Balfour Beatty

SSEN ASTI FRAMEWORK CAMBUSHINNIE 400KV BRACO HAUL TRACK

Drainage Impact Assessment

CMBS-LT520-BB-TRAC-ZZ-RPT-C-0006
MAY 2025

CONFIDENTIAL

Balfour Beatty

SSEN ASTI FRAMEWORK CAMBUSHINNIE 400KV BRACO HAUL TRACK

Drainage Impact Assessment

TYPE OF DOCUMENT (VERSION) CONFIDENTIAL

PROJECT NO. 70108968

OUR REF. NO. CMBS-LT520-BB-TRAC-ZZ-RPT-C-0006

DATE: MAY 2025

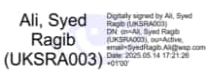
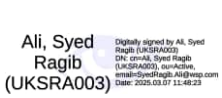
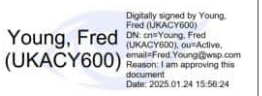
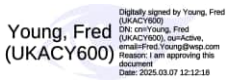
WSP

110
Queen Street
Glasgow
G1 3BX

Phone: +44 0141 429 3555

WSP.com

QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	First Draft	Second Issue	Third Issue	
Date	January 2025	March 2025	May 2025	
Prepared by	Syed Ragib Ali	Syed Ragib Ali	Syed Ragib Ali	
Signature				
Checked by	Syed Ragib Ali	Syed Ragib Ali	Fred Young	
Signature				
Authorised by	Fred Young	Fred Young	Fred Young	
Signature				
Project number	70108968			
Document number	CMBS-LT520-BB-TRAC-ZZ-RPT-C-0006			
File reference	CMBS-LT520-BB-TRAC-ZZ-RPT-C-0006			

CONTENTS

APPENDICES

1. INTRODUCTION

1.1. APPOINTMENT AND BRIEF

1.1.1. WSP has been commissioned by Balfour Beatty to undertake this Drainage Impact Assessment (DIA) to accompany the planning application for the haul track proposed for the construction of the Cambushinnie 400kV Substation.

1.1.2. As part of this application Scottish and Southern Electricity Networks (SSEN) are proposing to install a new substation and associated infrastructure including the necessary upgrade works to the Non-Public Road (NPR) located to the east of the Braco West Sub substation.

1.1.3. The proposed haul track is located at Braco, Scotland and is designed to facilitate access for transformer deliveries and construction traffic, connecting from the existing A822 road to the planned substation, whilst bypassing Braco Village. The proposed haul track is hereafter referred to as the 'proposed development' in this document and Braco, Scotland is hereafter referred to as the 'site.'

1.1.4. This document relates solely to the above proposed development and site and addresses the associated surface water drainage and flood relief assessment (carried out by Jacobs on behalf of SSEN).

1.1.5. This document is intended for the sole benefit of the parties named above and shall not be capable of assignment without prior agreement. WSP shall not be liable for any use of the document for any reasons other than that for which it was originally prepared and provided.

1.1.6. Although this document was prepared using the degree of skill and care ordinarily exercised by engineers practicing under similar circumstances, please note that WSP cannot take responsibility for errors in the information provided by third parties.

1.1.7. This document is to be read in conjunction with all preliminaries, general conditions and all contract drawings.

1.1.8. This document does not address the temporary situation or Construction CAR licence, if required, during the construction phase of any part of the proposed development which may have implications on the drainage network.

1.2. OBJECTIVE OF STUDY & METHODOLOGY

1.2.1. Drainage is a material consideration in the determination of planning applications. This Drainage Strategy document establishes an acceptable method of disposal for surface water for the proposed development.

1.2.2. For the purposes of the drainage design strategy, the guidance from the following documents has been considered:

- The Water Environment (Controlled Activities) (Scotland) Regulations 2011, as amended.
- CIRIA C753 UK SuDS Manual
- SEPA Regulatory Method (WAT-RM-08)
- DMRB CG 501 – Design of Highway Drainage Systems
- Sewers for Scotland version 4.0
- Perth and Kinross Council (PKC), Flood Risk and Flood Risk Assessments, March 2021.
- Forestry Commission Road Specification

2. EXISTING SITE

2.1. SITE LOCATION

2.1.1. The application site is located to the south of Braco Village, Dunblane, FK15 9QZ (National Grid Reference NN832091; X: 283288, Y: 709119). The site location is shown in Figure 1 below.

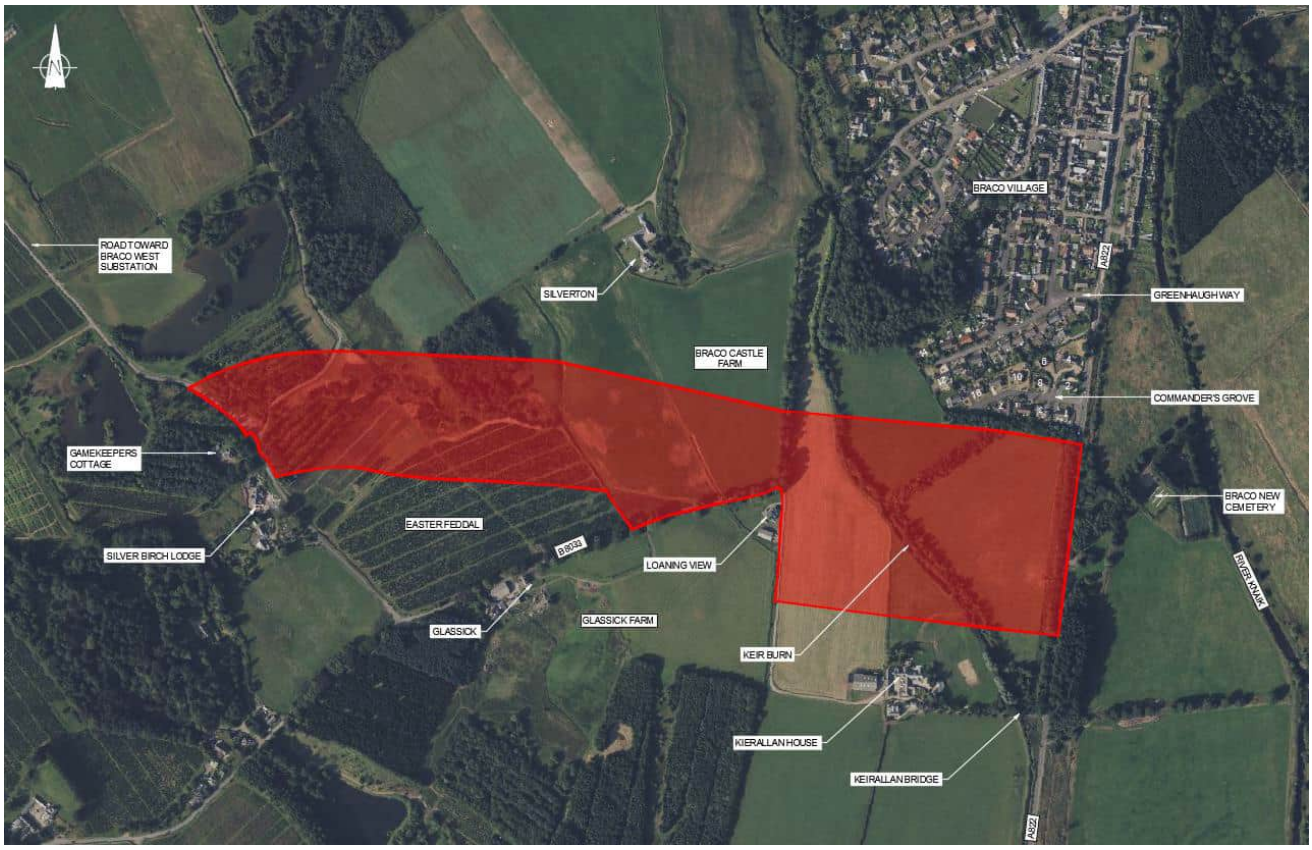


Figure 1 - Site Location Plan

2.1.2. The proposed development is located on the south of Braco village. The haul track is to leave the A822 to the west, cross the Keir Burn, intersect with the B8033, and continue westwards until joining with the existing access track north of Gamekeeper's Cottage.

2.1.3. The location of the site is shown against OS background on Braco Haul Track Supplementary Location Plan CMBS-LT520-BB-TRAC-ZZ-PLN-T-0002 included in *Appendix A* of this document.

2.1.4. The proposed haul track shall feature a bound asphalt construction from chainage 0 to 450 on the eastern end. From chainage 450 to the tie-in with the existing NPR, the haul track shall have an unbound Type 1 construction.

2.2. LAND USE

2.2.1. The site and surrounding area are currently used for grazing and tree plantation of varying ages, with farmland to the east and a Christmas tree plantation to the west.

2.2.2. The land ownership is shown on Land Ownership Plan drawing number LT00273_WAY_010 included in *Appendix A* of this document.

2.3. SITE TOPOGRAPHY

2.3.1. The existing topography of the proposed development area generally falls from north-west to south-east, with existing ground elevations along the haul track ranging from approximately 106m (the low point in the field immediately adjacent to the A822) up to 130m at the northwestern tie-in point with the existing track near Gamekeeper's Cottage.

2.3.2. At its eastern end, where the proposed haul track connects with the A822, the proposed track level is approximately 107.1m. The track then ascends to cross the Keir Burn at approximately 110.9m before tying in with the B8033 at 109.1m. Beyond the B8033, the track generally follows the existing topography, rising to meet the existing NPR at the northwestern end at an approximate level of 129.7m.

2.3.3. For further details, refer to the plan and profile drawings CMBS-LT520-BB-TRAC-ZZ-D-H-0001 and CMBS-LT520-BB-TRAC-ZZ-D-H-0002 included within *Appendix A* of this document.

2.4. EXISTING DRAINAGE

2.4.1. As the site is a greenfield area, no formal drainage infrastructure, such as manholes or pipes, is expected to be present within the proposed development area. However, the site does include the Keir Burn, which crosses the haul track at its eastern end, as well as several watercourses and ditches located west of the B8033. These features are detailed in the Existing Drainage Plan (Drawing No. CMBS-LT520-BB-TRAC-ZZ-D-H-0028) included in *Appendix B* of this document.

2.4.2. The network of existing watercourses west of the B8033, along with ditches, manages runoff from the steep topography of the existing terrain.

2.4.3. Given the nature of the site location, no public or private foul drainage infrastructure is anticipated within the working area or its immediate vicinity.

3. WATER REGULATORY PROCESS

3.1. WATER FRAMEWORK DIRECTIVE AND WATER ENVIRONMENT & WATER SERVICES (SCOTLAND) ACT 2003

3.1.1. The Water Environment and Water Services (Scotland) Act 2003 (WEWS) transposes the Water Framework Directive into national law and provides a framework to assess, protect and enhance the water environment in Scotland. The water environment includes wetlands, rivers, lochs, transitional waters (estuaries), coastal waters and groundwater. The Water Environment (Controlled Activities) (Scotland) Regulations 2011, as amended, (CAR) mean that from 1st April 2006 it is an offence to undertake the following activities without a CAR authorisation:

- Discharges to all wetlands, surface waters and groundwaters;
- Disposal to land (replacing the Groundwater Regulations 1998);
- Abstractions from all wetlands, surface waters and groundwaters;
- Impoundments (dams and weirs) of rivers, lochs, wetlands, and transitional waters;
- Engineering works in inland waters and wetlands.

3.1.2. A CAR authorisation is intended to control impacts on the water environment. It does not cover wider impacts that may be associated with a development such as visual impact or damage to terrestrial ecosystems. Under CAR, three types of authorisations allow for proportionate and risk-based regulation:

- General Binding Rules (GBRs)
- Registration
- Licence

3.1.3. GBRs represent the lowest level of control and include the discharges of surface water runoff. GBR activities taking place in accordance with the rules do not require an application for authorisation from SEPA, and therefore, there are no associated charges. The GBR activities are specified in schedule 3 of CAR.

3.1.4. Registrations allow for the recording of small-scale activities, which individually pose a small environmental risk but, cumulatively, can result in environmental harm. Operators must apply to SEPA to register these activities, for which there is an application fee.

3.1.5. Licences allow for site-specific conditions to be set to protect the water environment. They will be able to cover linked activities on a number of sites over a wide area, as well as multiple activities on a single site. Application fees apply to all licences. SEPA has divided licence activities into simple licence and complex licence activities dependent on the risk and scale.

3.2. POLLUTION CONTROL

3.2.1. WEWS requires any activity that is liable to cause pollution to be authorised. SEPA will use these powers to control point source discharges of pollution.

3.2.2. As stated in section 2.1.4 above the proposed development features both bound (asphalt) and unbound (Type 1) pavement construction. Under CAR regulations, a waterbound road/track is defined as “a road constructed of coarse stone and fine aggregate to form a tightly bound, semi-impervious surface.” As such, the unbound Type 1 pavement section is classified as a waterbound track.

3.2.3. CAR authorisations for both pavement construction types are discussed in the following sections.

BOUND PAVEMENT SECTION

3.2.4. CAR Authorisation **GBR 10B** within schedule 3 of CAR refers to the activity of "The discharge of water run-off from a surface water drainage system to the water environment from buildings, roads other than waterbound roads, yards, or any other built development, with the exception of run-off from land of more than 30 hectares which is used for residential premises, industrial estates, land used as a motorised vehicle parking area with more than 1000 parking spaces, and motorways and trunk roads where any one outfall serves a length of road greater than 1km".

3.2.5. The rules that apply to **GBR 10B** are mentioned below:

(a) All reasonable steps must be taken to ensure that the discharge must not result in pollution of the water environment,

(b) The discharge must not

(i) contain any trade effluent or sewage,

(ii) result in visible discolouration, iridescence, foaming or growth of sewage fungus in the water environment, or

(iii) contain any water run-off from a construction site.

(c) The discharge must not result in the destabilisation of the banks or bed of the receiving surface water,

(d) The development must be drained by a SUD system equipped to avoid pollution of the water environment, unless-

(i) the run-off is from a development that is a single dwelling and its curtilage, or

(ii) the discharge is to coastal water,

(e) The discharge must not contain any water run-off from-

(i) any fuel delivery areas constructed on or after 1 April 2007, or any areas where vehicles, plant and equipment are refuelled constructed on or after 1 April 2007,

(ii) vehicle loading or unloading bays constructed on or after 1 April 2007 where potentially polluting matter is handled, or

(iii) oil and chemical storage handling and delivery areas constructed on or after 1 April 2007,

(f) All facilities with which the surface water drainage system is equipped to avoid pollution, including oil interceptors, silt traps and SUD system attenuation, settlement and treatment facilities, must be maintained in good order and repair,

(g) All reasonable steps must be taken to ensure that any matter liable to block, obstruct, or otherwise impair the ability of the surface water drainage system to avoid pollution of the water environment is prevented from entering the drainage system.

3.2.6. In order to establish the amount of treatment required for the nature of the development the CIRIA UK SuDS Simple Index Approach (SIA) shall be utilised. This is investigated further within this document.

3.2.7. In consideration of the above-mentioned rules, the levels of authorisation applicable to the drainage for the bound pavement section of the proposed development should be covered under the GBR.

UNBOUND PAVEMENT SECTION

3.2.8. CAR Authorisation **GBR 22** within schedule 3 of CAR refers to the activity of "The discharge of surface water from waterbound roads and tracks to the water environment, including during the construction and maintenance of such roads and tracks".

3.2.9. The rules that apply to **GBR 22** are mentioned below:

(a) All reasonable steps must be taken to ensure that any discharge does not result in pollution of the water environment,

(b) any discharge must not result in visible discolouration, iridescence, foaming or sewage fungus in the water environment, and

(c) any discharge must not result in the destabilisation of the banks or bed of the receiving surface water.

3.2.10. In consideration of the above-mentioned rules, the levels of authorisation applicable to the drainage for the unbound pavement section of the proposed development should be covered under the GBR.

NOTES

3.2.11. This document does not address the temporary situation or Construction CAR authorisation during the construction phase.

3.2.12. This document does not address the CAR authorisation requirements for construction of the temporary bridge and abutment over Keir Burn.

3.2.13. This document does not address the CAR authorisation requirements for construction of culverts on existing watercourses crossing the proposed haul track west of the B8033. An assessment of the proposed culverts against CAR requirements will be carried out during the detailed design stage.

4. SURFACE WATER DRAINAGE STRATEGY

4.1. PROPOSED DEVELOPMENT

4.1.1. The proposed development comprises the haul track, inclusive of the associated Keir Burn temporary bridge and drainage provided along the haul track.

4.1.2. The proposed drainage is shown on Drainage Layout drawing numbers CMBS-LT520-BB-TRAC-ZZ-D-H-0015 and CMBS-LT520-BB-TRAC-ZZ-D-H-0016 included within *Appendix C* of this document.

4.1.3. Drainage standard details, including check dams proposed for attenuation of runoff, are shown on drawing number CMBS-LT520-BB-TRAC-ZZ-D-H-0017 included within *Appendix C* of this document.

4.2. WATER QUANTITY MANAGEMENT

4.2.1. Section 7.2 of the 'PKC Flood Risk and Flood Risk Assessments' document outlines the hydraulic design criteria for adopting surface water drainage systems, typically applied to permanent roads intended for regular traffic. However, since the haul track is proposed as a semi-permanent private route, the drainage strategy focuses on minimising the proposed discharge rates. This strategy is further discussed in the sections below based on the types of pavement construction proposed.

4.2.2. **Climate Change Factor:** The hydraulic design incorporates a 39% climate change factor for peak rainfall intensity, in accordance with SEPA guidelines for the Forth River basin region.

4.2.3. **BOUND PAVEMENT SECTION**

- The design's objective for the bound pavement section of track is to limit the 1-in-30-year proposed discharge rates to the equivalent greenfield rates whilst ensuring the proposed drainage system does not flood. The design storm event of 1-in-30-year is based on guidance in *Sewers for Scotland* sections 2.11 and 2.6.

4.2.4. **UNBOUND PAVEMENT SECTION**

- For sections of track with a Type 1 unbound construction, the run-off has been discharged mostly unrestricted with minor flow control proposed via orifice plates and checks dams.
- Further reduction in attenuation would necessitate check dams with pipe sizes below 75mm, increasing the risk of blockages and, consequently, maintenance demands. Alternatively, detention basins with Hydrobrakes could be provided, but this approach would increase costs and land requirements, which may not be suitable given the scale of the haul track.

4.3. WATER QUALITY MANAGEMENT

4.3.1. Water quality treatment is a *SEPA* requirement in accordance with *Regulatory Method* (WAT-RM-08) for the regulation of urban drainage. Treatment is required to prevent pollution entering the water environment due to the surface water discharge or ground water pollution.

4.3.2. The haul track is proposed as a single carriageway route with low-speed traffic. Based on the Simple Index Approach as defined in *CIRIA C753 SuDS Manual*, the category of land use in terms of pollution hazard level should be low (low traffic routes).

4.3.3. The hazard indices mentioned in *CIRIA C753 SuDS Manual* Table 26.2 are shown in Figure 2 below.

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways[1]	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways[1]	High	0.8[2]	0.8[2]	0.9[2]

Figure 2 – Pollution hazard indices

4.3.4. The indicative SuDS mitigation indices mentioned in *CIRIA C753 SuDS Manual* Table 26.3 are shown in Figure 3 below.

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters

	Mitigation indices[1]		
Type of SuDS component	TSS	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4[2]	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond[4]	0.7[3]	0.7	0.5
Wetland	0.8[3]	0.8	0.8
Proprietary treatment systems[5,6]	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

Figure 3 – SuDS mitigation indices

4.3.5. **BOUND PAVEMENT SECTION**

- The surface water drainage runoff from the bound pavement section of track shall be over-the-edge drainage to proposed swales. The proposed swale shall allow sufficient mitigation to pollution hazard.
- The proposed swales shall also comply with CAR GBR 10B requirements by incorporating Sustainable Drainage Systems (SuDS) for water quality management.

4.3.6. **UNBOUND PAVEMENT SECTION**

- The surface water drainage runoff from the unbound pavement section of track shall be either over-the-edge drainage to proposed swales or to proposed filter drains in sections of cutting or where site constraints do not permit over the edge drainage.
- Whilst CAR GBR 22 does not mandate drainage via SuDS, incorporating filter drains provides additional mitigation against surface water runoff pollution.

4.4. PROPOSED SUDS

4.4.1. Filter drains are shallow trenches filled with stone, which provide additional storage attenuation for surface water runoff and reduce pollutant levels by filtering out fine sediments, metals, hydrocarbons and other pollutants. After passing through the filter trench the surface water runoff will enter a perforated pipe that will discharge to existing watercourse/ditch.

4.4.2. Swales are shallow channels which can be used to treat and attenuate runoff. These channels are vegetated along the sides and flat bottomed to help reduce the flow rate of the surface water runoff and to reduce the transfer of sediment to the downstream SuDS facilities. Swales with shallow side slopes also presents an opportunity for evapotranspiration, infiltration, and increased biodiversity opportunity. The side slope of the swales shall be 1 in 4 in accordance with the *PKC Flood Risk and Flood Risk Assessment* document clause 8.8.

4.4.3. Typical sections of proposed swale and ditch are shown in Figure 4 below.

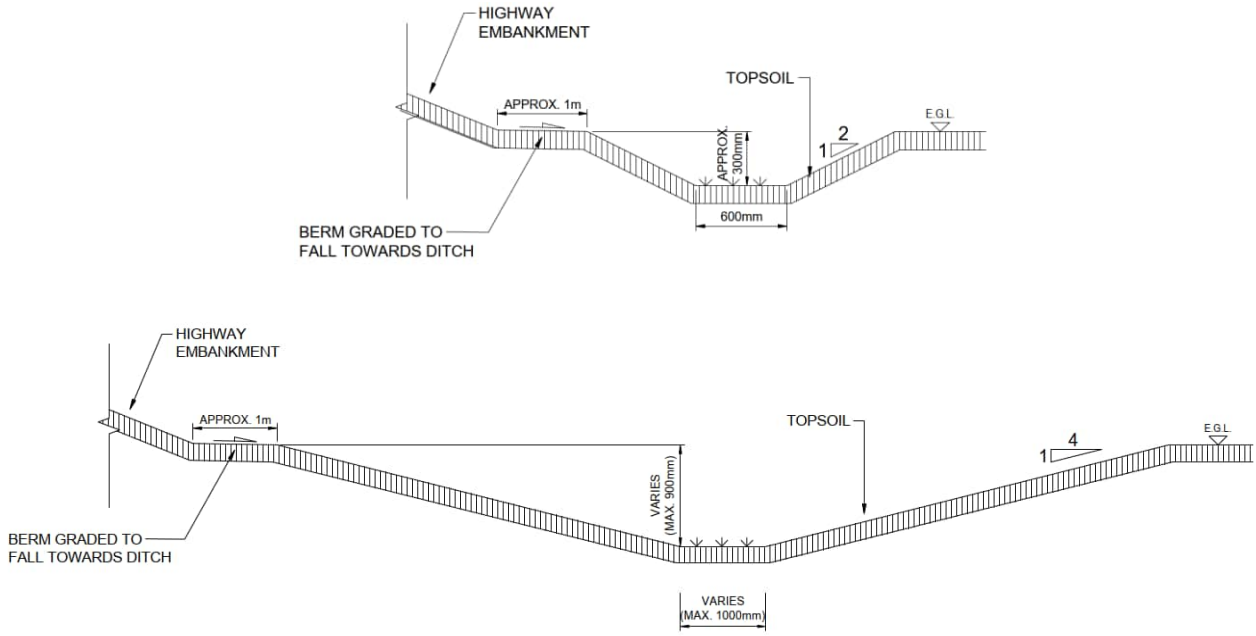


Figure 4 – Swale and Ditch typical sections

4.5. HYDRAULIC PARAMETERS AND CALCULATIONS

4.5.1. **Greenfield Run-Off Rates:** As per the *PKC Flood Risk and Flood Risk Assessment* document, the greenfield run off rate is to be determined using the Institute of Hydrology report 124 (IH124) for development size smaller than 50 Ha. More details on IH124 method are provided in UK SuDS manual clause 24.3.2.

The greenfield runoff rates were determined from Causeway Flow using the following parameters (determined from UK SuDS website and is based on the site location):

- SAAR (mm): 1200
- Soil Index: 2
- SPR: 0.37
- Hydrological Region: Region 2

4.5.2. **Rainfall Data:** FSR rainfall data has been considered for the hydraulic modelling with the following values derived from MicroDrainage software:

- M5-60 (mm): 16.1
- Ratio R: 0.24

4.5.3. **Roughness Coefficient:** The roughness coefficients considered for hydraulic modelling are as follows:

Table 4-1 – Run-off Rates for Proposed drainage networks

Conduit Type	Colebrook-White K value (mm)	Mannings Coefficient
Carrier Drain	0.6	-
Filter Drain	1.5	-
Swales/ Ditches	-	0.045

4.5.4. **Flood Resilience:** The design storms and associated flood risks are shown in Table 4-2 below and are based on guidance DMRB CG 501 *Design of Highway Drainage Systems* and *Sewers for Scotland*.

Table 4-2 – Flood Resilience Design Criteria

Drain Type	1 in 1 Yr Storm	1 in 5 Yr Storm	1 in 30 Yr Storm
Swales	No Surcharge (150mm freeboard)	No Flooding	No Flooding
Filter Drains / Carrier Drains	No Surcharge (except for sewers in existing ground and sewers with flow control orifice plates)	No Flooding	No Flooding

4.6. PROPOSED DRAINAGE NETWORKS

4.6.1. The proposed track catchment has been split into 6 drainage networks. Exact locations of these can be found on drainage layout drawing numbers CMBS-LT520-BB-TRAC-ZZ-D-H-0015 and CMBS-LT520-BB-TRAC-ZZ-D-H-0016 included within *Appendix C* of this document.

4.6.2. A brief description of the drainage networks is mentioned below:

BOUND PAVEMENT SECTION

- ***Network 1A: Chainage 0 to 290***

  The track in this section is designed with full-depth bituminous construction. Drainage will be provided through over-the-edge drainage leading to a proposed swale, with the outfall discharging into the existing A822 toe-of-earthworks ditch via a proposed headwall. The high point is located at Chainage 290, west of the Keir Burn bridge. Runoff from the bridge will be channelled along the edge of the track and captured by proposed gullies, which will discharge into the proposed swales.

  Pollution Hazard mitigation is acceptable in accordance with Simple Index Approach.

  Attenuation has been provided though proposed check dams with proposed discharge rates being limited to 1 in 1-,1 in 5-year, and 1 in 30-year storm greenfield rates.

- ***Network 2A: Chainage 290 to 520***

  The track in this section features a full depth bituminous construction up to Chainage 450, beyond which the pavement type transitions to Type 1 unbound construction. Drainage between Chainage 290 and 405 will be managed through filter drains, whilst from Chainage 405 to 520, over-the-edge drainage will direct runoff to a proposed swale. The outfall from the swale will discharge into the existing watercourse. The proposal of filter drain (from Chainage 290 and 405) has been incorporated due to the low point in the existing field, which restricts the feasibility of over-the-edge drainage in this section and the resulting exceedance path in case of flooding being close to Keirallan House.

  Pollution Hazard mitigation is acceptable in accordance with Simple Index Approach.

  Attenuation has been provided though proposed check dams with proposed discharge rates being limited to 1 in 1-,1 in 5-year, and 1 in 30-year storm greenfield rates.

UNBOUND PAVEMENT SECTION

- ***Network 3A: Chainage 520 to 710***

  The track in this section is proposed to have Type 1 unbound construction. The drainage shall be over-the-edge drainage to proposed swales on either side of the track. Both the swales shall outfall to an existing ditch.

  Attenuation has been provided though proposed check dams with proposed discharge rates being limited to 1 in 1-,1 in 5-year, and 1 in 30-year storm greenfield rates.

- ***Network 4A: Chainage 710 to 905***

  The track in this section is proposed to have Type 1 unbound construction. The drainage shall be via proposed filter drains because of the section of track located in cutting. The outfall shall be to an existing ditch via a proposed swale. Runoff from adjacent land flowing towards the development

will either be intercepted by a cutoff ditch and directed to existing watercourses or, where feasible, the existing ground will be regraded to channel runoff away from the earthworks in cutting.

Attenuation has been provided though proposed check dam to minimise the discharge rate.

- ***Network 5A: Chainage 905 to 1100***

  The track in this section is proposed to have Type 1 unbound construction. The drainage shall be via proposed filter drains because of the section of track being partially in cutting or approximately at ground level, providing the benefit of sub-surface drainage. The outfall shall be to existing watercourses.

  Attenuation has been provided though proposed orifice plates to minimise the discharge rate.

- ***Network 6A: Chainage 1100 to 1230 (northern tie-in)***

  The track in this section is proposed to have Type 1 unbound construction. The drainage shall be via proposed filter drains because of the section of track being partially in cutting or approximately at ground level, providing the benefit of sub-surface drainage. The outfall shall be to existing watercourses.

  Attenuation has been provided though proposed orifice plates to minimise the discharge rate.

4.6.3. If PKC and/or SEPA require further reductions in discharge rates or consideration of a higher design storm for sections of bound pavement construction, detention basins within the red line boundary can be investigated during the detailed design stage. However, it should be noted that this section of the haul track is expected to be prone to flooding during higher storm events, which could render the basin ineffective due to inundation. For further details, refer to Section 5 of the Flood Risk Assessment in this document.

4.6.4. Runoff rates for the unbound sections have not been further reduced to meet greenfield rates, as achieving this would necessitate a detention basin. However, proposing such a basin is challenging due to the steep topography of the existing terrain. Additionally, this drainage strategy aligns with the existing Non-Public Road, which also allows unrestricted discharge to watercourses.

4.6.5. Additional water quality treatment through vegetation strips, such as the incorporation of a reed bed, shall be evaluated during the detailed design stage.

4.6.6. The catchment areas, greenfield runoff rates, and proposed discharge rates are presented in Table 4-3 below. The pre-development and post-development catchment areas are shown in the Existing Drainage Plan (drawing number CMBS-LT520-BB-TRAC-ZZ-D-H-0028) and the Proposed Drainage Catchment Plan (drawing number CMBS-LT520-BB-TRAC-ZZ-D-H-0030), both of which are included in *Appendix B* of this document.

4.6.7. The hydraulic modelling simulation results for the climate change scenario have been exported from MicroDrainage and are included in *Appendix D* of this document.

Table 4-3 – Run-off Rates for Proposed drainage networks

Network Reference	Track Pavement Construction	Storm Return Period (1 in X Yr)	Greenfield Catchment Area (ha)	Greenfield Rates* Calculated Using IH124 Method (l/s)	Proposed Discharge Rate without Climate Change (l/s)	Proposed Discharge Rate with 39% Climate Change (l/s)
Network 1A	Bound Asphalt	1	6.63	31.1	24.8	27.2
		5		39.7	27.5	30.2
		30		71.2	30.5	33.3
Network 2A	Bound Asphalt	1	5.09	23.9	20.6	23.3
		5		30.5	23.8	26.8
		30		54.7	27.1	30.4
Network 3A	Unbound Type 1	1	3.99	18.7	15.2	17.1
		5		23.9	17.5	20.2
		30		42.9	21.3	32.6
Network 4A	Unbound Type 1	1	0.74	3.5	17.3	22.9
		5		4.4	24.2	30.1
		30		8.0	31.7	37.2
Network 5A	Unbound Type 1	1	0.18	0.8	9.7	13.1
		5		1.1	15.5	18.8
		30		1.9	19.4	22.2
Network 6A	Unbound Type 1	1	0.12	0.6	8.1	10.7
		5		0.7	11.6	13.8
		30		1.3	14.7	18.3

* Refer to section 4.5.1 for details of greenfield runoff rate calculation parameters.

4.7. DESIGN FOR EXCEEDANCE

4.7.1. During extreme rainfall events, the capacities of swales and filter drains may occasionally be exceeded.

4.7.2. Exceedance flows that cannot be attenuated below ground will result in overland flow. In such cases, these flows will be directed through flood relief culverts, designed to replicate natural runoff patterns. Flood relief culverts have been installed along the section of the haul track between Chainage 0 and 450. For further details, refer to Section 5 of the flood risk assessment.

4.7.3. Beyond chainage 450, where the haul track consists of unbound pavement construction, any exceedance of overland flows will overtop the track and follow natural flow patterns to the existing watercourses.

4.8. APPROVALS AND ADOPTION

4.8.1. The proposed surface water drainage and SuDS on the site will be privately owned and maintained. Should any CAR requirements be identified, these will be quantified during the detailed design phase, to ensure that correct and detailed information can be included as part of the applications, and to determine if these are truly required.

5. KEIR BURN FLOOD RISK ASSESSMENT

5.1. INTRODUCTION

5.1.1. Jacobs UK Ltd. conducted a fluvial flood risk assessment to evaluate the potential impact of flooding on the proposed development, its effects on surrounding areas, and the mitigation measures incorporated into the design.

5.1.2. Key findings from the assessment are summarized in this document, with full details available in the *Cambushinnie Haul Track: Flood Risk Assessment* (Document No. B2468300_DOC_006).

5.2. HYDROLOGY

5.2.1. The proposed development is within the catchments of the Keir Burn (Bullie Burn) and an unnamed tributary of the Allan Water. All of the proposed development to the west and a small part of the south-east of the B8033, drains into the unnamed tributary. The Keir Burn, east of the B8033, drains the eastern area of the proposed development boundary, flowing south past Braco before joining the Allan Water 50 metres downstream of the A822. Outside the proposed development boundary, the River Knaik flows southward, crossing the A822 twice before merging with the Allan Water, whilst the Feddal Burn follows a similar pattern, discharging 900 metres downstream of the A822. Additionally, several ponds are near the existing access track to Braco West Substation, about 500 metres northwest of the B8033, but lie outside the proposed development boundary.

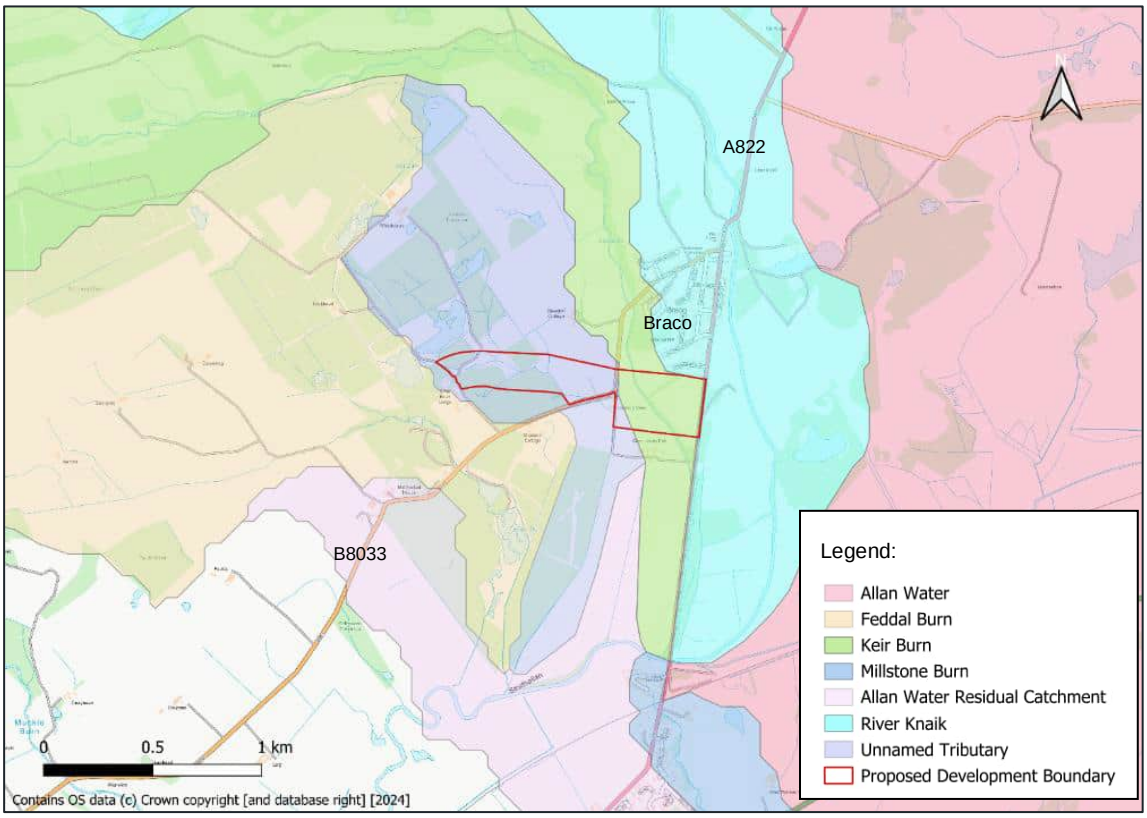


Figure 5 – Catchments and hydrological features in the area surrounding the proposed development

5.3. HYRAULIC MODELLING

5.3.1. Given the limitations of the SEPA Flood Map, which is based on high level hydraulic modelling, a hydraulic model has been developed for the area of the proposed development. The model adopts a linked one-dimensional (1D)/two-dimensional (2D) technique, where it represents the river channel as a 1D component using Flood Modeller software, which is linked dynamically to the floodplain, which is represented in 2D, using TUFLOW software. A baseline hydraulic model was developed to reflect the existing situation and includes a representation of the Allan Water, River Knaik, Keir Burn, Feddal Burn, Millstone Burn and an unnamed watercourse.

5.3.2. Hydraulic modelling for the baseline design flood event (0.5% AEP, including climate change) indicates extensive flooding between Braco and Greenloaning due to overflow from the Allan Water and its tributaries, including Keir Burn, River Knaik, and Feddal Burn. Most land within the proposed development east of the B8033, and some to the west, is submerged, with water depths generally below 0.25m but reaching up to 1.0m in isolated areas. Keir Burn is the primary contributor, overtopping west of Braco and flooding land between the unnamed watercourse and the A822. Key receptors affected include properties on Greenhaugh Way and Commander's Grove, Keirallan Farm buildings, and Loaning View cottage. Given these conditions, the proposed development faces a high risk of flooding from fluvial sources. Baseline flood depths are illustrated in Figure 6. To assess flood risk and the impact of the proposed development, hydraulic modelling compares baseline conditions with scenarios both with and without mitigation, considering various flood events as per *SEPA* guidelines. Permanent works within the fluvial flood risk area include the surfaced haul track with verges on an embankment, at-grade junction tie-ins with the A822 and B8033, a single-span bridge over the Keir Burn, pre-earthworks drainage using swales along the haul track embankment, and proposed screening at the A822 junction and near Keirallan Farm.

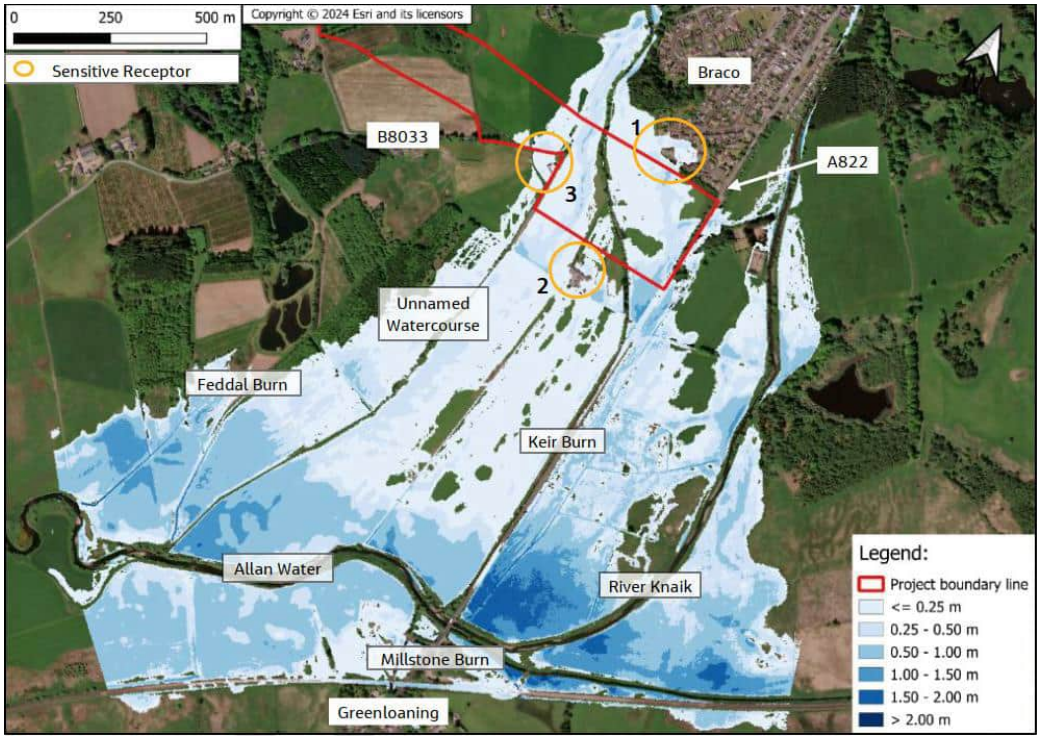


Figure 6 – Baseline Flood Depth (0.5% AEP, plus Climate Change)

5.3.3. To assess flood risk and the impact of the proposed development (permanent works), hydraulic modelling compares baseline conditions with scenarios both with and without mitigation, considering various flood events as per SEPA guidelines. Permanent works within the fluvial flood risk area include a 6.5m-wide surfaced haul track with verges on an embankment, at-grade junction tie-ins with the A822 and B8033, a single-span bridge over the Keir Burn, pre-earthworks drainage using swales along the haul track embankment, and proposed screening at the A822 junction and near Keirallan Farm.

5.3.4. Hydraulic modelling of the with-scheme condition (including the proposed development) without mitigation shows that the proposed development generally has a major adverse effect upstream of the proposed haul track compared to the baseline scenario. This is due to the proposed haul track embankment damming much of the out of bank flow from the Keir Burn. Additionally, the flood water overtops the haul track at its proposed junctions with the A822 and the B8033.

5.3.5. The corresponding difference in depth between the baseline and design scenario **pre-mitigation** for the peak water levels is presented in Figure 7 below.

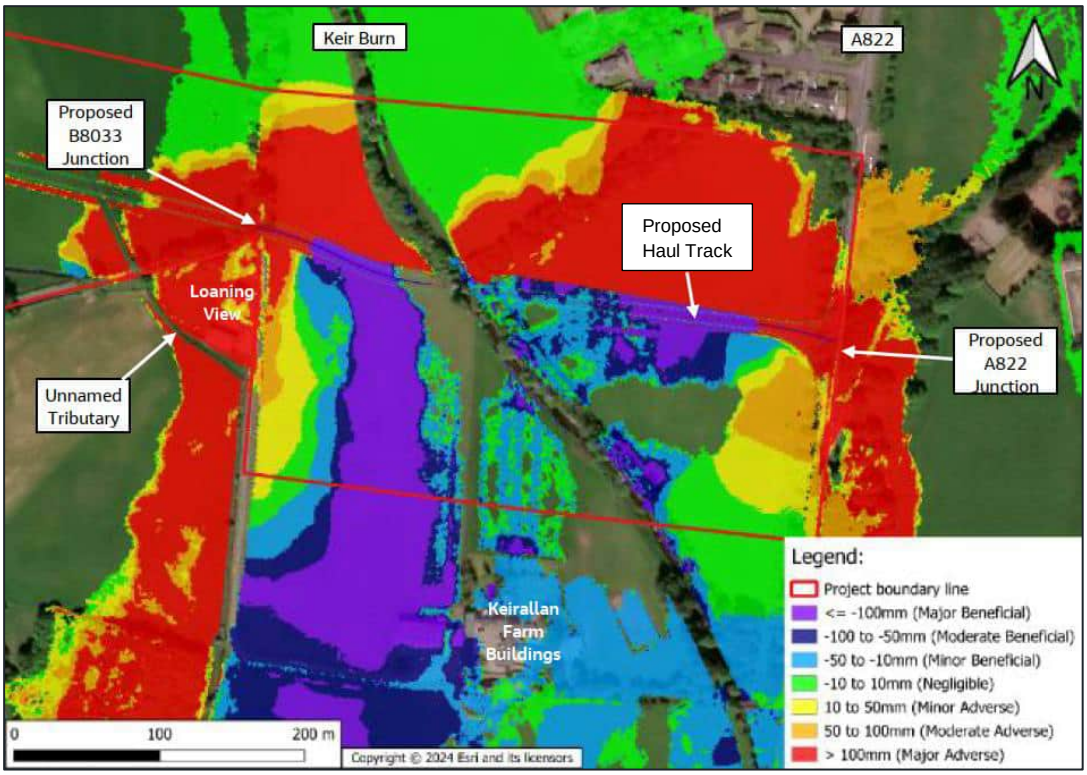


Figure 7 – Design Pre-Mitigation vs Baseline Depth Difference (0.5% AEP Plus Climate Change)

5.3.6. **Mitigation:** An iterative approach was used to determine suitable mitigation measures, considering options such as flood relief culverts, bunds, land reprofiling, and modifications to existing flood embankments. The final mitigation measures include the provision of 56 flood relief culverts in eight clusters positioned along the proposed haul track and the modification of an existing Keir Burn flood embankment downstream of the proposed haul track. This involves raising the existing flood embankment on the right (south-west) bank of the Keir Burn by 200mm over a length of approximately 30 metres to reduce overtopping and remove the associated impacts on Keirallan farm buildings. The proposed mitigation measures are indicatively shown in Figure 8.

Figure 8 – Proposed Mitigation Measures

5.3.7. Post-mitigation, all adverse impacts are limited to within 60 metres of the proposed haul track embankment and are subsequently within the proposed development boundary. A comparison between baseline and post-mitigation flood depths at the peak water level are presented in Figure 9.

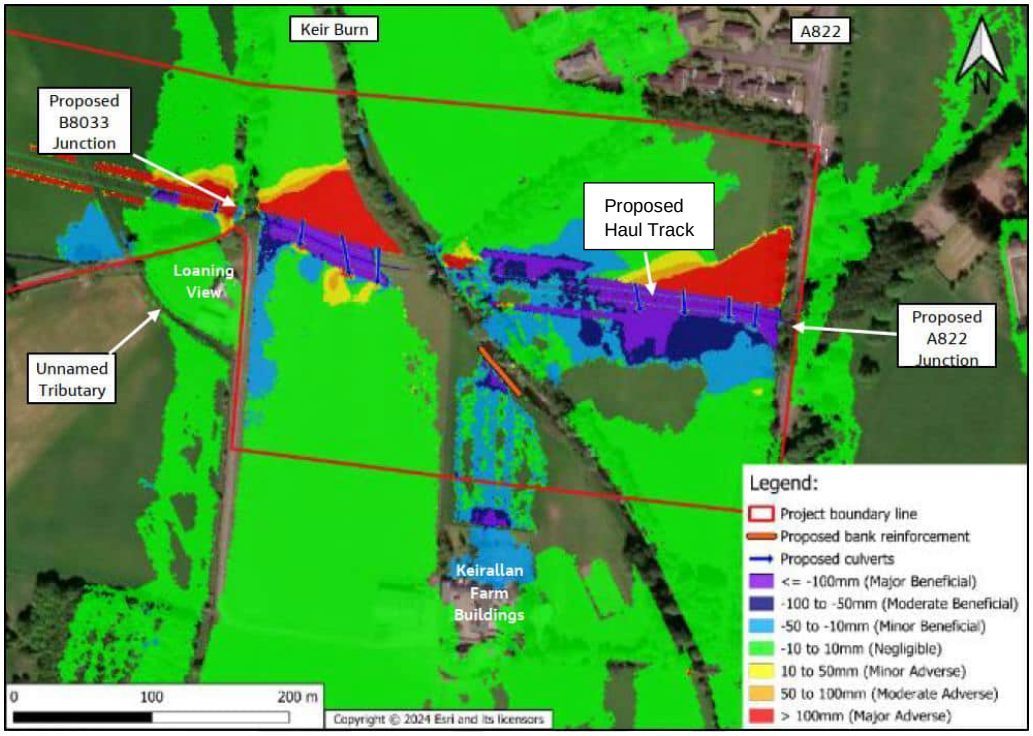


Figure 9 – Post-Mitigation modelling vs Baseline Depth Difference (0.5% AEP Plus Climate Change)

5.4. SUMMARY OF FRA

5.4.1. The proposed development is located within an area which is at 'high risk' from fluvial flooding. No significant risks were identified from flooding from other sources assessed. Mitigation measures have been proposed for fluvial and surface water flooding.

5.4.2. Fluvial flood mitigation measures have been proposed to replicate existing flooding mechanisms across the modelled area. The proposal includes the introduction of 56 culverts to provide conveyance of flood waters through the haul track embankment, as well as the modification of an existing flood embankment on the right bank of the Keir Burn downstream of the proposed haul track to reduce overtopping and associated impacts on a sensitive receptor.

5.4.3. 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.

5.4.4. Whilst the fluvial flooding mitigation measures have 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 (0.5% AEP plus climate change).

6. CONSTRUCTION AND MAINTENANCE

6.1. CONSTRUCTION

6.1.1. During the construction of SuDS features within the development, it is important that the risk of pollution from the site be kept to a minimum. Method statements for the control of pollution should be provided by the developers, and/or their contractors outlining their pollution prevention measures prior to development commencing on site.

6.1.2. Hazardous and environmentally damaging chemicals and other materials shall be managed and stored to ensure that they do not enter the existing drainage systems or cause local soil contamination. Guidance on the handling and storage of materials on site is available from SEPA. Materials which fall into this category include:

- Petrochemicals (e.g., fuel, lubricants)
- Building materials (e.g., cement)
- General (e.g., excavation arisings, mud, litter, site waste materials)

Note this is not a comprehensive list.

6.1.3. Care shall be taken to ensure that any excavation works, and control of groundwater which may be necessary to facilitate the works, does not result in mobilisation of silts leading to contamination of any watercourses.

6.1.4. The works shall be managed and sequenced to ensure that the risk of contaminated runoff or groundwater from the site entering the drainage systems is kept to a minimum. On-site facilities for containment and controlled release of runoff and groundwater to the existing drainage system shall be implemented. These facilities shall be designed to trap debris and allow settlement and collection of silt.

6.1.5. SEPA stipulates that the surface water discharge on construction sites does not require authorisation so long as the surface water is discharged in line with the General Binding Rules outlined in the Water Environment (Controlled Activities) Regulations 2011 (as amened) and none of the following points apply.

- The site area is greater than 4 hectares
- The site contains a road or track length greater than 5km
- The site includes an area of more than 1 hectare or any length of more than 500 metres on ground with a slope in excess of 25 degrees.

6.1.6. More guidance on this regulation can be found at www.sepa.org.uk.

6.2. MAINTENANCE

6.2.1. Maintenance schedules for the proposed SuDS are provided below in Table 6-1 and Table 6-2.

Table 6-1 – Maintenance Requirements for Filter Trenches

Maintenance Requirements for Filter Drains	
Operation	**Frequency Required**
Removal of litter	Monthly (or as required)
Inspect filter drain trench, inlet and outlet pipework and control systems	Monthly
Inspect pre-treatment systems, inlets and perforated pipework	Six Monthly
Remove sediment from pre-treatment devices	Six monthly, or as required
Remove or control tree roots where they are near the sides of the trench	As required
Where high pollution loads exist, surface geotextile to be replaced, and overlying filter medium to be replaced or washed	Five yearly, or as required
Clear perforated pipework of any blockages	As required

Table 6-2 – Maintenance Requirements for Swales/Ditches

Maintenance Requirements for Swales	
Operation	**Frequency Required**
Inspections to identify mowing requirements	Monthly
Litter removal	Monthly
Scarifying and spiking following inspection	As required
Repair damaged vegetation following inspections	As required
Inspect inlets, outlets and overflows, clearing blockages when required	Monthly
Inspect inlets and surfaces for silt, and remove where required	Half yearly
Safely remove oil or petrol residues	As required

6.3. RISK ASSESSMENT

6.3.1. The risk assessment parameters were developed in accordance with Chapter 36 of SuDS manual and have been briefly discussed below:

- Drowning Risks: Low Risk
  - Where deeper swales (maximum 900mm deep) have been proposed, a fence has been installed around the development area to prevent unauthorized public access to SuDS features, ensuring safety. Access to water is restricted to construction and maintenance personnel, who will implement appropriate risk management measures.
  - In haul track sections without fencing, shallow ditches have been proposed to mitigate drowning risks.
  - Flood exceedance routes follow existing topography, directing water away from houses and toward existing watercourses and ditches.
- Slip and fall risks: Low Risk
  - Swale side slopes are designed at 1:4 to minimize sudden level changes and reduce the risk of slips and falls.
  - Safety grills are included for all proposed culverts and headwalls to enhance protection.
- Health risks from untreated or polluted risk management: Low Risk
  - The proposed haul track will have very low traffic flows, keeping pollution levels minimal.
  - Routine inspection and maintenance of SuDS features will be conducted by the developer and/or their contractors to reduce associated health risks.
  - Check dams with pipes at invert levels are included to allow water drawdown and prevent standing water.
  - The developer and/or contractors shall undertake measures to address risks from Weil's disease, blue-green algae, and disease-carrying insects.

6.3.2. This assessment has determined that the proposed SuDS features (swales and filter drains) pose a low risk for construction and maintenance, subject to confirmation of the detailed drainage design.

6.3.3. The need for, or provision of, any detention basins shall be finalised at the detailed design stage based on consultations with PKC.

7. FOUL WATER DRAINAGE STRATEGY

7.1. EXISTING FOUL DRAINAGE INFRASTRUCTURE

7.1.1. As discussed in Section 2.4 of this document, interaction with foul water drainage is not anticipated at this stage of design.

7.1.2. The nearby properties located south of the proposed haul track are likely serviced by individual septic tanks and associated soakaways. The proposed design is not expected to impact these systems.

7.2. PROPOSED FOUL DRAINAGE

7.2.1. The proposed foul drainage for the construction site offices will discharge via a gravity drainage system into a suitably placed package treatment plant/tank. Details of this will be confirmed during the detailed design stage.

7.2.2. Should a package treatment plant be the chosen option, the positioning will be vital to ensure that a sample chamber can be positioned before this enters the onsite surface water drainage system. Due to the small nature of the flows expected from such a system these will not be modelled as part of the overall hydraulic analysis for flooding.

7.2.3. If septic tanks or soakaways associated with nearby properties are identified during the detailed design phase, appropriate mitigation measures, such as repositioning the tanks and/or soakaways, will be implemented as necessary

7.3. APPROVALS AND ADOPTION

7.3.1. The foul water drainage for the site will be privately owned and maintained. If any licenses are required from SEPA, these will be determined at the next stage once the design has been finalised to ensure all correct information is submitted as part of that assessment.

8. CONCLUSION

8.1.1. The primary objective of the haul track drainage design is to limit the 1-in-30-year discharge rates to equivalent greenfield rates for the bound pavement sections, whilst ensuring that the proposed drainage system remains flood-free. The hydraulic design incorporates a 39% allowance for climate change, in accordance with SEPA guidelines.

8.1.2. The water quality treatment for the haul track has been designed and assessed in accordance with the Simple Index Approach specified in the *CIRIA C753 SuDS Manual*. The SuDS strategy complies with the requirements of the Simple Index Approach.

8.1.3. Interaction with foul water drainage is not anticipated at this stage of design. Nearby properties are likely to be served by individual septic tanks and associated soakaways. If these are encountered at detailed design then suitable mitigation (e.g., repositioning of tanks and/or soakaways) will be undertaken where necessary.

8.1.4. In line with the General Binding Rules (GBR) for activity GBR 10b and GBR 22 in Schedule 3 of the Controlled Activities Regulations (CAR), the drainage for the proposed development is expected to comply with these rules and fall within their scope. A reassessment of the proposed drainage against these requirements will be conducted during the detailed design stage.

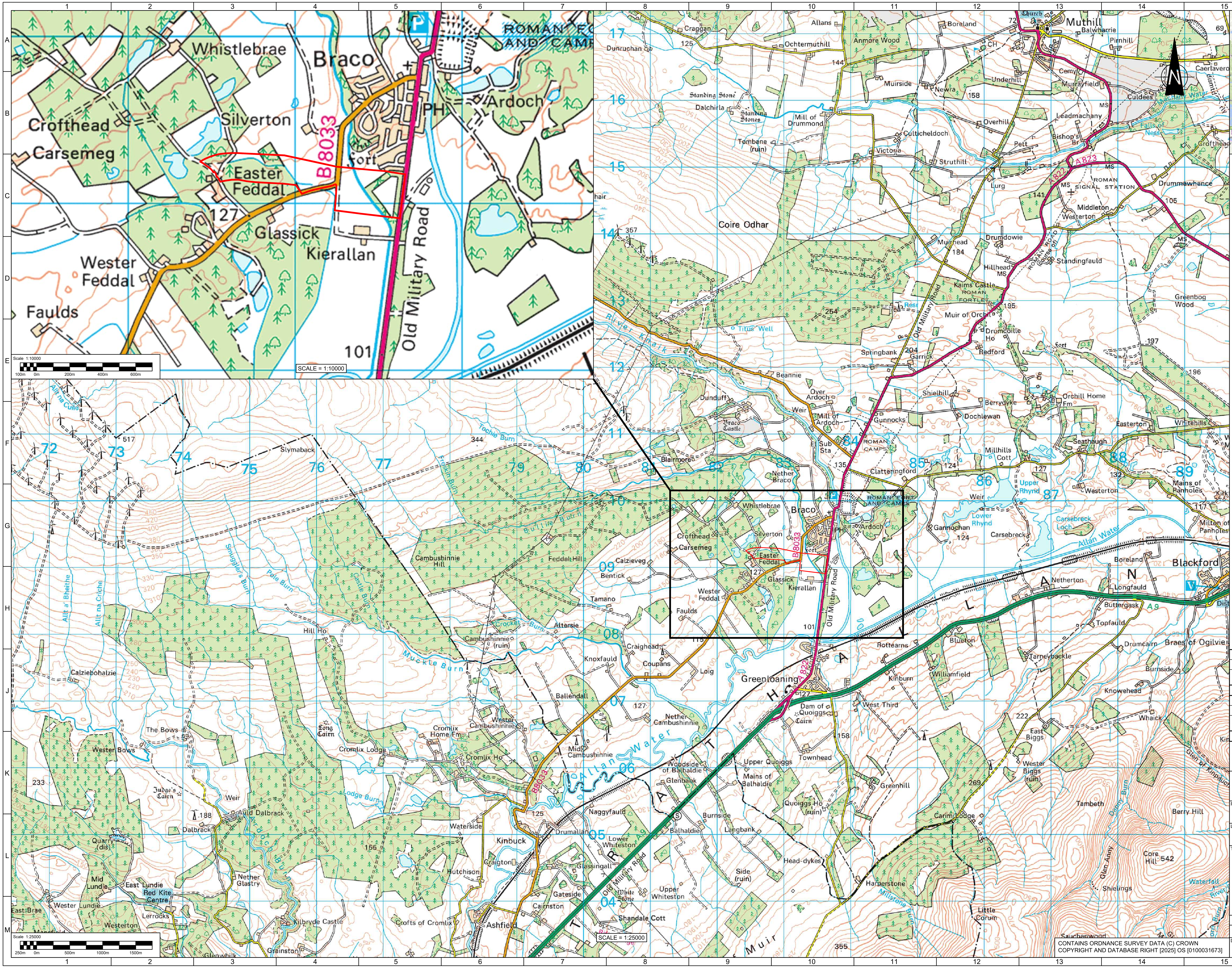
8.1.5. The health and safety risks associated with the proposed SuDS are considered low. These risks will be reassessed during the next design stage following finalisation of the drainage design.

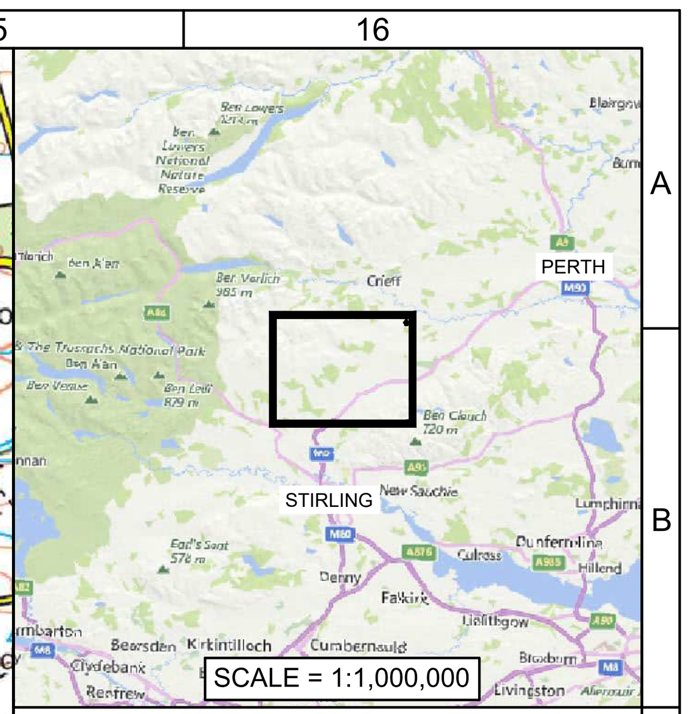
8.1.6. A flood risk assessment for fluvial flooding of Keir Burn was conducted by Jacobs. Based on the proposed mitigation measures, it was concluded that there will be no adverse impacts on downstream properties. All identified impacts are confined within the proposed development boundary. The flood risk assessment considered a 1-in-200-year design storm event, incorporating a 39% climate change factor.

8.1.7. The design for the realignment of the existing ditch and the associated proposed culvert at the tie-in location with the existing Non-Public Road (north of Gamekeepers Cottage) shall be finalised during the detailed design stage.

Appendix A

SUPPLEMENTARY LOCATION PLAN, LAND OWNERSHIP PLAN, PLAN AND PROFILE DRAWINGS





NOTES:

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL DIMENSIONS ARE SHOWN IN METRES UNLESS OTHERWISE STATED.
3. THE DRAWING IS TO BE PRINTED IN COLOUR.
4. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSE.
5. FOR MORE DETAILS ON THE PROPOSED HAUL TRACK DEVELOPMENT REFER TO PLAN AND PROFILE DRAWING NUMBERS CMBS-LT520-BB-TRAC-ZZ-D-H-0001 AND CMBS-LT520-BB-TRAC-ZZ-D-H-0002.

KEY:

BRACO HAUL TRACK RED LINE BOUNDARY

DRAWN	SRA	REMARKS: SECOND ISSUE – MINOR AMENDMENTS				
CHKD	FY					
DESIGN	SRA	STATUS	S5	DATE	14/05/2025	
APPD	FY	FOR ACCEPTANCE		REV	P02	
DRAWN	SRA	REMARKS: FIRST ISSUE				
CHKD	FY					
DESIGN	SRA	STATUS	S5	DATE	13/01/2025	
APPD	FY	FOR ACCEPTANCE		REV	P01	

Scottish & Southern Electricity Networks

Balfour Beatty

PROJECT NAME: ASTI-ECE

LOCATION: CAMBUSHINNIE 400kV S/S — SITE: CMBS

TITLE:

BRACO HAUL TRACK SUPPLEMENTARY LOCATION PLAN

SIZE	SCALE	FORMAT	SHEET No.
A1	As Shown	ACAD	01 OF 01

DRAWING No. CMBS-LT520-BB-TRAC-ZZ-PLN-T-0002

Scottish & Southern Electricity Networks

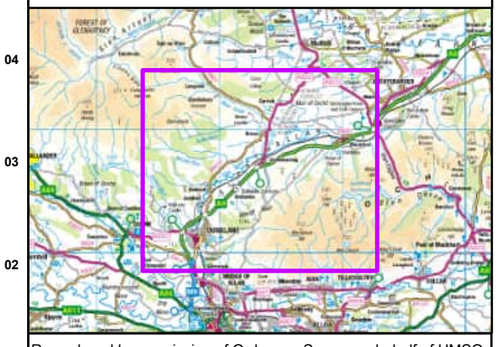
TRANSMISSION

Legend

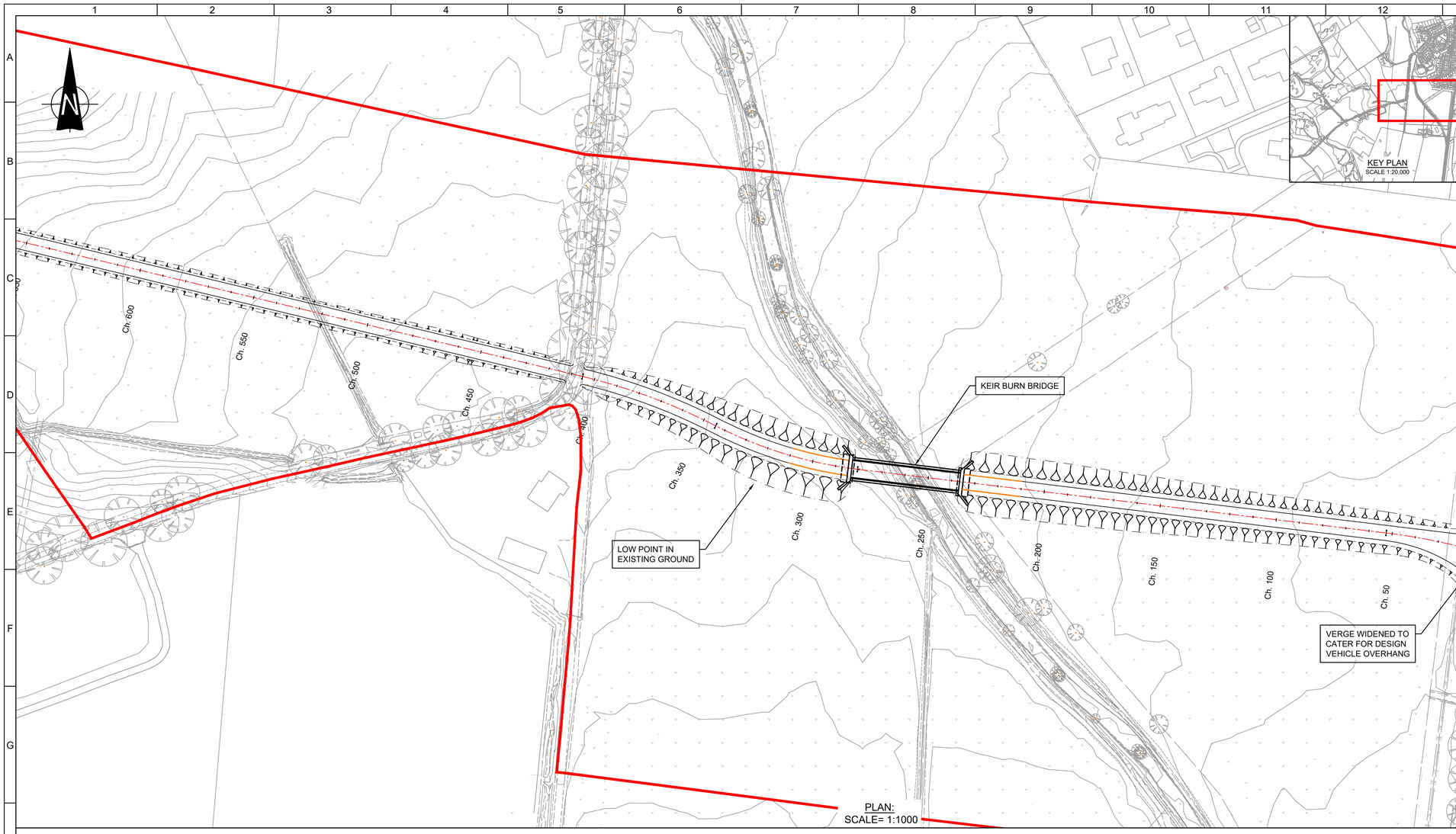
- Barn House Flat, Keirallan, Braco
- Braco Castle Farm
- Cambushinnie Hill
- Cromlix Estate
- Glassick Farm, Braco, Dunblane
- Greenscares Wood
- Keirallan – A & J Stephen Ltd
- Keirallan – The Browns
- Knoxfauld Farm
- The Moor, Feddal Forest
- Feddal Estate
- Blackford Estate, Blackford

Scale @ A3: 1:60,000

0 0.375 0.75 1.5 2.25 3 3.75 km



Project No:	LT000520
Project:	Cambushinnie 400kV Substation
Title:	Landownership Plan
Drawn by:	SS
Date:	31/05/2024
Drawing:	LT000273_WAY_010



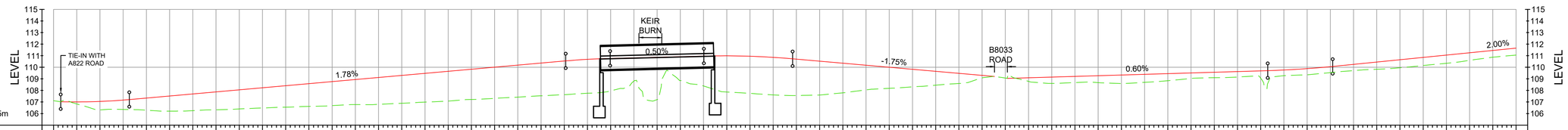
PLAN:
SCALE= 1:1000

NOTES:

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL DIMENSIONS ARE SHOWN IN METRES UNLESS OTHERWISE STATED.
3. THE DRAWING IS TO BE PRINTED IN COLOUR.
4. THE EARTHWORKS ARE AT 1 in 3 SLOPE. THIS IS SUBJECT TO CHANGE BASED ON GROUND INVESTIGATION RESULTS.
5. ALL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH RELEVANT SPECIFICATION AND ALL OTHER RELEVANT DRAWINGS.
6. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSE.

KEY:

- HAUL TRACK CENTRELINE
- PROPOSED DESIGN
- PROPOSED HIGH CONTAINMENT KERB
- RED LINE BOUNDARY



CHAINAGE	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000	210.000	220.000	230.000	240.000	250.000	260.000	270.000	280.000	290.000	300.000	310.000	320.000	330.000	340.000	350.000	360.000	370.000	380.000	390.000	400.000	410.000	420.000	430.000	440.000	450.000	460.000	470.000	480.000	490.000	500.000	510.000	520.000	530.000	540.000	550.000	560.000	570.000	580.000	590.000	600.000	610.000	620.000	630.000
PROPOSED LEVELS	107.111	107.006	107.048	107.166	107.341	107.519	107.696	107.874	108.051	108.229	108.406	108.584	108.761	108.939	109.116	109.294	109.471	109.649	109.826	110.004	110.181	110.359	110.536	110.685	110.766	110.816	110.866	110.916	110.966	110.988	110.950	110.854	110.700	110.525	110.350	110.175	110.000	109.825	109.650	109.475	109.300	109.057	109.089	109.149	109.209	109.269	109.329	109.389	109.449	109.509	109.569	109.629	109.689	109.761	109.881	110.051	110.251	110.451	110.651	110.851	111.051	111.251	111.451	111.651
EXISTING LEVELS	107.111	106.833	106.315	106.357	106.289	106.209	106.251	106.326	106.400	106.480	106.549	106.621	106.686	105.775	105.796	106.891	106.989	107.081	107.217	107.314	107.421	107.534	107.634	107.756	107.962	108.804	107.204	108.850	108.382	107.861	107.745	107.612	107.556	107.601	107.792	108.046	108.177	108.309	108.453	108.595	109.074	109.061	108.781	108.602	108.679	108.671	108.595	108.696	108.837	109.033	109.099	109.155	109.055	109.274	109.347	109.537	109.711	109.827	109.957	110.150	110.343	110.596	110.869	111.053
LEVEL DIFFERENCE	0.000	0.173	0.733	0.810	1.052	1.310	1.445	1.548	1.651	1.749	1.857	1.963	2.075	2.164	2.320	2.402	2.483	2.567	2.609	2.690	2.760	2.824	2.903	2.928	2.805	2.012	3.662	2.066	2.585	3.126	3.205	3.242	3.144	2.923	2.558	2.129	1.822	1.516	1.196	0.880	0.225	-0.004	0.308	0.546	0.531	0.598	0.734	0.693	0.612	0.476	0.470	0.473	0.634	0.487	0.534	0.514	0.540	0.624	0.694	0.701	0.708	0.655	0.582	0.597

HORIZONTAL ALIGNMENT: R=255.000m | R=180.000m | R=255.000m

VERTICAL ALIGNMENT: G=-2.86% K=13.0 | G=1.78% | K=15.0 | G=0.50% | K=17.0 | G=-1.75% | G=0.60% | K=20.0 | G=2.00%

PROFILE:
SCALE= H 1:1000,V:200

Designer's Site Specific Risk Assessment

This assessment is for non-standard or unusual Hazards and it is expected that Hazards associated with standard installations and designs are well understood by a competent Contractor.

By: | Date:

[-] No works associated with this drawing

HAZARDS/ ACTIVITY - Assessed as Low (L) / Medium (M) / High (H)

[-]	Falls From Height	[-]	Drowning/Fall onto Rebar
[-]	Hazardous Material	[-]	Contaminated Land
[-]	Excavation/Service Strike	[-]	Poor Ground conditions
[-]	HAVS	[-]	Site Fabrication/drilling
[-]	Confined Workplace	[-]	Manual Handling
[-]	Access/Egress	[-]	Stored Energy
[-]	Weight Limit	[-]	Congested site
[-]	Residual Electricity	[-]	Existing equipment in close proximity

Interfaces: [-] Public [-] Operatives [-] Vehicle/Plant

WHO COULD BE HARMED?		CONTROL MEASURES	
[-]	Construction operatives	[-]	Existing work instruction
[-]	Dismantling crew	[-]	Method detailed on drawing
[-]	Future maintenance crew	[-]	Method detailed on separate document
[-]			

TEMPORARY WORKS

- [-] No temporary works required
- [-] Temporary works required and documented separately
- [-] Drawing contains temporary works:

DC0	[-]	
DC1	[-]	
DC2	[-]	More complex design
DC3	[-]	Complex/Innovative
DC4	[-]	Abnormal Highly innovative

} Complete temporary works design check certificate: ENG-SF-0101C

Level 1 Control
OK to proceed, no significant design hazards and risks, standard control measures apply.

Level 2 Control
OK to proceed as detailed in existing work instruction or procedure detailed on drawing or separate document.

Level 3 Control
OK to proceed providing specific design hazards and risks have been recognised, acknowledged and understood by the operation team. Site operatives may require additional instruction/training.

CDM REGULATIONS RESIDUAL RISKS

Design based hazards are actively eliminated where possible. Where hazards cannot be eliminated, this symbol along with an attached note will identify the hazard and indicate that an action is required by the person supervising the works to manage the design hazard during construction.

Other than those noted, we are not aware of any further residual design risks apart from those that a competent Contractor would ordinarily consider.

RESIDUAL RISK METER — MEDIUM (LOW / HIGH, 0 – 100)
OVERALL RISK SCORE = xx / xx

DRAWN	RS	REMARKS:			
CHKD	SRA	FIFTH ISSUE – MINOR AMENDMENTS			
DESIGN	RS	STATUS	S5	DATE	13/05/2025
APPD	FY	FOR ACCEPTANCE		REV	P05
DRAWN	RS	REMARKS:			
CHKD	SRA	FOURTH ISSUE – MINOR AMENDMENTS			
DESIGN	RS	STATUS	S5	DATE	21/03/2025
APPD	FY	FOR ACCEPTANCE		REV	P04
DRAWN	RS	REMARKS:			
CHKD	SRA	THIRD ISSUE			
DESIGN	RS	STATUS	S5	DATE	06/02/2025
APPD	FY	FOR ACCEPTANCE		REV	P03
DRAWN	GU	REMARKS:			
CHKD	SRA	SECOND ISSUE			
DESIGN	GU	STATUS	S5	DATE	15/01/2025
APPD	FY	FOR ACCEPTANCE		REV	P02
DRAWN	GU	REMARKS:			
CHKD	AC	FIRST ISSUE			
DESIGN	SRA	STATUS	S5	DATE	12/12/2024
APPD		FOR ACCEPTANCE		REV	P01

Scottish & Southern Electricity Networks

Balfour Beatty

PROJECT NAME: ASTI-ECE

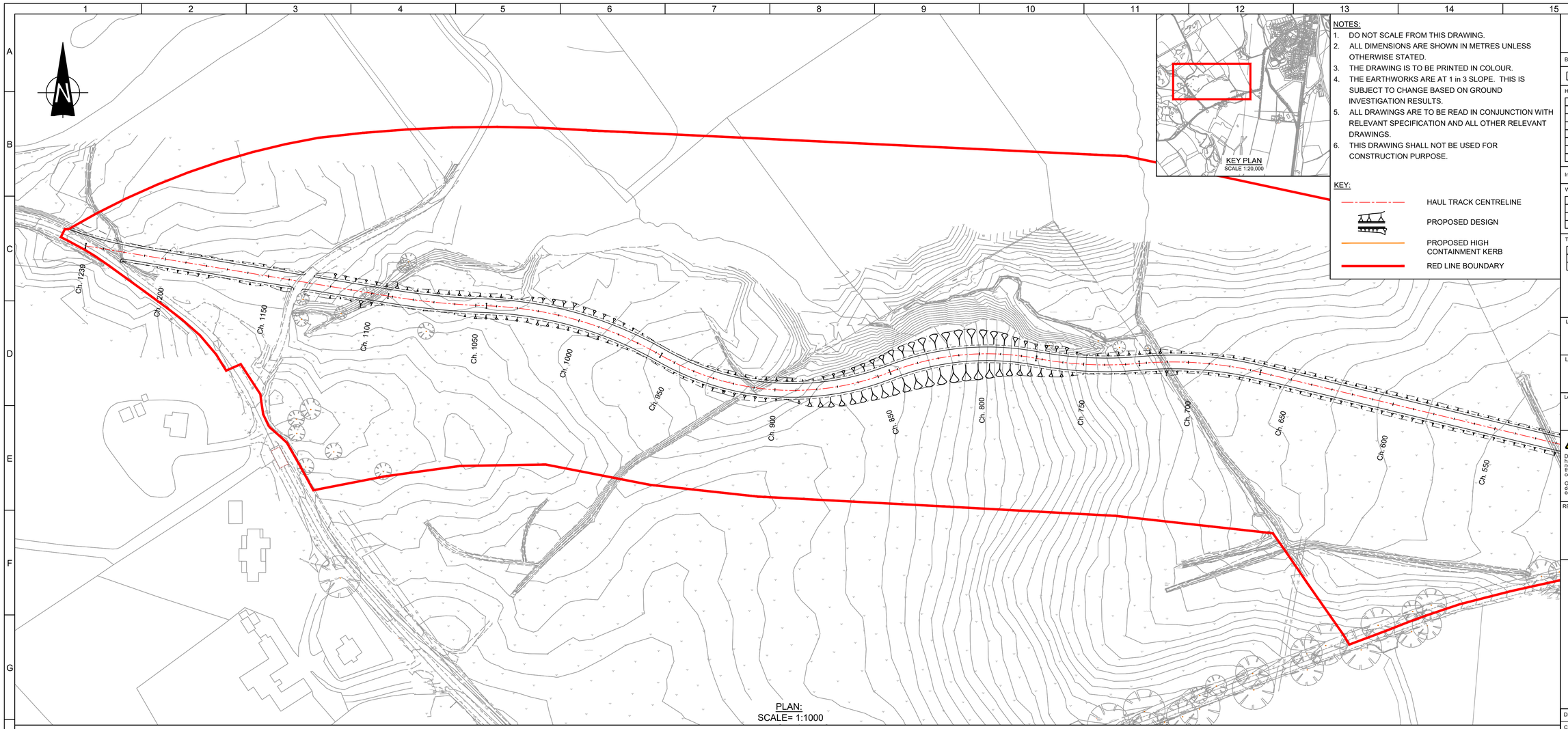
LOCATION: CAMBUSHINNIE 400kV S/S | SITE: CMBS

TITLE:

BRACO HAUL TRACK PLAN AND PROFILE SHEET 1

SIZE	SCALE	FORMAT	SHEET No.
A1	As Shown	ACAD	01 OF 02

DRAWING No. CMBS-LT520-BB-TRAC-ZZ-D-H-0001



PLAN:
SCALE= 1:1000

NOTES:

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL DIMENSIONS ARE SHOWN IN METRES UNLESS OTHERWISE STATED.
3. THE DRAWING IS TO BE PRINTED IN COLOUR.
4. THE EARTHWORKS ARE AT 1 in 3 SLOPE. THIS IS SUBJECT TO CHANGE BASED ON GROUND INVESTIGATION RESULTS.
5. ALL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH RELEVANT SPECIFICATION AND ALL OTHER RELEVANT DRAWINGS.
6. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSE.

KEY:

- HAUL TRACK CENTRELINE
- PROPOSED DESIGN
- PROPOSED HIGH CONTAINMENT KERB
- RED LINE BOUNDARY

Designer's Site Specific Risk Assessment

This assessment is for non-standard or unusual Hazards and it is expected that Hazards associated with standard installations and designs are well understood by a competent Contractor.

By: | Date:

- No works associated with this drawing

HAZARDS/ ACTIVITY - Assessed as Low (L) / Medium (M) / High (H)

- Falls From Height
- Hazardous Material
- Excavation/Service Strike
- HAVS
- Confined Workplace
- Access/Egress
- Weight Limit
- Residual Electricity
- Drowning/Fall onto Rebar
- Contaminated Land
- Poor Ground conditions
- Site Fabrication/drilling
- Manual Handling
- Stored Energy
- Congested site
- Existing equipment in close proximity

Interfaces: Public | Operatives | Vehicle/Plant

WHO COULD BE HARMED?

- Construction operatives
- Dismantling crew
- Future maintenance crew

CONTROL MEASURES

- Existing work instruction
- Method detailed on drawing
- Method detailed on separate document

TEMPORARY WORKS

- No temporary works required
- Temporary works required and documented separately
- Drawing contains temporary works:

DC0	-	
DC1	-	
DC2	-	More complex design
DC3	-	Complex/Innovative
DC4	-	Abnormal Highly innovative

Complete temporary works design check certificate: ENG-SF-0101C

Level 1 Control
OK to proceed, no significant design hazards and risks, standard control measures apply.

Level 2 Control
OK to proceed as detailed in existing work instruction or procedure detailed on drawing or separate document.

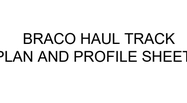
Level 3 Control
OK to proceed providing specific design hazards and risks have been recognised, acknowledged and understood by the operation team. Site operatives may require additional instruction/training.

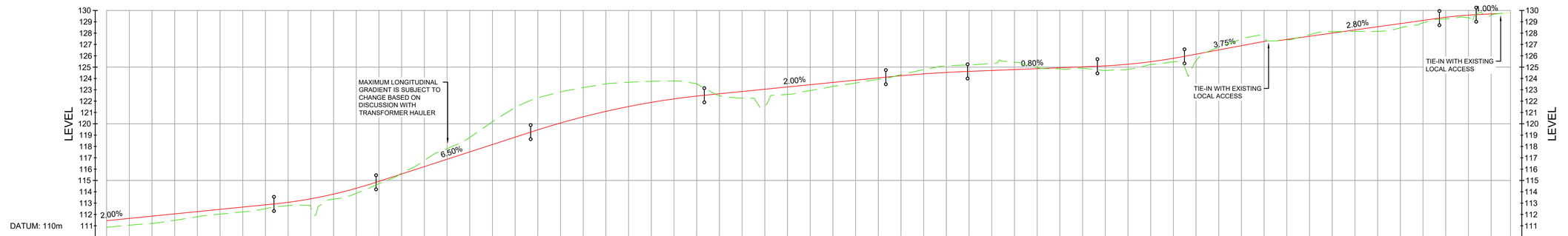
CDM REGULATIONS RESIDUAL RISKS

Design based hazards are actively eliminated where possible. Where hazards cannot be eliminated, this symbol along with an attached note will identify the hazard and indicate that an action is required by the person supervising the works to manage the design hazard during construction.

Other than those noted, we are not aware of any further residual design risks apart from those that a competent contractor would ordinarily consider.

RESIDUAL RISK METER





CHAINAGE	620.000 630.000 640.000 650.000 660.000 670.000 680.000 690.000 700.000 710.000 720.000 730.000 740.000 750.000 760.000 770.000 780.000 790.000 800.000 810.000 820.000 830.000 840.000 850.000 860.000 870.000 880.000 890.000 900.000 910.000 920.000 930.000 940.000 950.000 960.000 970.000 980.000 990.000 1000.000 1010.000 1020.000 1030.000 1040.000 1050.000 1060.000 1070.000 1080.000 1090.000 1100.000 1110.000 1120.000 1130.000 1140.000 1150.000 1160.000 1170.000 1180.000 1190.000 1200.000 1210.000 1220.000 1230.000 1238.533
PROPOSED LEVELS	111.451 111.651 111.851 112.051 112.251 112.451 112.651 112.851 113.077 113.384 113.796 114.309 114.921 115.571 116.221 116.871 117.521 118.171 118.821 119.468 120.070 120.613 121.097 121.523 121.890 122.197 122.447 122.650 122.850 123.050 123.250 123.450 123.650 123.850 124.050 124.242 124.403 124.531 124.626 124.706 124.786 124.866 124.946 125.026 125.110 125.255 125.477 125.776 126.142 126.517 126.892 127.267 127.442 127.722 128.002 128.282 128.562 128.842 129.122 129.397 129.591 129.693
EXISTING LEVELS	110.869 111.053 111.213 111.486 111.797 112.031 112.223 112.512 112.781 112.620 113.350 113.872 114.712 115.655 116.764 117.794 118.789 120.186 121.457 122.292 122.805 123.196 123.523 123.665 123.748 123.775 123.518 122.479 122.271 121.537 122.589 122.935 123.297 123.600 123.924 124.339 124.773 125.120 125.192 125.329 124.706 125.436 124.965 124.854 124.900 124.698 124.808 125.224 125.469 125.559 126.753 127.485 127.576 127.402 127.860 128.126 128.150 128.169 128.463 128.907 129.266 129.358 129.573 129.785
LEVEL DIFFERENCE	0.582 0.597 0.638 0.565 0.454 0.420 0.428 0.339 0.290 0.764 0.446 0.437 0.203 -0.084 -0.544 -0.923 -1.269 -2.016 -2.636 -2.824 -2.735 -2.583 -2.425 -2.142 -1.858 -1.578 -1.072 0.171 0.579 1.513 0.660 0.515 0.353 0.250 0.129 -0.096 -0.370 -0.589 -0.566 -0.623 -0.651 -0.097 0.092 0.126 0.412 0.448 0.253 0.307 0.583 -0.236 -0.593 -0.303 0.040 -0.138 -0.125 0.131 0.402 0.378 0.215 0.131 0.233 0.124
HORIZONTAL ALIGNMENT	R=180.000m R=180.000m R=127.000m R=127.000m R=180.000m R=360.000m
VERTICAL ALIGNMENT	G=2.00% K=10.0 G=6.50% K=17.0 G=2.00% K=30.0 G=0.80% K=13.0 G=3.75% G=2.80% K=9.0 G=1.00%

PROFILE:
SCALE= H 1:1000,V:200

DRAWN	RS	REMARKS:			
CHKD	SRA	FOURTH ISSUE – MINOR AMENDMENTS			
DESIGN	RS	STATUS	S5	DATE	13/05/2025
APPD	FY	FOR ACCEPTANCE		REV	P04
DRAWN	RS	REMARKS:			
CHKD	SRA	THIRD ISSUE – MINOR AMENDMENTS			
DESIGN	RS	STATUS	S5	DATE	21/03/2025
APPD	FY	FOR ACCEPTANCE		REV	P03
DRAWN	GU	REMARKS:			
CHKD	SRA	SECOND ISSUE			
DESIGN	GU	STATUS	S5	DATE	15/01/2025
APPD	FY	FOR ACCEPTANCE		REV	P02
DRAWN	GU	REMARKS:			
CHKD	AC	FIRST ISSUE			
DESIGN	SRA	STATUS	S5	DATE	12/12/2024
APPD		FOR ACCEPTANCE		REV	P01

Scottish & Southern Electricity Networks

Balfour Beatty

PROJECT NAME:
ASTI-ECE

LOCATION: CAMBUSHINNIE 400kV S/S | SITE: CMBS

TITLE:

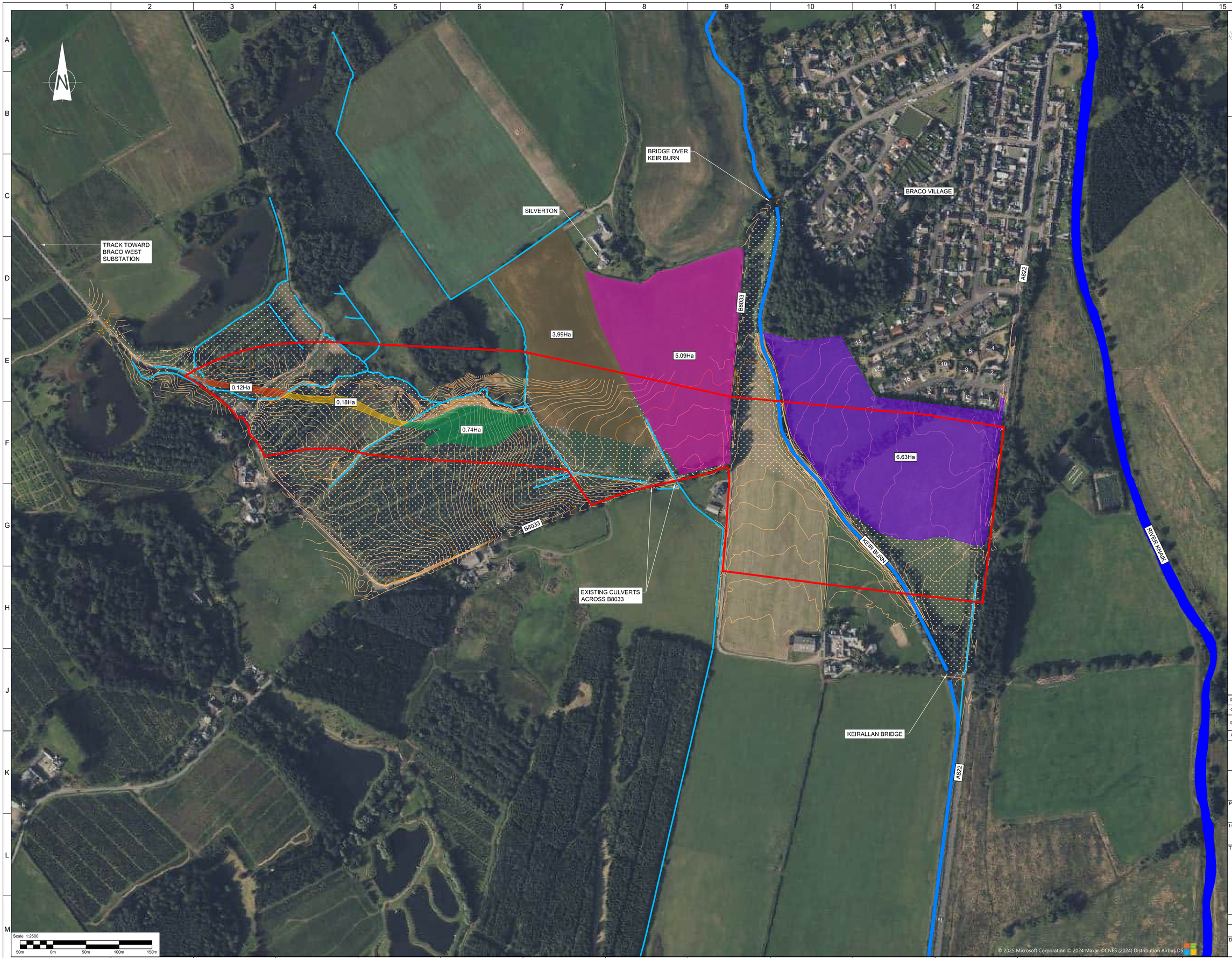
BRACO HAUL TRACK PLAN AND PROFILE SHEET 2

SIZE	SCALE	FORMAT	SHEET No.
A1	As Shown	ACAD	02 OF 02

DRAWING No.
CMBS-LT520-BB-TRAC-ZZ-D-H-0002

Appendix B

EXISTING DRAINAGE PLAN, PROPOSED DRAINAGE CATCHMENT PLAN



SCALE = 1:50,000

NOTES:

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL DIMENSIONS ARE SHOWN IN METRES UNLESS OTHERWISE STATED.
3. THE DRAWING IS TO BE PRINTED IN COLOUR.
4. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSE.
5. FOR MORE DETAILS ON THE PROPOSED HAUL TRACK DEVELOPMENT REFER TO PLAN AND PROFILE DRAWING NUMBERS CMBS-LT520-BB-TRAC-ZZ-D-H-0001 AND CMBS-LT520-BB-TRAC-ZZ-D-H-0002.
6. CONTOURS SHOWN ON THE DRAWING ARE BASED ON TOPOGRAPHICAL SURVEY CONDUCTED AS PART OF THE PROPOSED DEVELOPMENT.
7. THE AREAS SHOWN REPRESENT PRE-DEVELOPMENT CATCHMENT AREAS CONTRIBUTING TO PROPOSED DRAINAGE NETWORKS. FOR LOCATION OF PROPOSED DRAINAGE OUTFALLS REFER TO DRAWING NUMBER CMBS-LT520-BB-TRAC-ZZ-D-H-0030.
8. THE AREAS THAT NATURALLY DRAIN INTO THE EXISTING DITCH OR WHERE RUNOFF IS CAPTURED BY CUTOFF DITCHES IN THE PROPOSED DEVELOPMENT HAVE BEEN SHOWN AS NON CONTRIBUTING AREAS FOR CONSISTENCY.

KEY:

- BRACO HAUL TRACK RED LINE BOUNDARY
- RIVER KNAIK
- KEIR BURN
- LOCAL DITCHES
- MAJOR CONTOURS (5m INTERVALS)
- MINOR CONTOURS (0.5m INTERVALS)
- PRE-DEVELOPMENT CATCHMENT 1A
- PRE-DEVELOPMENT CATCHMENT 2A
- PRE-DEVELOPMENT CATCHMENT 3A
- PRE-DEVELOPMENT CATCHMENT 4A
- PRE-DEVELOPMENT CATCHMENT 5A
- PRE-DEVELOPMENT CATCHMENT 6A
- NON CONTRIBUTING CATCHMENT

DRAWN	SRA	REMARKS:			
CHKD	FY	FIRST ISSUE			
DESIGN	SRA	STATUS	S5	DATE	14/05/2025
APPD	FY	FOR ACCEPTANCE		REV	P01

Scottish & Southern Electricity Networks

Balfour Beatty

PROJECT NAME: ASTI-ECE

LOCATION: CAMBUSHINNIE 400kV S/S

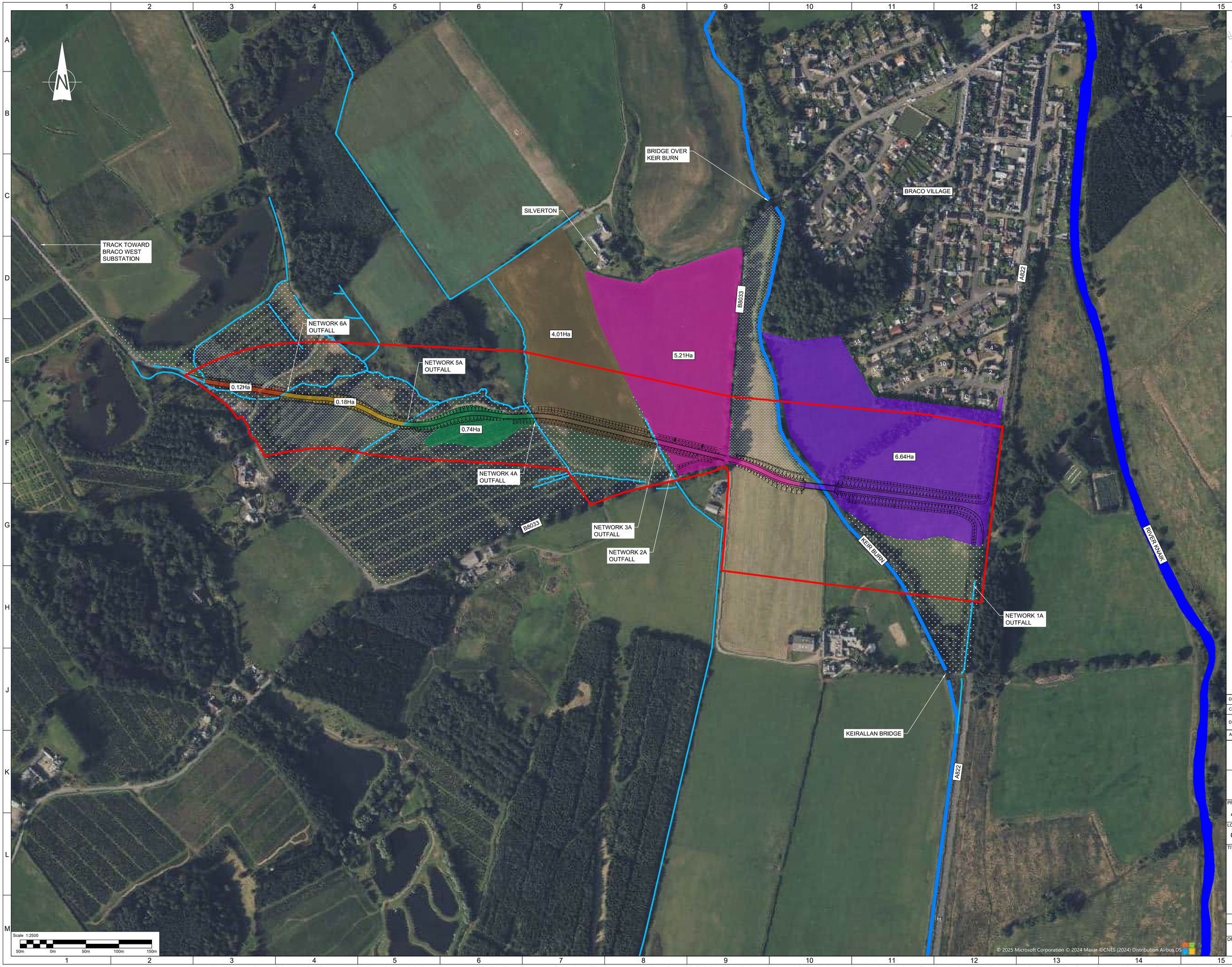
SITE: CMBS

TITLE:

BRACO HAUL TRACK EXISTING DRAINAGE PLAN

SIZE	SCALE	FORMAT	SHEET No.
A1	1:2500	ACAD	01 OF 01

DRAWING No. CMBS-LT520-BB-TRAC-ZZ-D-H-0028



SCALE = 1:50,000

NOTES:

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL DIMENSIONS ARE SHOWN IN METRES UNLESS OTHERWISE STATED.
3. THE DRAWING IS TO BE PRINTED IN COLOUR.
4. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSE.
5. FOR MORE DETAILS ON THE PROPOSED HAUL TRACK DEVELOPMENT REFER TO PLAN AND PROFILE DRAWING NUMBERS CMBS-LT520-BB-TRAC-ZZ-D-H-0001 AND CMBS-LT520-BB-TRAC-ZZ-D-H-0002.
5. FOR MORE DETAILS ON THE PROPOSED HAUL TRACK DRAINAGE DESIGN REFER TO DRAWING NUMBERS CMBS-LT520-BB-TRAC-ZZ-D-H-0015 AND CMBS-LT520-BB-TRAC-ZZ-D-H-0016.
6. THE OUTFALL FOR NETWORKS 1A AND 2A IS VIA PROPOSED CARRIER DRAIN AND HEADWALL; THEREFORE, THE AREA BETWEEN THE SWALE AND THE OUTFALL HAS BEEN CONSIDERED AS NON-CONTRIBUTING.

KEY:

- BRACO HAUL TRACK RED LINE BOUNDARY
- EXISTING WATERCOURSES/ DITCHES
- CATCHMENT 1A
- CATCHMENT 2A
- CATCHMENT 3A
- CATCHMENT 4A
- CATCHMENT 5A
- CATCHMENT 6A
- CATCHMENT DISCHARGING NATURALLY
- CATCHMENT INTERCEPTED BY CUT-OFF DITCHES

DRAWN	SRA	REMARKS:			
CHKD	FY	FIRST ISSUE			
DESIGN	SRA	STATUS	S5	DATE	14/05/2025
APPD	FY	FOR ACCEPTANCE		REV	P01

Scottish & Southern Electricity Networks

Balfour Beatty

PROJECT NAME: ASTI-ECE

LOCATION: CAMBUSHINNIE 400kV S/S

SITE: CMBS

TITLE:

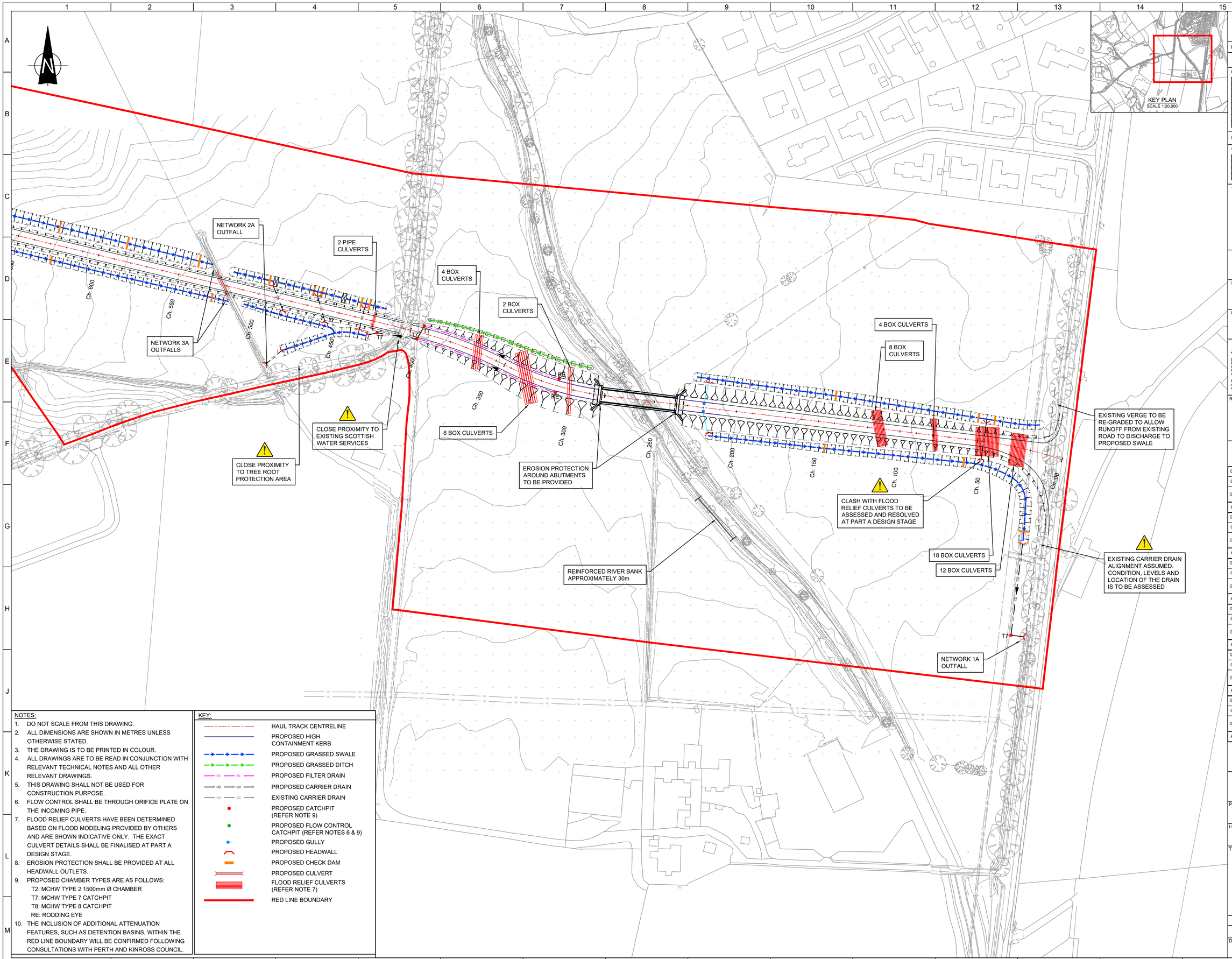
BRACO HAUL TRACK
PROPOSED DRAINAGE
CATCHMENT PLAN

SIZE	SCALE	FORMAT	SHEET No.
A1	1:2500	ACAD	01 OF 01

DRAWING No. CMBS-LT520-BB-TRAC-ZZ-D-H-0030

Appendix C

DRAINAGE LAYOUT DRAWINGS, DRAINAGE STANDARD DETAIL DRAWING,



KEY PLAN
SCALE 1:20,000

Designer's Site Specific Risk Assessment

This assessment is for non-standard or unusual Hazards and it is expected that Hazards associated with standard installations and designs are well understood by a competent Contractor.

By: | Date:

[-] No works associated with this drawing

HAZARDS/ ACTIVITY - Assessed as Low (L) / Medium (M) / High (H)

[-] Falls From Height	[-] Drowning/Fall onto Rebar
[-] Hazardous Material	[-] Contaminated Land
[-] Excavation/Service Strike	[-] Poor Ground conditions
[-] HAVS	[-] Site Fabrication/drilling
[-] Confined Workplace	[-] Manual Handling
[-] Access/Egress	[-] Stored Energy
[-] Weight Limit	[-] Congested site
[-] Residual Electricity	[-] Existing equipment in close proximity

Interfaces: [-] Public [-] Operatives [-] Vehicle/Plant

WHO COULD BE HARMED?	CONTROL MEASURES
[-] Construction operatives	[-] Existing work instruction
[-] Dismantling crew	[-] Method detailed on drawing
[-] Future maintenance crew	[-] Method detailed on separate document
[-]	

TEMPORARY WORKS

[-] No temporary works required
[-] Temporary works required and documented separately
[-] Drawing contains temporary works:

DC0	-	
DC1	-	
DC2	-	More complex design
DC3	-	Complex/Innovative
DC4	-	Abnormal Highly innovative

} Complete temporary works design check certificate: ENG-SF-0101C

Level 1 Control
OK to proceed, no significant design hazards and risks, standard control measures apply.

Level 2 Control
OK to proceed as detailed in existing work instruction or procedure detailed on drawing or separate document.

Level 3 Control
OK to proceed providing specific design hazards and risks have been recognised, acknowledged and understood by the operation team. Site operatives may require additional instruction/training.

CDM REGULATIONS RESIDUAL RISKS

Design based hazards are actively eliminated where possible. Where hazards cannot be eliminated, this symbol along with an attached note will identify the hazard and indicate that an action is required by the person supervising the works to manage the design hazard during construction.

Other than those noted, we are not aware of any further residual design risks apart from those that a competent Contractor would ordinarily consider.

RESIDUAL RISK METER — MEDIUM — LOW — HIGH — 0 — 100
OVERALL RISK SCORE = xx / xx

DRAWN	RS	REMARKS:			
CHKD	SRA	SIXTH ISSUE – MINOR AMENDMENTS			
DESIGN	RS	STATUS	S5	DATE	14/05/2025
APPD	FY	FOR ACCEPTANCE		REV	P06
DRAWN	RS	REMARKS:			
CHKD	SRA	FIFTH ISSUE – MINOR AMENDMENTS			
DESIGN	RS	STATUS	S5	DATE	20/03/2025
APPD	FY	FOR ACCEPTANCE		REV	P05
DRAWN	RS	REMARKS:			
CHKD	SRA	FOURTH ISSUE			
DESIGN	RS	STATUS	S5	DATE	26/02/2025
APPD	FY	FOR ACCEPTANCE		REV	P04
DRAWN	RS	REMARKS:			
CHKD	SRA	THIRD ISSUE			
DESIGN	RS	STATUS	S5	DATE	06/02/2025
APPD	FY	FOR ACCEPTANCE		REV	P03
DRAWN	GU	REMARKS:			
CHKD	SRA	SECOND ISSUE			
DESIGN	GU	STATUS	S5	DATE	15/01/2025
APPD	FY	FOR ACCEPTANCE		REV	P02
DRAWN	GU	REMARKS:			
CHKD	AC	FIRST ISSUE			
DESIGN	SRA	STATUS	S5	DATE	12/12/2024
APPD		FOR ACCEPTANCE		REV	P01

Scottish & Southern Electricity Networks

Balfour Beatty

PROJECT NAME: ASTI-ECE

LOCATION: CAMBUSHINNIE 400kV S/S | SITE: CMBS

TITLE:

BRACO HAUL TRACK
DRAINAGE LAYOUT
SHEET 1

SIZE	SCALE	FORMAT	SHEET No.
A1	1:1000	ACAD	01 OF 02

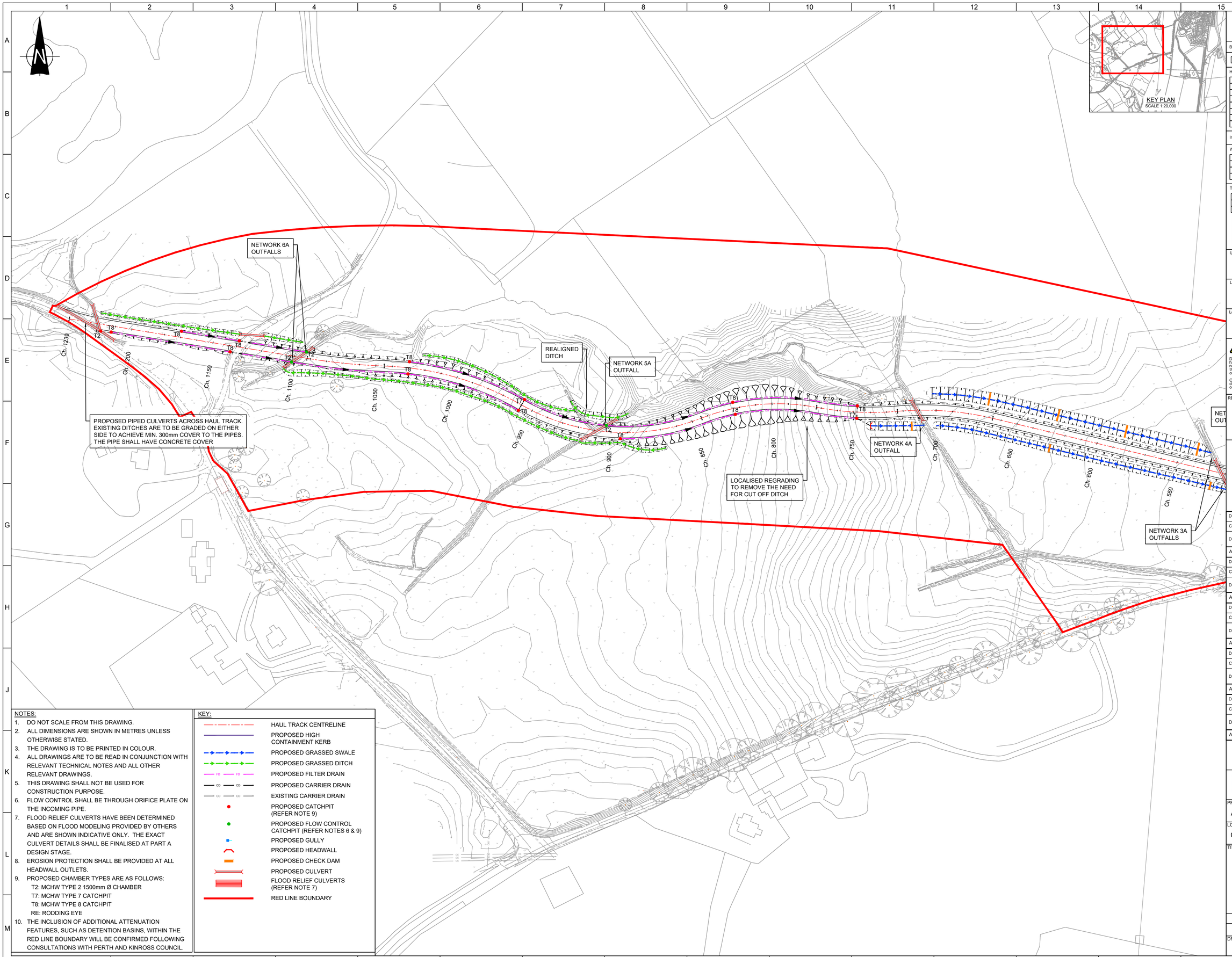
DRAWING No. CMBS-LT520-BB-TRAC-ZZ-D-H-0015

NOTES:

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL DIMENSIONS ARE SHOWN IN METRES UNLESS OTHERWISE STATED.
3. THE DRAWING IS TO BE PRINTED IN COLOUR.
4. ALL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH RELEVANT TECHNICAL NOTES AND ALL OTHER RELEVANT DRAWINGS.
5. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSE.
6. FLOW CONTROL SHALL BE THROUGH ORIFICE PLATE ON THE INCOMING PIPE.
7. FLOOD RELIEF CULVERTS HAVE BEEN DETERMINED BASED ON FLOOD MODELING PROVIDED BY OTHERS AND ARE SHOWN INDICATIVE ONLY. THE EXACT CULVERT DETAILS SHALL BE FINALISED AT PART A DESIGN STAGE.
8. EROSION PROTECTION SHALL BE PROVIDED AT ALL HEADWALL OUTLETS.
9. PROPOSED CHAMBER TYPES ARE AS FOLLOWS:
   T2: MCHW TYPE 2 1500mm Ø CHAMBER
   T7: MCHW TYPE 7 CATCHPIT
   T8: MCHW TYPE 8 CATCHPIT
   RE: RODDING EYE
10. THE INCLUSION OF ADDITIONAL ATTENUATION FEATURES, SUCH AS DETENTION BASINS, WITHIN THE RED LINE BOUNDARY WILL BE CONFIRMED FOLLOWING CONSULTATIONS WITH PERTH AND KINROSS COUNCIL.

KEY:

- HAUL TRACK CENTRELINE
- PROPOSED HIGH CONTAINMENT KERB
- PROPOSED GRASSED SWALE
- PROPOSED GRASSED DITCH
- PROPOSED FILTER DRAIN
- PROPOSED CARRIER DRAIN
- EXISTING CARRIER DRAIN
- PROPOSED CATCHPIT (REFER NOTE 9)
- PROPOSED FLOW CONTROL CATCHPIT (REFER NOTES 6 & 9)
- PROPOSED GULLY
- PROPOSED HEADWALL
- PROPOSED CHECK DAM
- PROPOSED CULVERT
- FLOOD RELIEF CULVERTS (REFER NOTE 7)
- RED LINE BOUNDARY



NOTES:

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL DIMENSIONS ARE SHOWN IN METRES UNLESS OTHERWISE STATED.
3. THE DRAWING IS TO BE PRINTED IN COLOUR.
4. ALL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH RELEVANT TECHNICAL NOTES AND ALL OTHER RELEVANT DRAWINGS.
5. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSE.
6. FLOW CONTROL SHALL BE THROUGH ORIFICE PLATE ON THE INCOMING PIPE.
7. FLOOD RELIEF CULVERTS HAVE BEEN DETERMINED BASED ON FLOOD MODELING PROVIDED BY OTHERS AND ARE SHOWN INDICATIVE ONLY. THE EXACT CULVERT DETAILS SHALL BE FINALISED AT PART A DESIGN STAGE.
8. EROSION PROTECTION SHALL BE PROVIDED AT ALL HEADWALL OUTLETS.
9. PROPOSED CHAMBER TYPES ARE AS FOLLOWS:
   T2: MCHW TYPE 2 1500mm Ø CHAMBER
   T7: MCHW TYPE 7 CATCHPIT
   T8: MCHW TYPE 8 CATCHPIT
   RE: RODDING EYE
10. THE INCLUSION OF ADDITIONAL ATTENUATION FEATURES, SUCH AS DETENTION BASINS, WITHIN THE RED LINE BOUNDARY WILL BE CONFIRMED FOLLOWING CONSULTATIONS WITH PERTH AND KINROSS COUNCIL.

KEY:

- HAUL TRACK CENTRELINE
- PROPOSED HIGH CONTAINMENT KERB
- PROPOSED GRASSED SWALE
- PROPOSED GRASSED DITCH
- PROPOSED FILTER DRAIN
- PROPOSED CARRIER DRAIN
- EXISTING CARRIER DRAIN
- PROPOSED CATCHPIT (REFER NOTE 9)
- PROPOSED FLOW CONTROL CATCHPIT (REFER NOTES 6 & 9)
- PROPOSED GULLY
- PROPOSED HEADWALL
- PROPOSED CHECK DAM
- PROPOSED CULVERT
- FLOOD RELIEF CULVERTS (REFER NOTE 7)
- RED LINE BOUNDARY

Designer's Site Specific Risk Assessment

This assessment is for non-standard or unusual Hazards and it is expected that Hazards associated with standard installations and designs are well understood by a competent Contractor.

By: | Date:

[-] No works associated with this drawing

HAZARDS/ ACTIVITY - Assessed as Low (L) / Medium (M) / High (H)

[-] Falls From Height	[-] Drowning/Fall onto Rebar
[-] Hazardous Material	[-] Contaminated Land
[-] Excavation/Service Strike	[-] Poor Ground conditions
[-] HAVS	[-] Site Fabrication/drilling
[-] Confined Workplace	[-] Manual Handling
[-] Access/Egress	[-] Stored Energy
[-] Weight Limit	[-] Congested site
[-] Residual Electricity	[-] Existing equipment in close proximity

Interfaces: [-] Public [-] Operatives [-] Vehicle/Plant

WHO COULD BE HARMED?
- [-] Construction operatives
- [-] Dismantling crew
- [-] Future maintenance crew
- [-]

CONTROL MEASURES
- [-] Existing work instruction
- [-] Method detailed on drawing
- [-] Method detailed on separate document

TEMPORARY WORKS
- [-] No temporary works required
- [-] Temporary works required and documented separately
- [-] Drawing contains temporary works:

DC0	-	
DC1	-	
DC2	-	More complex design
DC3	-	Complex/Innovative
DC4	-	Abnormal Highly innovative

} Complete temporary works design check certificate: ENG-SF-0101C

Level 1 Control
[-] OK to proceed, no significant design hazards and risks, standard control measures apply.

Level 2 Control
[-] OK to proceed as detailed in existing work instruction or procedure detailed on drawing or separate document.

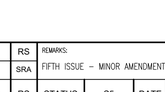
Level 3 Control
[-] OK to proceed providing specific design hazards and risks have been recognised, acknowledged and understood by the operation team. Site operatives may require additional instruction/training.

CDM REGULATIONS RESIDUAL RISKS

Design based hazards are actively eliminated where possible. Where hazards cannot be eliminated, this symbol along with an attached note will identify the hazard and indicate that an action is required by the person supervising the works to manage the design hazard during construction.

Other than those noted, we are not aware of any further residual design risks apart from those that a competent Contractor would ordinarily consider.

RESIDUAL RISK METER



DRAWN	RS	REMARKS:			
CHKD	SRA	FIFTH ISSUE – MINOR AMENDMENTS			
DESIGN	RS	STATUS	S5	DATE	14/05/2025
APPD	FY	FOR ACCEPTANCE		REV	P05
DRAWN	RS	REMARKS:			
CHKD	SRA	FOURTH ISSUE – MINOR AMENDMENTS			
DESIGN	RS	STATUS	S5	DATE	21/03/2025
APPD	FY	FOR ACCEPTANCE		REV	P04
DRAWN	RS	REMARKS:			
CHKD	SRA	THIRD ISSUE			
DESIGN	RS	STATUS	S5	DATE	26/02/2025
APPD	FY	FOR ACCEPTANCE		REV	P03
DRAWN	GU	REMARKS:			
CHKD	SRA	SECOND ISSUE			
DESIGN	GU	STATUS	S5	DATE	15/01/2025
APPD	FY	FOR ACCEPTANCE		REV	P02
DRAWN	GU	REMARKS:			
CHKD	AC	FIRST ISSUE			
DESIGN	SRA	STATUS	S5	DATE	12/12/2024
APPD		FOR ACCEPTANCE		REV	P01

Scottish & Southern Electricity Networks

Balfour Beatty

PROJECT NAME: ASTI-ECE

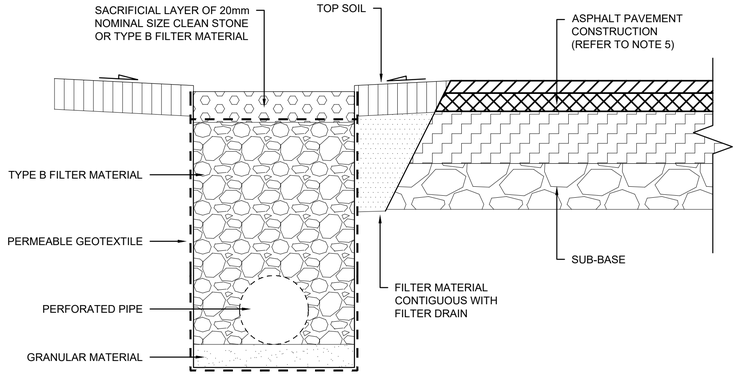
LOCATION: CAMBUSHINNIE 400kV S/S | SITE: CMBS

TITLE:

BRACO HAUL TRACK DRAINAGE LAYOUT SHEET 2

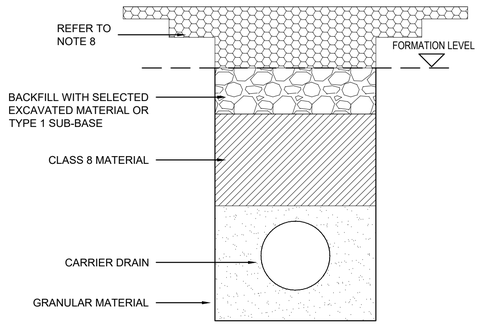
SIZE	SCALE	FORMAT	SHEET No.
A1	1:1000	ACAD	02 OF 02

DRAWING No. CMBS-LT520-BB-TRAC-ZZ-D-H-0016



TRENCH AND BEDDING TO BE IN ACCORDANCE WITH
TYPE H DETAIL SHOWN IN HCD DRAWING NUMBER F2

FILTER DRAIN
1:10



TRENCH AND BEDDING TO BE IN ACCORDANCE WITH
TYPE S DETAIL SHOWN IN HCD DRAWING NUMBER F1

TRENCH REINSTATEMENT DETAILS
1:10

NOTES:

1. ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
2. ANY DISCREPANCIES OR CONFLICTING INFORMATION IDENTIFIED IN THE INFORMATION PROVIDED SHALL BE REFERRED TO THE DESIGNER AT THE EARLIEST OPPORTUNITY AND WORKS SHOULD NOT COMMENCE UNTIL RESOLVED.
4. ALL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH RELEVANT TECHNICAL NOTES AND ALL OTHER RELEVANT DRAWINGS.
5. FOR PAVEMENT CONSTRUCTION DETAILS REFER TO DRAWING NO. CMBS-LT520-BB-TRAC-ZZ-D-H-0021.
6. PRECAST HEADWALL DIMENSIONS AND SHAPE ARE INDICATIVE ONLY AND ARE SUBJECT TO MANUFACTURER'S SPECIFICATIONS.
7. PROPOSED CHECK DAMS WILL BE CONSTRUCTED USING GABION BASKETS. EACH CHECK DAM SHALL INCLUDE A PIPE INSTALLED AT THE INVERT OF THE SWALE/DITCH FOR CONTROLLED DISCHARGE OF RUN-OFF AND TO ALLOW DRAIN DOWN. RIP RAP SCOUR PROTECTION OR SIMILAR SHALL BE PROVIDED ON THE DOWNSTREAM END OF EACH CHECK DAM.
8. PAVEMENT CONSTRUCTION FOR TRENCH REINSTATEMENT SHALL MATCH EXISTING CONSTRUCTION. A MINIMUM BENCHING OF 150mm SHALL BE PROVIDED BETWEEN PAVEMENT LAYERS.
9. PROPOSED SWALE SHALL HAVE A SIDE SLOPE OF 1 IN 4.

Designer's Site Specific Risk Assessment

This assessment is for non-standard or unusual Hazards and it is expected that Hazards associated with standard installations and designs are well understood by a competent Contractor.

By:	Date:

- [-] No works associated with this drawing

HAZARDS/ ACTIVITY - Assessed as Low (L) / Medium (M) / High (H)

[-] Falls From Height	[-] Drowning/Fall onto Rebar
[-] Hazardous Material	[-] Contaminated Land
[-] Excavation/Service Strike	[-] Poor Ground conditions
[-] HAVS	[-] Site Fabrication/drilling
[-] Confined Workplace	[-] Manual Handling
[-] Access/Egress	[-] Stored Energy
[-] Weight Limit	[-] Congested site
[-] Residual Electricity	[-] Existing equipment in close proximity

Interfaces: [-] Public [-] Operatives [-] Vehicle/Plant

WHO COULD BE HARMED?	CONTROL MEASURES
[-] Construction operatives	[-] Existing work instruction
[-] Dismantling crew	[-] Method detailed on drawing
[-] Future maintenance crew	[-] Method detailed on separate document
[-]	

TEMPORARY WORKS

- [-] No temporary works required
- [-] Temporary works required and documented separately
- [-] Drawing contains temporary works:

DC0	[-]	
DC1	[-]	
DC2	[-]	More complex design
DC3	[-]	Complex/Innovative
DC4	[-]	Abnormal Highly innovative

} Complete temporary works design check certificate: ENG-SF-0101C

Level 1 Control

OK to proceed, no significant design hazards and risks, standard control measures apply.

Level 2 Control

OK to proceed as detailed in existing work instruction or procedure detailed on drawing or separate document.

Level 3 Control

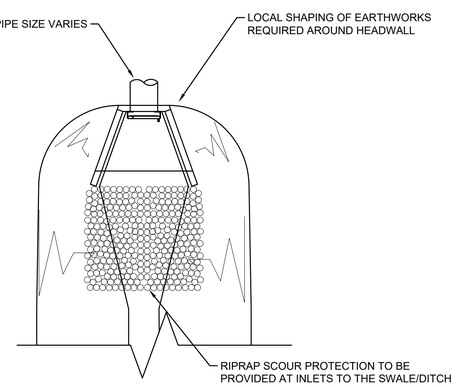
OK to proceed providing specific design hazards and risks have been recognised, acknowledged and understood by the operation team. Site operatives may require additional instruction/training.

CDM REGULATIONS RESIDUAL RISKS

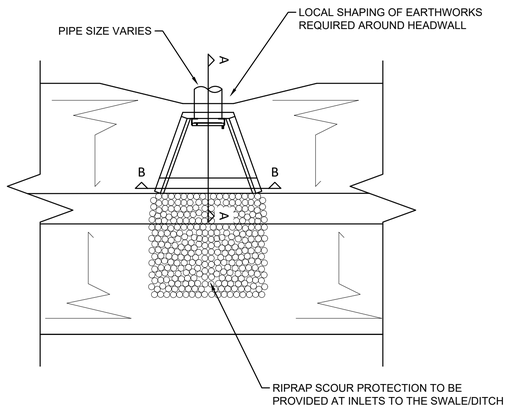
Design based hazards are actively eliminated where possible. Where hazards cannot be eliminated, this symbol along with an attached note will identify the hazard and indicate that an action is required by the person supervising the works to manage the design hazard during construction.

Other than those noted, we are not aware of any further residual design risks apart from those that a competent Contractor would ordinarily consider.

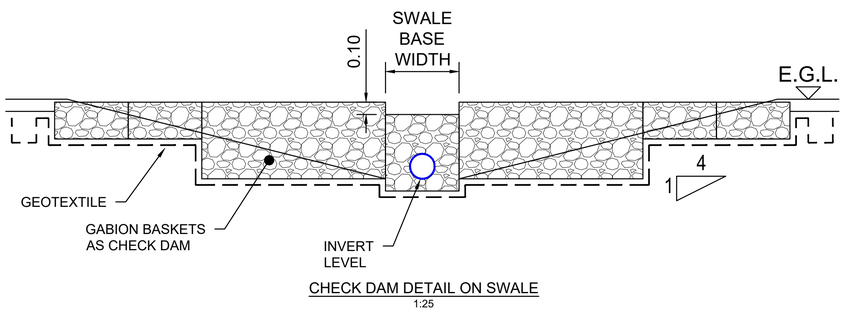
RESIDUAL RISK METER



PRECAST CONCRETE HEADWALL - START/END OF SWALE
PLAN VIEW
1:50



PRECAST CONCRETE HEADWALL - SIDE OF SWALE
PLAN VIEW
1:50



CHECK DAM DETAIL ON SWALE
1:25

DRAWN	GU	REMARKS:			
CHKD	AC	SECOND ISSUE – MINOR AMENDMENTS			
DESIGN	SRA	STATUS	S5	DATE	14/05/2025
APPD		FOR ACCEPTANCE		REV	P02
DRAWN	GU	REMARKS:			
CHKD	AC	FIRST ISSUE			
DESIGN	SRA	STATUS	S5	DATE	12/12/2024
APPD		FOR ACCEPTANCE		REV	P01

Scottish & Southern Electricity Networks

Balfour Beatty

PROJECT NAME:
ASTI-ECE

LOCATION:	SITE:
CAMBUSHINNIE 400kV S/S	CMBS

TITLE:

BRACO HAUL TRACK
DRAINAGE STANDARD DETAILS
SHEET 1

SIZE	SCALE	FORMAT	SHEET No.
A1	1:1000	ACAD	01 OF 01

DRAWING No.
CMBS-LT520-BB-TRAC-ZZ-D-H-0017

Appendix D

PROPOSED DRAINAGE CALCULATIONS

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Network 1A

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	1	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	16.100	Volumetric Runoff Coeff.	0.750	Min Design Depth for Optimisation (m)	0.600
Ratio R	0.240	PIMP (%)	100	Min Vel for Auto Design only (m/s)	0.75
Maximum Rainfall (mm/hr)	100	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.600		

Designed with Level Soffits

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 1A

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 6 Number of Storage Structures 13 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.100 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.240 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 150.0 DTS Status ON Inertia Status OFF
Analysis Timestep Fine DVD Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 5, 30
Climate Change (%) 39, 39, 39

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
N1A/1.000	N1A/1	30 Winter	1	+39%					107.152	-0.618	0.000	0.01		41.0	OK
N1A/1.001	N1A/2	60 Winter	1	+39%					106.626	-0.194	0.000	0.01		30.8	OK

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 1A

PN	US/MH Name	Level Exceeded
N1A/1.000	N1A/1	
N1A/1.001	N1A/2	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 1A

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
N1A/1.002	N1A/3	180 Winter	1	+39%	30/180 Winter				105.955	-0.295	0.000	0.01		20.2
N1A/2.000	N1A/4	30 Winter	1	+39%					105.898	-0.642	0.000	0.01		23.4
N1A/2.001	N1A/5	180 Winter	1	+39%					105.877	-0.483	0.000	0.00		14.2
N1A/2.002	N1A/6	180 Winter	1	+39%					105.877	-0.358	0.000	0.00		11.4
N1A/1.003	N1A/7	180 Winter	1	+39%	5/120 Summer				105.780	-0.055	0.000	0.28		29.1
N1A/3.000	N1A/8	15 Winter	1	+39%					107.413	-0.387	0.000	0.01		17.3
N1A/3.001	N1A/9	30 Winter	1	+39%					106.652	-0.218	0.000	0.00		12.0
N1A/3.002	N1A/10	180 Winter	1	+39%					105.892	-0.288	0.000	0.00		5.6
N1A/1.004	N1A/11	180 Winter	1	+39%					105.770	-0.420	0.000	0.03		34.2
N1A/1.005	N1A/12	180 Winter	1	+39%					105.768	-0.492	0.000	0.05		31.9
N1A/1.006	N1A/13	180 Winter	1	+39%					105.768	-0.302	0.000	0.02		30.6
N1A/1.007	N1A/14	180 Winter	1	+39%	30/120 Winter				105.767	-0.233	0.000	0.02		27.5
N1A/1.008	N1A/15	180 Winter	1	+39%	1/30 Winter				105.584	0.084	0.000	0.84		27.2
N1A/1.009	N1A/16	180 Winter	1	+39%	1/15 Summer				105.447	0.217	0.000	2.34		27.2

PN	US/MH Name	Status	Level Exceeded
N1A/1.002	N1A/3	OK	
N1A/2.000	N1A/4	OK	
N1A/2.001	N1A/5	OK	
N1A/2.002	N1A/6	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 1A

PN	US/MH Name	Status	Level Exceeded
N1A/1.003	N1A/7	OK*	
N1A/3.000	N1A/8	OK	
N1A/3.001	N1A/9	OK	
N1A/3.002	N1A/10	OK	
N1A/1.004	N1A/11	OK	
N1A/1.005	N1A/12	OK	
N1A/1.006	N1A/13	OK	
N1A/1.007	N1A/14	OK	
N1A/1.008	N1A/15	SURCHARGED*	
N1A/1.009	N1A/16	SURCHARGED	

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 1A

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 6 Number of Storage Structures 13 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.100 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.240 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 150.0 DTS Status ON Inertia Status OFF
Analysis Timestep Fine DVD Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 5, 30
Climate Change (%) 39, 39, 39

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
N1A/1.000	N1A/1	30 Winter	5	+39%					107.172	-0.598	0.000	0.02		58.7	OK
N1A/1.001	N1A/2	30 Winter	5	+39%					106.708	-0.112	0.000	0.02		60.0	FLOOD RISK*

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 1A

PN	US/MH Name	Level Exceeded
N1A/1.000	N1A/1	
N1A/1.001	N1A/2	

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 1A

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
N1A/1.002	N1A/3	180 Winter	5	+39%	30/180 Winter				106.074	-0.176	0.000	0.01		25.0
N1A/2.000	N1A/4	240 Winter	5	+39%					105.984	-0.556	0.000	0.00		12.7
N1A/2.001	N1A/5	240 Winter	5	+39%					105.984	-0.376	0.000	0.01		16.0
N1A/2.002	N1A/6	240 Winter	5	+39%					105.983	-0.252	0.000	0.00		12.5
N1A/1.003	N1A/7	180 Winter	5	+39%	5/120 Summer				105.887	0.052	0.000	0.35		35.8
N1A/3.000	N1A/8	15 Winter	5	+39%					107.428	-0.372	0.000	0.01		25.7
N1A/3.001	N1A/9	60 Winter	5	+39%					106.762	-0.108	0.000	0.00		13.8
N1A/3.002	N1A/10	180 Winter	5	+39%					106.008	-0.172	0.000	0.00		6.0
N1A/1.004	N1A/11	180 Winter	5	+39%					105.876	-0.314	0.000	0.03		40.2
N1A/1.005	N1A/12	180 Winter	5	+39%					105.875	-0.385	0.000	0.05		37.0
N1A/1.006	N1A/13	180 Winter	5	+39%					105.874	-0.196	0.000	0.02		34.7
N1A/1.007	N1A/14	180 Winter	5	+39%	30/120 Winter				105.873	-0.127	0.000	0.02		30.3
N1A/1.008	N1A/15	180 Winter	5	+39%	1/30 Winter				105.677	0.177	0.000	0.93		30.2
N1A/1.009	N1A/16	180 Winter	5	+39%	1/15 Summer				105.508	0.278	0.000	2.59		30.2

PN	US/MH Name	Status	Level Exceeded
N1A/1.002	N1A/3	OK	
N1A/2.000	N1A/4	OK	
N1A/2.001	N1A/5	OK	
N1A/2.002	N1A/6	OK	

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 1A

PN	US/MH Name	Status	Level Exceeded
N1A/1.003	N1A/7	SURCHARGED*	
N1A/3.000	N1A/8	OK	
N1A/3.001	N1A/9	FLOOD RISK*	
N1A/3.002	N1A/10	OK	
N1A/1.004	N1A/11	OK	
N1A/1.005	N1A/12	OK	
N1A/1.006	N1A/13	OK	
N1A/1.007	N1A/14	FLOOD RISK*	
N1A/1.008	N1A/15	SURCHARGED*	
N1A/1.009	N1A/16	SURCHARGED	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 1A

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 6 Number of Storage Structures 13 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.100 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.240 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 150.0 DTS Status ON Inertia Status OFF
Analysis Timestep Fine DVD Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 5, 30
Climate Change (%) 39, 39, 39

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
N1A/1.000	N1A/1	30 Winter	30	+39%					107.198	-0.572	0.000	0.03		88.7	OK
N1A/1.001	N1A/2	30 Winter	30	+39%					106.780	-0.040	0.000	0.03		101.9	FLOOD RISK*

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 1A

PN	US/MH Name	Level Exceeded
N1A/1.000	N1A/1	
N1A/1.001	N1A/2	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 1A

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
N1A/1.002	N1A/3	240 Winter	30	+39%	30/180 Winter				106.208	-0.042	0.000	0.01		30.4
N1A/2.000	N1A/4	240 Winter	30	+39%					106.129	-0.411	0.000	0.01		17.9
N1A/2.001	N1A/5	240 Winter	30	+39%					106.129	-0.231	0.000	0.01		21.8
N1A/2.002	N1A/6	240 Winter	30	+39%					106.129	-0.106	0.000	0.00		15.7
N1A/1.003	N1A/7	240 Winter	30	+39%	5/120 Summer				106.018	0.183	0.000	0.42		43.2
N1A/3.000	N1A/8	15 Winter	30	+39%					107.448	-0.352	0.000	0.02		33.0
N1A/3.001	N1A/9	60 Winter	30	+39%					106.837	-0.033	0.000	0.01		32.0
N1A/3.002	N1A/10	240 Winter	30	+39%					106.152	-0.028	0.000	0.00		6.5
N1A/1.004	N1A/11	240 Winter	30	+39%					106.005	-0.185	0.000	0.04		46.8
N1A/1.005	N1A/12	240 Winter	30	+39%					106.004	-0.256	0.000	0.06		42.5
N1A/1.006	N1A/13	240 Winter	30	+39%					106.004	-0.066	0.000	0.03		40.0
N1A/1.007	N1A/14	240 Winter	30	+39%	30/120 Winter				105.999	-0.001	0.000	0.03		33.5
N1A/1.008	N1A/15	240 Winter	30	+39%	1/30 Winter				105.789	0.289	0.000	1.03		33.3
N1A/1.009	N1A/16	240 Winter	30	+39%	1/15 Summer				105.583	0.353	0.000	2.87		33.3

PN	US/MH Name	Status	Level Exceeded
N1A/1.002	N1A/3	FLOOD RISK*	
N1A/2.000	N1A/4	OK	
N1A/2.001	N1A/5	OK	
N1A/2.002	N1A/6	FLOOD RISK*	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 1A

PN	US/MH Name	Status	Level Exceeded
N1A/1.003	N1A/7	FLOOD RISK*	
N1A/3.000	N1A/8	OK	
N1A/3.001	N1A/9	FLOOD RISK*	
N1A/3.002	N1A/10	FLOOD RISK*	
N1A/1.004	N1A/11	OK	
N1A/1.005	N1A/12	OK	
N1A/1.006	N1A/13	FLOOD RISK*	
N1A/1.007	N1A/14	FLOOD RISK*	
N1A/1.008	N1A/15	SURCHARGED*	
N1A/1.009	N1A/16	SURCHARGED	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Network 2A

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	1	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	16.100	Volumetric Runoff Coeff.	0.750	Min Design Depth for Optimisation (m)	0.600
Ratio R	0.240	PIMP (%)	100	Min Vel for Auto Design only (m/s)	0.75
Maximum Rainfall (mm/hr)	100	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.600		

Designed with Level Soffits

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2A

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 6 Number of Storage Structures 20 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.100 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.240 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 150.0 DTS Status ON Inertia Status OFF
Analysis Timestep Fine DVD Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 5, 30
Climate Change (%) 39, 39, 39

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
N2A/1.000	N2/1	60 Winter	1	+39%					108.857	-0.463	0.000	0.01		13.9	OK
N2A/1.001	N2/2	60 Winter	1	+39%					108.856	-0.304	0.000	0.00		5.8	OK

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2A

PN	US/MH Name	Level Exceeded
N2A/1.000	N2/1	
N2A/1.001	N2/2	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2A

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
N2A/1.002	N2/3	60 Winter	1	+39%					108.581	-0.174	0.000	0.12		5.8
N2A/2.000	N2/4	15 Winter	1	+39%					108.813	-0.267	0.000	0.00		3.1
N2A/1.003	N2/5	30 Winter	1	+39%					108.377	-0.388	0.000	0.00		9.2
N2A/3.000	N2/6	30 Winter	1	+39%					108.559	-0.561	0.000	0.00		13.0
N2A/3.001	N2/7	60 Winter	1	+39%					108.477	-0.283	0.000	0.00		5.2
N2A/4.000	N2/8	120 Winter	1	+39%					108.438	-0.362	0.000	0.01		6.5
N2A/4.001	N2/9	120 Winter	1	+39%					108.438	-0.322	0.000	0.00		3.4
N2A/3.002	N2/10	120 Winter	1	+39%	5/60 Winter				108.312	-0.063	0.000	0.16		7.7
N2A/1.004	N2/11	120 Winter	1	+39%					108.302	-0.298	0.000	0.01		12.2
N2A/5.000	N2/12	15 Winter	1	+39%					109.806	-0.954	0.000	0.01		3.2
N2A/5.001	N2/13	15 Winter	1	+39%					109.227	-0.933	0.000	0.02		6.1
N2A/6.000	N2/14	15 Winter	1	+39%					109.813	-0.947	0.000	0.01		3.0
N2A/6.001	N2/15	15 Winter	1	+39%					109.228	-0.932	0.000	0.02		5.9
N2A/6.002	N2/16	120 Winter	1	+39%	5/60 Winter				108.310	-0.065	0.000	0.23		2.7
N2A/5.002	N2/17	120 Winter	1	+39%	5/120 Winter				108.307	-0.093	0.000	0.15		5.4
N2A/5.003	N2/18	120 Winter	1	+39%	1/60 Summer				108.303	0.043	0.000	0.19		4.9
N2A/5.004	N2/19	120 Winter	1	+39%					108.302	-0.308	0.000	0.01		6.4
N2A/7.000	N2/20	120 Winter	1	+39%					108.445	-0.355	0.000	0.00		9.1
N2A/7.001	N2/21	120 Winter	1	+39%					108.445	-0.355	0.000	0.00		6.1
N2A/8.000	N2/22	120 Winter	1	+39%					108.407	-0.293	0.000	0.01		13.2
N2A/8.001	N2/23	120 Winter	1	+39%					108.407	-0.393	0.000	0.00		9.3
N2A/7.002	N2/24	120 Winter	1	+39%	1/60 Winter				108.319	0.034	0.000	0.49		14.5
N2A/5.005	N2/25	120 Winter	1	+39%					108.302	-0.273	0.000	0.02		19.4
N2A/1.005	N2/26	120 Winter	1	+39%					108.302	-0.298	0.000	0.03		25.0

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2A

PN	US/MH Name	Status	Level Exceeded
N2A/1.002	N2/3	OK*	
N2A/2.000	N2/4	OK	
N2A/1.003	N2/5	OK	
N2A/3.000	N2/6	OK	
N2A/3.001	N2/7	OK	
N2A/4.000	N2/8	OK	
N2A/4.001	N2/9	OK	
N2A/3.002	N2/10	OK*	
N2A/1.004	N2/11	OK	
N2A/5.000	N2/12	OK	
N2A/5.001	N2/13	OK	
N2A/6.000	N2/14	OK	
N2A/6.001	N2/15	OK	
N2A/6.002	N2/16	OK	
N2A/5.002	N2/17	OK	
N2A/5.003	N2/18	SURCHARGED	
N2A/5.004	N2/19	OK	
N2A/7.000	N2/20	OK	
N2A/7.001	N2/21	OK	
N2A/8.000	N2/22	OK	
N2A/8.001	N2/23	OK	
N2A/7.002	N2/24	SURCHARGED*	
N2A/5.005	N2/25	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2A

PN	US/MH Name	Status	Level Exceeded
N2A/1.005	N2/26	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2A

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
N2A/1.006	N2/27	120 Winter	1	+39%	1/30 Summer				108.296	0.096	0.000	0.46		23.3

PN	US/MH Name	Status	Level Exceeded
N2A/1.006	N2/27	SURCHARGED*	

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2A

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 6 Number of Storage Structures 20 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.100 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.240 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 150.0 DTS Status ON Inertia Status OFF
Analysis Timestep Fine DVD Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 5, 30
Climate Change (%) 39, 39, 39

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
N2A/1.000	N2/1	60 Winter	5	+39%					108.948	-0.372	0.000	0.01		20.2	OK
N2A/1.001	N2/2	60 Winter	5	+39%					108.948	-0.212	0.000	0.00		6.7	OK

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2A

PN	US/MH Name	Level Exceeded
N2A/1.000	N2/1	
N2A/1.001	N2/2	

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2A

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
N2A/1.002	N2/3	60 Winter	5	+39%					108.585	-0.170	0.000	0.13		6.7
N2A/2.000	N2/4	15 Winter	5	+39%					108.819	-0.261	0.000	0.00		4.7
N2A/1.003	N2/5	180 Winter	5	+39%					108.407	-0.358	0.000	0.00		8.7
N2A/3.000	N2/6	60 Winter	5	+39%					108.575	-0.545	0.000	0.01		15.4
N2A/3.001	N2/7	60 Winter	5	+39%					108.569	-0.191	0.000	0.00		5.4
N2A/4.000	N2/8	180 Winter	5	+39%					108.543	-0.257	0.000	0.01		7.6
N2A/4.001	N2/9	180 Winter	5	+39%					108.543	-0.217	0.000	0.00		3.5
N2A/3.002	N2/10	180 Winter	5	+39%	5/60 Winter				108.412	0.037	0.000	0.16		7.5
N2A/1.004	N2/11	180 Winter	5	+39%					108.401	-0.199	0.000	0.01		13.0
N2A/5.000	N2/12	15 Winter	5	+39%					109.814	-0.946	0.000	0.01		4.9
N2A/5.001	N2/13	15 Winter	5	+39%					109.239	-0.921	0.000	0.04		9.2
N2A/6.000	N2/14	15 Winter	5	+39%					109.821	-0.939	0.000	0.02		4.5
N2A/6.001	N2/15	15 Winter	5	+39%					109.240	-0.920	0.000	0.04		8.9
N2A/6.002	N2/16	180 Winter	5	+39%	5/60 Winter				108.410	0.035	0.000	0.25		3.0
N2A/5.002	N2/17	180 Winter	5	+39%	5/120 Winter				108.407	0.007	0.000	0.16		5.9
N2A/5.003	N2/18	180 Winter	5	+39%	1/60 Summer				108.402	0.142	0.000	0.21		5.6
N2A/5.004	N2/19	180 Winter	5	+39%					108.401	-0.209	0.000	0.01		7.5
N2A/7.000	N2/20	60 Winter	5	+39%					108.573	-0.227	0.000	0.01		18.8
N2A/7.001	N2/21	60 Winter	5	+39%					108.573	-0.227	0.000	0.00		9.1
N2A/8.000	N2/22	120 Winter	5	+39%					108.524	-0.176	0.000	0.02		19.4
N2A/8.001	N2/23	120 Winter	5	+39%					108.524	-0.276	0.000	0.00		13.0
N2A/7.002	N2/24	180 Winter	5	+39%	1/60 Winter				108.421	0.136	0.000	0.58		17.5
N2A/5.005	N2/25	180 Winter	5	+39%					108.401	-0.174	0.000	0.02		23.4
N2A/1.005	N2/26	180 Winter	5	+39%					108.401	-0.199	0.000	0.03		28.4

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2A

PN	US/MH Name	Status	Level Exceeded
N2A/1.002	N2/3	OK*	
N2A/2.000	N2/4	OK	
N2A/1.003	N2/5	OK	
N2A/3.000	N2/6	OK	
N2A/3.001	N2/7	OK	
N2A/4.000	N2/8	OK	
N2A/4.001	N2/9	OK	
N2A/3.002	N2/10	SURCHARGED*	
N2A/1.004	N2/11	OK	
N2A/5.000	N2/12	OK	
N2A/5.001	N2/13	OK	
N2A/6.000	N2/14	OK	
N2A/6.001	N2/15	OK	
N2A/6.002	N2/16	SURCHARGED	
N2A/5.002	N2/17	SURCHARGED	
N2A/5.003	N2/18	SURCHARGED	
N2A/5.004	N2/19	OK	
N2A/7.000	N2/20	OK	
N2A/7.001	N2/21	OK	
N2A/8.000	N2/22	OK	
N2A/8.001	N2/23	OK	
N2A/7.002	N2/24	SURCHARGED*	
N2A/5.005	N2/25	OK	

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2A

PN	US/MH Name	Status	Level Exceeded
N2A/1.005	N2/26	OK	

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2A

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
N2A/1.006	N2/27	180 Winter	5	+39%	1/30 Summer				108.398	0.198	0.000	0.53		26.8

PN	US/MH Name	Status	Level Exceeded
N2A/1.006	N2/27	SURCHARGED*	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2A

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 6 Number of Storage Structures 20 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.100 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.240 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 150.0 DTS Status ON Inertia Status OFF
Analysis Timestep Fine DVD Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 5, 30
Climate Change (%) 39, 39, 39

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
N2A/1.000	N2/1	120 Winter	30	+39%					109.073	-0.247	0.000	0.01		20.7	OK
N2A/1.001	N2/2	120 Winter	30	+39%					109.072	-0.088	0.000	0.00		7.9	FLOOD RISK*

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2A

PN	US/MH Name	Level Exceeded
N2A/1.000	N2/1	
N2A/1.001	N2/2	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2A

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
N2A/1.002	N2/3	120 Winter	30	+39%					108.589	-0.166	0.000	0.16		7.9
N2A/2.000	N2/4	15 Winter	30	+39%					108.826	-0.254	0.000	0.01		6.9
N2A/1.003	N2/5	180 Winter	30	+39%					108.528	-0.237	0.000	0.00		10.6
N2A/3.000	N2/6	120 Winter	30	+39%					108.687	-0.433	0.000	0.01		15.4
N2A/3.001	N2/7	120 Winter	30	+39%					108.687	-0.073	0.000	0.00		5.2
N2A/4.000	N2/8	180 Winter	30	+39%					108.681	-0.119	0.000	0.01		11.1
N2A/4.001	N2/9	180 Winter	30	+39%					108.681	-0.079	0.000	0.00		4.1
N2A/3.002	N2/10	180 Winter	30	+39%	5/60 Winter				108.539	0.164	0.000	0.16		7.7
N2A/1.004	N2/11	180 Winter	30	+39%					108.527	-0.073	0.000	0.02		15.1
N2A/5.000	N2/12	15 Winter	30	+39%					109.821	-0.939	0.000	0.01		7.2
N2A/5.001	N2/13	15 Winter	30	+39%					109.259	-0.901	0.000	0.06		14.7
N2A/6.000	N2/14	15 Winter	30	+39%					109.830	-0.930	0.000	0.03		6.7
N2A/6.001	N2/15	15 Winter	30	+39%					109.261	-0.899	0.000	0.06		14.0
N2A/6.002	N2/16	180 Winter	30	+39%	5/60 Winter				108.536	0.161	0.000	0.35		4.2
N2A/5.002	N2/17	180 Winter	30	+39%	5/120 Winter				108.533	0.133	0.000	0.23		8.5
N2A/5.003	N2/18	180 Winter	30	+39%	1/60 Summer				108.529	0.269	0.000	0.32		8.3
N2A/5.004	N2/19	180 Winter	30	+39%					108.527	-0.083	0.000	0.01		11.1
N2A/7.000	N2/20	60 Winter	30	+39%					108.755	-0.045	0.000	0.01		28.1
N2A/7.001	N2/21	60 Winter	30	+39%					108.755	-0.045	0.000	0.00		10.8
N2A/8.000	N2/22	60 Winter	30	+39%					108.680	-0.020	0.000	0.04		40.8
N2A/8.001	N2/23	60 Winter	30	+39%					108.679	-0.121	0.000	0.01		20.9
N2A/7.002	N2/24	180 Winter	30	+39%	1/60 Winter				108.550	0.265	0.000	0.78		23.2
N2A/5.005	N2/25	180 Winter	30	+39%					108.527	-0.048	0.000	0.03		31.9
N2A/1.005	N2/26	180 Winter	30	+39%					108.527	-0.073	0.000	0.04		33.0

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2A

PN	US/MH Name	Status	Level Exceeded
N2A/1.002	N2/3	OK*	
N2A/2.000	N2/4	OK	
N2A/1.003	N2/5	OK	
N2A/3.000	N2/6	OK	
N2A/3.001	N2/7	FLOOD RISK*	
N2A/4.000	N2/8	FLOOD RISK*	
N2A/4.001	N2/9	FLOOD RISK*	
N2A/3.002	N2/10	SURCHARGED*	
N2A/1.004	N2/11	FLOOD RISK*	
N2A/5.000	N2/12	OK	
N2A/5.001	N2/13	OK	
N2A/6.000	N2/14	OK	
N2A/6.001	N2/15	OK	
N2A/6.002	N2/16	SURCHARGED	
N2A/5.002	N2/17	SURCHARGED	
N2A/5.003	N2/18	FLOOD RISK	
N2A/5.004	N2/19	FLOOD RISK*	
N2A/7.000	N2/20	FLOOD RISK*	
N2A/7.001	N2/21	FLOOD RISK*	
N2A/8.000	N2/22	FLOOD RISK*	
N2A/8.001	N2/23	FLOOD RISK*	
N2A/7.002	N2/24	SURCHARGED*	
N2A/5.005	N2/25	FLOOD RISK*	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2A

PN	US/MH Name	Status	Level Exceeded
N2A/1.005	N2/26	FLOOD RISK*	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2A

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
N2A/1.006	N2/27	180 Winter	30	+39%	1/30 Summer				108.524	0.324	0.000	0.60		30.4

PN	US/MH Name	Status	Level Exceeded
N2A/1.006	N2/27	SURCHARGED*	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Network 3A

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	1	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	16.100	Volumetric Runoff Coeff.	0.750	Min Design Depth for Optimisation (m)	0.600
Ratio R	0.240	PIMP (%)	100	Min Vel for Auto Design only (m/s)	0.75
Maximum Rainfall (mm/hr)	100	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.200		

Designed with Level Soffits

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 3A

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 6 Number of Storage Structures 9 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.100 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.240 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 150.0 DTS Status ON Inertia Status OFF
Analysis Timestep Fine DVD Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 5, 30
Climate Change (%) 39, 39, 39

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
N3A/1.000	N3A/1	15 Winter	1	+39%					112.271	-0.839	0.000	0.00		21.5	OK
N3A/1.001	N3A/2	60 Winter	1	+39%					111.921	-0.299	0.000	0.00		8.8	OK

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 3A

PN	US/MH Name	Level Exceeded
N3A/1.000	N3A/1	
N3A/1.001	N3A/2	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 3A

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
N3A/1.002	N3A/3	240 Winter	1	+39%					110.933	-0.187	0.000	0.00		9.4	OK
N3A/1.003	N3A/4	360 Winter	1	+39%					109.950	-0.170	0.000	0.00		9.9	OK
N3A/1.004	N3A/5	360 Winter	1	+39%					108.827	-0.643	0.000	0.00		9.9	OK
N3A/1.005	N3A/6	360 Winter	1	+39%					108.373	-0.547	0.000	0.02		9.9	OK*
N3A/2.000	N3A/7	15 Winter	1	+39%					112.130	-0.470	0.000	0.00		6.3	OK
N3A/2.001	N3A/8	15 Winter	1	+39%					111.361	-0.459	0.000	0.01		10.7	OK
N3A/2.002	N3A/9	30 Winter	1	+39%	30/15 Winter				110.766	-0.194	0.000	0.01		10.6	OK
N3A/2.003	N3A/10	60 Winter	1	+39%	30/30 Winter				109.108	-0.192	0.000	0.01		8.7	OK
N3A/1.006	N3A/11	60 Winter	1	+39%					108.150	-0.790	0.000	0.02		17.1	OK

PN	US/MH Name	Level Exceeded
N3A/1.002	N3A/3	
N3A/1.003	N3A/4	
N3A/1.004	N3A/5	
N3A/1.005	N3A/6	
N3A/2.000	N3A/7	
N3A/2.001	N3A/8	
N3A/2.002	N3A/9	
N3A/2.003	N3A/10	
N3A/1.006	N3A/11	

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 3A

Simulation Criteria

Areal Reduction Factor	1.000	Manhole Headloss Coeff (Global)	0.500	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Foul Sewage per hectare (l/s)	0.000	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Additional Flow - % of Total Flow	0.000	Flow per Person per Day (l/per/day)	0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 6 Number of Storage Structures 9 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.100 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.240 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 150.0 DTS Status ON Inertia Status OFF
Analysis Timestep Fine DVD Status OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 5, 30
Climate Change (%)	39, 39, 39

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
N3A/1.000	N3A/1	15 Winter	5	+39%					112.287	-0.823	0.000	0.00		32.4	OK
N3A/1.001	N3A/2	120 Winter	5	+39%					112.069	-0.151	0.000	0.00		9.8	OK

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 3A

PN	US/MH Name	Level Exceeded
N3A/1.000	N3A/1	
N3A/1.001	N3A/2	

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 3A

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
N3A/1.002	N3A/3	240 Winter	5	+39%					111.042	-0.078	0.000	0.00		14.4
N3A/1.003	N3A/4	240 Winter	5	+39%					109.985	-0.135	0.000	0.00		18.3
N3A/1.004	N3A/5	360 Winter	5	+39%					109.059	-0.411	0.000	0.00		14.1
N3A/1.005	N3A/6	360 Winter	5	+39%					108.385	-0.535	0.000	0.03		14.1
N3A/2.000	N3A/7	15 Winter	5	+39%					112.138	-0.462	0.000	0.01		9.6
N3A/2.001	N3A/8	15 Winter	5	+39%					111.371	-0.449	0.000	0.01		16.2
N3A/2.002	N3A/9	30 Winter	5	+39%	30/15 Winter				110.869	-0.091	0.000	0.01		13.3
N3A/2.003	N3A/10	60 Winter	5	+39%	30/30 Winter				109.194	-0.106	0.000	0.01		10.0
N3A/1.006	N3A/11	180 Winter	5	+39%					108.161	-0.779	0.000	0.02		20.2

PN	US/MH Name	Status	Level Exceeded
N3A/1.002	N3A/3	FLOOD RISK*	
N3A/1.003	N3A/4	FLOOD RISK*	
N3A/1.004	N3A/5	OK	
N3A/1.005	N3A/6	OK*	
N3A/2.000	N3A/7	OK	
N3A/2.001	N3A/8	OK	
N3A/2.002	N3A/9	FLOOD RISK*	
N3A/2.003	N3A/10	FLOOD RISK*	
N3A/1.006	N3A/11	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 3A

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 6 Number of Storage Structures 9 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.100 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.240 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 150.0 DTS Status ON Inertia Status OFF
Analysis Timestep Fine DVD Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 5, 30
Climate Change (%) 39, 39, 39

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
N3A/1.000	N3A/1	15 Winter	30	+39%					112.303	-0.807	0.000	0.01		39.3	OK
N3A/1.001	N3A/2	60 Winter	30	+39%					112.177	-0.043	0.000	0.00		26.0	FLOOD RISK*

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 3A

PN	US/MH Name	Level Exceeded
N3A/1.000	N3A/1	
N3A/1.001	N3A/2	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 3A

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
N3A/1.002	N3A/3	120 Winter	30	+39%					111.098	-0.022	0.000	0.00		37.5
N3A/1.003	N3A/4	240 Winter	30	+39%					110.088	-0.032	0.000	0.00		32.9
N3A/1.004	N3A/5	240 Winter	30	+39%					109.304	-0.166	0.000	0.00		17.5
N3A/1.005	N3A/6	240 Winter	30	+39%					108.391	-0.529	0.000	0.03		17.5
N3A/2.000	N3A/7	15 Winter	30	+39%					112.147	-0.453	0.000	0.01		14.0
N3A/2.001	N3A/8	15 Winter	30	+39%					111.386	-0.434	0.000	0.02		25.3
N3A/2.002	N3A/9	30 Winter	30	+39%	30/15 Winter				110.926	-0.034	0.000	0.02		30.6
N3A/2.003	N3A/10	30 Winter	30	+39%	30/30 Winter				109.253	-0.047	0.000	0.02		23.2
N3A/1.006	N3A/11	60 Winter	30	+39%					108.200	-0.740	0.000	0.04		32.6

PN	US/MH Name	Status	Level Exceeded
N3A/1.002	N3A/3	FLOOD RISK*	
N3A/1.003	N3A/4	FLOOD RISK*	
N3A/1.004	N3A/5	OK	
N3A/1.005	N3A/6	OK*	
N3A/2.000	N3A/7	OK	
N3A/2.001	N3A/8	OK	
N3A/2.002	N3A/9	FLOOD RISK*	
N3A/2.003	N3A/10	FLOOD RISK*	
N3A/1.006	N3A/11	OK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Network 4A

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	1	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	16.100	Volumetric Runoff Coeff.	0.750	Min Design Depth for Optimisation (m)	0.600
Ratio R	0.240	PIMP (%)	100	Min Vel for Auto Design only (m/s)	0.75
Maximum Rainfall (mm/hr)	100	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.200		

Designed with Level Soffits

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 4A

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 7 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.100 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.240 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 150.0 DTS Status ON Inertia Status OFF
Analysis Timestep Fine DVD Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 5, 30
Climate Change (%) 39, 39, 39

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
N4A/1.000	N4A/1	15 Winter	1	+39%					121.802	-0.888	0.000	0.01		1.0	OK
N4A/1.001	N4A/2	15 Winter	1	+39%					120.262	-0.868	0.000	0.02		7.0	OK

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 4A

PN	US/MH Name	Level Exceeded
N4A/1.000	N4A/1	
N4A/1.001	N4A/2	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 4A

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
N4A/1.002	N4A/3	15 Winter	1	+39%					115.947	-0.863	0.000	0.02		8.8	OK
N4A/2.000	N4A/4	15 Winter	1	+39%					121.481	-0.869	0.000	0.02		4.4	OK
N4A/2.001	N4A/5	15 Winter	1	+39%					120.300	-0.870	0.000	0.01		5.8	OK
N4A/2.002	N4A/6	15 Winter	1	+39%					116.099	-0.871	0.000	0.01		6.0	OK
N4A/2.003	N4A/7	15 Winter	1	+39%					114.483	-0.097	0.000	0.27		6.0	OK
N4A/1.003	N4A/8	15 Winter	1	+39%	30/15 Summer				114.342	-0.078	0.000	0.46		14.4	OK
N4A/1.004	N4A/9	15 Winter	1	+39%					113.963	-0.697	0.000	0.00		25.1	OK
N4A/1.005	N4A/10	15 Winter	1	+39%					112.913	-0.437	0.000	0.00		22.9	OK

PN	US/MH Name	Level Exceeded
N4A/1.002	N4A/3	
N4A/2.000	N4A/4	
N4A/2.001	N4A/5	
N4A/2.002	N4A/6	
N4A/2.003	N4A/7	
N4A/1.003	N4A/8	
N4A/1.004	N4A/9	
N4A/1.005	N4A/10	

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 4A

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 7 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.100 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.240 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 150.0 DTS Status ON Inertia Status OFF
Analysis Timestep Fine DVD Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 5, 30
Climate Change (%) 39, 39, 39

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
N4A/1.000	N4A/1	15 Winter	5	+39%					121.808	-0.882	0.000	0.01		1.5	OK
N4A/1.001	N4A/2	15 Winter	5	+39%					120.271	-0.859	0.000	0.02		10.5	OK

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 4A

PN	US/MH Name	Level Exceeded
N4A/1.000	N4A/1	
N4A/1.001	N4A/2	

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 4A

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
N4A/1.002	N4A/3	15 Winter	5	+39%					115.957	-0.853	0.000	0.03		13.3	OK
N4A/2.000	N4A/4	15 Winter	5	+39%					121.489	-0.861	0.000	0.02		6.7	OK
N4A/2.001	N4A/5	15 Winter	5	+39%					120.308	-0.862	0.000	0.02		8.8	OK
N4A/2.002	N4A/6	15 Winter	5	+39%					116.106	-0.864	0.000	0.02		9.0	OK
N4A/2.003	N4A/7	15 Winter	5	+39%					114.496	-0.084	0.000	0.40		9.1	OK
N4A/1.003	N4A/8	15 Winter	5	+39%	30/15 Summer				114.363	-0.057	0.000	0.70		21.9	OK
N4A/1.004	N4A/9	15 Winter	5	+39%					113.977	-0.683	0.000	0.01		38.3	OK
N4A/1.005	N4A/10	30 Winter	5	+39%					113.087	-0.263	0.000	0.01		30.1	OK

PN	US/MH Name	Level Exceeded
N4A/1.002	N4A/3	
N4A/2.000	N4A/4	
N4A/2.001	N4A/5	
N4A/2.002	N4A/6	
N4A/2.003	N4A/7	
N4A/1.003	N4A/8	
N4A/1.004	N4A/9	
N4A/1.005	N4A/10	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 4A

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 7 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.100 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.240 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 150.0 DTS Status ON Inertia Status OFF
Analysis Timestep Fine DVD Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 5, 30
Climate Change (%) 39, 39, 39

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
N4A/1.000	N4A/1	15 Winter	30	+39%					121.814	-0.876	0.000	0.01		2.2	OK
N4A/1.001	N4A/2	15 Winter	30	+39%					120.289	-0.841	0.000	0.04		18.8	OK

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 4A

PN	US/MH Name	Level Exceeded
N4A/1.000	N4A/1	
N4A/1.001	N4A/2	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 4A

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
N4A/1.002	N4A/3	15 Winter	30	+39%					115.978	-0.832	0.000	0.06		22.8
N4A/2.000	N4A/4	15 Winter	30	+39%					121.499	-0.851	0.000	0.03		9.7
N4A/2.001	N4A/5	15 Winter	30	+39%					120.319	-0.851	0.000	0.03		13.0
N4A/2.002	N4A/6	15 Winter	30	+39%					116.116	-0.854	0.000	0.03		13.4
N4A/2.003	N4A/7	15 Winter	30	+39%					114.549	-0.031	0.000	0.60		13.4
N4A/1.003	N4A/8	15 Winter	30	+39%	30/15 Summer				114.495	0.075	0.000	1.10		34.3
N4A/1.004	N4A/9	15 Winter	30	+39%					113.996	-0.664	0.000	0.01		62.7
N4A/1.005	N4A/10	30 Winter	30	+39%					113.301	-0.049	0.000	0.01		37.2

PN	US/MH Name	Status	Level Exceeded
N4A/1.002	N4A/3	OK	
N4A/2.000	N4A/4	OK	
N4A/2.001	N4A/5	OK	
N4A/2.002	N4A/6	OK	
N4A/2.003	N4A/7	OK	
N4A/1.003	N4A/8	SURCHARGED	
N4A/1.004	N4A/9	OK	
N4A/1.005	N4A/10	FLOOD RISK*	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Network 5A

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	1	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	16.100	Volumetric Runoff Coeff.	0.750	Min Design Depth for Optimisation (m)	0.600
Ratio R	0.240	PIMP (%)	100	Min Vel for Auto Design only (m/s)	0.75
Maximum Rainfall (mm/hr)	100	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.200		

Designed with Level Soffits

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 5A

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.100 Cv (Summer) 0.750
Region England and Wales Ratio R 0.240 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 150.0 DTS Status ON Inertia Status OFF
Analysis Timestep Fine DVD Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 5, 30
Climate Change (%) 39, 39, 39

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
N5A/1.000	N5A/1	15 Winter	1	+39%					123.737	-0.103	0.000	0.21		3.9	OK
N5A/2.000	N5A/2	15 Winter	1	+39%					125.039	-0.111	0.000	0.15		3.6	OK*

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 5A

PN	US/MH Name	Level Exceeded
N5A/1.000	N5A/1	
N5A/2.000	N5A/2	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 5A

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
N5A/2.001	N5A/3	15 Winter	1	+39%	30/15 Summer				123.755	-0.085	0.000	0.37		6.5
N5A/2.002	N5A/4	15 Winter	1	+39%	30/15 Summer				123.008	-0.092	0.000	0.32		6.5
N5A/1.001	N5A/5	15 Winter	1	+39%	5/15 Summer				122.902	-0.068	0.000	0.56		14.0
N5A/1.002	N5A/6	15 Winter	1	+39%	1/15 Summer				122.079	0.179	0.000	0.73		13.1

PN	US/MH Name	Status	Level Exceeded
N5A/2.001	N5A/3	OK	
N5A/2.002	N5A/4	OK	
N5A/1.001	N5A/5	OK	
N5A/1.002	N5A/6	SURCHARGED	

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 5A

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.100 Cv (Summer) 0.750
Region England and Wales Ratio R 0.240 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 150.0 DTS Status ON Inertia Status OFF
Analysis Timestep Fine DVD Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 5, 30
Climate Change (%) 39, 39, 39

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
N5A/1.000	N5A/1	15 Winter	5	+39%					123.753	-0.087	0.000	0.34		6.5	OK
N5A/2.000	N5A/2	15 Winter	5	+39%					125.052	-0.098	0.000	0.25		6.0	OK*

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 5A

PN	US/MH Name	Level Exceeded
N5A/1.000	N5A/1	
N5A/2.000	N5A/2	

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 5A

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
N5A/2.001	N5A/3	15 Winter	5	+39%	30/15 Summer				123.778	-0.062	0.000	0.61		10.9
N5A/2.002	N5A/4	15 Winter	5	+39%	30/15 Summer				123.078	-0.022	0.000	0.52		10.4
N5A/1.001	N5A/5	15 Winter	5	+39%	5/15 Summer				123.048	0.078	0.000	0.82		20.6
N5A/1.002	N5A/6	15 Winter	5	+39%	1/15 Summer				122.422	0.522	0.000	1.05		18.8

PN	US/MH Name	Status	Level Exceeded
N5A/2.001	N5A/3	OK	
N5A/2.002	N5A/4	OK	
N5A/1.001	N5A/5	SURCHARGED	
N5A/1.002	N5A/6	SURCHARGED	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 5A

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.100 Cv (Summer) 0.750
Region England and Wales Ratio R 0.240 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 150.0 DTS Status ON Inertia Status OFF
Analysis Timestep Fine DVD Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 5, 30
Climate Change (%) 39, 39, 39

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
N5A/1.000	N5A/1	15 Winter	30	+39%					123.767	-0.073	0.000	0.49		9.3	OK
N5A/2.000	N5A/2	15 Winter	30	+39%					125.063	-0.087	0.000	0.36		8.6	OK*

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 5A

PN	US/MH Name	Level Exceeded
N5A/1.000	N5A/1	
N5A/2.000	N5A/2	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 5A

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
N5A/2.001	N5A/3	15 Winter	30	+39%	30/15 Summer				123.952	0.112	0.000	0.87		15.4
N5A/2.002	N5A/4	15 Winter	30	+39%	30/15 Summer				123.584	0.484	0.000	0.63		12.8
N5A/1.001	N5A/5	30 Winter	30	+39%	5/15 Summer				123.539	0.569	0.000	0.92		23.1
N5A/1.002	N5A/6	30 Winter	30	+39%	1/15 Summer				122.668	0.768	0.000	1.24		22.2

PN	US/MH Name	Status	Level Exceeded
N5A/2.001	N5A/3	SURCHARGED	
N5A/2.002	N5A/4	SURCHARGED	
N5A/1.001	N5A/5	SURCHARGED	
N5A/1.002	N5A/6	FLOOD RISK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Network 6A

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	1	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	16.100	Volumetric Runoff Coeff.	0.750	Min Design Depth for Optimisation (m)	0.600
Ratio R	0.240	PIMP (%)	100	Min Vel for Auto Design only (m/s)	0.75
Maximum Rainfall (mm/hr)	100	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.200		

Designed with Level Soffits

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 6A

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.100 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.240 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 150.0 DTS Status ON Inertia Status OFF
Analysis Timestep Fine DVD Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 5, 30
Climate Change (%) 39, 39, 39

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
N6A/1.000	N6A/1	15 Winter	1	+39%					128.325	-0.095	0.000	0.28		8.1	OK
N6A/1.001	N6A/2	15 Winter	1	+39%					126.331	-0.089	0.000	0.34		8.2	OK

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 6A

PN	US/MH Name	Level Exceeded
N6A/1.000	N6A/1	
N6A/1.001	N6A/2	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 6A

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
N6A/1.002	N6A/3	15 Winter	1	+39%					126.149	-0.091	0.000	0.32		10.9	OK*
N6A/1.003	N6A/4	15 Winter	1	+39%	1/15 Summer				125.226	0.076	0.000	0.33		10.5	SURCHARGED
N6A/2.000	N6A/5	15 Winter	1	+39%					127.340	-0.140	0.000	0.01		0.4	OK
N6A/2.001	N6A/6	15 Winter	1	+39%					126.383	-0.137	0.000	0.02		0.4	OK
N6A/2.002	N6A/7	15 Winter	1	+39%					126.244	-0.136	0.000	0.02		0.8	OK*
N6A/1.004	N6A/8	15 Winter	1	+39%	1/15 Summer				124.985	0.085	0.000	0.85		10.7	SURCHARGED

PN	US/MH Name	Level Exceeded
N6A/1.002	N6A/3	
N6A/1.003	N6A/4	
N6A/2.000	N6A/5	
N6A/2.001	N6A/6	
N6A/2.002	N6A/7	
N6A/1.004	N6A/8	

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 6A

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.100 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.240 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 150.0 DTS Status ON Inertia Status OFF
Analysis Timestep Fine DVD Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 5, 30
Climate Change (%) 39, 39, 39

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
N6A/1.000	N6A/1	15 Winter	5	+39%					128.340	-0.080	0.000	0.42		12.3	OK
N6A/1.001	N6A/2	15 Winter	5	+39%					126.347	-0.073	0.000	0.52		12.3	OK

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 6A

PN	US/MH Name	Level Exceeded
N6A/1.000	N6A/1	
N6A/1.001	N6A/2	

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 6A

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
N6A/1.002	N6A/3	15 Winter	5	+39%					126.164	-0.076	0.000	0.49		16.5	OK*
N6A/1.003	N6A/4	15 Winter	5	+39%	1/15 Summer				125.484	0.334	0.000	0.44		13.7	SURCHARGED
N6A/2.000	N6A/5	15 Winter	5	+39%					127.344	-0.136	0.000	0.02		0.6	OK
N6A/2.001	N6A/6	15 Winter	5	+39%					126.386	-0.134	0.000	0.03		0.6	OK
N6A/2.002	N6A/7	15 Winter	5	+39%					126.247	-0.133	0.000	0.03		1.1	OK*
N6A/1.004	N6A/8	15 Winter	5	+39%	1/15 Summer				125.177	0.277	0.000	1.10		13.8	SURCHARGED

PN	US/MH Name	Level Exceeded
N6A/1.002	N6A/3	
N6A/1.003	N6A/4	
N6A/2.000	N6A/5	
N6A/2.001	N6A/6	
N6A/2.002	N6A/7	
N6A/1.004	N6A/8	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 6A

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.100 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.240 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 150.0 DTS Status ON Inertia Status OFF
Analysis Timestep Fine DVD Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 5, 30
Climate Change (%) 39, 39, 39

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
N6A/1.000	N6A/1	15 Winter	30	+39%					128.358	-0.062	0.000	0.62		18.0	OK
N6A/1.001	N6A/2	15 Winter	30	+39%					126.398	-0.022	0.000	0.75		18.0	OK

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 6A

PN	US/MH Name	Level Exceeded
N6A/1.000	N6A/1	
N6A/1.001	N6A/2	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 6A

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
N6A/1.002	N6A/3	15 Winter	30	+39%					126.240	0.000	0.000	0.71		23.9
N6A/1.003	N6A/4	15 Winter	30	+39%	1/15 Summer				125.982	0.832	0.000	0.57		17.9
N6A/2.000	N6A/5	15 Winter	30	+39%					127.347	-0.133	0.000	0.03		0.8
N6A/2.001	N6A/6	15 Winter	30	+39%					126.389	-0.131	0.000	0.04		0.8
N6A/2.002	N6A/7	15 Winter	30	+39%					126.252	-0.128	0.000	0.05		1.9
N6A/1.004	N6A/8	15 Winter	30	+39%	1/15 Summer				125.429	0.529	0.000	1.46		18.3

PN	US/MH Name	Status	Level Exceeded
N6A/1.002	N6A/3	SURCHARGED*	
N6A/1.003	N6A/4	FLOOD RISK	
N6A/2.000	N6A/5	OK	
N6A/2.001	N6A/6	OK	
N6A/2.002	N6A/7	OK*	
N6A/1.004	N6A/8	SURCHARGED	

110
Queen Street
Glasgow
G1 3BX

wsp.com