Cambushinnie 400kV Substation: Flood Risk Assessment

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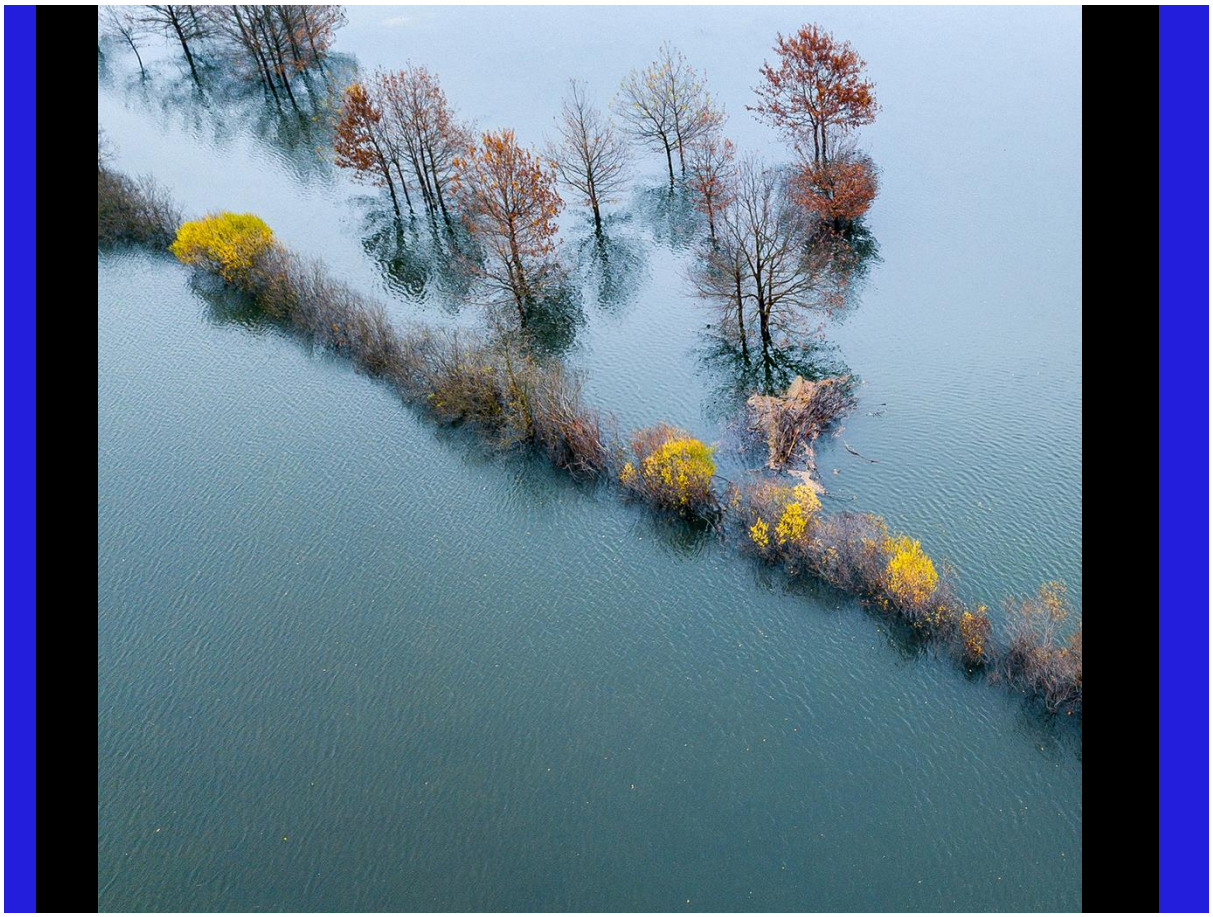
Scottish and Southern Electricity Networks
LT520

SSEN Braco West / Fasnakyle
10 February 2025



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1. Introduction

Scottish and Southern Electricity Networks (SSEN) have commissioned Jacobs UK Ltd. to carry out a Flood Risk Assessment (FRA) to support a planning application for a new 400kV substation comprising new buildings, platform, laydown/work compound areas, drainage and other ancillary works (the Proposed Development). The Proposed Development is situated on land located immediately adjacent to the existing Beauly-Denny overhead line, approximately 250 metres (m) southwest of the existing Braco West substation, and approximately 3.5 kilometres (km) west of the village of Braco.

1.1 Aims and Objectives

The aim of the FRA is to outline the potential for the Proposed Development to be impacted by flooding; the impacts of the Proposed Development on flooding in the vicinity of the Proposed Development; and the proposed measures which are incorporated into the design of the Proposed Development to mitigate any identified risks.

To achieve this aim, the following objectives have been met:

- Reviewed available information in the public domain from various websites (Scottish Environment Protection Agency (SEPA) Flood Maps, British Geological Survey (BGS), Scottish Government and Scotland's Soils).
- Undertaken a qualitative assessment of flood risk from all sources to and arising from the Proposed Development for the construction and operational phases accounting for all information available; and
- Where necessary identified measures to mitigate for flood risk to and arising from the Proposed Development including preparation of a surface water drainage strategy to comply with local policy and regulatory requirements.

1.2 Structure

The FRA is structured as follows:

- Section 2 presents a review of both local and national policies relevant to the assessment of flood risk.
- Section 3 describes the setting of the site in relation to the Proposed Development.
- Section 4 presents information on flood risk to the Proposed Development and how flood risk may change in the surrounding area as a result of the Proposed Development.
- Section 5 presents a summary of the assessment and outlines its key findings.

2. Planning Policy Context

2.1 National Planning Policy

2.1.1 National Planning Framework 4

National Planning Framework 4 (NPF4) is Scotland's national spatial strategy, which was introduced in February 2023 (Scottish Government, 2023). NPF4 supersedes National Planning Framework 3 and Scottish Planning Policy.

Flood risk is addressed in Policy 22 of NPF4. There are several factors in determining the suitability of development proposals, as outlined below:

- Is the development proposal essential for operational reasons in its location and does it have water compatible uses.
- Local Development Plans (LDPs) have identified positive use for development or redevelopment proposals and that there is guaranteed long-term safety and resilience based on relevant SEPA advice.
- An existing or proposed flood protection scheme is in place.
- All risks of flooding are understood and addressed and there is no reduction in flood plain capacity, or an increase in flood risk for other areas.
- The development remains safe and operational during a flood, where flood resistant and flood resilient materials and construction methods are in are used.
- Development proposals must not increase the risk of surface water flooding to others.
- Sustainable urban drainage systems (SUDS) should be in place to manage rain and surface water.

Blue and green infrastructure is addressed in Policy 20 of NPF4. Policy 20 outlines several factors of blue and green infrastructure to determine suitability including the following:

- LDPs should cover multiple functions and benefits of blue and green infrastructure, with a spatial strategy that identifies and protect the infrastructure assets and networks.
- LDPs should encourage the permanent or temporary use of unused or under-used land as green infrastructure. They should also safeguard access rights and core paths, including active travel routes and encourage new and enhanced opportunities for access linked to wider networks.
- Development proposals that could result in loss or fragmentation of current existing infrastructure should only be supported where it can be proved that the development will not cause a deficit in blue or green infrastructure provision, and the overall integrity of the network will be maintained.
- Development proposals shall be supported for incorporating or creating new or enhanced blue and/or green infrastructure.
- Development proposals in regional and country parks will be supported only where they are proved to be compatible with the uses, natural habitats and character of the park.
- Development proposals that include new or enhanced blue and/or green infrastructure will provide effective management and maintenance plans covering the funding arrangements for their long-term delivery and upkeep, and the party or parties responsible for these.

NPF4 defines a flood risk area for the purposes of planning to be an area at risk of flooding with an annual probability of greater than 0.5% which must include an appropriate allowance for future climate change. Where the risk of flooding is less than this threshold, areas will not be considered 'at risk of flooding' for planning purposes. This does not mean that there is no risk at all, but that the risk is sufficiently low to be acceptable for the purposes of planning.

2.1.2 National Guidance

SEPA's Technical Flood Risk Guidance for Stakeholders (SEPA, 2022a) states that a precautionary approached should be applied to the completion of FRAs and outlines the information required within an FRA including:

- The likelihood of flooding in the designated area of study, including flood risk from all possible sources.
- Detailed plans of the specific site.
- An assessment of future climate change.
- Details of any structures that could influence local hydraulics, such as culverts.
- The flood extent for appropriate return periods indicated on a site plan.
- Details of any mitigation measures proposed.

2.1.3 SEPA – Flood Risk and Land Use Vulnerability Guidance, 2024

SEPA has five types of land use vulnerability classifications in relation to flooding (SEPA, 2024a). These five categories are:

1. Most vulnerable uses
2. Highly vulnerable uses
3. Least vulnerable uses
4. Essential infrastructure
5. Water compatible uses

The Proposed Development is classified as essential infrastructure, as it is comprised of essential utility infrastructure (this includes electricity-generating power stations composed of generating power stations and grid and primary sub-stations).

There are a number of considerations which SEPA have when it comes to the Essential Infrastructure category:

- For very low to low risk Annual Exceedance Probabilities (AEP) (<0.1% AEP) there are no constraints.
- For low to medium risk, land is generally suitable for development.
- For medium to high risk within built up areas (>0.5% AEP), the land is suitable for essential infrastructure, designed and constructed to remain operational during floods (i.e., 0.5% AEP), and not impede water flow.
- For medium to high risk within undeveloped and sparsely developed area (>0.5% AEP) construction is generally suitable where a flood risk location is required for operational reasons and an alternative lower-risk location, is not available. If this is the case, then development should be designed and constructed to be operational during floods (i.e., 0.5% AEP), and not impede water flow.

2.1.4 SEPA – Flood Risk Standing Advice for Planning Authorities and Developers, 2024

The SEPA Flood Risk Standing Advice (SEPA, 2024b) gives many regulations for building essential infrastructure in flood risk areas. These are as follows:

- The infrastructure must remain operational during floods and not impede water flow.
- Safe and flood-free access and egress should be provided, where possible, for people of all mobilities.

- Finished floor levels (or formation levels) should be set 600mm above the design flood level to provide an allowance for freeboard.
- An allowance for climate change should be included within design flood levels calculation, of which SEPA guidance specifies.
- Designs should be flood resistant or resilient depending on the characteristics of the design flood.
- A minimum riparian corridor width of 10 to 30m from bank top along both banks of all watercourses dependent on channel width.

2.2 Local Planning Policy

2.2.1 Perth and Kinross Local Development Plan 2019

The Perth and Kinross Council (PKC) Local Development Plan 2 (LDP2) (PKC, 2019) was adopted in November 2019 and guides all future development and use of land in the PKC Area. It sets out the policies and proposals which the council wishes to use to guide development across the PKC Council Area up to 2029 and beyond.

Policy 52 for new development and flooding includes the following:

- Category 1: Medium to High Flood Risk – A flood risk assessment should be undertaken in accordance with the Flood Risk and Flood Risk Supplementary Guidance where an additional Drainage Impact Assessment is usually required.
- Category 1: Medium to High Flood Risk – No homes or premises should be occupied before flood protection measures are complete and operational.
- Category 2: Low to Medium Flood Risk – Suitable for most forms of development but should still be subject to a Flood Risk Assessment in accordance with the Flood Risk and Flood Risk Supplementary Guidance. Flood resilient materials and construction methods are encouraged in areas where they are adjacent to medium and high-risk areas.
- Category 3: No Flood Risk: There is no need for flood related constraints on development.

Policy 53 for water environment and drainage includes the following:

- Policy 53A: Water Environment – Any development, no matter of location or scale, should protect the water environment in accordance with Water Framework Directive 2000/60/EC. If practical, development could even improve the water environment. Proposals for development which do not accord with the Scotland River Basin Management Plan will not be permitted unless the development is judged by the Council to be of significant specified benefit to society and/or the wider environment.
- Policy 53B: Foul Drainage – Foul drainage from all developments within and close to settlements which have public sewerage systems will require connection to the public sewer. A private system could be permitted as long as it does not have an adverse effect on the natural environment and if it is a settlement with little or no public sewerage system.
- Policy 53C: Surface Water Drainage – All new development must employ sustainable urban drainage systems (SUDS) measures. Within the SUDS, measures must include relevant temporary measures at the construction phase. The SUDS should achieve multiple benefits including floodwater management, landscape and green infrastructure.
- Policy 53D: Reinstatement of Natural Watercourses - The council will not support development over an existing culvert or the culverting of watercourses as part of a new development unless there is not another practical alternative. Adequate access for maintenance must be provided where necessary. Existing culverts should be opened, and redundant water engineering structures removed whenever possible to benefit wildlife and improve amenity and a suitable riparian buffer zone between development and the watercourse should be provided.

- Policy 53E: Water Supply – All new development must be served by a satisfactory mains or private water supply which comply with the Water (Scotland) Act 1980 and associated Private Water Regulations, without prejudicing existing users. The developer is responsible for the demonstration of the new supply's suitability, and that it is safe to be consumed as drinking water.

2.2.2 Perth and Kinross Council Supplementary Guidance – Flood Risk and Flood Risk Assessments 2021

The adopted flood risk and flood risk assessment supplementary guidance (PKC, 2021) is intended to support the planning process in relation flooding and drainage including when a flood risk assessment will be required, and what the assessment should contain.

2.3 River Basin Management Plan for Scotland 2021-2027

The River Basin Management Plan (RBMP) for Scotland 2021-2027 (SEPA, 2021) outlines the framework for protecting and improving the benefits provided by the water environment across Scotland. The RBMP outlines how it is proposed rural land is used to provide a contribution to Scotland. This includes using a spatial approach, including the use of flood risk data to assess opportunities for development in rural areas.

3. Proposed Development & Site Setting

3.1 Proposed Development

The Proposed Development will involve construction of a new outdoor 400kV Air Insulated Switchgear substation and consists of the following elements:

- The proposed substation platform is approximately 420m by 230m, not including the earthworks required during the construction of the platform;
- Areas associated with drainage, landscape/screening and habitat enhancement;
- Permanent and temporary access roads, including the upgrade of an existing non-public road (NPR); and
- Temporary construction areas for laydown and welfare facilities.

Figure 3.1 provides an overview of the location of the Proposed Development.

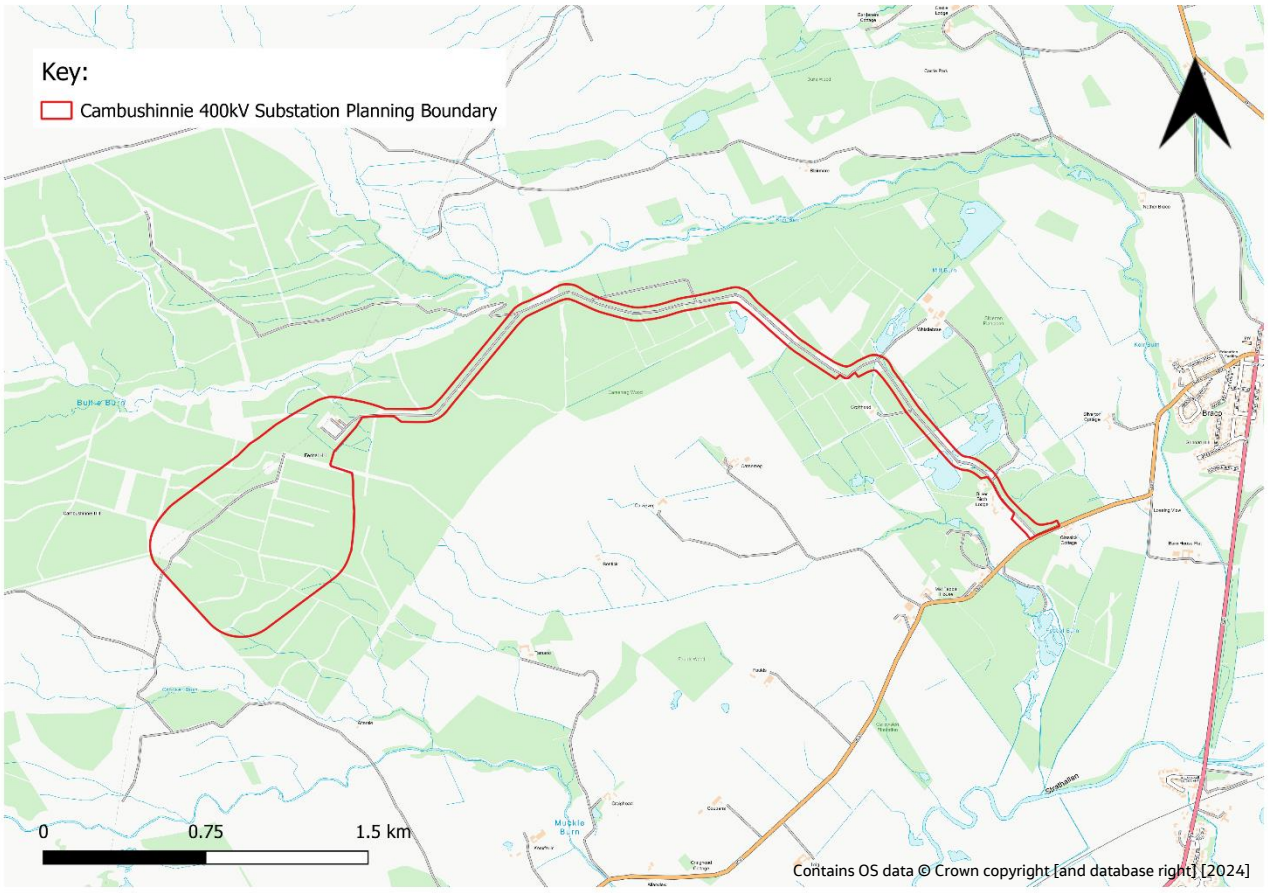

Figure 3.1: Proposed Development Location Plan

3.2 Site Description

The Proposed Development site is located within a commercial forestry plantation dominated by replanted Sitka spruce.

The existing access track within the Proposed Development runs from the B8033 to the existing Braco West Substation. The B8033 runs between the village of Braco and Kinbuck.

3.2.1 Topography

The platform and substation area associated with the Proposed Development sits at approximately 240m above Ordnance Datum (AOD). The highest elevation in the immediate vicinity is Cambushinnie Hill at 270mAOD located to the west of the proposed substation site. The lowest elevation is approximately 127mAOD at the access track junction with the B8033.

3.2.2 Hydrology

The Proposed Development is located within the catchments of the Bullie Burn, Mill Burn, Feddal Burn and Muckle Burn. A summary of the various water bodies located within close proximity of the Proposed Development are outlined below:

- The northern extent of the Proposed Development drains to the Bullie Burn which becomes the Keir Burn as it continues to flow east and the south towards Braco.
- The Mill Burn drains the eastern existing access track and flows south to meet the Feddal Burn. A number of unnamed watercourses or ditches are located to the west of the Mill Burn that drain the arable grassland to the south of the existing access track below the forestry plantation. The Feddal Burn continues south to meet the Allan Water approximately 1.2km to the south of the Proposed Development.
- The Muckle Burn is located to the west of the Proposed Development and drains the majority of the platform and substation site.
- There are several ponds that lie in close proximity to the existing access track, with two ponds either side of the existing access track approximately 500m North-West of the B8033.

Figure 3.2 shows the hydrological features within the area of the Proposed Development.

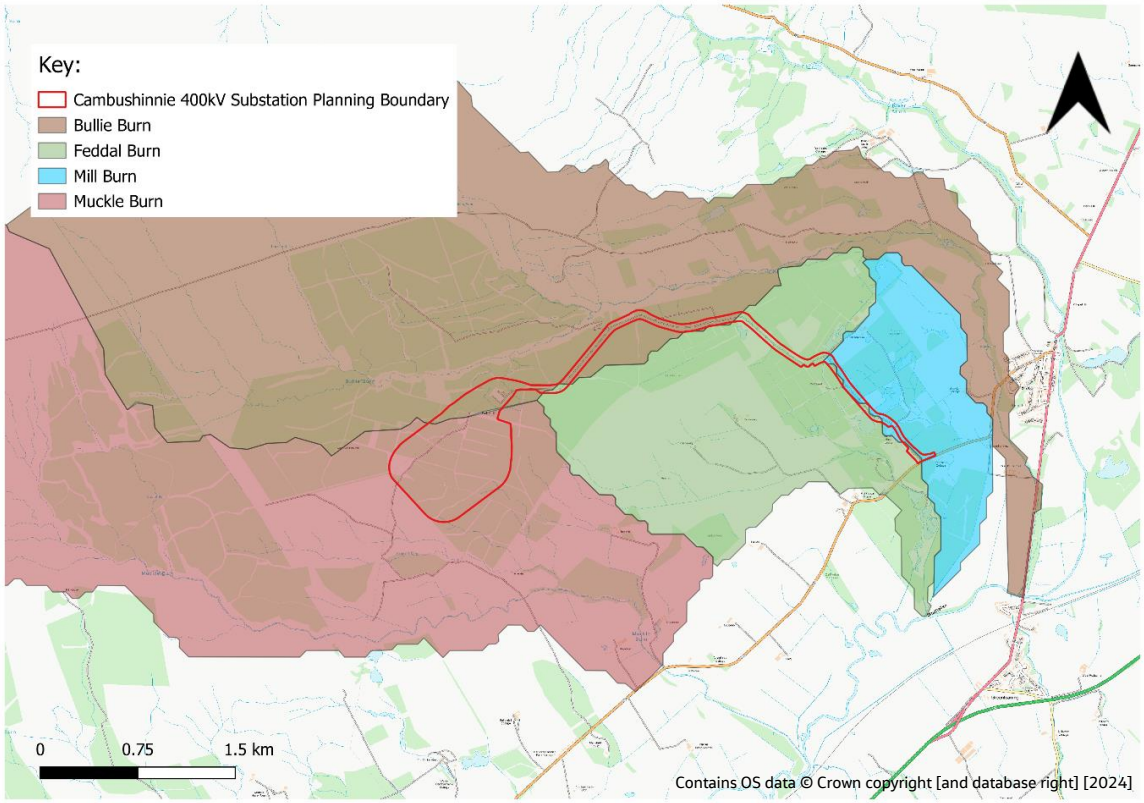

Figure 3.2: Catchments and hydrological features in the area surrounding the Proposed Development

3.2.3 Soils, Geology and Hydrogeology

3.2.3.1 Soils

The National Soil Map of Scotland (Scottish Government, 2024a) classifies the soils in the eastern area of the Proposed Development associated with the lower elevations to be Brown Earth soils. Brown Earth soils are described as being generally free draining, moderately acidic soils with brown mineral top soils and brown or yellowish subsoils. Where these are less well drained the soils are duller and subsoils have rust coloured or grey patches. As elevations increases towards the west the soil type is classed as peaty gleyed podzols. Peaty gleyed podzols are acidic soils with a wet peaty surface layer overlying a wet, greyish subsoil. These will often have a thin iron-pan which restricts the flow of water deeper into the soil.

3.2.3.2 Geology

The British Geological Survey (BGS) GeoIndex viewer (BGS, 2024) identifies a number of superficial deposits across the Proposed Development site. Glaciofluvial ice contact deposits, comprising gravels, sands and silts are present towards the East of the Proposed Development, by the B8033. To the north of the glaciofluvial deposits are large areas of mapped till, underlying the existing access track towards the existing Braco West substation. The area of the proposed Cambushinnie Substation is mapped as comprising of peat.

The bedrock geology underlying the platform and substation site is described as a reddish-brown, grey, purple and brown, cross-bedded sandstone from the Teith Sandstone Formation with locally interbedded siltstones and mudstone. Across the central region of the Proposed Development the existing access track is underlain by the Cromlix Mudstone Formation, consisting of soft, red to dull reddish-brown or purplish brown mudstone with poorly sorted fine-grained silty sandstones and sandy siltstones. In the area of the existing access track junction with the B8033 the bedrock geology consists of the Dunblane Sandstone Member. This comprises of purple and brown, medium- and coarse-grained sandstones.

A Ground Investigation survey was carried out in late 2023 at the proposed substation location. The general sequence of strata encountered during the investigation included the following geotechnical units: Made Ground; Peat; Cohesive Glacial Till; Granular Glacial Till; Teith Sandstone Formation and Cromlix Mudstone Formation.

3.2.3.3 Hydrogeology

The majority of the Proposed Development overlies the Straythmore Group aquifer, which is designated as a moderately productive aquifer where the dominant groundwater method of flow is through fractures and other discontinuities (Scottish Government, 2024b). The other aquifer, which sits beneath a very small portion of the Proposed Development by the B8033, is the Arbuthnott-Garvock Group which is also a moderately productive aquifer with the same flow mechanism as the Strathmore Group.

There is a borehole record located at the current existing Braco West substation (BGS 2024), which has been drilled to a depth of 150m below ground.

A Ground Investigation survey was carried out in late 2023 at the proposed substation location. During the Ground Investigation no groundwater strikes were recorded due to the presence of shallow superficial deposits and the requirement to use drilling flush medium during coring operations. Two groundwater strikes were recorded in trial pits, 1.2m below ground level (bgl) and 2mbgl. Small surface seepages were also noted at several trial pit locations.

A number of boreholes were fitted with perforated standpipes to allow for groundwater monitoring to be carried out. These were installed to a range of depths varying from 1.5mbgl to 10mbl. Groundwater level readings over a number of visits between January 2024 and March 2024 have shown a range of between 0.88mbgl and 8.77mbgl.

4. Flood Risk Assessment

4.1 Flood Risk Assessment to Proposed Development

4.1.1 Fluvial Flood Risk

Fluvial flooding is defined as flooding which arises where excessive rainfall causes the water level in a river, lake or stream to rise and overflow onto the surrounding banks, shores and neighbouring land, it occurs when excessive rainfall causes a waterbody to exceed its capacity.

The functional floodplain is defined by SEPA as the 0.5% AEP (200-year) flood extent. Figure 4.1 shows the fluvial flood risk from SEPA Flood Maps. It should be noted that SEPA Flood Maps do not show watercourses with catchment sizes less than 3km^2. Fluvial flood risk is separated into three risk categories: high, medium and low. Table 4.1 defines the magnitude of flood events associated with these categories (SEPA, 2024c).

Table 4.1: Risk category classifications for the SEPA Flood Maps

Risk Category	Annual Exceedance Probability (AEP)	Return Period
High	10%	1 in 10 year
Medium	0.5%	1 in 200 year
Low	0.1%	1 in 1,000 year

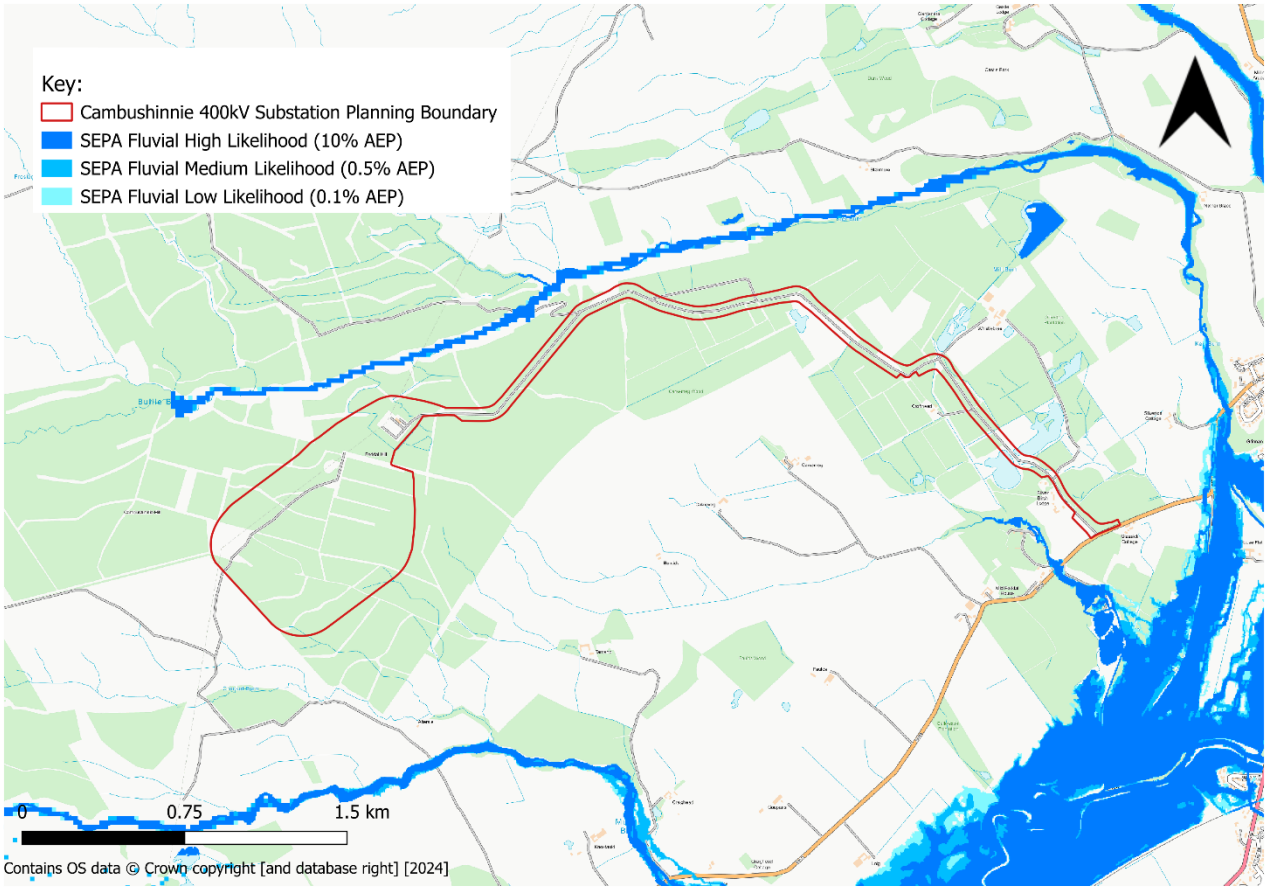

Figure 4.1: Fluvial Risk of Flooding

The SEPA flood mapping shows that the area within the proposed Development boundary is not at risk from fluvial flooding. The nearest mapped fluvial flooding is located to the west of the junction of the existing access track with the B8033 and is associated with Mill Burn/Feddal Burn. The Proposed Development is not anticipated to be at risk of the flooding identified along the Bullie Burn owing to the significant elevation differences from the burn to the existing access track.

The SEPA flood mapping also shows a future projection for the medium likelihood (0.5% AEP) scenario, inclusive of climate change. This scenario is broadly similar to that of the low likelihood (0.1% AEP) scenario, and is shown in Figure 4.2.

On this basis, the Proposed Development has a **low** risk of flooding from fluvial sources.

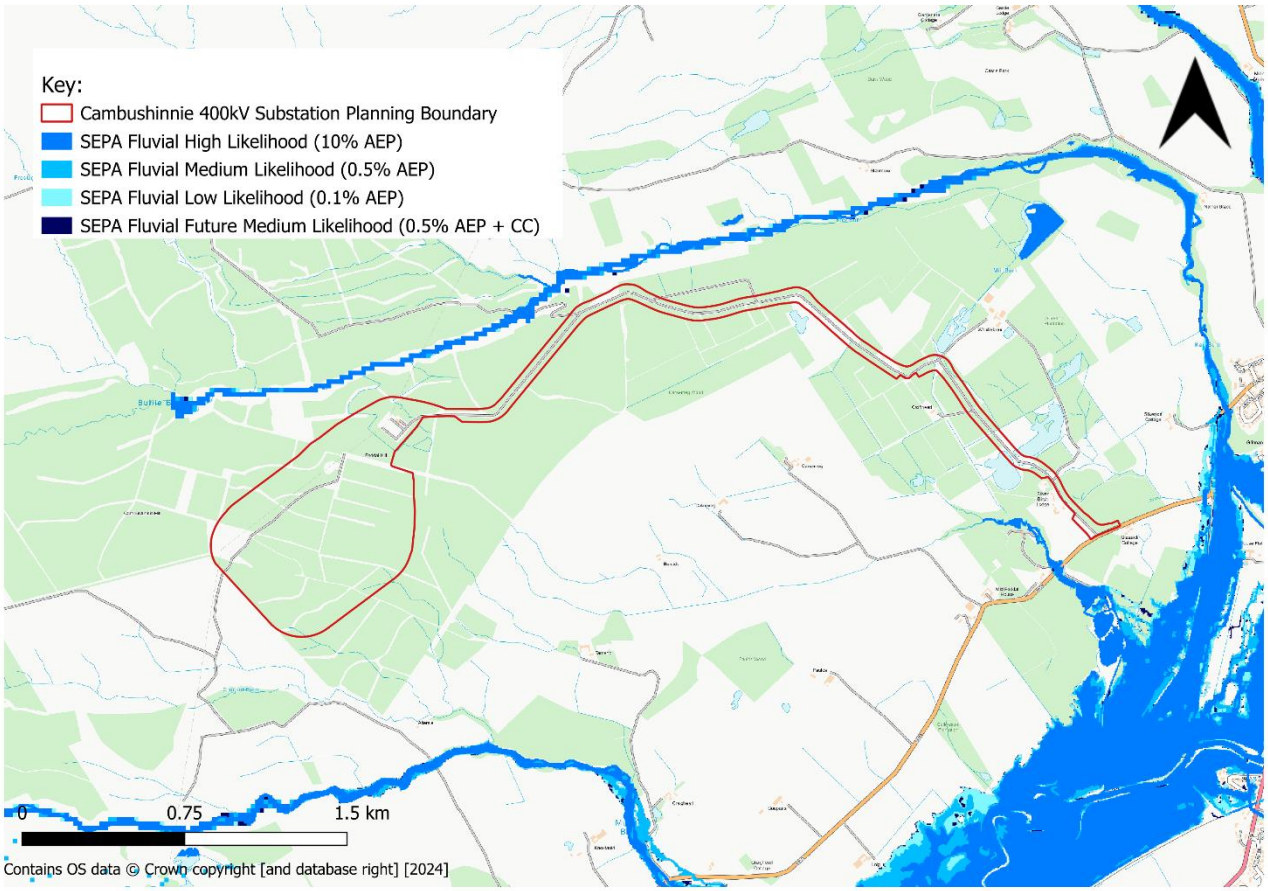

Figure 4.2: Fluvial Risk of Flooding, Including Future Scenario

4.1.2 Surface Water Flood Risk

Surface water flooding typically occurs during or following intense periods of rainfall, where the ground's ability to absorb rainfall is overwhelmed or unable to enter drainage systems.

SEPA flood maps define three areas at risk of flooding:

- The area at risk from a 10% AEP flood (high probability).
- The area at risk from a 0.5% AEP flood (medium probability).
- The area at risk from a 0.1% AEP flood (low probability).

The SEPA surface water flood risk maps (shown in Figure 4.1) show the Proposed Development is largely not at risk from flooding from surface water.

A small area by the Mill Burn, approximately 150m north-west of Gamekeeper Cottage has a high probability of flooding. The area is immediately right of the Proposed Development. On the other side of the proposed Development, a small area approximately 120m north-west of Gamekeeper Cottage has a low probability of flooding. The area within the Proposed Development, in which the Cambushinnie Substation is being proposed, is shown to have a number of small areas at a medium probability of flooding, with the exception of one area at a high probability. These are small, localised depressions in the landscape that are highlighted by the pluvial modelling process.

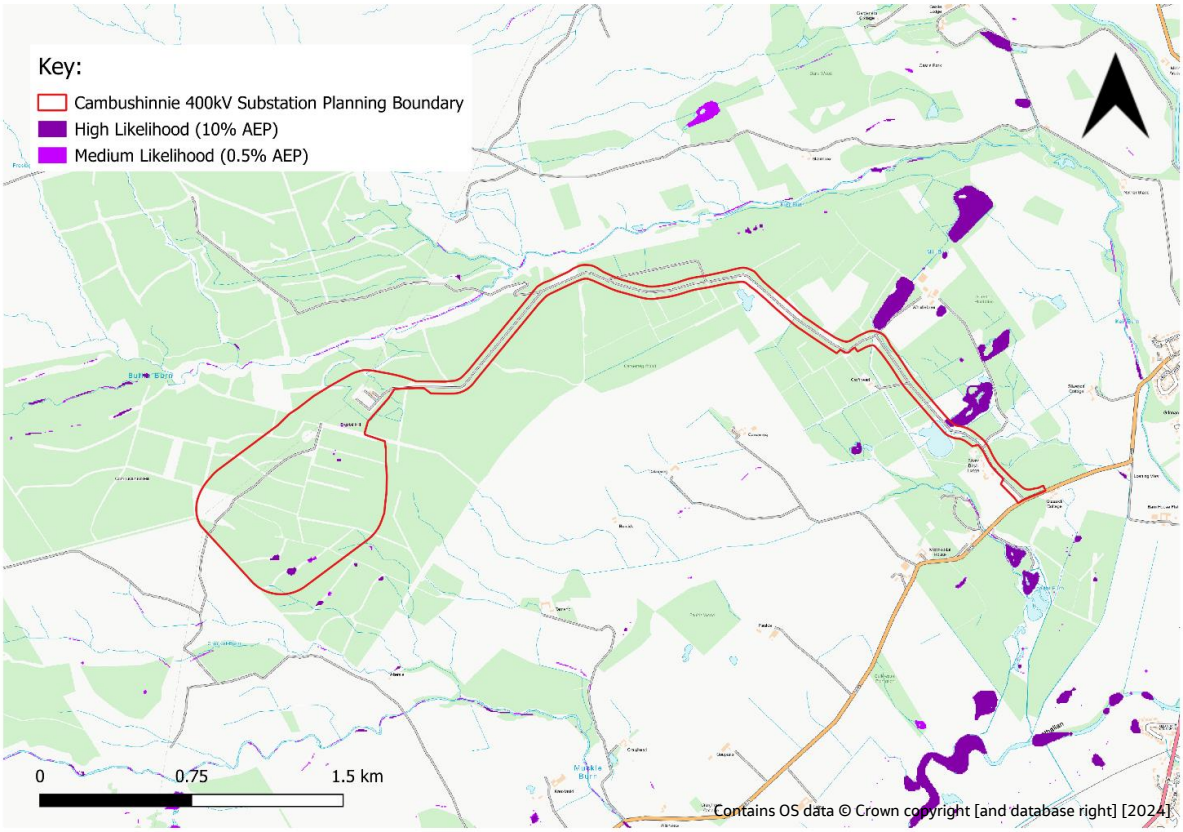

Figure 4.1: Risk of Surface Water Flooding

No formal drainage infrastructure has been identified on the site, however culverts are provided along the existing ditch network for the non-public road (NPR). There are also numerous ditches associated with the tree plantation in the vicinity of the Proposed Development. Field drains are also likely to be present within areas of farmland. Due to steep topography and ground conditions, these features are required to manage large amounts of runoff.

It is assumed that an existing surface water drainage system is in place for the existing platform.

On this basis, the Proposed Development has a **low** risk of flooding from surface water.

4.1.3 Groundwater Flood Risk

Groundwater flooding can occur in low-lying areas when groundwater levels rise above surface levels, or within underground structures.

There is a nearby river catchment, to the north of the Proposed Development (SEPA, 2022b) which has identified groundwater as being a contributory factor to flooding. On this basis, the Proposed Development has a **low** risk of flooding from groundwater.

4.1.4 Flood Risk from Sewers/Mains

Flooding from sewers primarily occurs when flow entering a sewer system exceeds the available capacity or if the network capacity has been reduced through blockage or collapse. In the case of surface water sewers that discharge to watercourses, the same effect can be caused as a result of high-water levels in the receiving watercourse. As a result, water can begin to surcharge the sewer network, emerging at ground level through gullies and manholes and potentially causing flooding to highways and properties. If this occurs flooding can represent a significant hazard to human health due to the potential for contaminants in flood water. As there are no sewers identified within the Proposed Development, the likelihood of flooding is **negligible**.

Similarly, the risk of a failure in a water main is **low**. Scottish Water mapping indicates that there is a water supply pipe which runs alongside the existing access track from the B8033 up to a number of properties at the southern end of the Proposed Development.

4.1.5 Flood Risk from Other Sources

The risk of flooding associated with reservoirs, canals and other artificial structures is considered to be **negligible** given the absence of any such structures in the vicinity of the Proposed Development.

Similarly, the risk of flooding from tidal/coastal sources is considered **negligible** due to the nearest mapped coastal flooding being over 13km from the Proposed Development as well as the difference in elevation.

4.2 Assessment of risk arising from the Proposed Development

4.2.1 Fluvial Flood Risk

The Proposed Development will not introduce any changes that would exacerbate fluvial flooding as there is no known existing fluvial flood risk from identified watercourses that affect the Proposed Development boundary.

Where there are any requirements to replace or install culverts at any encountered crossings these will need to be designed to current standards. These should be designed to accommodate the 1 in 200-year flow plus an allowance for climate change.

As such, the risk of fluvial flooding from the Proposed Development is considered to be **low**.

4.2.2 Surface Water Flood Risk

4.2.2.1 General

As discussed within section 4.1.2, culverts, ditches and field drains are present within the vicinity of the Proposed Development. Where existing water features interact with the scheme, culverts of an appropriate size will be provided to mitigate flood risk impacts.

Surface water from the Proposed Development will be managed by a new surface water drainage system, as described in the Drainage Impact Assessment for the scheme (Balfour Beatty, 2024).

The western side of the proposed site platform is to be positioned on an existing access track and associated drainage ditch/watercourse, which flows in a south-eastern direction and becomes undefined to the south of the platform. This will need to be diverted to accommodate the proposed platform. An existing water feature, which is likely fed by an existing field drain to the east of the access road also requires to be diverted. Works to this feature will need to be discussed and agreed with SEPA. Similarly, any impact on drainage infrastructure for the existing platform will need to be mitigated.

4.2.2.2 Non-Public Road Drainage

The non-public road (NPR) is an existing unpaved aggregate access track which is used by the Forestry Land Scotland and SSEN. The NPR is to be widened as part of the Proposed Development. Existing ditches are located along the length of the NPR to convey flow from the NPR and surrounding topography. Where possible, the existing ditches will be retained. No flow restrictions or attenuation features are proposed due to steep topography. However, proposed ditches will comprise varying sizes of gabion stones along the base to slow flows in steep sections. Existing sections do not have any flow restrictions and likely comprise smaller rocks in the base.

As described in the Drainage Impact Assessment for the scheme (Balfour Beatty, 2024), from chainages 0m to 80m, the NPR is to drain to an existing ditch on the southern side. The next section, up to chainage 300m, will drain to a new section of ditch, replacing the existing ditch. From chainages 300m to 1950m, the NPR will drain to an existing ditch along its eastern/southern side. A new ditch will then be installed along the eastern/southern side of the NPR to replace the existing ditch between chainages 1950m and 2220m. At chainage 2220m, a crossing will be provided to enable the proposed drainage to flow into a new 120m section of ditch on the northern side of the NPR. This will connect into an existing section of ditch, which runs up to chainage 2580m, where a 100m section of new ditch is proposed before it is culverted to the eastern side of the NPR, before discharging into a watercourse at chainage 2780m.

Another new section of ditch is proposed on the western side of the NPR from chainages 2780m to 3000m, where it is culverted to a 20m section of existing ditch on the eastern side of the NPR, before discharging into a larger watercourse. The watercourse flows in a west-east direction and is culverted perpendicular to the NPR.

From chainages 3220m to 3500m, a new ditch is proposed on the eastern side of the NPR. A watercourse from the east connects into this ditch before the drainage continues into an area of dense woodland.

The drainage for the remaining section of the NPR is proposed to remain as existing.

4.2.2.3 Access Track and Platform Drainage

The access track adjoining the NPR has been split into a number of sections, based on local topography. To the north-east of the proposed platform, the existing access tracks (Sections 1 and 2) will be drained to filter trenches and a swale prior to discharging to tributaries of the Bullie Burn. The existing route, condition and location of these tributaries are to be confirmed.

The new section of access track (Section 3), starting from the north-east of the proposed platform to the south of the proposed platform, will drain to filter trenches prior to discharging to a detention basin that ultimately discharges to a tributary of the Crocket Burn to the south-west of the site. The route, condition and location of this tributary are to be confirmed.

The attenuation of surface water runoff from the platform will be provided through the construction layers of the platform. A collector drain, which surrounds the perimeter of the platform will assist with the collection of runoff which will be connected to a downstream pipe network. Runoff from the pipe network will be collected in the same detention basin as the new access track (Section 3) before discharging into a tributary of the Crocket Burn.

The drainage design allows for flow through the free draining platform material to the collector drains. Platform roads will drain by crossfall to adjacent platform material and roofs will drain via gravity fall pipes also linking to the collector drain.

The runoff rates for the platform and access track surface water drainage system have been calculated in line with PKC requirements (PKC, 2021). The discharge rates from the existing access tracks, Sections 1 and 2, would result in a flow control with an orifice of less than 75mm, therefore, discharges will be unrestricted in line with Sewers for Scotland, to prevent blockage. The proposed discharge rate from the detention basin

(Section 3 and the platform) will be restricted to the 2-year greenfield runoff rate of 34.5l/s, with the 1 in 100 year event not exceeding a discharge rate of 35.2l/s and the 1 in 200 year event not exceeding 38.7l/s.

4.2.2.4 Summary

Based on the above, the risk of surface water flooding from the Proposed Development is considered to be **low**, when the above mitigation measures are considered.

4.2.3 Groundwater Flood Risk

Groundwater monitoring has noted relatively steady readings across the site with groundwater being encountered at the interface between the superficial deposits and bedrock. Other than dealing with shallow groundwater emergence during any excavation works, the risk of groundwater flooding from the Proposed Development to third parties is considered **low**.

4.2.4 Sewers and Mains

There will be no new connection to third-party sewers or drains as a result of the Proposed Development.

As such, the risk of flooding from sewers and drainage systems within the Proposed Development to third parties is considered to be **negligible**, for which mitigation measures are not considered necessary.

4.2.5 Other Sources

The Proposed Development does not involve any works which would on the integrity of reservoirs, canals or other artificial structures. As such the risk is considered to be **negligible**.

Similarly, the Proposed Development will not involve any works which would lead to an increased tidal flood risk impact to others. As such the risk is considered to be **negligible**.

5. Summary and Conclusions

5.1 Summary

The aim of this FRA is to outline the potential for the Proposed Development to be impacted by flooding as well as the potential impacts of the Proposed Development on flooding to receptors in the immediate vicinity or downstream of the development. The FRA has been prepared in line with the requirements of NPF4 as well as local authority guidance on the assessment of flood risk for planning purposes.

Table 5.1 presents a summary of the flood risk to and arising from the Proposed Development, including measures proposed to mitigate identified risks.

Table 5.2: Summary of flood risk

Flood Source	Risk to the Proposed Development	Risk Arising from the Proposed Development	Mitigation Proposed
Fluvial	Low	Low	No
Surface water	Low	Low	A surface water drainage strategy has been developed for the Proposed Development to manage runoff.
Groundwater	Low	Low	No
Sewers and Mains	Low	Negligible	No
Other Sources (e.g. reservoirs, canals, tidal/coastal)	Negligible	Negligible	No

5.2 Conclusions

The Proposed Development is located within an area which is at 'low risk' from fluvial, surface water and groundwater flooding. No significant risks were identified from flooding from other sources assessed. No mitigation measures have been proposed other than for surface water flooding. Due to the increases in impermeable surfaces a surface water drainage strategy for the Proposed Development has been developed to manage and treat runoff from these areas.

Surface water attenuation has been proposed in the form of a permeable platform which is linked to a perimeter collection ditch which leads to a detention basin before discharging to a nearby watercourse. The discharge rates have been restricted to the greenfield runoff rate in line with Perth and Kinross Council requirements (PKC, 2021). The new access track (section 3) is drained by filter drains before flowing into the detention basin. The existing access tracks are drained by filter trenches and swales before being discharged to nearby watercourses.

A combination of new and existing ditches along the length of the NPR will convey flow from the NPR and surrounding topography. No flow restrictions or attenuation features are proposed due to topographical constraints.

Overall, it has been demonstrated that the Proposed Development is not at risk of flooding or that the Proposed Development is likely to lead to an increase in flood risk elsewhere.

The drainage network has been designed to attenuate the 1 in 30 year storm event, with the 1 in 200 year event, inclusive of 39% climate change, to be contained within the site. Whilst the drainage for the Proposed Development has been designed to meet the requirements of the local authority, there is a residual risk that the drainage will be unable to cope with events larger than the design event.

6. References

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