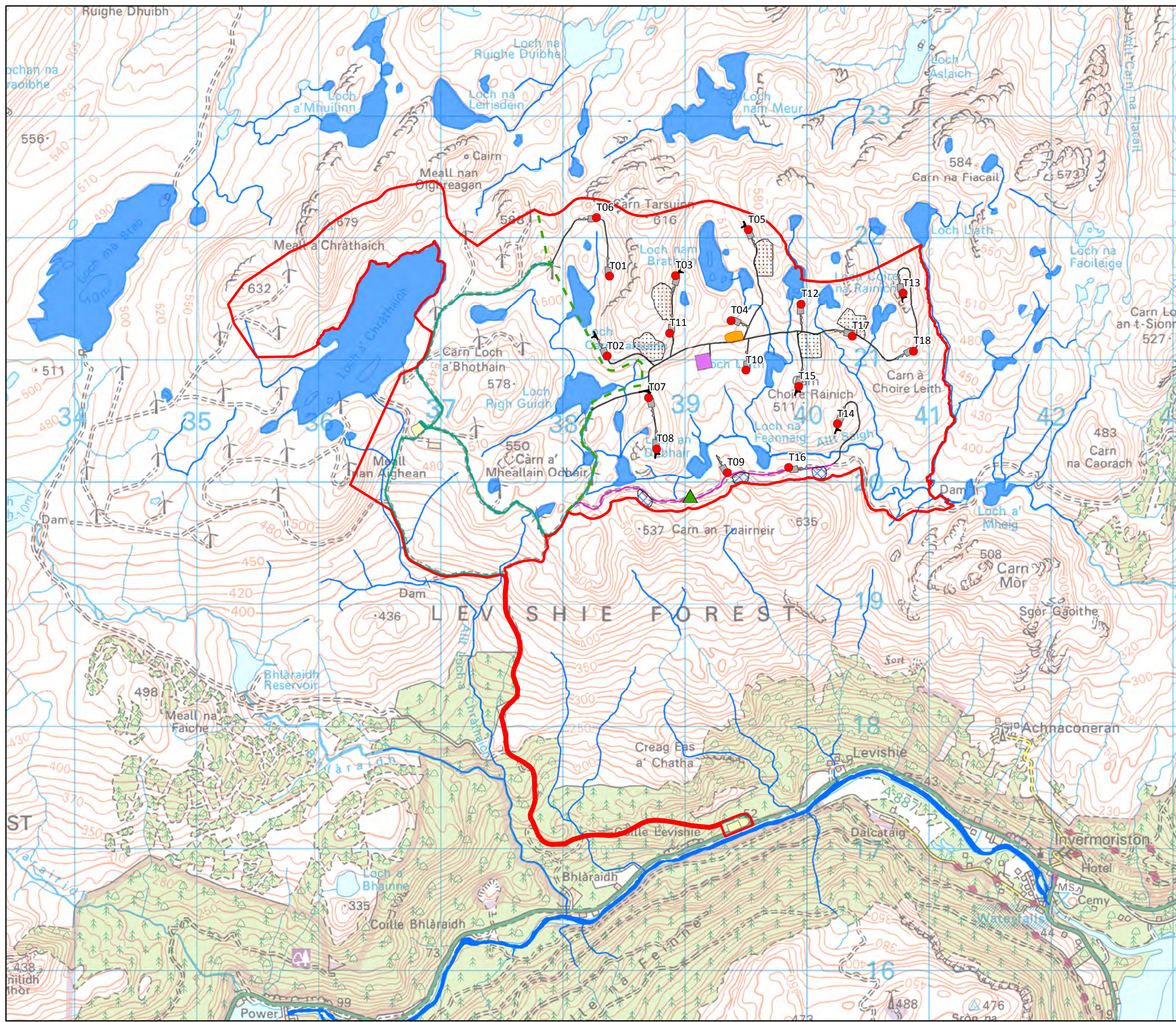
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 Site Boundary

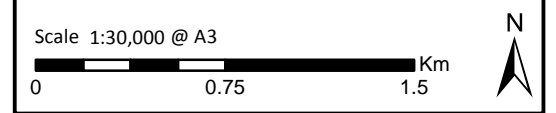


Drawing 001
Site Location Plan

Bhlaraidh Wind Farm Extension
Flood Risk Assessment



- KEY**
- Site Boundary
 - Turbine Development Area
 - Turbine
 - Hardstanding
 - Turning Head
 - ▲ LIDAR
 - Access route via existing Livishie Hydro track (track to be updated)
 - New Track
 - Access route via existing wind farm track
 - Temporary Construction Compound
 - Batching Plant Search Area
 - Borrow Pit Search Area
 - Hydro Borrow Pit Search Area
 - Substation
 - Watercourses
 - Waterbodies
 - River Moriston



Drawing 002
Existing Hydrological Overview

Bhlaraidh Wind Farm Extension
Flood Risk Assessment



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