LT521 Bingally 400kV Substation

Drainage Impact Assessment: Substation Platform

BING4-LT521-SEBAM-DRAI-ZZ-RPT-C-0002

Scottish & Southern Electricity Networks
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1.0 INTRODUCTION

1.1 General

1.1.1 Fairhurst have been appointed by Siemens Energy BAM Joint Venture (SEBAM) to prepare a Drainage Impact Assessment (DIA) to assess the development of the proposed Bingally 400kV Substation in the Scottish Highlands.

1.1.2 This report will assess potential impacts of existing watercourse / channels and their required realignments, surface water drainage and foul water drainage across the site. This report also considers any relevant information from the drainage strategy report compiled for the proposed substation at Bingally.

1.1.3 For the Drainage Strategy report see document no. BING-LT521-SEBAM-DRAI-ZZ-RPT-C-0001.

1.1.4 The site is part of Scottish and Southern Electricity Networks (SSEN) £7bn upgrade of their onshore electricity transmission infrastructure.

1.1.5 The development forms part of a proposed 400kV upgrade from the existing 275kV network between Beauly and Denny. The proposed substation at Bingally forms part of this network route.

1.1.6 This DIA has been compiled to outline the potential impacts for the substation platform to support the planning application for the proposed electrical substation at Bingally. An addendum to this report will be provided at a later date which will include the DIA for the access track to the substation platform.

1.1.7 While this report takes into account relevant information from ground investigation reports and flood risk assessments, these reports will be issued separately to the client.

1.1.8 This DIA covers the drainage system designed by Fairhurst only. Paterson Reeves & Partners (PRP) are responsible for substation platform drainage design inside the substation platform fenceline.

1.2 Site Location

1.2.1 The proposed Bingally substation site is situated approximately 2.5km South of the village of Tomich. The site access is via a proposed 9.5 km long access track off the A831, 1.5km east of the town of Cannich within the Highland Council Area. A plan of the location of the proposed development in relation to the local area is provided in *Figure 1*.

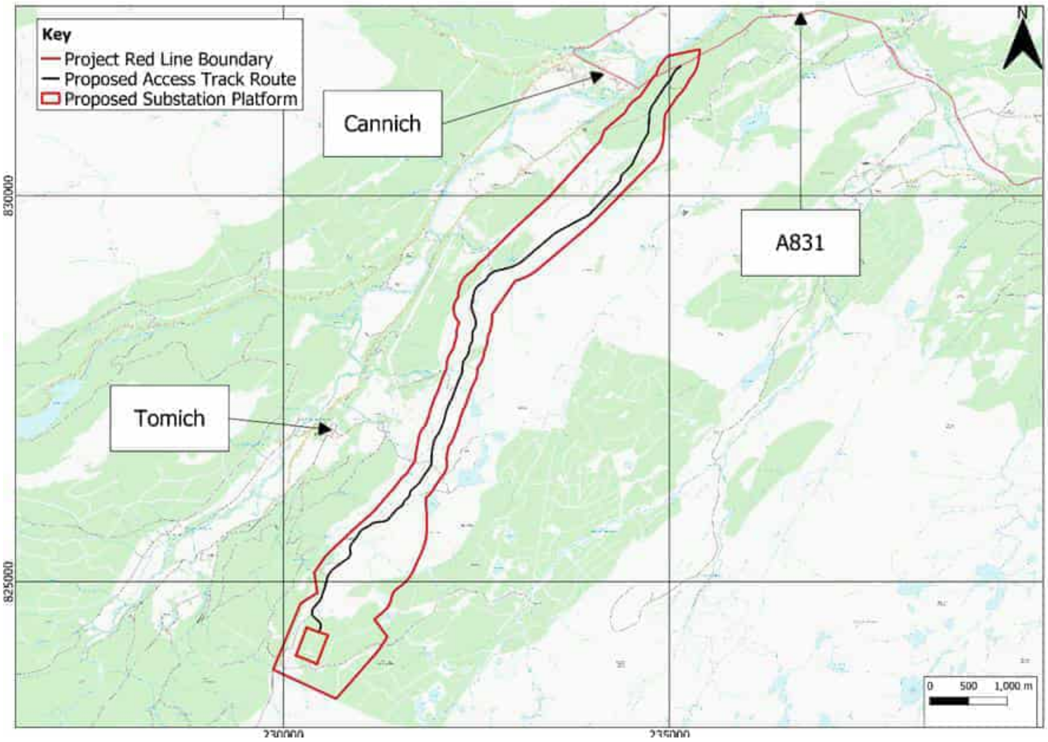

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Figure 1: Indicative Site Location

1.2.2 The site area within the red line boundary is approximately 619 Ha. The proposed substation platform covers an area of approximately 11.6 Ha. The remainder of the site is allocated to material storage and a new forestry access track. Refer to proposed site layout drawing BING4-LT521-SEBAM-ZZ-ZZ-D-C-0131 in **Appendix 1** for details of the proposed platform and surrounding site arrangements.

1.3 Design Considerations

1.3.1 The DIA has been prepared to define the scheme for the site with regards to the proposed drainage channel realignments, surface water and foul water drainage. The assessment will consider overall drainage impacts for the proposed substation platform.

1.3.2 The DIA will assess the surface water run-off and any foul water from the proposed site. This report will also highlight and detail the management of existing ground water and temporary drainage during the construction, and the maintenance of the completed network. The drainage has been prepared to the requirements and recommendations of the following documents:

- SEPA Water Assessment and Drainage Assessment Guide
- The Highland Council - Flood Risk and drainage Impact Assessment: Supplementary Guidance
- CIRIA – SuDS Manual C753
- SSEN Earthworks Specification SP-NET-CIV-501
- SSEN Drainage Specification SP-NET-CIV-502
- Sewers for Scotland v4.0 (note this document was considered as a reference for design although not applicable as the drainage will not be vested by Scottish Water)

1.3.3 Further to the above documentation the DIA also relies on information provided in the Drainage Strategy.

2.0 EXISTING SITE DESCRIPTION

2.1 Existing Site Description

2.1.1 The current site is located in an area of moor and woodland with areas of boggy land and peat. In June 2023 a wildfire burned through an estimated 80km² of the surrounding area. This resulted in a large section of woodland being burned down or the charred remains being felled. The remnants of the fire can still be seen on site as scorched earth and burnt wooden embers.

2.1.2 The existing access to the proposed substation area is via forestry tracks originating from the village of Tomich. Several tracks lead to either the north or the south side of the proposed substation area.

2.1.3 Multiple unbound access tracks are situated throughout the red line boundary of the overall site, extending in numerous different directions. However, currently there are no uninterrupted access provisions to the proposed substation site from the A831.

2.1.4 There are no existing residential dwellings or farm buildings within the site boundary.

2.1.5 An existing site layout plan can be seen in drawing BING4-LT521-SEBAM-DRAI-ZZ-D-C-0198 in **Appendix 2**.

2.2 Site Topography

2.2.1 The topography around the substation within the redline boundary varies in direction and gradient. The existing ground levels range from approximately 333mAOD to the east of the site to approximately 264mAOD at the north west of the platform/layout areas. There is an area to the south of the proposed substation platform that falls to approximately 306mAOD.

2.3 Ground Conditions

2.3.1 Ground investigation information has been taken from the *Fairhurst – Geo-environmental Desk Study Report* (Doc no. BING4-LT521-SEBAM-ZZ-ZZ-RPT-G-0001). The present site is a mixture of woodland area, boggy land, numerous watercourses, peat, and rock.

Peat

2.3.2 Peat can be found over a large percentage of the proposed site. Recent ground investigations have shown that the peat reaches thicknesses of up to 7m at the North West area of the site. Further investigation is required but, it is likely that the peat areas will require some removal and replacement with suitable fill below structures.

2.3.3 Areas where peat does not require removal should be left in-tact. Due to the possibility of removal leading to the release carbon into the atmosphere, peat should only be removed if there are no suitable alternatives.

Groundwater

2.3.4 Groundwater is present at shallow levels on site. Borehole investigation show groundwater levels ranging from 0.10mbgl to 3.20mbgl. The groundwater is also usually encountered below areas of peat. Due to the shallow depths of the groundwater, careful management will be required during the construction phase (particularly with any excavations) with long term management plans required for the post-construction phase.

2.4 Flood Risk

2.4.1 A review of *SEPA Flood Maps* shows no fluvial flood risk within the location of the proposed substation development. The Flood Maps also show some discreet areas likely to experience minor surface water (pluvial) flooding.

2.4.2 A Flood Risk Assessment (FRA) shall be undertaken for the scheme, which shall provide full details of the flood risk across the site, and the corresponding impact.

2.5 Utilities

2.5.1 There are no private water supplies or foul water systems located at the proposed substation site, within the proposed substation platform boundary. It is also assumed that any underground cables associated with the transmission line will run in parallel with the transmission overhead structures.

2.5.2 A proposed electrical and fibre optic cable will be buried below the proposed access track from Fasnakyle Electricity Distribution Station. Construction of this utility will be managed by the project manager and construction manager. *Figure 2* below shows the pathway of the transmission overhead line and its location within the proposed platform area.

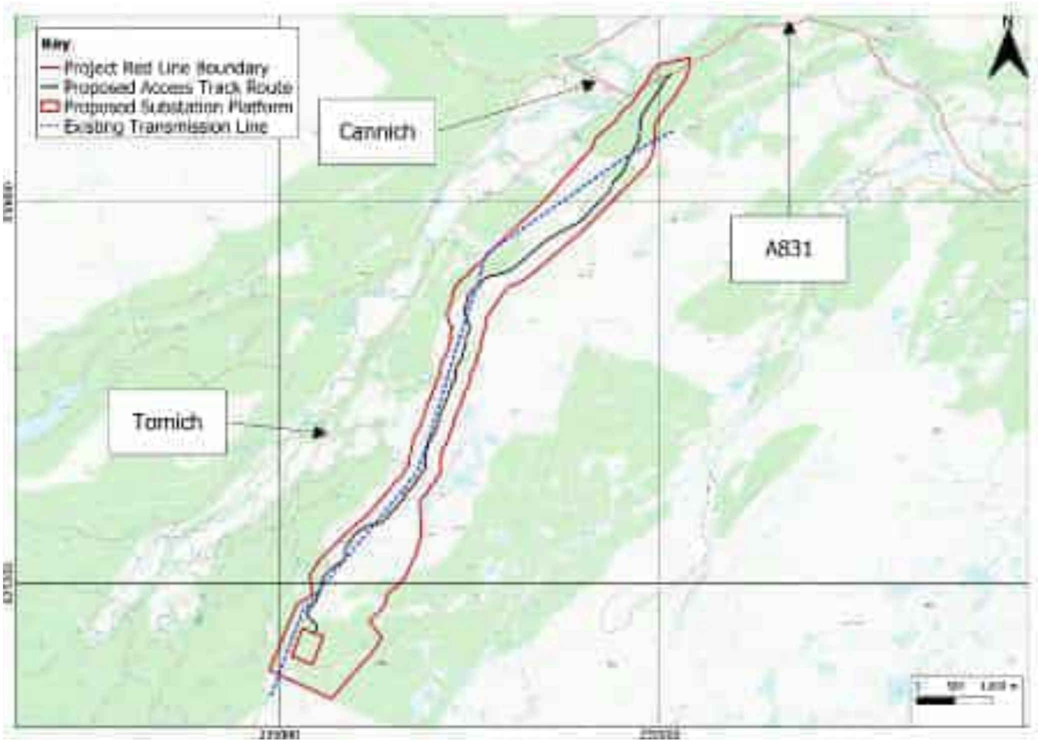

Figure 2: Plan of Existing Transmission Line

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2.5.3 During both the planning and construction phases, the proximity of the overhead lines to the platform must be taken into consideration. *Health and Safety Executive guidance note G56: Avoiding danger from overhead power lines* must be followed during the planning and construction phases.

3.0 EXISTING WATERCOURSES AND DRAINAGE FEATURES

3.1 Watercourses

3.1.1 Although there are several watercourses and small tributary channels present within the red line boundary of the site, no channels are directly affected by the proposed substation platform layout in terms of realignment or diversion design. A tributary channel to the Allt an Rathain located adjacent to the substation, on the south west side is affected by a realignment of the forestry access track. Similarly, a tributary of the Allt a' Bhuachaille is located to the north of the substation, and is proposed to accommodate drainage outfalls.

3.1.2 Refer to **Appendix 2** for details on existing tributaries near the proposed substation platform.

3.1.3 Due to the extensive area and numerous informal surface water drainage channels in the region, there may be further drainage paths within the platform area which have not been identified using OS maps or visual inspection (It should be noted that a range of tributaries are not visible on the 1:50,000 scale OS maps). A detailed investigation of the site is required prior to detailed design.

3.1.4 Several existing watercourses and tributaries are impacted by the substation access track, but are discussed in *BING4-LT521-SEBAM-DRAI-ZZ-RPT-C-0005 Drainage Impact Assessment: Access Track*.

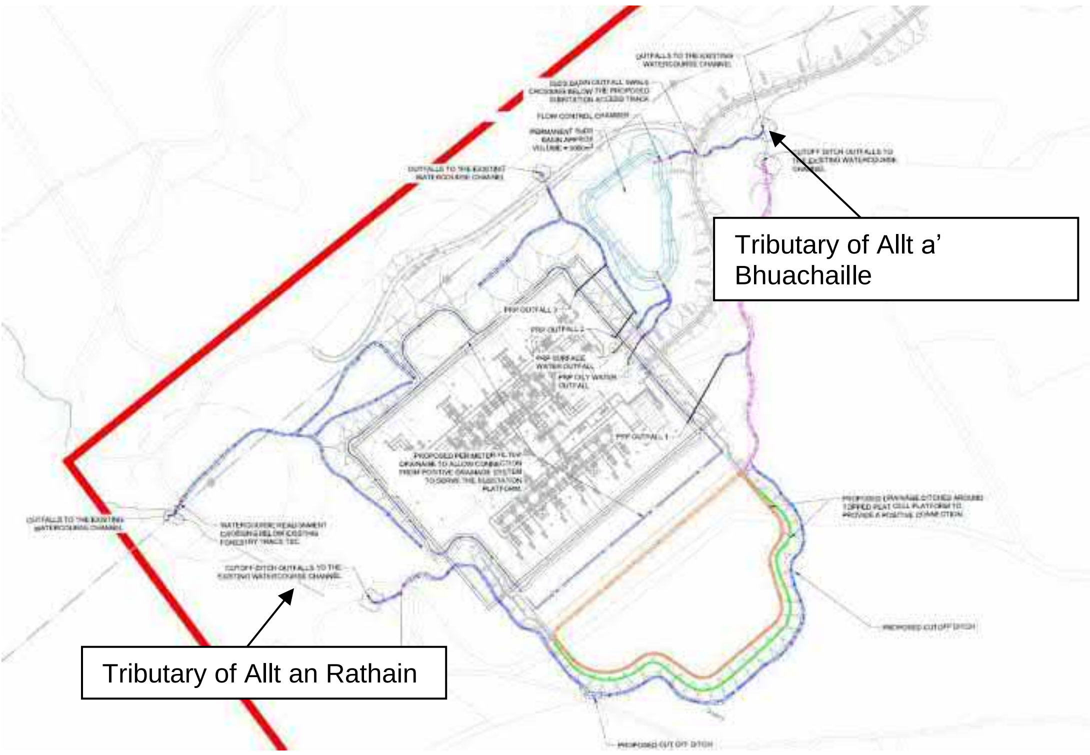


Figure 3: Location of tributary of Allt an Rathain and Allt a' Bhuachaille

3.2 Drainage Features

3.2.1 Throughout the site there are numerous visible land ditches, and are naturally formed. These ditches have been piped below the existing forestry tracks on their natural route. Outfalls from these ditches could not be located whilst on site.

3.2.2 Due to the extensiveness of the site, further investigation would be required to confirm the location and details of all culverts on site prior to detailed design.

4.0 PROPOSED DEVELOPMENT

4.1 Proposed Substation Platform

4.1.1 To upgrade the existing Beauly to Denny overhead line from 275kV to 400kV, additional substations are required for the line to be able to connect to the upgraded circuit. This includes the proposed Bingally 400kV substation.

4.1.2 The proposed Bingally 400kV substation development consists of a platform of approximately 11.6ha area which will sit at a formation level of 323mAOD with a finished platform level of 324mAOD. The 11.6ha area does not include engineered slopes.

4.1.3 The proposed drainage arrangement for the Bingally substation is shown below in *Figure 4***.**

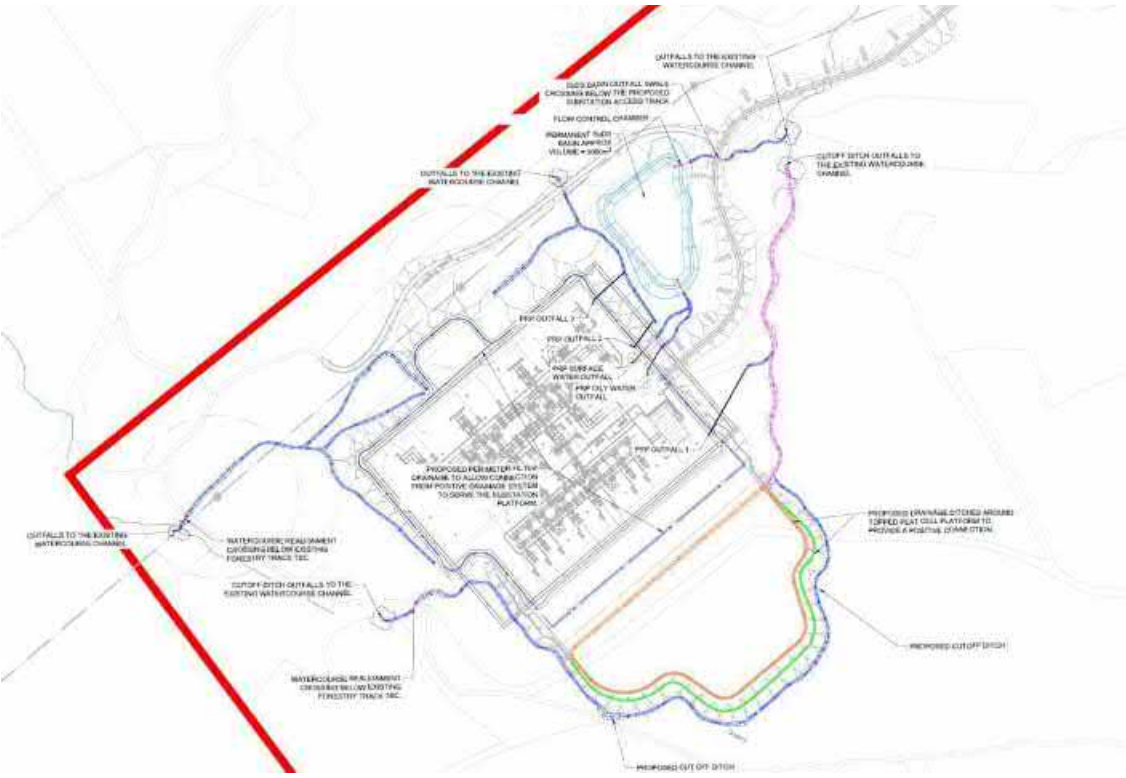


Figure 4: Bingally 400kV Proposed Substation Layout

4.1.4 The proposed substation platform shall be formed of a build-up of a minimum of 1m crushed rock and will be predominantly free draining material, acting as a drainage blanket. This makes up part of the PRP drainage philosophy, who are the designers of the drainage inside the fenceline of the substation platform.

4.1.5 The substation will contain of several buildings and hardstanding areas which will be impermeable. It is assumed that the PRP substation platform drainage design includes remediation measures for any oil that may contaminate run-off.

4.1.6 The drainage for the area within the fenceline of the substation platform will be designed by Patterson Reeves & Partners (PRP). This can be found, along with their associated drainage philosophy, in **Appendix 3**.

4.2 Proposed Access Tracks

4.2.1 The substation will be accessed from the A831 prior to the village of Cannich. The main substation access track will be approximately 9500m in length to the substation.

4.2.2 Access tracks within the proposed substation layout will be provided for maintenance of proposed SuDS basins and other SuDS features.

4.2.3 It is assumed that access tracks where the gradient exceeds 8% will have a sealed surface, in accordance with SSE Specification. Gradients < 8% will have an unsealed surface. SSEN specifications state that unbound material type 2 sub-base is used. This will be confirmed by the contractor.

4.2.4 SuDS access tracks will be unsealed unless stated otherwise by the contractor.

4.2.5 As addendum to this report will be provided to detail the Bingally Substation access track design.

5.0 PROPOSED DRAINAGE: STRATEGY

5.1 Drainage Principles

5.1.1 The principles of the drainage impact assessment for Bingally will be to replicate the existing quality and quantities of run-off presently at the site wherever it is reasonable and practical to do so. Post development run-off shall also be dispersed in accordance with:

- CIRIA C753 – SuDS Manual,
- The Highland Council guidelines (THC),
- SEPA guidelines, and
- SSEN Specifications (SSEN Drainage Specifications: Document SP-NET-CIV-502).

5.2 Design Philosophy

5.2.1 In addition to complying with SSEN drainage specification and Local Authority guidelines, the proposed surface water design has been developed in accordance with the principles outlined in CIRIA: The SuDS Manual C753, as far as practicable. The manual states:

- Wherever possible, run-off should be managed at source (i.e. close to where the rain falls) with residual flows then conveyed downstream to further storage or treatment components where required.
- The passage of water between individual components should be through the use of above ground conveyance systems (e.g. swales and rills).
- Pipework may be a more suitable option depending on the specific scheme, especially where space is limited.
- Pre-treatment (the removal of litter and sediment) and maintenance are vital to ensure the long-term and sustained effectiveness of all SuDS components.
- Overland flow routes may also be required to convey and control floodwater safely during extreme events.

5.2.2 All drainage generated within the site will be drained using Sustainable Drainage Systems (SuDS) principles and will be adhered to during the design with the following:

- Natural run-off collection and diversion (where required);
- Platform surface water run-off drainage collection and routing; and
- SuDS basins, cut-off drains & ditches for treatment and attenuation.

5.3 Design Assumptions

5.3.1 Fairhurst have received instruction from SSEN to assume the substation platform as 100% impermeable, for the purposes of the drainage design. Further assumptions include:

- The Substation surface run-off will be collected via filter drain within the platform;
- Global Entry time to drainage features for the substation platform is set at 90 minutes.
- All oily water or water requiring specific treatment due to operations within the substation platform fence line shall be treated sufficiently inside the fence line as part of the PRP drainage design. The run-off shall then connect to the proposed

Fairhurst designed SuDS drainage outside of the substation platform fence line for attenuation purposes;

- All surface water run-off from hard standing surfaces within the substation platform fence line will discharge to the SuDS drainage outside of the fence line, and tie-in points shall be coordinated between PRP and Fairhurst;
- PRP will discharge to two separate locations from the substation platform:
  - No. 1 to the north of the platform;
  - No. 2 to the south of the platform.

5.4 Design Parameters

5.4.1 SSEN drainage specification document SP-NET-CIV-502, states the following parameters are to be considered during design as a minimum:

- *1 in 200 year rainfall period protection for operational areas*
- *1 in 1000 year rainfall return period protection for critical equipment*
- *1 in 200 year rainfall return period for off-site flooding"*

5.4.2 SSEN specifications state that both the platform and access road should be considered operational areas.

5.4.3 The Highland Council flood risk and drainage guidance states that "formal on-site storage should be provided up to the 1 in 30-year return period event and attenuation measures should be designed such that SuDS features will not surcharge during a 30-year return period rainfall event." However, the drainage design has accommodated on-site storage of up to and including the 1 in 200-year return period storm with a discharge rate equivalent to the 1 in 2-year return period, to accommodate SSEN Specifications.

5.4.4 Climate Change (CC) allowances have been included when considering the proposed surface water drainage design within the development site. The *SEPA climate change allowances for flood risk assessment in land use planning, version 4, Table 2* recommends a 42% uplift for rainfall data for the North Highland basin region where Bingally is located. This climate change allowance shall be considered during surface water drainage design as required by SEPA guidelines.

5.4.5 Modelling of the drainage features has been analysed by using FEH 22 rainfall data for storm events from the 1 in 2-year storm event up to the 1 in 200-year return period, including an allowance for climate change.

5.5 Drainage Outfall

5.5.1 The options available for discharging surface water are recommended by *CIRIA: The SuDS Manual C753* hierarchy. The hierarchy with relevant site considerations are summarised in **Table 1** below:

Table 1: CIRIA: The SuDS Manual C753 Outfall Heirarchy

Outfall Method	Suitability	Comments
Infiltrate run-off back into the ground.	Suitability is not known at this time as no infiltration test have been completed.	Conclusive infiltration tests are required prior to confirming if this option is available at the Bingally development site.
Discharge run-off to watercourse	There are a number of watercourses located across the site. Based on the proposed surface water design and development levels, outfalls can be achieved to nearby watercourses following suitable approvals.	A number of outfalls may be required to allow for this option, along with confirmation of levels detailed design stages.
Discharge run-off to surface or combined sewers.	There are no known Scottish Water sewers at the site location so there could be no discharge to a sewer network.	Not feasible.
Discharge run-off into existing water features such as ponds.	Further investigations and agreements would be required to consider this outfall option.	Not feasible.

6.0 PROPOSED DRAINAGE: PLATFORM

6.1.1 The drainage of the substation platform has been designed by PRP. Information provided in the PRP drainage philosophy shows the platform to be constructed with a 1m free-draining granular material to provide infiltration through the platform, acting as a drainage blanket. It has been assumed this will be positively drained to the proposed surface water drainage design outside of the substation fence line.

6.1.2 Flows from the run-off from proposed building roofs and pumped flows from the bunds and tanker standing areas are positively drained into pipework which are sized to prevent any surface flooding during a 1 in 1000-year return period storm. The philosophy of the surface water drainage strategy is to replicate the equivalent Greenfield run-off rates.

6.1.3 Foul drains associated with oily water within the substation platform have positive drainage to a Klargester treatment plant to be fitted with a remote monitoring early fault detection system. Oily water will discharge in to the external drainage network once fully treated.

6.1.4 Further information can be found on the drainage drawing provided by PRP, and can be referred to in **Appendix 3**.

6.1.5 Calculations have been carried out by Fairhurst to estimate the attenuated volume of surface water run-off from the platform to the maximum allowable discharge rate. This has been coordinated with flow information provided by PRP for the platform. Following completion of geotechnical assessment across the site, the final volumes will be determined during the detailed design stage.

7.0 PROPOSED DRAINAGE: SuDS & ATTENUATION

7.1 Simple Index Analysis (SIA) Tool

7.1.1 All proposed SuDS schemes are designed in compliance with *CIRIA C753, The SuDS Manual (2015)*. The *Simple Index Analysis (SIA) Tool* has been developed by SEPA to assess the suitability of proposed SuDS components at a development and to minimise any risks to the water quality of any receiving waterbodies.

7.1.2 Outputs from the SIA study for each area are detailed below for the substation platform.

7.1.3 It is assumed that PRP are providing all required treatment of the substation platform site operations, including for any required specialist treatments. For example, oily water treatment shall be designed and contained within the substation platform by others (PRP). Therefore, it is assumed Fairhurst will provide suitable treatment for both low trafficked roads, and simple industrial roofing.

7.1.4 As detailed in *Section 6*, Information provided by PRP drainage philosophy shows the platform is to be constructed with a 1m free-draining granular material to provide infiltration through the platform and will act as a drainage blanket. This has been included to the SIA tool as a filter drain for design purposes.

Table 2: SIA Tool Summary Table - Platform (Roads)

Run-off area land-use description	Platform: Low Trafficked Roads			
Pollution hazard indices:	Hazard Level	Suspended Solids	Metals	Hydrocarbons
	Low	0.5	0.4	0.4
Pollution mitigation indices (SuDS basin):		0.5	0.5	0.6
Pollution mitigation indices (Filter drain):		0.4	0.4	0.4
Total mitigation Index:		0.9	0.9	1.0
Sufficiency:		Sufficient	Sufficient	Sufficient

Table 3: SIA Tool Summary Table - Platform (Roofs)

Run-off area land-use description	Platform: Commercial / Industrial Roofing (High Potential for Metal Leaching Assumed)			
Pollution hazard indices:	Hazard Level	Suspended Solids	Metals	Hydrocarbons
	Low	0.3	0.8	0.05
Pollution mitigation indices (SuDS basin):		0.5	0.5	0.6
Pollution mitigation indices (Filter drain):		0.4	0.4	0.4
Total mitigation Index:		0.9	0.9	1.0
Sufficiency:		Sufficient	Sufficient	Sufficient

7.1.5 Both *Table 2* and *Table 3* above show that sufficient treatment has been proposed for the substation platform based on the SEPA – Pollution Mitigation Index Tool.

7.2 Discharge Rates

7.2.1 Discharge rates for the proposed permanent drainage design have been calculated. Both IH 124 and the FEH methods have been determined, with the most conservative rate having been used in the design modelling. It is recommended to use the IH124 method for catchment areas less than 200Ha, with 200Ha and above should use the FEH method. Where both are used for catchment areas less than 50Ha each method is to be interpolated. It should also be noted that the preferred method in the Council guidance is IH 124. The interpolated results can be seen in the *Table 4* below.

Return Period	Calculation Method			
	IH 124		**FEH**	
	Run-off (l/s)		Run-off (l/s)	
	11.5 ha	5.75 ha	11.5 ha	5.75 ha
2	**113**	**59.8**	222.5	111.2

Table 4: Greenfield Discharge Rates

7.2.2 The most conservative discharge rates for both the SuDS basins have been calculated using the IH124 method, allowing a discharge rate of 59.8 l/s from the site. It should be noted that the total impermeable site area covers approximately 11.5 ha, but due to existing catchments, only 5.75ha was considered when determining the discharge rate. This rate will be achieved through the inclusion of a vortex control chamber downstream of the basin. This is equivalent to the pre-development Greenfield run-off rate from the substation platform area for the 1 in 2-year flood event for the catchment to Allt a' Bhuachaille.

7.2.3 Greenfield calculations can be found in **Appendix 4.**

7.3 Attenuation

7.3.1 The proposed substation site surface water run-off will be gathered by perimeter drainage around the substation platform. This run-off will then be carried to the proposed

Sustainable Drainage Systems (SuDS) basins, where it will be treated and attenuated, and finally discharged at the required discharge rate into nearby existing water channels.

7.3.2 Following the guidelines and assumptions outlined in *Section 5*, source control calculations using MicroDrainage software have been produced to estimate the total storage volume required for attenuating the surface water run-off from the proposed substation platform. The attenuation has been designed to store rainfall events up to and including the 1 in 200-year return period event plus an allowance for climate change for the catchment area of the platform, and discharge to a 1 in 2-year Greenfield run-off rate. This conservative approach has been used to ensure suitable storage extents across the site to ensure each storm event is adequately attenuated to its corresponding Greenfield run-off rate within the site red line boundary. The catchment area of the platform has been determined using the FEH 22-point data, which provides an accurate Standard Average Annual Rainfall (SAAR) value.

7.3.3 Source Control estimations can be seen in **Appendix 5**.

7.3.4 A Sustainable Drainage Systems (SuDS) basin is proposed on the site. Calculations have shown that a storage volume of approximately 8000m³ is required for the SuDS basin.

7.3.5 The drainage design has been further evaluated by producing an initial drainage model in Causeway Flow. This has been used to validate the proposed arrangement and storage requirements, whilst accommodating flow and level information from the substation platform as best as possible from the PRP drainage design. The summary and results can be found in **Appendix 6**.

7.4 Basin Design

7.4.1 The SuDS basins have been designed following guidance from *CIRIA The SuDS Manual (C753)*. Basins have been designed to provide a total depth of 2.0m. This includes a 0.3m freeboard allowance and a maximum 1.7m water depth for the 1 in 200-year plus climate change storm event. The basin design includes proposed side slopes of 1 in 4 (25°).

7.4.2 A proposed minimum 3.5m access track for the purposes of maintenance has been designed, which is in accordance with Sewers for Scotland v4.0. It should be noted this has been referenced as best practice, although the SuDS elements are not adoptable and will not be vested by Scottish Water. Further cutting and fill will be required to tie back in to the natural topography of the surrounding landscape. 1 in 3 slopes have been proposed for these earthworks' requirements, but further coordination with regards to geotechnical requirements are necessary.

7.4.3 The proposed permanent drainage and SuDS arrangement can be seen in **Appendix 7**.

7.5 Cut-Off Ditches

7.5.1 Cut-off ditches have been designed to allow for the management of the overland flows at the top of the substations cut slope using the same philosophy as the above channel realignment. Ditches will be designed in line with the natural topography of the site providing channel capacity for up to and including the 1 in 200-year return period rainfall event. As the catchment is natural run-off it is proposed to discharge directly into the existing channels on site.

8.0 DRAINAGE IMPACT: TEMPORARY DRAINAGE

8.1 Temporary Platform Drainage

8.1.1 Temporary drainage at the platform area has been design to collect and control run-off during the construction phase. This also includes the control of temporary 'laydown areas' required during the construction phase.

8.1.2 *The proposed temporary drainage network consists of:*

- Conveyance ditches around the substation platform and temporary laydown areas. These have been designed to collect any run-off from laydown areas. Run-off will then disperse to settlement lagoons (location to be determined) prior to discharging to the existing watercourse.
- Temporary piped crossings under temporary access tracks as required.
- Temporary settlement lagoons (location to be determined) to remove silts and suspended solids prior to discharge to the receiving watercourses.

8.1.3 The location of the proposed settlement lagoons will be determined during detailed design prior to the commencement of works. These will be in accordance with *CIRIA C648 & C649 – Control of water pollution from linear construction projects*, to provide the required settlement volume and discharge rate for the construction works suspended solid run-off for up to the 1 in 10-year storm. The guide allows for adjustments to this design event taking into account the nature of the risk and the duration of the construction activity. An assessment has been undertaken considering the worst-case scenario in the guidance of a 1 in 10-year event to establish temporary treatment volumes required, for the duration of the construction activities. To further accommodate SSEN requirements, the temporary drainage design has been sized up to a 1 in 20-year storm event, with a further check against the 1 in 30-year storm event.

8.1.4 The sizing of the temporary settlement lagoons will be based on the following assumptions:

- Conveyance ditches around the temporary laydown areas contributing to run-off of surface water that requires treatment;
- All surface water run-off requires treatment before discharge;
- No climate change allowance has been included;
- Run-off is collected in each catchment and directed towards a single location before discharge;
- All run-off is to be stored for approximately 6-10 hours to allow settlement for assumed fine silts. Note this will require confirmation from the geotechnical team upon further site inspections and design, and may require reassessed based on the final detailed design arrangement.

8.1.5 The temporary lagoon areas are required to store the surface water run-off volume. The location of the proposed settlement lagoons will be determined during detailed design prior to the commencement of works.

8.1.6 In addition to the volumes of storage quoted above, allowance in the overall pond volume is required for freeboard, and to accommodate local topography.

8.1.7 The discharge rates for the temporary drainage design will be determined using *CIRIA C648 – Table 19.2*, which provides a suitable time for settlement based on the required run-off area and volume for each temporary laydown area. See *Figure 5* below for details on particle settling velocities for various soil types. The discharge rates for the temporary lagoons will vary depending on the corresponding laydown area is it attenuating. This will be confirmed at detailed design prior to the commencement of works.

Solid type	mm/sec	m/hr*[1]		Proposed Typical pond/ tank depth (m)
Fine Clay	0.001	0.0036		0.5
Fine Silt	0.02	0.072		1
Medium silt	0.05	0.18		1.5
Course Sand	30	108		2
Flocculated Silt	10	36		2.5

Figure 5: Extract from CIRIA C648, Table 19.2. Particle settling velocities for soil type.

8.1.8 The proposed temporary drainage arrangement drawing can be seen in **Appendix 7**.

9.0 DRAINAGE IMPACT: GROUNDWATER

9.1.1 SEPA flood maps indicate areas where groundwater could influence the duration and extent of flooding from other sources. The proposed site is situated out with groundwater influenced flood extent shown on these maps apart from at the northern end of the proposed track where it approaches the A831.

9.1.2 The 1:50,000 British Geological Society (BGS) digital mapping shows that the substation site is underlain by sedimentary bedrock, comprising the Tarvie Psammite Formation. The BGS 1:625,000 hydrogeology map classifies this as a low productivity aquifer with small amounts of flow occurring predominantly through near surface fractures and discontinuities.

9.1.3 The BGS identifies that superficial deposits across the site, where present, are predominantly Glacial Till. Glacial Till is more prevalent in the southern half of the site. Overlying both bedrock and Glacial Till are pockets and areas of Peat.

9.1.4 Please refer to Geo-Environmental Report No. BING4-LT521-SEBAM-ZZ-ZZ-RPT-G-0001 for details on potential for groundwater flooding.

9.1.5 Considerations for groundwater as part of the surface water drainage design are to be finalised upon completion of ground investigations on site. An indicative groundwater seepage rate has been incorporated into the drainage model to consider potential seepage from the cut slope at the platform, but will be finalised at detailed design.

9.2 Design Considerations

9.2.1 Groundwater has been observed to be shallow at the proposed substation site and throughout the site. Due to the shallow groundwater depths and overland flows cut-off ditches have been designed for careful management and to ensure excavation stability during construction and for the permanent design e.g., culvert operation, slope stability and any groundwater changes which may cause flooding or dewatering of localised peat.

10.0 DRAINAGE IMPACT: FOUL WATER MANAGEMENT

10.1.1 Foul water drainage management within the substation platform has been designed by PRP. Refer to drawing BING4-LT521-SEBAM-DRAI-XX-LAY-C-0001 in **Appendix 3**. PRP design philosophy references the foul design shall comply with *Sewers for Scotland v4.0*. However, it should be noted that the foul drainage within the site does not connect to multiple dwellings and will not be adopted by Scottish Water. The PRP drainage philosophy also states that foul drains are to be 100mm diameter and will drain by gravity to a KLARGESTER BA BIODISC 750 package treatment plant.

10.1.2 During construction the office and welfare facilities will be connected to a septic tank to separate the foul sediment and the waste from other facilities. Before the waste water can be discharged to the existing water environment it will require to be treated sufficiently via infiltration systems. Coordination with PRP is required to finalise this proposal.

10.1.3 Septic tanks and infiltration systems are to be sized based on calculations from the *Code of Practice British Flow and Loads – 4* guidance. To assess the requirements for the proposed foul water system details (for both the temporary and permanent conditions), coordination with PRP and the contractor at later stages is required.

11.0 MAINTENANCE SCHEDULE

All surface water drainage features will require regular maintenance to ensure the features can maintain their drainage capabilities. The frequency of a maintenance schedule varies depending on the feature and can become less regular over time again, depending on the feature type. The SuDS Manual (C753) provides recommended maintenance requirements, which is summarised below.

11.1 Swales/Ditches

Table 4: Maintenance Schedule, Swales/ Ditches, The SuDS Manual (C753)

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Inspect inlets/outlets and overflows for blockages and clear if required	Monthly
	Litter and debris removal	Monthly/as required
	Grass cutting – to retain grass height within specified design range.	Monthly (during growing season) or as required
	Manage other vegetation and remove nuisance plants	Monthly at start then as required
	Inspect infiltration surfaces for ponding, compaction & silt accumulation. Record areas where ponding occurs for >48 hours.	Monthly/as required
	Inspect vegetation coverage	Monthly for 6 months then quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies	Bi-annually
Occasional Maintenance	Reseed areas of poor vegetation growth and alter plant types to better suit conditions if required	As required of if bare soil is exposed over 10% or more of swale treatment area.
Remedial Maintenance	Repair erosion or other damage by re-turfing or re-seeding.	As required
	Re-level uneven surfaces and reinstate design levels.	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip.	As required
	Remove and dispose of oil or petrol residues using safe standard practices	As required

11.2 SuDS Basins

Table 5: Maintenance Schedule, SuDS Basins, The SuDS Manual (C753)

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Inspect inlets/outlets and overflows for blockages and clear if required.	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly for first year then annually or as required
	Inspect banksides, structures and pipework for evidence of physical damage	Monthly
	Litter and debris removal	Monthly
	Grass cutting (spillways and access routes).	Monthly (during growing season) or as required.
	Grass cutting (meadow grass in and around basin).	Bi-annually (Spring, before nesting season then again in Autumn)
	Manage other vegetation and remove nuisance plants.	Monthly, at start then as required
	Check any penstocks and other mechanical devices.	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets/outlets and forebay	Annually or as required
	Manage wetland plants in outlet pool – where provided	Annually
Occasional Maintenance	Re-seed areas of poor vegetation growth.	As required
	Prune and trim any trees and remove cuttings	Every 2 years or as required.
	Remove sediment from inlets/outlets, forebays and main basin when required	Every 5 years or as required (likely to be minimal requirements where effective upstream source control is provided).
Remedial Maintenance	Repair erosion or other damage by re-seeding or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

12.0 CONCLUSION

12.1.1 This Drainage Impact Assessment (DIA) shows the proposed drainage infrastructure, the methodology behind the designs and potential impacts that may arise during development. Design parameters have also been included in this report and appropriate guidelines have been observed in order to influence the design process.

12.1.2 Fairhurst are responsible for all surface water drainage proposals outside of the substation platform boundary fence. All drainage inside the fence line is designed by others.

12.1.3 The proposed permanent surface water drainage has been designed in accordance with The Highland Council, SEPA and SSEN guidance. The proposed surface water design proposes run-off to be stored up to and including the 1 in 200-year storm event, to the 1 in 2-year greenfield run-off rate. This has contributed to the SuDS design throughout the scheme allowing for the sizing of the attenuation basin of up to 8,000m^3 storage capacity. Swales / ditches shall convey surface water, and discharge treated surface water run-off into the existing channels / drainage ditches across the site in 2 no. locations.

12.1.4 The proposed foul design outside of the substation platform fenceline shall be coordinated with the designers of the foul network within the substation fenceline as the design progresses. Foul water drainage management within the substation platform has been designed by others, but has been recorded to be designed with reference to *Sewers for Scotland v4.0*.

12.1.5 The temporary surface water drainage design has also been considered. This consists of conveyance ditches around the temporary construction ‘laydown area’ platforms, which then discharge to settlement lagoons (locations to be determined during detailed design prior to the works commencing). The settlement lagoons will be designed to allow the settlement of suspended solids prior to discharge to the natural environment, for up to the 1 in 20-year storm event, with a check against the 1 in 30-year event.

13.0 REFERENCE DOCUMENTS

Table 6: Reference Documents

Document Name	Reference	Publisher	Date of Publication
Drainage Specification	SP-NET-CIV-502	SSEN	July 2023
Climate Change Allowances for Flood Risk Assessment in Land Use Planning	Version 3	SEPA	April 2023
The SuDS Manual	C753	CIRIA	2019
The Highland Council: Flood Risk & Drainage Impact Assessment: Supplementary Guidance	N/A	The Highland Council	2023
Highlands & Argyll: Flood Risk Management Plan	N/A	SEPA	December 2021
Water Assessment and Drainage Assessment Guide		Sustainable Urban Drainage Scottish Working Party (SUDSWP)	N/A
Avoiding danger from overhead power lines.	Guidance Note G56 (Fourth Edition)	Health and Safety Executive	2013

Appendix 1 Proposed Site Boundary and Layout

DRAWING STATUS: ISSUED FOR ACCEPTANCE S5

REVISION:	P01	P03	P04	P05	P06	P07	P07
DRAWN:	RG 26/01/2024	RG 28/03/2024	RG 14/05/2024	RG 14/02/2025	JM 15/09/2025	JM 01/10/2025	JM 17/10/2025
CHECKED:	GI 26/01/2024	GI 28/03/2024	GI 14/05/2024	GI 14/02/2025	SC 15/09/2025	SC 01/10/2025	SC 17/10/2025
APPROVED:	CG 26/01/2024	CG 28/03/2024	CG 14/05/2024	CG 14/02/2025	CG 15/09/2025	CG 01/10/2025	CG 17/10/2025
PROJECT REF:	BING4-LT521	BING4-LT521	BING4-LT521	BING4-LT521	BING4-LT521	BING4-LT521	BING4-LT521
	FIRST ISSUE	DRAWING RENUMBERED	PHASE 2C	NOTES UPDATED	LAYOUT UPDATED	UPDATED WITH LATEST DESIGN	UPDATED WITH LATEST DESIGN

NOTES
1. THE PROPOSALS SHOWN ON THIS DRAWING HAVE BEEN DETERMINED FROM TOPOGRAPHICAL SURVEY INFORMATION PROVIDED BY OTHERS
2. DESIGN PROPOSALS SHOWN ARE PRELIMINARY AND SUBJECT TO DETAILED DESIGN.
3. SITE CONSTRAINTS FROM UNDERGROUND HV CABLES OVERHEAD AND ACCESS TO OHL TO BE CONFIRMED
4. TEMPORARY LAYDOWN AREAS TO BE REINSTATED, WHERE APPROPRIATE, WITH PEAT FROM ADJACENT TEMPORARY STORAGE AREAS.
5. PERMANENT PEAT STORAGE AREAS FOR SURPLUS PEAT GENERATED FROM CONSTRUCTION OF THE ACCESS ROAD TO BE CONFIRMED.
6. DEVELOPMENT OF BOTH TEMPORARY AND PERMANENT PEAT STORAGE AREAS WILL BE DETERMINED ON THE BASIS OF GEOTECHNICAL SITE INVESTIGATION.

Customer: Scottish & Southern Electricity Networks TRANSMISSION

Project: LT521-BINGALLY 400kv SUBSTATION

Contractor: SIEMENS energy + bam Joint Venture Substation Delivery Framework

Title: TEMPORARY SITE LAYOUT

Subcon. Drawing No.: FAIRHURST BING4-LT521-SEBAM-ZZ-ZZ-D-C-0103

Contractor Drawing No.: BING4-LT521-SEBAM-ZZ-ZZ-D-C-0103

Customer Drawing No.: BING4-LT521-SEBAM-ZZ-ZZ-D-C-0103

Designed	Drawn	Checked	Approved	Date	Scale	Size	Sheet	Revision
RG	AC	GI	CG	08/01/2024	1:2500	A1	1 of 1	P07

KEY

PROPOSED RED LINE BOUNDARY	DRAINAGE	DRAINAGE
EARTHWORK SLOPES	SUDS FEATURE	PROPOSED BORROW PIT
ACCESS TRACK	OVERHEAD LINES	VERGE
	WATERCOURSES	EXISTING TRACK

NOTES
1. THE PROPOSALS SHOWN ON THIS DRAWING HAVE BEEN DETERMINED FROM TOPOGRAPHICAL SURVEY INFORMATION PROVIDED BY OTHERS
2. DESIGN PROPOSALS SHOWN ARE PRELIMINARY AND SUBJECT TO DETAILED DESIGN.
3. SITE CONSTRAINTS FROM UNDERGROUND HV CABLES OVERHEAD AND ACCESS TO OHL TO BE CONFIRMED
4. PERMANENT PEAT STORAGE AREAS FOR SURPLUS PEAT GENERATED FROM CONSTRUCTION OF THE ACCESS ROAD TO BE CONFIRMED.
5. DEVELOPMENT OF BOTH TEMPORARY AND PERMANENT PEAT STORAGE AREAS WILL BE DETERMINED ON THE BASIS OF GEOTECHNICAL SITE INVESTIGATION.

DRAWING STATUS: ISSUED FOR ACCEPTANCE S5

REVISION:	DRAWN:	CHECKED:	APPROVED:	Description
P02	RG 23/02/2024	GI 23/02/2024	CG 23/02/2024	PROJECT REF. BING4-LT521 FIRST ISSUE
P03	RG 28/03/2024	GI 28/03/2024	CG 28/03/2024	PROJECT REF. BING4-LT521 DRAWING RENUMBERED
P04	RG 14/05/2024	GI 14/05/2024	CG 14/05/2024	PROJECT REF. BING4-LT521 PHASE 2C
P05	RG 16/05/2024	GI 16/05/2024	CG 16/05/2024	PROJECT REF. BING4-LT521 VIEWPORT CHANGES
P06	RG 14/02/2025	GI 14/02/2025	CG 14/02/2025	PROJECT REF. BING4-LT521 NOTES UPDATED
P07	JM 26/09/2025	SC 26/09/2025	CG 26/09/2025	PROJECT REF. BING4-LT521 UPDATED WITH LATEST DESIGN
P07	JM 17/10/2025	SC 17/10/2025	CG 17/10/2025	PROJECT REF. BING4-LT521 UPDATED WITH LATEST DESIGN

Customer: Scottish & Southern Electricity Networks TRANSMISSION

Contractor: SIEMENS energy + bam Joint Venture Substation Delivery Framework

Subcon. Drawing No. FAIRHURST SHEET 1 OF 1

Project: LT521-BINGALLY 400kv SUBSTATION

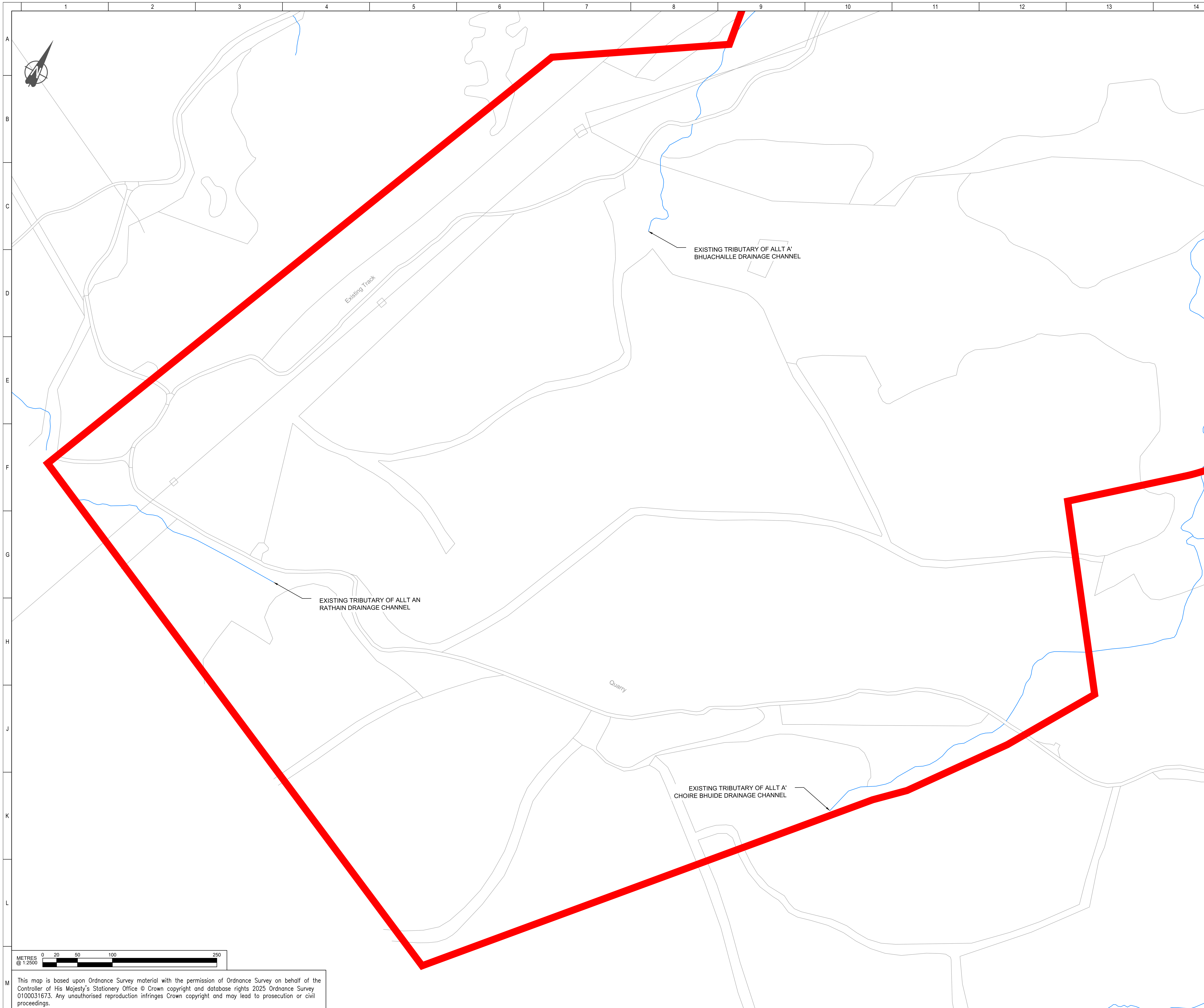
Title: PERMANENT SITE LAYOUT SHEET 1 OF 1

Contractor Drawing No. BING4-LT521-SEBAM-ZZ-ZZ-D-C-0109

Customer Drawing No. BING4-LT521-SEBAM-ZZ-ZZ-D-C-0109

Designed	Drawn	Checked	Approved	Date	Scale	Size	Sheet	Revision
RG	RG	GI	CG	26/01/2024	AS SHOWN	A1	1 of 1	P07

Appendix 2 Existing Drainage Layout



NOTES:

1. The proposals shown on this drawing have been determined from topographical survey information provided by others
2. Site layout based on drawing Fasnakyle - Site D alternative Siemens BAM layout
3. Substation layout based on S345-SEL-V00-XX-M3-C-5001.rvt.
4. Design proposals shown are preliminary and subject to detailed design.
5. All dimensions in mm unless stated otherwise.
6. Refer to design decision log for assumptions associated with proposed design.
7. Tie-in locations to existing watercourse channels to be confirmed.
8. The contractor shall check all dimensions on site and report any difference to the designer.
9. All levels are in metres (m) above ordnance datum unless stated otherwise.
10. Services to be confirmed to allow for co-ordination.
11. Existing drainage unknown and to be confirmed.
12. Site constraints from underground HV cables and access to OHL to be confirmed
13. Refer to drawings - BING4-LT521-SEBAM-DRAI-ZZ-D-C-0151, BING4-LT521-SEBAM-DRAI-ZZ-D-C-0152 & BING4-LT521-SEBAM-DRAI-ZZ-D-C-0153 for access track drainage design
14. Refer to drawing - BING4-LT521-SEBAM-DRAI-ZZ-D-C-0190 for proposed permanent drainage design.

LEGEND:

Existing watercourse

Red line site boundary

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION
(REFER TO CDM REGISTER BING4-LT521-SEBAM-ZZ-EXT-REG-OS)

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following :

It is assumed that all works will be carried out by a competent contractor working, where appropriate, to an approved method statement

CONSTRUCTION RISK

17 - unknown ground
23 - Overhead cables
24 - Overhead cables 11kV
25 - Underground electrical cables

MAINTENANCE / CLEANING RISK

· There are no unusual or unforeseen risks in addition to the hazards which can normally be identified by a competent contractor

DECOMMISSIONING / DEMOLITION RISK

· No known residual hazard at this stage of the design development

REV:	DATE:	DRWN:	CHKD:	APPVD:	DESCRIPTION:
P01.01	03/02/25	CMcL	RD	RJM	FIRST ISSUE

STATUS: S4 ISSUED FOR REVIEW

CONTRACTOR:

Joint Venture Substation Delivery Framework

CLIENT:

PROJECT: LT521 - BINGALLY 400kV SUBSTATION

PROJECT NUMBER: BING4-LT521 | LOCATION: BINGALLY

TITLE: EXISTING DRAINAGE LAYOUT - SUBSTATION

DRAWN:	C.McLaughlin	ENG CHECK:	R.Duncan
DESIGNER:	A.Peters	COORDINATION:	R.Duncan
SCALE :	1:2500	APPROVED:	R.Minto
DATE OF FIRST ISSUE:	03/02/2025	SECURITY:	

ORIGINATOR DRAWING NUMBER: BING4-LT521-SEBAM-DRAI-ZZ-D-C-0196 | SHEET No: 1 of 1

CLIENT DRAWING NUMBER: BING4-LT521-SEBAM-DRAI-ZZ-D-C-0196 | REV. No: P01.01

Appendix 3 Proposed PRP Layout Drawing

1. DO NOT SCALE, WORK TO DIMENSIONS SHOWN. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE.

2. THE CONTRACTOR IS RESPONSIBLE FOR THE LOCATION OF ALL EXISTING SERVICES WITHIN THE WORKS AREA AND FOR THE STRUCTURAL STABILITY THROUGHOUT THE WORKS.

3. CONTRACTORS ARE TO BE AWARE OF THEIR RESPONSIBILITIES UNDER THE CDM REGULATIONS & COMPLY WITH THEM AT ALL TIMES. NOTE THAT ANY HAZARDS IDENTIFIED ON THE DRAWINGS ARE ONLY THOSE WHICH MAY NOT BE OBVIOUS TO COMPETENT PERSONS OR ARE UNUSUAL OR WHICH MIGHT BE DIFFICULT TO MANAGE.

4. WORKING AREAS AND METHODS TO BE AGREED BEFORE WORK COMMENCES.

5. THE TERM 'CONTRACTOR' REFERS TO THE CONTRACTOR RESPONSIBLE FOR THE INDIVIDUAL ELEMENT OF THE WORKS.

6. UNLESS NOTED OTHERWISE THE SPECIFICATION FOR THE WORKS IS :-
- SP-NET-CIV-501, SPECIFICATION FOR EARTHWORKS - Rev 2.00 February 2023.
- SP-NET-CIV-502, DRAINAGE SPECIFICATION - Rev 1.01 July 2020.
- WHERE PROPRIETARY ITEMS HAVE BEEN SPECIFIED, SIMILAR APPROVED PRODUCTS WILL BE ACCEPTABLE BUT
- ONLY WHERE AGREED WITH PATTERSON REEVES & PARTNERS.

7. MINIMUM 120,000 LITRE BURIED FIRE FIGHTING WATER STORAGE TANK. HYDRANTS WILL NOT BE PROVIDED, WATER STORAGE TANK SHALL BE ACCESSIBLE FROM OUTSIDE THE SUBSTATION. FIRE FIGHTING AUTHORITY WILL NEED TO USE THEIR OWN SUCTION DEVICE TO GAIN ACCESS TO FIRE FIGHTING WATER.

DRAINAGE LEGEND

- CARRIER DRAIN - 300 DIA. TYPICAL U.N.O
- FILTER DRAIN - 300 DIA. TYPICAL U.N.O
- OILY WATER DRAIN - 150 DIA. TYPICAL
- FOUL WATER DRAIN - 100 DIA. TYPICAL
- SURFACE WATER CHAMBER - 600 DIA
- OILY WATER CHAMBER - 600 DIA
- FOUL WATER CHAMBER - 450 DIA
- BUND
- BUILDING
- TANKER STAND AREA
- * ABOVE GROUND OIL SEPERATOR

ALL CHAMBER COVERS WITHIN 2m OF FENCELINE SHALL BE GRP

DRAINAGE PHILOSOPHY

NORMAL SITE OPERATION

SURFACE WATER

APART FROM BUILDINGS, IMPERMEABLE ROADS AND BUNDS, THE SITE WILL GENERALLY BE SURFACED IN A LAYER OF STONE CHIPPINGS ON TOP OF A POROUS SUB-BASE LAYER THAT WILL ACT AS A DRAINAGE BLANKET. THE SSE SPECIFICATION CALLS FOR A 725MM SUB-BASE TO HAVE AN ABSORBENCY OF $3x10^{-2}$ /M/S. RAINFALL WILL INFILTRATE INTO THE BLANKET. DUE TO THE SIGNIFICANT CUT AND FILL WORKS, THERE WILL BE A DEPTH OF GRANULAR MATERIAL OVER A LARGE PORTION OF THE SITE I.E. THE FILLED SECTION. THE UNDERLYING ROCK WILL BE CUT AS REQUIRED AND PROCESSED ON-SITE TO BE USED AS ENGINEERED FILL. THE DEPTH OF UNDERLYING PROCESSED FILL WILL BE SEVERAL METRES THICK IN PLACES. AT THIS STAGE IT IS ASSUMED THAT THIS UNDERLYING ENGINEERED STRATA WILL BE IMPERVIOUS.

THE PHILOSOPHY OF THE SURFACE WATER DRAINAGE STRATEGY IS IN PRINCIPLE TO MIMIC THE QUALITY AND QUANTITY OF THE RUNOFF FROM THE SITE IN ITS 'GREENFIELD' STATE. IN SO FAR AS IT IS REASONABLE AND PRACTICABLE, WHERE APPROPRIATE ADDITIONAL POST-DEVELOPMENT RUNOFF SHALL BE DISPERSED IN ACCORDANCE WITH LOCAL AUTHORITY, SEPA AND SEWERS FOR SCOTLAND.

DESIGN EVENT RAIN-FALL SHALL BE BASED ON THE USE OF THE MOST RECENT VERSION OF THE 'FLOOD ESTIMATION HANDBOOK' SPECIFIC TO THE LOCATION OF THE DEVELOPMENT. AN ALLOWANCE FOR CLIMATE CHANGE SHALL BE APPLIED IN ACCORDANCE WITH SEPA CLIMATE CHANGE (CC) ALLOWANCES FOR FLOOD RISK ASSESSMENTS IN LAND USE PLANNING, VERSION 6.

EXCLUDING TANKER STANDING AREAS, OTHER PAVED AREAS WILL DRAIN DIRECTLY INTO THE UPPER PLATFORM DRAINAGE BLANKET. SURFACE WATER FLOWS WILL BE GIVEN INITIAL TREATMENT AS IT PASSES THROUGH THE STONE BLANKET LAYER. IN ORDER TO DRAIN THE UPPER DRAINAGE BLANKET A SERIES OF FILTER DRAINS ARE PROPOSED. THE NEED FOR THESE FILTER DRAINS WILL BE REVIEWED FOLLOWING TESTING OF THE UNDERLYING ENGINEERED STRATA TO DETERMINE THE POROSITY. EVEN IF THE UNDERLYING FORMATION IS IMPERVIOUS, AN ANALYSIS OF THE FLOW OF SURFACE WATER THROUGH THE DRAINAGE BLANKET TOWARDS FILTER DRAINS INDICATES THAT THE OUTFLOW IS CONSIDERABLY LESS THAN THE GREENFIELD RUNOFF RATE FOR ANY PARTICULAR RETURN PERIOD STORM. THEREFORE, WITH REGARDS TO RAINFALL ONTO THE PERMEABLE AREAS, THERE IS NO NEED FOR ANY ADDITIONAL ATTENUATION.

FLOWS FROM THE RUNOFF FROM BUILDING ROOFS, TANKER STANDING AREAS AND PUMPED FLOWS FROM BUNDS WILL BE POSITIVELY DRAINED INTO PIPEWORK WHICH WILL BE SIZED TO PREVENT ANY SURFACE FLOODING DURING A 1 IN 200 YEAR RETURN PERIOD STORM, PLUS CLIMATE CHANGE.

IT IS ANTICIPATED THAT FLOWS TO DOWNSTREAM WATERCOURSES WILL BE RESTRICTED TO THE GREEN FIELD RUNOFF RATE WHEN CONSIDERING THE TOTAL IMPERMEABLE AREAS, WHICH IN THIS CASE IS 0.269 HA. THE GREENFIELD RUNOFF RATE FOR A 1 IN 2 YEAR RETURN PERIOD STORM IS 3.2L/S. FLOWS TO DOWNSTREAM WATERCOURSE WILL THEREFORE BE RESTRICTED TO THIS RATE. INFODRAINAGE ANALYSIS HAS DETERMINED THAT AN ATTENUATION VOLUME OF **$225.7m^3$ W**ILL BE REQUIRED DURING A 1 IN 200 YEAR RETURN PERIOD STORM.

AS A MINIMUM, THE SURFACE WATER DRAINAGE SYSTEM WILL FULLY MANAGE SURFACE WATER FLOWS RESULTING FROM THE DEVELOPED SITE UP TO THE 1 IN 1000-YEAR + CC RAIN FALL RETURN PERIOD PROTECTION FOR 'CRITICAL EQUIPMENT'. ANY ON SITE FLOODING WHICH RESULTS FROM A 1 IN 1000 YEAR RETURN PERIOD STORM WILL BE EASILY ABSORBED INTO THE DRAINAGE STONE PLATFORM. IN ADDITION, A MINIMUM OF 1 IN 200-YEAR + CC RAIN-FALL RETURN PERIOD PROTECTION WILL BE PROVIDED FOR BOTH ON AND OFF SITE FLOODING. THE DETAIL OF THE ATTENUATION AND ADDITIONAL SuDS TREATMENT OUTSIDE THE SECURITY FENCE LINE WILL BE DESIGNED BY OTHERS

EQUIPMENT CONTAINING OIL WILL BE SITUATED IN IMPERMEABLE BUNDS. BECAUSE THERE MAY BE OIL PRESENT WITHIN WATER WITHIN THESE BUNDS, INTELLIGENT PUMPING SYSTEMS WHICH WILL DETECT THE PRESENCE OF OIL WILL BE USED. THESE WILL CEASE OPERATION IF OIL IS DETECTED. IN ADDITION, FLOWS FROM THESE LOCATIONS WILL PASS THROUGH ABOVE-GROUND OIL SEPARATORS, BEFORE PASSING DOWNSTREAM. IN ACCORDANCE WITH SSE SPECIFICATION FLOWS FROM OIL CONTAINMENT AREAS, INCLUDING TANKER STANDING AREAS, WILL DISCHARGE THROUGH A SEPARATE OUTFALL AND INTO A SWALE SO THAT ANY SIGNS OF OIL CAN BE EASILY IDENTIFIED. DURING ANY OPERATION INVOLVING OIL TANKERS OR TREATMENT, FLOWS FROM THE TANKER STANDING AREAS WILL BE TEMPORARILY DIRECTED TO AN UNDERGROUND STORAGE CONTAINER SO THAT ANY SPILLAGES WILL NOT PASS DOWNSTREAM TO WATERCOURSES.

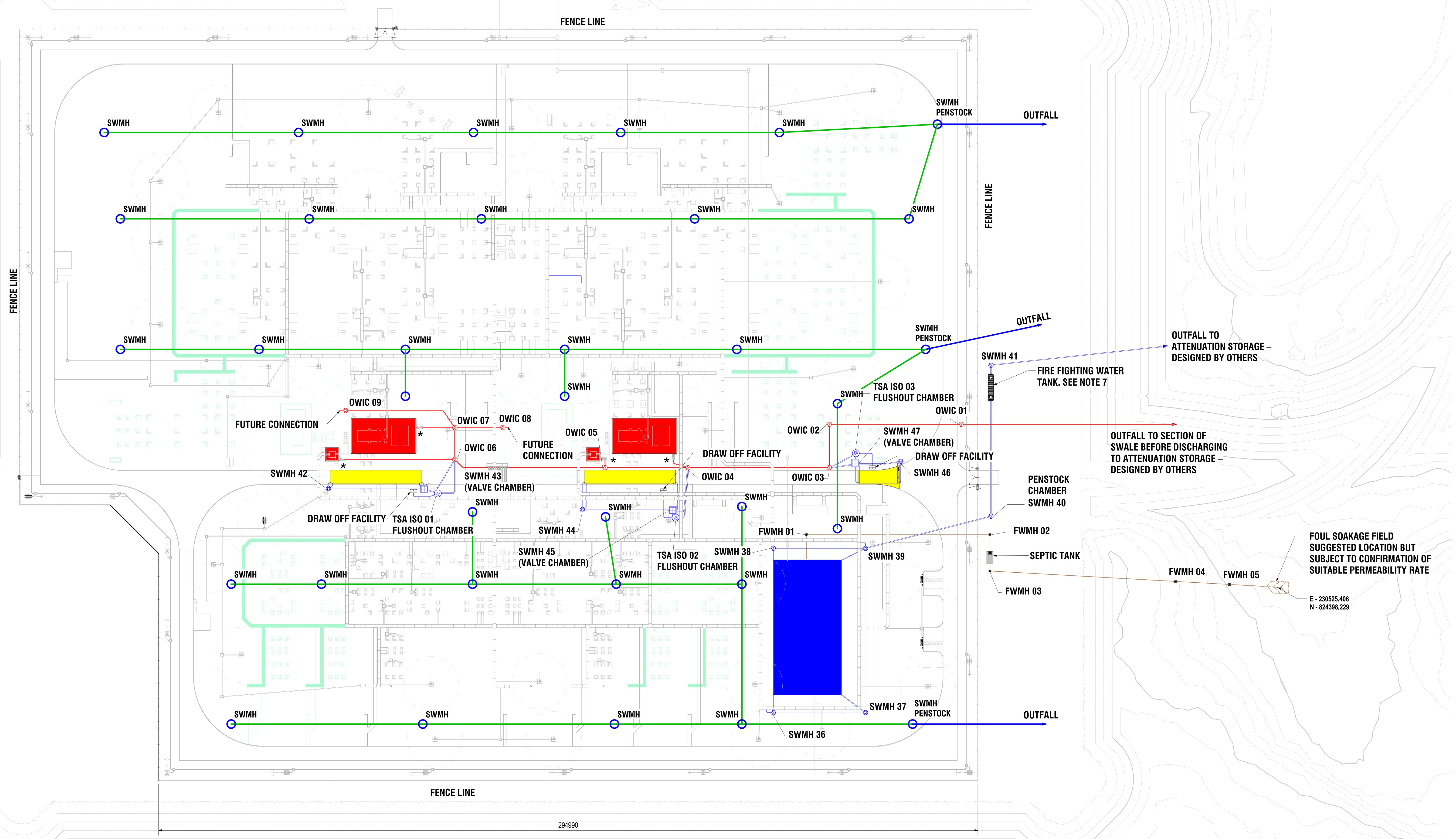
IN ADDITION, COOLING PLANT CONTAINING GLYCOL WILL ALSO BE HOUSED IN BUNDS. RAINWATER ENTERING THESE BUNDS WILL ALSO BE PUMPED OUT INTO THE SURFACE WATER SYSTEM. IF A PRESSURE DROP IS INDICATED IN THE GLYCOL PIPEWORK, THE SURFACE WATER PUMPS WILL SWITCH OFF ENSURING CONTAMINATED WATER IS RETAINED WITHIN THE COOLER BUND.

WHERE OILY WATER AND SURFACE WATER CARRIER DRAINS ARE USED WITHIN THE SUBSTATION, THE CHAMBERS SHALL BE CONSIDERED AS 'MANHOLES', IN ACCORDANCE WITH SP-NET-CIV-502 THESE CHAMBERS SHALL HAVE 1200mm INTERNAL DIAMETER AND SHALL ALL BE BENCHED. CATCHPITS SHALL NOT BE USED WITHIN THE SUBSTATION.

FOUL WATER

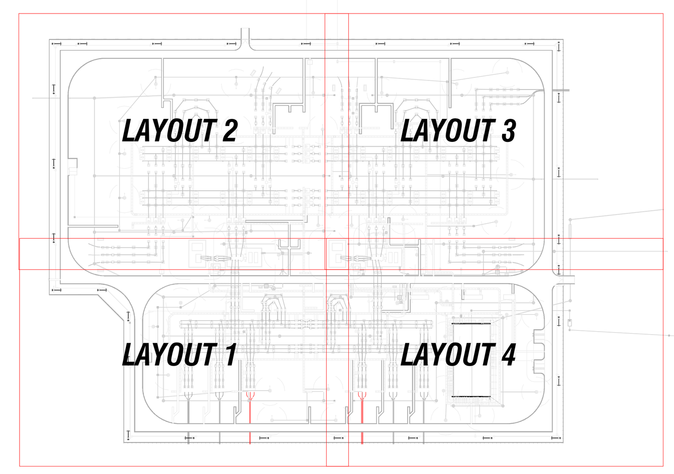
SEWERS FOR SCOTLAND V4.0 STIPULATES THAT ALL GRAVITY SEWER PIPES SHALL BE 150mm INTERNAL DIAMETER AND SHALL BE UPVC. HOWEVER, THE FOUL DRAINAGE HERE DOESN'T CONNECT MULTIPLE PROPERTIES AND THEREFORE NOT CONSIDERED TO BE A 'SEWER'. WHERE GRAVITY DRAINS ARE PROVIDED THESE WILL BE 100mm INTERNAL DIAMETER. THE FOUL DRAIN FROM THE BUILDING SHALL DRAIN DIRECTLY INTO A FOUL PUMPING STATION (DUTY/STANDBY). THE PUMPING MAIN SHALL BE 50 DIA. (1200 DEEP TO CROWN) AND SHALL BE PUMPED TO A MANHOLE OUTSIDE THE SUBSTATION SECURITY FENCE. FROM THERE FOUL WATER SHALL DRAIN VIA GRAVITY INTO A SEPTIC TANK (ALSO LOCATED OUTSIDE THE SUBSTATION FENCELINE) LOCATED AS CLOSE AS PRACTICALLY POSSIBLE TO THE ENTRANCE FOR EASE OF ACCESS FOR MAINTENANCE.

THE OUTFALL FROM THE SEPTIC TANK SHALL DRAIN INTO A SUITABLY SIZED DRAINAGE FIELD. IF IT IS NOT POSSIBLE TO DRAIN BY GRAVITY THEN THE EFFLUENT WILL NEED TO BE PUMPED TO A FOUL SOAKAGE FIELD. THE SOAKAGE FIELD SHALL BE LOCATED IN AN AREA WHERE THERE ARE SUITABLE DRAINAGE CHARACTERISTICS. ALSO WHERE THE LEVELS PERMIT THE SOAKAGE FIELD TO BE NO GREATER THAN 700mm TO CROWN OF PIPE. ALL IN ACCORDANCE WITH BS 6297 WHICH COVERS 'DEALING WITH DIFFICULT SITES AND GROUND CONDITIONS', THIS MUST BE REFERRED TO WHEN DETERMINING THE CORRECT LOCATION. REFER TO FIGURE 6 OF BS 6297.



DRAINAGE OVERVIEW AND PHILOSPHY

(1 : 750)



OVERALL KEY PLAN

(1 : 3000)

FINISHED SUBSTATION LEVEL 324m AOD

0 15 30 45 60 75 m

SCALE 1:750

CDM REGULATIONS:

SIGNIFICANT OR UNUSUAL RESIDUAL HAZARDS HIGHLIGHTED BELOW:

THERE ARE NO RISKS UNFAMILIAR TO A COMPETENT CONTRACTOR

SAFE METHODS OF WORK ARE THE RESPONSIBILITY OF THE CONTRACTOR AND ARE TO BE IDENTIFIED IN THE HEALTH AND SAFETY PLAN.

Subcontractor	Patterson Reeves & Partners, Westleigh House, 83 - 85 Leigh Road, Eastleigh, Hampshire SO50 9DQ
Project Reference	BING-LT521
Contractor	Siemens Energy + bam
Client	Scottish & Southern Electricity Networks TRANSMISSION
Project Title	BINGALLY 400kV SUBSTATION
Drawing Title	OVERVIEW AND PHILOSOPHY DRAINAGE
Site	BINGALLY 400kV SUBSTATION
Contractor Drawing Number	
Client Drawing Number	BING-LT521-PRP-DRAI-XX-LAY-C-0001
Sheet	01 of 01
Suitability Code	S2
Purpose of Issue	FOR INFORMATION
Scale	1:750
Size	A0
Revision	P01

REVISION:	P01		P02	
DRAWN:	D.Wheatland 15.05.2025	FOR INFORMATION / PROJECT REF: LT521 / FIRST ISSUE	D.Wheatland NYI	FOR INFORMATION / PROJECT REF: LT521 / FIRST ISSUE
CHECKED:	G.Hooper 15.05.2025		G.Hooper NYI	
APPROVED:	N.Patterson 15.05.2025		N.Patterson NYI	

WORK IN PROGRESS

Appendix 4 Greenfield Run-off Calculations

Greenfield runoff rate estimation tool

www.uksuds.com | Greenfield runoff rate estimation tool (https://www.uksuds.com/)

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Project details

Date	03/10/2025
Calculated by	RD
Reference	Bingally Perm Platform
Model version	2.1.2

Location

Site name	Bingally
Site location	

Site easting (British National Grid)	230700
Site northing (British National Grid)	824654

Site details

Total site area (ha)	5.75	ha

Greenfield runoff

Method

Method	IH124		

IH124

	My value		Map value
SAAR (mm)	1475 mm		1475
How should SPR be derived?	WRAP soil type		
WRAP soil type	4		5
SPR	0.47		
QBar (IH124) (l/s)	66.4 l/s		

Growth curve factors

	My value		Map value
Hydrological region	1		1
1 year growth factor	0.85		
2 year growth factor	0.9		
10 year growth factor	1.45		
30 year growth factor	1.95		
100 year growth factor	2.48		
200 year growth factor	2.84		

Results

Method	IH124
Flow rate 1 year (l/s)	56.4 l/s
Flow rate 2 year (l/s)	59.8 l/s
Flow rate 10 years (l/s)	96.3 l/s
Flow rate 30 years (l/s)	129.5 l/s
Flow rate 100 years (l/s)	164.7 l/s
Flow rate 200 years (l/s)	188.6 l/s

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent 'zero' figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

Disclaimer

Appendix 5 MicroDrainage Source Control Calculations

Summary of Results for 200 year Return Period (+42%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	98.263	0.263	47.0	1051.2	O K
30 min Summer	98.335	0.335	69.3	1339.9	O K
60 min Summer	98.423	0.423	90.4	1691.0	O K
120 min Summer	98.532	0.532	97.1	2128.1	O K
180 min Summer	98.600	0.600	101.0	2401.6	O K
240 min Summer	98.646	0.646	103.5	2585.7	O K
360 min Summer	98.704	0.704	106.7	2816.7	O K
480 min Summer	98.742	0.742	108.7	2968.5	O K
600 min Summer	98.768	0.768	110.0	3071.0	O K
720 min Summer	98.785	0.785	110.9	3139.1	O K
960 min Summer	98.788	0.788	111.1	3152.6	O K
1440 min Summer	98.766	0.766	109.9	3064.1	O K
2160 min Summer	98.709	0.709	106.9	2834.1	O K
2880 min Summer	98.648	0.648	103.6	2591.4	O K
4320 min Summer	98.502	0.502	95.2	2007.2	O K
5760 min Summer	98.412	0.412	89.7	1647.3	O K
7200 min Summer	98.369	0.369	80.1	1475.7	O K
8640 min Summer	98.340	0.340	70.9	1358.6	O K
10080 min Summer	98.317	0.317	63.7	1266.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	107.977	0.0	966.4	99
30 min Summer	70.803	0.0	1316.3	108
60 min Summer	46.427	0.0	1896.7	126
120 min Summer	30.443	0.0	2514.6	164
180 min Summer	23.783	0.0	2961.2	206
240 min Summer	19.962	0.0	3323.5	248
360 min Summer	15.595	0.0	3907.5	320
480 min Summer	13.090	0.0	4380.7	388
600 min Summer	11.427	0.0	4785.2	456
720 min Summer	10.226	0.0	5142.0	524
960 min Summer	8.453	0.0	5668.1	660
1440 min Summer	6.464	0.0	6490.7	928
2160 min Summer	4.942	0.0	7598.4	1320
2880 min Summer	4.085	0.0	8368.2	1696
4320 min Summer	2.940	0.0	8969.9	2408
5760 min Summer	2.327	0.0	9589.5	3080
7200 min Summer	1.942	0.0	9989.9	3784
8640 min Summer	1.675	0.0	10319.6	4504
10080 min Summer	1.478	0.0	10570.5	5224

Summary of Results for 200 year Return Period (+42%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	98.292	0.292	56.0	1168.3	O K
30 min Winter	98.372	0.372	81.1	1487.5	O K
60 min Winter	98.473	0.473	93.5	1890.6	O K
120 min Winter	98.599	0.599	100.9	2394.5	O K
180 min Winter	98.677	0.677	105.2	2709.5	O K
240 min Winter	98.731	0.731	108.1	2922.3	O K
360 min Winter	98.793	0.793	111.3	3170.9	O K
480 min Winter	98.828	0.828	113.1	3310.6	O K
600 min Winter	98.849	0.849	114.2	3395.5	O K
720 min Winter	98.860	0.860	114.7	3440.5	O K
960 min Winter	98.847	0.847	114.1	3389.0	O K
1440 min Winter	98.791	0.791	111.2	3165.2	O K
2160 min Winter	98.689	0.689	105.9	2757.6	O K
2880 min Winter	98.594	0.594	100.6	2377.3	O K
4320 min Winter	98.414	0.414	89.9	1657.3	O K
5760 min Winter	98.354	0.354	75.3	1414.1	O K
7200 min Winter	98.317	0.317	63.7	1266.8	O K
8640 min Winter	98.290	0.290	55.3	1160.3	O K
10080 min Winter	98.270	0.270	49.1	1078.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	107.977	0.0	1101.2	99
30 min Winter	70.803	0.0	1494.8	108
60 min Winter	46.427	0.0	2135.4	128
120 min Winter	30.443	0.0	2827.5	170
180 min Winter	23.783	0.0	3327.8	212
240 min Winter	19.962	0.0	3733.6	256
360 min Winter	15.595	0.0	4388.0	340
480 min Winter	13.090	0.0	4918.4	412
600 min Winter	11.427	0.0	5371.8	486
720 min Winter	10.226	0.0	5771.9	562
960 min Winter	8.453	0.0	6361.9	708
1440 min Winter	6.464	0.0	7285.3	990
2160 min Winter	4.942	0.0	8518.7	1392
2880 min Winter	4.085	0.0	9382.7	1772
4320 min Winter	2.940	0.0	10067.3	2424
5760 min Winter	2.327	0.0	10745.9	3104
7200 min Winter	1.942	0.0	11196.3	3824
8640 min Winter	1.675	0.0	11569.3	4552
10080 min Winter	1.478	0.0	11862.0	5272

Rainfall Details

Rainfall Model	FEH
Return Period (years)	200
FEH Rainfall Version	1999
Site Location	GB 382850 846800 NJ 82850 46800
C (1km)	-0.013
D1 (1km)	0.460
D2 (1km)	0.407
D3 (1km)	0.257
E (1km)	0.234
F (1km)	2.248
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+42

Time Area Diagram

Total Area (ha) 5.750

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	30	1.917	30	60	1.917	60	90	1.917

Model Details

Storage is Online Cover Level (m) 100.000

Tank or Pond Structure

Invert Level (m) 98.000

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	4000.0	2.000	4000.0

Pipe Outflow Control

Diameter (m)	0.300	Entry Loss Coefficient	0.500
Slope (1:X)	150.0	Coefficient of Contraction	0.600
Length (m)	90.000	Upstream Invert Level (m)	98.000
Roughness k (mm)	0.600		

Appendix 6 Initial Drainage Model Summary & Results

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Inverts
Additional Flow (%)	42	Minimum Backdrop Height (m)	0.500
CV	0.750	Preferred Cover Depth (m)	1.000
Time of Entry (mins)	60.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	550.0		

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	✓
Summer CV	0.750	Drain Down Time (mins)	240	2 year (l/s)	666.7
Winter CV	0.840	Additional Storage (m³/ha)	20.0	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	42	0	0
30	42	0	0
200	42	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	QBar/QMed conversion factor	1.111
Greenfield Method	FEH	Growth Factor 2 year	0.90
Positively Drained Area (ha)	32.870	Betterment (%)	0
SAAR (mm)	1549	QMed	666.7
Host	1	QBar	740.8
BFIHost	0.314	Q 2 year (l/s)	666.7
Region	1		

Node 44 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	305.434	Product Number	CTL-SHE-0305-5980-2000-5980
Design Depth (m)	2.000	Min Outlet Diameter (m)	0.375
Design Flow (l/s)	59.8	Min Node Diameter (mm)	3000

Node 99 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	321.349	Product Number	CTL-SHE-0091-6000-3000-6000
Design Depth (m)	3.000	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	6.0	Min Node Diameter (mm)	1200

Node 141 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	321.632	Product Number	CTL-SHE-0091-6000-3000-6000
Design Depth (m)	3.000	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	6.0	Min Node Diameter (mm)	1200

Node 146 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	321.525	Product Number	CTL-SHE-0091-6000-3000-6000
Design Depth (m)	3.000	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	6.0	Min Node Diameter (mm)	1200

Node 43 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	305.500
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	4000.0	5322.0	2.000	5994.7	7661.8

Node 98 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	321.538	Slope (1:X)	500.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	
Safety Factor	2.0	Width (m)	90.000	Inf Depth (m)	
Porosity	0.30	Length (m)	300.000		

Node 140 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	321.867	Slope (1:X)	500.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	
Safety Factor	2.0	Width (m)	90.000	Inf Depth (m)	
Porosity	0.30	Length (m)	300.000		

Node 145 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	322.043	Slope (1:X)	500.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	
Safety Factor	2.0	Width (m)	90.000	Inf Depth (m)	
Porosity	0.30	Length (m)	300.000		

Results for 2 year +42% CC Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	1	120	322.115	0.043	9.0	0.1084	0.0000	OK
180 minute winter	2	120	321.704	0.058	15.6	0.1816	0.0000	OK
180 minute winter	3	120	321.156	0.087	32.5	0.4010	0.0000	OK
180 minute winter	4	120	320.079	0.121	52.1	0.5994	0.0000	OK
180 minute winter	5	124	319.630	0.196	72.3	0.8971	0.0000	OK
180 minute winter	6	124	319.508	0.229	93.7	1.0553	0.0000	OK
180 minute winter	7	124	319.384	0.261	116.3	1.2169	0.0000	OK
180 minute winter	8	124	319.243	0.276	127.8	0.8740	0.0000	OK
180 minute winter	9	124	319.095	0.291	131.7	0.6252	0.0000	OK
180 minute winter	10	124	319.003	0.283	134.1	0.5657	0.0000	OK
180 minute winter	11	124	318.880	0.244	135.3	0.4601	0.0000	OK
180 minute winter	12	120	322.249	0.063	15.2	0.2672	0.0000	OK
180 minute winter	13	120	321.658	0.064	15.2	0.1139	0.0000	OK
180 minute winter	14	124	321.158	0.079	18.7	0.1873	0.0000	OK
180 minute winter	15	124	320.943	0.106	29.4	0.3639	0.0000	OK
180 minute winter	16	124	320.620	0.141	44.5	0.5463	0.0000	OK
180 minute winter	17	120	322.271	0.059	9.3	0.1579	0.0000	OK
180 minute winter	18	120	322.107	0.061	11.7	0.1443	0.0000	OK
180 minute winter	19	120	321.727	0.088	15.9	0.2311	0.0000	OK
180 minute winter	20	120	321.426	0.100	17.4	0.2040	0.0000	OK
180 minute winter	21	120	321.317	0.096	22.1	0.2490	0.0000	OK
180 minute winter	22	124	320.999	0.115	22.1	0.2025	0.0000	OK
180 minute winter	23	124	320.422	0.198	66.7	0.3554	0.0000	OK
180 minute winter	24	124	320.394	0.202	78.2	0.6593	0.0000	OK
180 minute winter	25	124	320.131	0.179	79.3	0.3386	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	1	1.000	2	9.0	0.865	0.010	0.3111	
180 minute winter	2	1.001	3	15.6	0.872	0.020	0.8678	
180 minute winter	3	1.002	4	32.4	0.998	0.047	3.6383	
180 minute winter	4	1.003	5	52.0	0.876	0.093	4.7301	
180 minute winter	5	1.004	6	72.3	0.810	0.237	6.9373	
180 minute winter	6	1.005	7	93.7	0.867	0.307	8.4518	
180 minute winter	7	1.006	8	116.3	0.953	0.381	9.5352	
180 minute winter	8	1.007	9	127.7	0.976	0.418	10.6846	
180 minute winter	9	1.008	10	131.6	0.989	0.431	5.6025	
180 minute winter	10	1.009	11	134.1	1.125	0.437	4.9923	
180 minute winter	11	1.010	29	135.2	1.870	0.441	1.5857	
180 minute winter	12	2.000	13	15.2	0.958	0.023	1.0556	
180 minute winter	13	2.001	14	15.2	0.796	0.025	1.2701	
180 minute winter	14	2.002	15	18.7	0.679	0.039	1.3809	
180 minute winter	15	2.003	16	29.4	0.707	0.071	4.0534	
180 minute winter	16	2.004	23	44.4	0.682	0.127	6.3554	
180 minute winter	17	3.000	18	9.3	0.931	0.081	0.1537	
180 minute winter	18	3.001	19	11.7	0.865	0.092	0.4210	
180 minute winter	19	3.002	20	15.9	0.848	0.188	1.0088	
180 minute winter	20	3.003	21	17.4	0.874	0.223	0.4208	
180 minute winter	21	3.004	22	22.1	1.005	0.222	0.9215	
180 minute winter	22	3.005	23	22.1	0.960	0.258	0.1393	
180 minute winter	23	2.005	24	66.7	0.814	0.152	0.6423	
180 minute winter	24	2.006	25	78.3	1.021	0.239	8.0486	
180 minute winter	25	2.007	26	79.3	1.066	0.152	1.1821	

Results for 2 year +42% CC Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	26	124	320.054	0.194	80.1	0.3612	0.0000	OK
180 minute winter	27	124	319.990	0.197	81.1	0.3720	0.0000	OK
180 minute winter	28	124	319.931	0.210	86.9	0.5146	0.0000	OK
180 minute winter	29	124	318.713	0.120	226.8	0.2658	0.0000	OK
180 minute winter	30	124	315.061	0.111	227.8	0.0731	0.0000	OK
180 minute winter	31	124	314.782	0.064	229.0	0.0503	0.0000	OK
180 minute winter	32	124	311.998	0.073	230.8	0.0975	0.0000	OK
180 minute winter	33	124	309.345	0.079	233.3	0.0786	0.0000	OK
180 minute winter	34	120	321.846	0.030	6.3	0.0956	0.0000	OK
180 minute winter	35	120	316.032	0.015	9.2	0.0422	0.0000	OK
180 minute winter	36	120	315.502	0.016	9.8	0.0104	0.0000	OK
180 minute winter	37	120	314.999	0.014	11.4	0.0217	0.0000	OK
180 minute winter	38	120	313.102	0.016	13.5	0.0339	0.0000	OK
180 minute winter	39	120	311.491	0.017	18.0	0.0727	0.0000	OK
180 minute winter	40	120	308.661	0.020	19.6	0.0192	0.0000	OK
180 minute winter	41	124	307.797	0.225	300.5	1.2391	0.0000	OK
960 minute winter	42	750	306.031	0.241	151.6	0.0000	0.0000	OK
960 minute winter	43	720	305.991	0.491	176.1	2082.5310	0.0000	OK
960 minute winter	44	735	305.990	0.556	117.6	3.9271	0.0000	SURCHARGED
960 minute winter	45	735	302.121	0.049	59.2	0.0000	0.0000	OK
960 minute winter	46	735	301.456	0.126	59.2	0.0000	0.0000	OK
960 minute winter	47	735	300.378	0.038	59.2	0.0000	0.0000	OK
180 minute winter	48	120	345.032	0.033	5.7	0.0986	0.0000	OK
240 minute summer	49	152	344.846	0.025	8.1	0.0541	0.0000	OK
180 minute winter	50	124	343.592	0.017	9.1	0.0200	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	26	2.008	27	80.1	1.008	0.181	1.2793	
180 minute winter	27	2.009	28	81.1	0.963	0.184	1.4921	
180 minute winter	28	2.010	29	86.8	1.064	0.259	8.0474	
180 minute winter	29	1.011	30	226.8	5.957	0.084	0.9120	
180 minute winter	30	1.012	31	227.8	3.001	0.044	0.9316	
180 minute winter	31	1.013	32	229.0	4.712	0.015	0.7765	
180 minute winter	32	1.014	33	230.8	4.176	0.020	1.3198	
180 minute winter	33	1.015	41	233.3	1.280	0.026	7.1952	
180 minute winter	34	4.000	35	6.3	3.080	0.031	0.0798	
180 minute winter	35	4.001	36	9.2	1.080	0.001	0.0943	
180 minute winter	36	4.002	37	9.8	1.204	0.001	0.0928	
180 minute winter	37	4.003	38	11.4	1.398	0.001	0.1550	
180 minute winter	38	4.004	39	13.5	1.507	0.001	0.1893	
180 minute winter	39	4.005	40	18.0	1.740	0.001	0.2485	
180 minute winter	40	4.006	41	19.6	0.321	0.003	3.7923	
180 minute winter	41	1.016	42	300.4	2.683	0.207	14.4288	
960 minute winter	42	1.017	43	176.1	2.791	0.189	2.7944	
960 minute winter	43	1.018	44	117.6	0.623	0.234	3.2140	
960 minute winter	44	1.019	45	59.2	4.753	0.048	0.2903	
960 minute winter	45	1.020	46	59.2	0.887	0.009	1.6179	
960 minute winter	46	1.021	47	59.2	2.830	0.111	1.4439	
960 minute winter	47	1.022	108	59.2	2.559	0.006	0.3092	
180 minute winter	48	5.000	49	5.7	0.604	0.019	0.3839	
240 minute summer	49	5.001	50	8.1	1.212	0.011	0.3418	
180 minute winter	50	5.002	51	9.1	1.566	0.007	0.1562	

Results for 2 year +42% CC Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	51	124	341.215	0.019	9.5	0.0105	0.0000	OK
180 minute winter	52	124	339.879	0.052	10.2	0.0456	0.0000	OK
180 minute winter	53	124	339.815	0.024	12.2	0.0587	0.0000	OK
180 minute winter	54	124	337.987	0.027	14.1	0.0639	0.0000	OK
180 minute winter	55	120	335.913	0.024	14.8	0.0210	0.0000	OK
180 minute winter	56	120	333.901	0.024	14.8	0.0000	0.0000	OK
180 minute winter	57	124	332.842	0.042	15.6	0.2401	0.0000	OK
180 minute winter	58	120	332.773	0.046	18.0	0.0692	0.0000	OK
180 minute winter	59	120	332.706	0.049	20.2	0.0640	0.0000	OK
180 minute winter	60	120	332.657	0.053	23.4	0.0930	0.0000	OK
180 minute winter	61	124	332.605	0.059	27.7	0.1346	0.0000	OK
180 minute winter	62	124	332.523	0.063	31.0	0.0989	0.0000	OK
180 minute winter	63	124	332.405	0.064	32.5	0.0399	0.0000	OK
180 minute winter	64	124	332.378	0.083	48.3	0.0345	0.0000	OK
15 minute summer	65	1	334.788	0.000	0.0	0.0000	0.0000	OK
180 minute winter	66	124	332.364	0.112	56.4	0.3637	0.0000	OK
180 minute winter	67	124	332.289	0.098	69.2	0.4747	0.0000	OK
180 minute winter	68	124	332.141	0.111	88.1	0.7098	0.0000	OK
180 minute winter	69	124	331.986	0.118	96.9	0.3192	0.0000	OK
180 minute winter	70	120	344.418	0.017	7.2	0.0979	0.0000	OK
180 minute winter	71	124	341.224	0.024	8.2	0.0399	0.0000	OK
180 minute winter	72	124	340.722	0.022	9.1	0.0336	0.0000	OK
180 minute winter	73	124	339.921	0.021	10.5	0.0478	0.0000	OK
180 minute winter	74	124	336.923	0.023	11.1	0.0234	0.0000	OK
180 minute winter	75	124	335.847	0.047	12.4	0.1033	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	51	5.003	52	9.5	0.795	0.008	0.2688	
180 minute winter	52	5.004	53	10.2	0.791	0.048	0.2191	
180 minute winter	53	5.005	54	12.2	1.448	0.012	0.3231	
180 minute winter	54	5.006	55	14.1	1.694	0.014	0.3597	
180 minute winter	55	5.007	56	14.8	1.896	0.012	0.2066	
180 minute winter	56	5.008	64	14.8	1.882	0.012	0.0748	
180 minute winter	57	6.000	58	15.6	0.424	0.004	1.3467	
180 minute winter	58	6.001	59	18.0	0.448	0.005	1.4120	
180 minute winter	59	6.002	60	20.2	0.461	0.005	1.1737	
180 minute winter	60	6.003	61	23.3	0.478	0.006	1.3971	
180 minute winter	61	6.004	62	27.7	0.516	0.007	2.3158	
180 minute winter	62	6.005	63	31.0	0.548	0.008	3.3616	
180 minute winter	63	6.006	64	32.5	0.479	0.009	1.5555	
180 minute winter	64	5.009	66	48.3	0.497	0.013	2.1150	
15 minute summer	65	7.000	66	0.0	0.000	0.000	0.2624	
180 minute winter	66	5.010	67	56.4	0.529	0.023	7.7496	
180 minute winter	67	5.011	68	69.2	0.653	0.018	8.5286	
180 minute winter	68	5.012	69	88.0	0.736	0.023	9.6869	
180 minute winter	69	5.013	84	96.7	0.832	0.026	9.4219	
180 minute winter	70	8.000	71	7.2	1.084	0.007	0.4161	
180 minute winter	71	8.001	72	8.2	1.107	0.012	0.1522	
180 minute winter	72	8.002	73	9.1	1.335	0.010	0.1370	
180 minute winter	73	8.003	74	10.5	1.484	0.009	0.3322	
180 minute winter	74	8.004	75	11.1	0.981	0.011	0.2869	
180 minute winter	75	8.005	76	12.4	1.000	0.034	0.3750	

Results for 2 year +42% CC Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	76	124	335.627	0.027	13.3	0.0391	0.0000	OK
180 minute winter	77	124	334.518	0.018	13.3	0.0000	0.0000	OK
180 minute winter	78	120	332.852	0.052	22.5	0.5503	0.0000	OK
180 minute winter	79	120	332.732	0.055	24.2	0.0557	0.0000	OK
180 minute winter	80	120	332.678	0.061	29.3	0.1747	0.0000	OK
180 minute winter	81	124	332.592	0.067	35.5	0.2102	0.0000	OK
180 minute winter	82	124	332.527	0.071	38.4	0.1015	0.0000	OK
180 minute winter	83	124	332.413	0.048	55.4	0.0767	0.0000	OK
180 minute winter	84	124	331.381	0.059	152.7	0.0076	0.0000	OK
180 minute winter	85	120	349.120	0.036	26.0	0.9321	0.0000	OK
180 minute winter	86	120	347.710	0.026	30.6	0.1190	0.0000	OK
180 minute winter	87	120	346.018	0.034	39.6	0.3047	0.0000	OK
180 minute winter	88	120	344.620	0.036	51.6	0.4279	0.0000	OK
180 minute winter	89	120	343.127	0.043	59.7	0.3433	0.0000	OK
180 minute winter	90	120	340.046	0.062	79.7	1.2333	0.0000	OK
180 minute winter	91	120	339.559	0.075	138.0	4.3131	0.0000	OK
180 minute winter	92	120	338.152	0.068	145.8	0.5271	0.0000	OK
180 minute winter	93	120	336.563	0.063	150.3	0.2798	0.0000	OK
180 minute winter	94	124	330.340	0.102	324.4	1.4678	0.0000	OK
180 minute winter	95	124	327.903	0.165	330.2	0.6233	0.0000	OK
180 minute winter	96	124	327.325	0.087	364.2	1.9729	0.0000	OK
180 minute winter	97	124	318.904	0.166	382.9	2.0622	0.0000	OK
1440 minute winter	98	1440	321.960	0.422	45.3	1216.2440	0.0000	OK
1440 minute winter	99	1440	321.960	0.611	5.0	1.0804	0.0000	SURCHARGED
180 minute winter	100	120	320.433	0.019	16.5	0.2035	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	76	8.006	77	13.3	1.840	0.013	0.1558	
180 minute winter	77	8.007	83	13.3	1.378	0.008	0.1593	
180 minute winter	78	9.000	79	22.5	0.489	0.006	2.8376	
180 minute winter	79	9.001	80	24.1	0.480	0.006	1.5203	
180 minute winter	80	9.002	81	29.3	0.512	0.008	2.6528	
180 minute winter	81	9.003	82	35.4	0.566	0.009	2.1188	
180 minute winter	82	9.004	83	38.5	0.736	0.010	2.4041	
180 minute winter	83	8.008	84	55.4	1.194	0.005	3.0438	
180 minute winter	84	5.014	94	152.7	2.013	0.007	1.4333	
180 minute winter	85	10.000	86	26.0	1.395	0.005	1.2539	
180 minute winter	86	10.001	87	30.6	1.710	0.003	0.4060	
180 minute winter	87	10.002	88	39.5	1.866	0.005	0.5830	
180 minute winter	88	10.003	89	51.6	2.119	0.005	0.5028	
180 minute winter	89	10.004	90	59.7	1.723	0.007	2.0857	
180 minute winter	90	10.005	91	79.7	1.642	0.015	1.0105	
180 minute winter	91	10.006	92	137.9	2.710	0.020	1.8289	
180 minute winter	92	10.007	93	145.8	3.208	0.016	1.1470	
180 minute winter	93	10.008	94	150.2	3.462	0.015	3.1544	
180 minute winter	94	5.015	95	324.5	2.699	0.036	4.8488	
180 minute winter	95	5.016	96	330.2	2.977	0.084	4.6284	
180 minute winter	96	5.017	97	364.2	3.261	0.027	6.9101	
180 minute winter	97	5.018	103	382.9	2.516	0.095	3.5123	
1440 minute winter	98	11.000	99	5.0	0.159	0.021	15.2064	
1440 minute winter	99	11.001	100	4.1	1.186	0.008	0.3629	
180 minute winter	100	11.002	101	16.5	1.385	0.002	0.1793	

Results for 2 year +42% CC Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	101	120	319.437	0.023	17.4	0.0187	0.0000	OK
180 minute winter	102	120	318.753	0.039	18.4	0.0331	0.0000	OK
180 minute winter	103	124	318.585	0.147	461.1	5.8528	0.0000	OK
180 minute winter	104	124	317.393	0.155	467.6	0.6685	0.0000	OK
180 minute winter	105	124	315.334	0.095	480.9	0.8341	0.0000	OK
180 minute winter	106	124	309.336	0.097	493.1	0.7879	0.0000	OK
180 minute winter	107	124	301.179	0.140	506.4	1.2429	0.0000	OK
180 minute winter	108	124	299.140	0.153	544.1	0.5598	0.0000	OK
120 minute summer	109	74	321.987	0.002	0.4	0.0007	0.0000	OK
180 minute winter	110	120	320.690	0.004	1.4	0.0038	0.0000	OK
180 minute winter	111	120	317.889	0.004	2.1	0.0028	0.0000	OK
180 minute winter	112	120	314.692	0.007	4.0	0.0133	0.0000	OK
180 minute winter	113	120	313.003	0.017	10.6	0.1085	0.0000	OK
180 minute winter	114	120	312.507	0.021	13.6	0.0615	0.0000	OK
180 minute winter	115	120	311.531	0.045	20.2	0.2918	0.0000	OK
180 minute winter	116	120	311.401	0.048	22.8	0.0959	0.0000	OK
180 minute winter	117	120	311.316	0.051	25.0	0.0803	0.0000	OK
180 minute winter	118	120	311.250	0.052	29.6	0.1504	0.0000	OK
180 minute winter	119	120	311.040	0.054	39.4	0.5180	0.0000	OK
180 minute winter	120	120	310.541	0.055	46.4	0.3860	0.0000	OK
180 minute winter	121	120	310.059	0.073	56.8	0.7494	0.0000	OK
180 minute winter	122	124	309.658	0.072	64.1	0.5183	0.0000	OK
180 minute winter	123	120	321.991	0.006	1.9	0.0113	0.0000	OK
180 minute winter	124	124	320.998	0.013	5.3	0.0429	0.0000	OK
180 minute winter	125	120	320.001	0.016	12.4	0.1119	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	101	11.003	102	17.4	0.937	0.003	0.3515	
180 minute winter	102	11.004	103	18.4	0.757	0.006	0.3607	
180 minute winter	103	5.019	104	461.1	3.198	0.075	5.7436	
180 minute winter	104	5.020	105	467.6	4.281	0.072	6.6799	
180 minute winter	105	5.021	106	480.9	6.352	0.032	2.4936	
180 minute winter	106	5.022	107	493.1	4.844	0.034	4.9170	
180 minute winter	107	5.023	108	506.5	3.687	0.068	6.3830	
180 minute winter	108	1.023	108_OUT	544.0	2.476	0.081	5.0124	4297.1
120 minute summer	109	12.000	110	0.4	0.000	0.000	0.0131	
180 minute winter	110	12.001	111	1.4	0.691	0.000	0.0597	
180 minute winter	111	12.002	112	2.1	0.729	0.000	0.0433	
180 minute winter	112	12.003	113	4.0	0.626	0.000	0.1051	
180 minute winter	113	12.004	114	10.6	1.013	0.001	0.1204	
180 minute winter	114	12.005	115	13.6	0.687	0.002	0.6292	
180 minute winter	115	12.006	116	20.2	0.677	0.008	0.7926	
180 minute winter	116	12.007	117	22.7	0.709	0.009	0.5638	
180 minute winter	117	12.008	118	25.0	0.744	0.010	0.4474	
180 minute winter	118	12.009	119	29.6	0.850	0.010	1.1472	
180 minute winter	119	12.010	120	39.3	1.085	0.011	1.7938	
180 minute winter	120	12.011	121	46.3	1.046	0.012	1.7789	
180 minute winter	121	12.012	122	56.8	1.096	0.019	2.9463	
180 minute winter	122	12.013	139	64.2	0.543	0.019	9.7647	
180 minute winter	123	13.000	124	1.9	0.383	0.000	0.1243	
180 minute winter	124	13.001	125	5.3	0.681	0.001	0.2809	
180 minute winter	125	13.002	126	12.4	1.265	0.001	0.5872	

Results for 2 year +42% CC Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	126	120	316.004	0.019	15.8	0.0657	0.0000	OK
180 minute winter	127	120	314.513	0.028	17.7	0.0543	0.0000	OK
180 minute winter	128	120	314.009	0.023	18.6	0.0195	0.0000	OK
180 minute winter	129	120	322.588	0.003	1.1	0.0033	0.0000	OK
180 minute winter	130	120	319.991	0.006	2.5	0.0087	0.0000	OK
180 minute winter	131	120	317.995	0.010	6.6	0.0398	0.0000	OK
180 minute winter	132	120	314.002	0.017	8.1	0.0264	0.0000	OK
180 minute winter	133	120	313.522	0.036	10.1	0.0748	0.0000	OK
180 minute winter	134	124	313.406	0.021	10.4	0.0066	0.0000	OK
180 minute winter	135	120	313.241	0.055	30.7	0.0931	0.0000	OK
180 minute winter	136	120	313.141	0.055	50.8	1.0886	0.0000	OK
180 minute winter	137	120	312.562	0.076	65.5	1.1056	0.0000	OK
180 minute winter	138	124	312.038	0.052	76.4	0.5584	0.0000	OK
180 minute winter	139	124	309.078	0.192	140.5	0.0000	0.0000	OK
1440 minute winter	140	1440	322.299	0.431	46.9	1270.6570	0.0000	OK
1440 minute winter	141	1440	322.298	0.666	5.4	1.1776	0.0000	SURCHARGED
30 minute summer	142	91	312.370	0.014	4.1	0.0000	0.0000	OK
180 minute winter	143	120	312.340	0.019	10.6	0.0962	0.0000	OK
180 minute winter	144	120	310.823	0.016	15.4	0.0670	0.0000	OK
1440 minute winter	145	1410	322.376	0.333	30.9	758.3036	0.0000	OK
1440 minute winter	146	1410	322.376	0.851	5.2	1.5041	0.0000	SURCHARGED
180 minute winter	147	116	309.176	0.019	19.3	0.0000	0.0000	OK
180 minute winter	148	120	306.783	0.026	22.6	0.0617	0.0000	OK
180 minute winter	149	120	305.301	0.044	33.6	0.3275	0.0000	OK
180 minute winter	150	120	308.548	0.062	20.5	1.2456	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	126	13.003	127	15.8	1.160	0.002	0.3538	
180 minute winter	127	13.004	128	17.7	1.190	0.003	0.3431	
180 minute winter	128	13.005	135	18.6	0.765	0.003	0.4664	
180 minute winter	129	14.000	130	1.1	0.452	0.000	0.0534	
180 minute winter	130	14.001	131	2.5	0.586	0.000	0.1282	
180 minute winter	131	14.002	132	6.6	0.888	0.001	0.3139	
180 minute winter	132	14.003	133	8.0	0.520	0.002	0.3611	
180 minute winter	133	14.004	134	10.1	0.610	0.005	0.5309	
180 minute winter	134	14.005	135	10.4	0.446	0.002	0.2409	
180 minute winter	135	13.006	136	30.6	0.838	0.012	0.6652	
180 minute winter	136	13.007	137	50.8	1.114	0.011	1.7269	
180 minute winter	137	13.008	138	65.4	1.476	0.019	2.4236	
180 minute winter	138	13.009	139	76.3	0.727	0.010	8.5199	
180 minute winter	139	12.014	139_OUT	140.6	1.585	0.151	0.8117	780.6
1440 minute winter	140	15.000	141	5.4	0.177	0.021	16.1561	
1440 minute winter	141	15.001	142	4.1	2.384	0.002	0.0668	
30 minute summer	142	15.002	143	4.1	0.609	0.001	0.0214	
180 minute winter	143	15.003	144	10.6	1.071	0.002	0.5283	
180 minute winter	144	15.004	147	15.4	1.708	0.001	0.1406	
1440 minute winter	145	16.000	146	5.2	0.205	0.033	8.6144	
1440 minute winter	146	16.001	147	4.1	2.785	0.004	0.0774	
180 minute winter	147	15.005	148	19.2	1.506	0.002	0.3145	
180 minute winter	148	15.006	149	22.6	1.059	0.003	0.7992	
180 minute winter	149	15.007	154	33.6	1.050	0.008	0.6492	
180 minute winter	150	17.000	151	20.5	0.692	0.014	1.4912	

Results for 2 year +42% CC Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	151	120	308.431	0.031	25.4	0.1270	0.0000	OK
180 minute winter	152	120	307.315	0.028	28.7	0.0923	0.0000	OK
180 minute winter	153	120	305.523	0.036	30.2	0.0584	0.0000	OK
180 minute winter	154	120	305.012	0.055	80.3	0.6065	0.0000	OK
180 minute winter	155	120	303.157	0.186	80.2	0.0000	0.0000	OK
180 minute winter	156	128	302.990	0.033	79.3	0.0000	0.0000	OK
180 minute winter	157	120	301.636	0.042	82.0	0.0000	0.0000	OK
15 minute summer	108_OUT	1	298.429	0.247	219.6	0.0000	0.0000	OK
180 minute winter	139_OUT	124	309.026	0.192	140.6	0.0000	0.0000	OK
15 minute summer	157_OUT	1	300.209	0.043	35.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	151	17.001	152	25.4	1.447	0.004	0.6346	
180 minute winter	152	17.002	153	28.6	1.476	0.004	0.6963	
180 minute winter	153	17.003	154	30.2	1.359	0.006	0.3930	
180 minute winter	154	15.008	155	80.2	0.775	0.011	5.8797	
180 minute winter	155	15.009	156	79.3	2.132	0.165	0.4185	
180 minute winter	156	15.010	157	82.0	3.626	0.005	0.1273	
180 minute winter	157	15.011	157_OUT	80.2	3.025	0.007	0.3570	575.9

Results for 30 year +42% CC Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	1	88	322.123	0.051	13.2	0.1294	0.0000	OK
120 minute winter	2	92	321.724	0.078	29.2	0.2446	0.0000	OK
120 minute winter	3	90	321.196	0.127	70.4	0.5852	0.0000	OK
120 minute winter	4	92	320.141	0.183	118.4	0.9066	0.0000	OK
120 minute winter	5	94	319.784	0.350	167.7	1.5998	0.0000	OK
120 minute winter	6	94	319.710	0.431	219.2	1.9911	0.0000	OK
120 minute winter	7	96	319.620	0.497	273.5	2.3120	0.0000	OK
120 minute winter	8	96	319.489	0.522	301.0	1.6560	0.0000	OK
120 minute winter	9	96	319.325	0.521	310.3	1.1187	0.0000	OK
120 minute winter	10	96	319.199	0.479	316.3	0.9569	0.0000	OK
120 minute winter	11	96	319.019	0.383	319.3	0.7214	0.0000	OK
120 minute winter	12	90	322.271	0.085	28.3	0.3607	0.0000	OK
120 minute winter	13	92	321.680	0.087	28.3	0.1531	0.0000	OK
120 minute winter	14	92	321.188	0.110	36.8	0.2601	0.0000	OK
120 minute winter	15	92	320.991	0.154	63.0	0.5302	0.0000	OK
120 minute winter	16	92	320.692	0.213	99.6	0.8265	0.0000	OK
120 minute winter	17	90	322.285	0.073	14.0	0.1949	0.0000	OK
120 minute winter	18	92	322.125	0.079	19.8	0.1877	0.0000	OK
120 minute winter	19	90	321.762	0.123	30.0	0.3254	0.0000	OK
120 minute winter	20	90	321.472	0.146	33.7	0.2991	0.0000	OK
120 minute winter	21	92	321.365	0.144	45.0	0.3754	0.0000	OK
120 minute winter	22	92	321.058	0.174	45.0	0.3068	0.0000	OK
120 minute winter	23	92	320.543	0.319	145.2	0.5734	0.0000	OK
120 minute winter	24	92	320.508	0.316	173.2	1.0312	0.0000	OK
120 minute winter	25	94	320.248	0.296	175.7	0.5618	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	1	1.000	2	13.2	0.873	0.015	0.4518	
120 minute winter	2	1.001	3	29.2	1.112	0.037	1.4433	
120 minute winter	3	1.002	4	70.4	1.224	0.102	6.4320	
120 minute winter	4	1.003	5	118.3	1.006	0.211	9.5455	
120 minute winter	5	1.004	6	167.0	0.901	0.547	15.0525	
120 minute winter	6	1.005	7	218.6	0.965	0.715	18.2114	
120 minute winter	7	1.006	8	273.2	1.079	0.894	19.9119	
120 minute winter	8	1.007	9	300.7	1.157	0.984	21.2283	
120 minute winter	9	1.008	10	310.4	1.237	1.016	10.5404	
120 minute winter	10	1.009	11	316.3	1.460	1.032	9.0234	
120 minute winter	11	1.010	29	319.3	2.416	1.042	2.8429	
120 minute winter	12	2.000	13	28.3	1.151	0.044	1.6362	
120 minute winter	13	2.001	14	28.3	0.940	0.047	2.0128	
120 minute winter	14	2.002	15	36.8	0.801	0.077	2.3106	
120 minute winter	15	2.003	16	62.9	0.863	0.151	7.1115	
120 minute winter	16	2.004	23	99.6	0.827	0.284	11.7196	
120 minute winter	17	3.000	18	14.0	0.999	0.121	0.2156	
120 minute winter	18	3.001	19	19.8	1.111	0.155	0.6494	
120 minute winter	19	3.002	20	30.0	0.977	0.354	1.6487	
120 minute winter	20	3.003	21	33.6	0.994	0.431	0.7147	
120 minute winter	21	3.004	22	45.0	1.188	0.452	1.5845	
120 minute winter	22	3.005	23	45.0	1.151	0.527	0.2366	
120 minute winter	23	2.005	24	145.1	0.960	0.331	1.1844	
120 minute winter	24	2.006	25	173.2	1.199	0.529	15.1543	
120 minute winter	25	2.007	26	175.7	1.203	0.336	2.3192	

Results for 30 year +42% CC Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	26	94	320.181	0.321	177.7	0.5984	0.0000	OK
120 minute winter	27	94	320.117	0.324	180.2	0.6128	0.0000	OK
120 minute winter	28	94	320.053	0.333	194.5	0.8142	0.0000	OK
120 minute winter	29	96	318.781	0.188	525.2	0.4146	0.0000	OK
120 minute winter	30	96	315.119	0.168	527.7	0.1105	0.0000	OK
120 minute winter	31	96	314.819	0.101	530.6	0.0787	0.0000	OK
120 minute winter	32	96	312.039	0.114	534.9	0.1517	0.0000	OK
120 minute winter	33	96	309.390	0.124	540.8	0.1237	0.0000	OK
120 minute winter	34	90	321.862	0.046	15.3	0.1453	0.0000	OK
120 minute winter	35	90	316.042	0.025	22.3	0.0710	0.0000	OK
120 minute winter	36	90	315.513	0.027	23.9	0.0175	0.0000	OK
120 minute winter	37	90	315.008	0.023	27.8	0.0367	0.0000	OK
120 minute winter	38	90	313.113	0.027	32.9	0.0571	0.0000	OK
120 minute winter	39	90	311.502	0.028	43.8	0.1221	0.0000	OK
120 minute winter	40	90	308.675	0.034	47.7	0.0323	0.0000	OK
120 minute winter	41	94	307.929	0.357	704.4	1.9632	0.0000	OK
720 minute winter	42	720	306.477	0.687	330.3	0.0000	0.0000	SURCHARGED
720 minute winter	43	720	306.476	0.976	330.9	4379.0350	0.0000	SURCHARGED
720 minute winter	44	720	306.475	1.041	60.2	7.3559	0.0000	SURCHARGED
120 minute winter	45	254	302.121	0.049	59.8	0.0000	0.0000	OK
120 minute winter	46	254	301.456	0.127	59.8	0.0000	0.0000	OK
120 minute winter	47	254	300.378	0.038	59.8	0.0000	0.0000	OK
120 minute winter	48	96	345.040	0.041	8.4	0.1225	0.0000	OK
120 minute winter	49	88	344.856	0.035	14.3	0.0758	0.0000	OK
120 minute winter	50	88	343.600	0.025	16.7	0.0288	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	26	2.008	27	177.7	1.152	0.401	2.4845	
120 minute winter	27	2.009	28	180.2	1.142	0.409	2.7985	
120 minute winter	28	2.010	29	194.4	1.329	0.579	14.4148	
120 minute winter	29	1.011	30	525.2	7.504	0.195	1.6767	
120 minute winter	30	1.012	31	527.7	3.905	0.101	1.6643	
120 minute winter	31	1.013	32	530.6	6.010	0.036	1.4108	
120 minute winter	32	1.014	33	534.9	5.254	0.045	2.4326	
120 minute winter	33	1.015	41	540.9	1.537	0.061	14.2467	
120 minute winter	34	4.000	35	15.3	3.860	0.075	0.1534	
120 minute winter	35	4.001	36	22.3	1.473	0.003	0.1678	
120 minute winter	36	4.002	37	23.9	1.652	0.003	0.1652	
120 minute winter	37	4.003	38	27.8	1.918	0.002	0.2761	
120 minute winter	38	4.004	39	32.9	2.060	0.003	0.3380	
120 minute winter	39	4.005	40	43.8	2.357	0.004	0.4474	
120 minute winter	40	4.006	41	47.7	0.509	0.006	8.3621	
120 minute winter	41	1.016	42	704.1	3.289	0.484	27.7234	
720 minute winter	42	1.017	43	330.9	3.225	0.355	4.4705	
720 minute winter	43	1.018	44	60.2	0.423	0.120	3.4883	
720 minute winter	44	1.019	45	59.8	4.764	0.048	0.2925	
120 minute winter	45	1.020	46	59.8	0.889	0.009	1.6294	
120 minute winter	46	1.021	47	59.8	2.838	0.112	1.4544	
120 minute winter	47	1.022	108	59.8	2.568	0.006	0.3114	
120 minute winter	48	5.000	49	8.4	0.662	0.028	0.5162	
120 minute winter	49	5.001	50	14.3	1.467	0.020	0.4987	
120 minute winter	50	5.002	51	16.7	1.933	0.012	0.2323	

Results for 30 year +42% CC Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	51	88	341.223	0.028	17.8	0.0153	0.0000	OK
120 minute winter	52	88	339.900	0.073	19.6	0.0641	0.0000	OK
120 minute winter	53	90	339.827	0.037	24.4	0.0889	0.0000	OK
120 minute winter	54	90	338.002	0.042	29.1	0.0984	0.0000	OK
120 minute winter	55	90	335.926	0.037	30.9	0.0327	0.0000	OK
120 minute winter	56	90	333.915	0.038	30.9	0.0000	0.0000	OK
120 minute winter	57	92	332.858	0.058	27.1	0.3290	0.0000	OK
120 minute winter	58	92	332.792	0.065	32.8	0.0973	0.0000	OK
120 minute winter	59	92	332.727	0.070	38.2	0.0918	0.0000	OK
120 minute winter	60	92	332.681	0.078	45.9	0.1359	0.0000	OK
120 minute winter	61	92	332.634	0.088	56.7	0.2004	0.0000	OK
120 minute winter	62	92	332.554	0.094	64.7	0.1486	0.0000	OK
120 minute winter	63	92	332.442	0.101	68.2	0.0630	0.0000	OK
120 minute winter	64	92	332.427	0.132	101.6	0.0549	0.0000	OK
15 minute summer	65	1	334.788	0.000	0.0	0.0000	0.0000	OK
120 minute winter	66	92	332.417	0.165	121.5	0.5331	0.0000	OK
120 minute winter	67	94	332.340	0.149	152.7	0.7221	0.0000	OK
120 minute winter	68	94	332.200	0.170	198.7	1.0857	0.0000	OK
120 minute winter	69	94	332.047	0.179	220.4	0.4847	0.0000	OK
120 minute winter	70	92	344.424	0.024	12.1	0.1337	0.0000	OK
120 minute winter	71	90	341.234	0.034	14.6	0.0562	0.0000	OK
120 minute winter	72	92	340.732	0.032	16.9	0.0485	0.0000	OK
120 minute winter	73	90	339.931	0.031	20.4	0.0712	0.0000	OK
120 minute winter	74	90	336.935	0.035	21.9	0.0352	0.0000	OK
120 minute winter	75	90	335.870	0.070	25.2	0.1547	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	51	5.003	52	17.8	1.003	0.016	0.4015	
120 minute winter	52	5.004	53	19.6	1.004	0.093	0.3323	
120 minute winter	53	5.005	54	24.4	1.819	0.025	0.5143	
120 minute winter	54	5.006	55	29.1	2.168	0.029	0.5802	
120 minute winter	55	5.007	56	30.9	2.448	0.025	0.3341	
120 minute winter	56	5.008	64	30.9	2.429	0.025	0.1210	
120 minute winter	57	6.000	58	27.1	0.498	0.007	1.9875	
120 minute winter	58	6.001	59	32.8	0.537	0.009	2.1500	
120 minute winter	59	6.002	60	38.2	0.558	0.010	1.8387	
120 minute winter	60	6.003	61	45.9	0.583	0.012	2.2542	
120 minute winter	61	6.004	62	56.6	0.640	0.015	3.8190	
120 minute winter	62	6.005	63	64.7	0.666	0.017	5.7791	
120 minute winter	63	6.006	64	68.2	0.555	0.018	2.8186	
120 minute winter	64	5.009	66	101.6	0.597	0.027	3.6988	
15 minute summer	65	7.000	66	0.0	0.000	0.000	0.4436	
120 minute winter	66	5.010	67	121.4	0.663	0.050	13.3152	
120 minute winter	67	5.011	68	152.7	0.813	0.040	15.1347	
120 minute winter	68	5.012	69	198.7	0.930	0.052	17.3092	
120 minute winter	69	5.013	84	220.2	1.036	0.058	17.2242	
120 minute winter	70	8.000	71	12.1	1.279	0.012	0.5935	
120 minute winter	71	8.001	72	14.6	1.344	0.021	0.2233	
120 minute winter	72	8.002	73	16.9	1.644	0.019	0.2068	
120 minute winter	73	8.003	74	20.4	1.864	0.018	0.5136	
120 minute winter	74	8.004	75	21.9	1.175	0.023	0.4550	
120 minute winter	75	8.005	76	25.2	1.270	0.068	0.6007	

Results for 30 year +42% CC Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	76	92	335.641	0.041	27.4	0.0602	0.0000	OK
120 minute winter	77	92	334.528	0.028	27.3	0.0000	0.0000	OK
120 minute winter	78	92	332.876	0.076	43.9	0.8015	0.0000	OK
120 minute winter	79	92	332.757	0.080	48.0	0.0819	0.0000	OK
120 minute winter	80	92	332.708	0.091	60.5	0.2612	0.0000	OK
120 minute winter	81	92	332.626	0.102	75.5	0.3188	0.0000	OK
120 minute winter	82	92	332.561	0.105	82.9	0.1514	0.0000	OK
120 minute winter	83	92	332.440	0.074	119.1	0.1181	0.0000	OK
120 minute winter	84	94	331.414	0.093	340.6	0.0119	0.0000	OK
120 minute winter	85	90	349.144	0.060	63.3	1.5364	0.0000	OK
120 minute winter	86	90	347.728	0.044	74.5	0.1980	0.0000	OK
120 minute winter	87	90	346.040	0.056	96.5	0.5031	0.0000	OK
120 minute winter	88	90	344.643	0.059	125.8	0.7052	0.0000	OK
120 minute winter	89	90	343.154	0.070	145.5	0.5620	0.0000	OK
120 minute winter	90	90	340.085	0.101	194.3	1.9859	0.0000	OK
120 minute winter	91	90	339.604	0.120	336.2	6.8775	0.0000	OK
120 minute winter	92	90	338.192	0.108	355.3	0.8450	0.0000	OK
120 minute winter	93	90	336.601	0.101	366.2	0.4502	0.0000	OK
120 minute winter	94	92	330.395	0.157	759.3	2.2569	0.0000	OK
120 minute winter	95	92	327.983	0.245	773.1	0.9233	0.0000	OK
120 minute winter	96	92	327.374	0.136	856.3	3.0654	0.0000	OK
120 minute winter	97	92	318.987	0.249	901.8	3.0816	0.0000	OK
1440 minute winter	98	1440	322.148	0.610	83.4	2530.5660	0.0000	SURCHARGED
600 minute winter	99	690	322.185	0.836	16.4	1.4770	0.0000	SURCHARGED
120 minute winter	100	90	320.443	0.029	34.2	0.3108	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	76	8.006	77	27.3	2.368	0.027	0.2491	
120 minute winter	77	8.007	83	27.4	1.724	0.016	0.2609	
120 minute winter	78	9.000	79	43.9	0.601	0.012	4.5097	
120 minute winter	79	9.001	80	48.0	0.587	0.013	2.4713	
120 minute winter	80	9.002	81	60.5	0.633	0.016	4.4343	
120 minute winter	81	9.003	82	75.5	0.719	0.020	3.5517	
120 minute winter	82	9.004	83	82.9	0.951	0.022	4.0140	
120 minute winter	83	8.008	84	119.1	1.499	0.011	5.2145	
120 minute winter	84	5.014	94	340.6	2.544	0.017	2.5387	
120 minute winter	85	10.000	86	63.3	1.861	0.012	2.2941	
120 minute winter	86	10.001	87	74.5	2.285	0.008	0.7413	
120 minute winter	87	10.002	88	96.4	2.479	0.012	1.0703	
120 minute winter	88	10.003	89	125.8	2.802	0.013	0.9274	
120 minute winter	89	10.004	90	145.5	2.254	0.018	3.8945	
120 minute winter	90	10.005	91	194.3	2.127	0.035	1.9037	
120 minute winter	91	10.006	92	336.1	3.503	0.048	3.4489	
120 minute winter	92	10.007	93	355.2	4.159	0.040	2.1567	
120 minute winter	93	10.008	94	366.2	4.494	0.036	5.9245	
120 minute winter	94	5.015	95	759.2	3.434	0.085	8.9272	
120 minute winter	95	5.016	96	773.1	3.799	0.196	8.5162	
120 minute winter	96	5.017	97	856.2	4.140	0.064	12.8487	
120 minute winter	97	5.018	103	901.8	3.169	0.224	6.5663	
1440 minute winter	98	11.000	99	15.1	0.167	0.063	16.3332	
600 minute winter	99	11.001	100	4.1	1.166	0.008	0.3994	
120 minute winter	100	11.002	101	34.2	1.770	0.004	0.2910	

Results for 30 year +42% CC Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	101	90	319.450	0.036	36.5	0.0287	0.0000	OK
120 minute winter	102	90	318.774	0.060	38.9	0.0502	0.0000	OK
120 minute winter	103	92	318.661	0.223	1086.9	8.8548	0.0000	OK
120 minute winter	104	92	317.472	0.234	1102.7	1.0071	0.0000	OK
120 minute winter	105	92	315.386	0.147	1135.1	1.2930	0.0000	OK
120 minute winter	106	92	309.390	0.151	1164.8	1.2200	0.0000	OK
120 minute winter	107	92	301.252	0.213	1197.4	1.8880	0.0000	OK
120 minute winter	108	92	299.216	0.229	1266.7	0.8405	0.0000	OK
120 minute winter	109	84	321.988	0.003	1.1	0.0014	0.0000	OK
120 minute winter	110	88	320.693	0.007	3.5	0.0066	0.0000	OK
120 minute winter	111	88	317.892	0.007	5.3	0.0049	0.0000	OK
120 minute winter	112	88	314.697	0.012	9.8	0.0226	0.0000	OK
120 minute winter	113	90	313.014	0.028	25.9	0.1826	0.0000	OK
120 minute winter	114	90	312.521	0.035	33.1	0.1028	0.0000	OK
120 minute winter	115	92	311.560	0.074	49.1	0.4764	0.0000	OK
120 minute winter	116	92	311.432	0.079	55.3	0.1566	0.0000	OK
120 minute winter	117	90	311.348	0.083	60.9	0.1307	0.0000	OK
120 minute winter	118	90	311.283	0.084	72.2	0.2444	0.0000	OK
120 minute winter	119	90	311.073	0.087	96.0	0.8401	0.0000	OK
120 minute winter	120	90	310.576	0.090	113.1	0.6251	0.0000	OK
120 minute winter	121	90	310.102	0.116	138.5	1.1974	0.0000	OK
120 minute winter	122	92	309.701	0.115	156.2	0.8281	0.0000	OK
120 minute winter	123	86	321.995	0.010	4.5	0.0189	0.0000	OK
120 minute winter	124	92	321.006	0.021	12.9	0.0724	0.0000	OK
120 minute winter	125	90	320.012	0.027	30.1	0.1878	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	101	11.003	102	36.5	1.190	0.005	0.5825	
120 minute winter	102	11.004	103	38.9	0.959	0.013	0.6026	
120 minute winter	103	5.019	104	1086.8	4.019	0.177	10.7726	
120 minute winter	104	5.020	105	1102.7	5.415	0.170	12.4865	
120 minute winter	105	5.021	106	1135.0	8.057	0.075	4.6393	
120 minute winter	106	5.022	107	1164.8	6.121	0.079	9.2082	
120 minute winter	107	5.023	108	1197.4	4.656	0.161	11.9348	
120 minute winter	108	1.023	108_OUT	1266.7	4.382	0.188	6.4064	6931.6
120 minute winter	109	12.000	110	1.1	0.435	0.000	0.0249	
120 minute winter	110	12.001	111	3.5	0.981	0.000	0.1052	
120 minute winter	111	12.002	112	5.3	1.049	0.000	0.0761	
120 minute winter	112	12.003	113	9.8	0.870	0.001	0.1868	
120 minute winter	113	12.004	114	25.9	1.378	0.004	0.2160	
120 minute winter	114	12.005	115	33.1	0.918	0.005	1.1557	
120 minute winter	115	12.006	116	49.1	0.886	0.020	1.4736	
120 minute winter	116	12.007	117	55.3	0.924	0.022	1.0520	
120 minute winter	117	12.008	118	60.9	0.971	0.024	0.8350	
120 minute winter	118	12.009	119	72.2	1.111	0.026	2.1417	
120 minute winter	119	12.010	120	95.9	1.416	0.027	3.3525	
120 minute winter	120	12.011	121	113.0	1.358	0.029	3.3451	
120 minute winter	121	12.012	122	138.5	1.416	0.047	5.5591	
120 minute winter	122	12.013	139	156.3	0.658	0.046	20.0714	
120 minute winter	123	13.000	124	4.5	0.522	0.001	0.2174	
120 minute winter	124	13.001	125	12.9	0.934	0.002	0.4983	
120 minute winter	125	13.002	126	30.1	1.720	0.003	1.0494	

Results for 30 year +42% CC Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	126	90	316.017	0.032	38.5	0.1102	0.0000	OK
120 minute winter	127	90	314.532	0.047	43.2	0.0902	0.0000	OK
120 minute winter	128	90	314.025	0.039	45.3	0.0325	0.0000	OK
120 minute winter	129	90	322.590	0.005	2.6	0.0056	0.0000	OK
120 minute winter	130	90	319.996	0.011	6.1	0.0148	0.0000	OK
120 minute winter	131	90	318.002	0.017	16.0	0.0674	0.0000	OK
120 minute winter	132	90	314.014	0.029	19.8	0.0445	0.0000	OK
120 minute winter	133	90	313.544	0.058	24.8	0.1215	0.0000	OK
120 minute winter	134	92	313.420	0.035	25.6	0.0111	0.0000	OK
120 minute winter	135	92	313.276	0.090	75.0	0.1510	0.0000	OK
120 minute winter	136	92	313.175	0.089	124.2	1.7672	0.0000	OK
120 minute winter	137	92	312.607	0.121	159.9	1.7564	0.0000	OK
120 minute winter	138	92	312.070	0.084	186.5	0.9081	0.0000	OK
120 minute winter	139	92	309.192	0.305	342.8	0.0000	0.0000	OK
1440 minute winter	140	1470	322.490	0.623	86.3	2638.1980	0.0000	SURCHARGED
960 minute winter	141	795	322.515	0.883	19.3	1.5599	0.0000	SURCHARGED
15 minute summer	142	254	312.370	0.014	4.1	0.0000	0.0000	OK
120 minute winter	143	90	312.349	0.028	19.9	0.1377	0.0000	OK
120 minute winter	144	90	310.832	0.025	31.6	0.1018	0.0000	OK
1440 minute winter	145	1440	322.534	0.491	56.9	1641.6620	0.0000	SURCHARGED
1440 minute winter	146	1440	322.534	1.009	7.2	1.7831	0.0000	SURCHARGED
120 minute winter	147	88	309.183	0.026	35.1	0.0000	0.0000	OK
120 minute winter	148	90	306.796	0.038	43.5	0.0897	0.0000	OK
120 minute winter	149	90	305.323	0.066	70.1	0.4919	0.0000	OK
120 minute winter	150	90	308.582	0.096	49.8	1.9445	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	126	13.003	127	38.5	1.565	0.005	0.6406	
120 minute winter	127	13.004	128	43.2	1.602	0.008	0.6226	
120 minute winter	128	13.005	135	45.2	1.017	0.006	0.8656	
120 minute winter	129	14.000	130	2.6	0.625	0.000	0.0923	
120 minute winter	130	14.001	131	6.1	0.820	0.001	0.2246	
120 minute winter	131	14.002	132	16.0	1.217	0.001	0.5592	
120 minute winter	132	14.003	133	19.7	0.713	0.004	0.6502	
120 minute winter	133	14.004	134	24.8	0.832	0.012	0.9585	
120 minute winter	134	14.005	135	25.6	0.598	0.005	0.4479	
120 minute winter	135	13.006	136	75.0	1.095	0.029	1.2462	
120 minute winter	136	13.007	137	124.2	1.453	0.028	3.2444	
120 minute winter	137	13.008	138	159.9	1.927	0.047	4.5489	
120 minute winter	138	13.009	139	186.5	0.885	0.025	17.5967	
120 minute winter	139	12.014	139_OUT	342.4	2.034	0.368	1.5409	1551.0
1440 minute winter	140	15.000	141	17.5	0.190	0.067	17.1956	
960 minute winter	141	15.001	142	4.1	2.384	0.002	0.0668	
15 minute summer	142	15.002	143	4.1	0.608	0.001	0.0246	
120 minute winter	143	15.003	144	20.0	1.308	0.003	0.8133	
120 minute winter	144	15.004	147	31.6	2.199	0.003	0.2238	
1440 minute winter	145	16.000	146	7.2	0.219	0.045	8.8856	
1440 minute winter	146	16.001	147	4.1	2.772	0.004	0.0784	
120 minute winter	147	15.005	148	35.1	1.813	0.003	0.4777	
120 minute winter	148	15.006	149	43.5	1.263	0.006	1.2946	
120 minute winter	149	15.007	154	70.1	1.267	0.016	1.1239	
120 minute winter	150	17.000	151	49.8	0.936	0.034	2.6919	

Results for 30 year +42% CC Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	151	92	308.451	0.051	61.6	0.2099	0.0000	OK
120 minute winter	152	92	307.333	0.047	69.6	0.1529	0.0000	OK
120 minute winter	153	92	305.546	0.060	73.5	0.0960	0.0000	OK
120 minute winter	154	90	305.043	0.086	183.5	0.9500	0.0000	OK
120 minute winter	155	92	303.256	0.285	183.5	0.0000	0.0000	OK
120 minute winter	156	84	303.010	0.052	200.3	0.0000	0.0000	OK
120 minute winter	157	90	301.660	0.066	182.8	0.0000	0.0000	OK
15 minute summer	108_OUT	1	298.429	0.247	586.2	0.0000	0.0000	OK
120 minute winter	139_OUT	92	309.140	0.305	342.4	0.0000	0.0000	OK
120 minute winter	157_OUT	92	300.232	0.066	183.5	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	151	17.001	152	61.6	1.932	0.010	1.1549	
120 minute winter	152	17.002	153	69.6	1.965	0.009	1.2724	
120 minute winter	153	17.003	154	73.5	1.801	0.014	0.7214	
120 minute winter	154	15.008	155	183.5	0.937	0.026	11.3946	
120 minute winter	155	15.009	156	200.3	2.745	0.418	0.7640	
120 minute winter	156	15.010	157	182.8	4.664	0.010	0.2237	
120 minute winter	157	15.011	157_OUT	183.5	4.005	0.016	0.6168	941.4

Results for 200 year +42% CC Critical Storm Duration. Lowest mass balance: 99.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	1	90	322.133	0.060	18.8	0.1527	0.0000	OK
120 minute winter	2	90	321.744	0.098	47.2	0.3081	0.0000	OK
120 minute winter	3	98	321.394	0.325	120.2	1.4982	0.0000	OK
120 minute winter	4	98	321.369	1.411	202.1	6.9995	0.0000	SURCHARGED
120 minute winter	5	98	321.290	1.856	286.8	8.4841	0.0000	SURCHARGED
120 minute winter	6	98	321.132	1.853	375.2	8.5532	0.0000	SURCHARGED
120 minute winter	7	98	320.856	1.733	470.6	8.0701	0.0000	SURCHARGED
120 minute winter	8	96	320.423	1.456	519.1	4.6166	0.0000	SURCHARGED
120 minute winter	9	96	319.875	1.071	536.1	2.3011	0.0000	SURCHARGED
120 minute winter	10	96	319.529	0.809	546.6	1.6172	0.0000	SURCHARGED
120 minute winter	11	96	319.178	0.542	551.9	1.0212	0.0000	OK
120 minute winter	12	90	322.293	0.107	45.6	0.4573	0.0000	OK
120 minute winter	13	92	321.702	0.109	45.6	0.1929	0.0000	OK
120 minute winter	14	92	321.219	0.141	60.6	0.3328	0.0000	OK
120 minute winter	15	92	321.039	0.202	107.0	0.6964	0.0000	OK
120 minute winter	16	94	320.777	0.298	171.9	1.1543	0.0000	OK
120 minute winter	17	90	322.301	0.089	20.2	0.2376	0.0000	OK
120 minute winter	18	92	322.145	0.099	30.5	0.2345	0.0000	OK
120 minute winter	19	90	321.801	0.162	48.5	0.4278	0.0000	OK
120 minute winter	20	90	321.530	0.204	55.0	0.4176	0.0000	OK
120 minute winter	21	90	321.423	0.202	75.3	0.5249	0.0000	OK
120 minute winter	22	92	321.139	0.255	75.3	0.4502	0.0000	OK
120 minute winter	23	94	320.697	0.473	247.8	0.8510	0.0000	OK
120 minute winter	24	94	320.657	0.465	297.4	1.5177	0.0000	OK
120 minute winter	25	94	320.413	0.460	301.9	0.8731	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	1	1.000	2	18.8	0.873	0.022	0.6138	
120 minute winter	2	1.001	3	47.2	1.112	0.060	4.1314	
120 minute winter	3	1.002	4	126.1	1.337	0.183	24.2897	
120 minute winter	4	1.003	5	209.2	1.039	0.373	22.1322	
120 minute winter	5	1.004	6	288.1	1.023	0.943	21.8838	
120 minute winter	6	1.005	7	375.6	1.334	1.229	22.0063	
120 minute winter	7	1.006	8	470.7	1.671	1.540	22.0063	
120 minute winter	8	1.007	9	519.1	1.843	1.698	22.9922	
120 minute winter	9	1.008	10	536.1	1.903	1.754	11.8535	
120 minute winter	10	1.009	11	546.5	1.942	1.784	11.5048	
120 minute winter	11	1.010	29	551.9	2.768	1.801	4.1090	
120 minute winter	12	2.000	13	45.6	1.321	0.070	2.2970	
120 minute winter	13	2.001	14	45.5	1.071	0.075	2.8424	
120 minute winter	14	2.002	15	60.6	0.912	0.127	3.3431	
120 minute winter	15	2.003	16	106.9	0.976	0.257	10.8022	
120 minute winter	16	2.004	23	171.5	0.910	0.488	18.3221	
120 minute winter	17	3.000	18	20.2	1.073	0.175	0.2897	
120 minute winter	18	3.001	19	30.5	1.111	0.239	0.9109	
120 minute winter	19	3.002	20	48.5	1.077	0.573	2.4155	
120 minute winter	20	3.003	21	55.0	1.084	0.705	1.0728	
120 minute winter	21	3.004	22	75.3	1.309	0.756	2.3879	
120 minute winter	22	3.005	23	75.3	1.275	0.880	0.3556	
120 minute winter	23	2.005	24	247.8	1.049	0.565	1.8511	
120 minute winter	24	2.006	25	297.4	1.279	0.908	24.4602	
120 minute winter	25	2.007	26	301.8	1.262	0.577	3.8002	

Results for 200 year +42% CC Critical Storm Duration. Lowest mass balance: 99.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	26	94	320.350	0.490	305.3	0.9137	0.0000	OK
120 minute winter	27	96	320.281	0.488	309.8	0.9233	0.0000	OK
120 minute winter	28	96	320.207	0.487	334.9	1.1910	0.0000	OK
120 minute winter	29	96	318.850	0.257	907.2	0.5680	0.0000	OK
120 minute winter	30	96	315.168	0.218	911.7	0.1427	0.0000	OK
120 minute winter	31	96	314.851	0.133	916.9	0.1041	0.0000	OK
120 minute winter	32	96	312.075	0.150	924.5	0.1999	0.0000	OK
120 minute winter	33	96	309.431	0.165	935.0	0.1645	0.0000	OK
120 minute winter	34	90	321.876	0.060	27.1	0.1921	0.0000	OK
120 minute winter	35	90	316.052	0.035	39.5	0.0986	0.0000	OK
120 minute winter	36	90	315.524	0.038	42.3	0.0243	0.0000	OK
120 minute winter	37	90	315.017	0.032	49.3	0.0511	0.0000	OK
120 minute winter	38	90	313.124	0.038	58.4	0.0793	0.0000	OK
120 minute winter	39	90	311.514	0.039	77.7	0.1695	0.0000	OK
120 minute winter	40	90	308.689	0.048	84.7	0.0451	0.0000	OK
120 minute winter	41	94	308.078	0.506	1224.8	2.7864	0.0000	OK
720 minute winter	42	735	307.113	1.322	525.3	0.0000	0.0000	SURCHARGED
720 minute winter	43	750	307.111	1.611	521.7	7739.8950	0.0000	SURCHARGED
720 minute winter	44	750	307.110	1.676	60.4	11.8482	0.0000	SURCHARGED
30 minute winter	45	158	302.121	0.049	59.8	0.0000	0.0000	OK
30 minute winter	46	157	301.456	0.127	59.8	0.0000	0.0000	OK
30 minute winter	47	157	300.378	0.038	59.8	0.0000	0.0000	OK
120 minute winter	48	94	345.049	0.050	12.0	0.1503	0.0000	OK
120 minute winter	49	90	344.866	0.045	22.5	0.0991	0.0000	OK
120 minute winter	50	90	343.608	0.033	26.7	0.0382	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	26	2.008	27	305.3	1.241	0.689	3.9610	
120 minute winter	27	2.009	28	309.7	1.263	0.703	4.3484	
120 minute winter	28	2.010	29	334.8	1.538	0.997	21.3141	
120 minute winter	29	1.011	30	907.2	8.750	0.336	2.4848	
120 minute winter	30	1.012	31	911.7	4.614	0.174	2.4366	
120 minute winter	31	1.013	32	916.9	6.991	0.062	2.0960	
120 minute winter	32	1.014	33	924.5	6.043	0.078	3.6558	
120 minute winter	33	1.015	41	935.0	1.611	0.105	24.4828	
120 minute winter	34	4.000	35	27.1	4.451	0.132	0.2341	
120 minute winter	35	4.001	36	39.5	1.785	0.005	0.2452	
120 minute winter	36	4.002	37	42.3	2.002	0.006	0.2413	
120 minute winter	37	4.003	38	49.3	2.326	0.004	0.4039	
120 minute winter	38	4.004	39	58.4	2.494	0.006	0.4955	
120 minute winter	39	4.005	40	77.7	2.831	0.006	0.6613	
120 minute winter	40	4.006	41	84.7	0.535	0.011	15.4082	
120 minute winter	41	1.016	42	1224.4	3.442	0.842	48.7406	
720 minute winter	42	1.017	43	521.7	3.529	0.560	4.4705	
720 minute winter	43	1.018	44	60.4	0.510	0.120	3.4883	
720 minute winter	44	1.019	45	59.8	4.764	0.048	0.2925	
30 minute winter	45	1.020	46	59.8	0.889	0.009	1.6294	
30 minute winter	46	1.021	47	59.8	2.838	0.112	1.4544	
30 minute winter	47	1.022	108	59.8	2.568	0.006	0.3114	
120 minute winter	48	5.000	49	12.0	0.727	0.040	0.6716	
120 minute winter	49	5.001	50	22.5	1.707	0.032	0.6746	
120 minute winter	50	5.002	51	26.7	2.270	0.020	0.3163	

Results for 200 year +42% CC Critical Storm Duration. Lowest mass balance: 99.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	51	90	341.233	0.038	28.6	0.0203	0.0000	OK
120 minute winter	52	86	339.925	0.098	31.8	0.0860	0.0000	OK
120 minute winter	53	88	339.840	0.050	41.6	0.1206	0.0000	OK
120 minute winter	54	92	338.017	0.057	49.2	0.1342	0.0000	OK
120 minute winter	55	92	335.940	0.051	52.3	0.0447	0.0000	OK
120 minute winter	56	92	333.929	0.052	52.3	0.0000	0.0000	OK
120 minute winter	57	90	332.875	0.075	42.3	0.4220	0.0000	OK
120 minute winter	58	90	332.811	0.084	52.5	0.1263	0.0000	OK
120 minute winter	59	92	332.749	0.092	62.0	0.1202	0.0000	OK
120 minute winter	60	92	332.706	0.103	75.6	0.1794	0.0000	OK
120 minute winter	61	92	332.662	0.116	94.8	0.2646	0.0000	OK
120 minute winter	62	92	332.585	0.125	109.1	0.1965	0.0000	OK
120 minute winter	63	92	332.484	0.143	115.3	0.0886	0.0000	OK
120 minute winter	64	92	332.474	0.179	172.0	0.0744	0.0000	OK
15 minute summer	65	1	334.788	0.000	0.0	0.0000	0.0000	OK
120 minute winter	66	94	332.465	0.213	207.0	0.6894	0.0000	OK
120 minute winter	67	94	332.387	0.196	262.2	0.9506	0.0000	OK
120 minute winter	68	92	332.254	0.224	344.1	1.4302	0.0000	OK
120 minute winter	69	94	332.103	0.235	382.5	0.6360	0.0000	OK
120 minute winter	70	92	344.431	0.031	18.5	0.1724	0.0000	OK
120 minute winter	71	92	341.244	0.044	22.9	0.0733	0.0000	OK
120 minute winter	72	92	340.742	0.042	26.9	0.0639	0.0000	OK
120 minute winter	73	92	339.941	0.041	33.0	0.0949	0.0000	OK
120 minute winter	74	92	336.947	0.047	35.6	0.0470	0.0000	OK
120 minute winter	75	92	335.893	0.093	41.4	0.2042	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	51	5.003	52	28.6	1.180	0.025	0.5672	
120 minute winter	52	5.004	53	33.0	1.209	0.157	0.4697	
120 minute winter	53	5.005	54	40.8	2.147	0.041	0.7287	
120 minute winter	54	5.006	55	49.2	2.574	0.050	0.8257	
120 minute winter	55	5.007	56	52.3	2.913	0.042	0.4753	
120 minute winter	56	5.008	64	52.3	2.890	0.043	0.1721	
120 minute winter	57	6.000	58	42.3	0.568	0.011	2.7210	
120 minute winter	58	6.001	59	52.4	0.617	0.014	2.9935	
120 minute winter	59	6.002	60	62.0	0.640	0.016	2.6022	
120 minute winter	60	6.003	61	75.7	0.672	0.020	3.2269	
120 minute winter	61	6.004	62	94.8	0.743	0.025	5.5035	
120 minute winter	62	6.005	63	109.0	0.741	0.029	8.7599	
120 minute winter	63	6.006	64	115.3	0.605	0.030	4.3682	
120 minute winter	64	5.009	66	171.8	0.680	0.045	5.4874	
15 minute summer	65	7.000	66	0.0	0.000	0.000	0.6189	
120 minute winter	66	5.010	67	206.7	0.770	0.084	19.4849	
120 minute winter	67	5.011	68	262.1	0.939	0.069	22.4996	
120 minute winter	68	5.012	69	344.0	1.080	0.091	25.8171	
120 minute winter	69	5.013	84	382.5	1.190	0.101	26.0473	
120 minute winter	70	8.000	71	18.5	1.467	0.018	0.7919	
120 minute winter	71	8.001	72	22.9	1.560	0.033	0.3018	
120 minute winter	72	8.002	73	26.9	1.915	0.030	0.2823	
120 minute winter	73	8.003	74	33.0	2.189	0.029	0.7082	
120 minute winter	74	8.004	75	35.6	1.376	0.037	0.6346	
120 minute winter	75	8.005	76	41.4	1.495	0.113	0.8421	

Results for 200 year +42% CC Critical Storm Duration. Lowest mass balance: 99.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	76	90	335.655	0.055	45.3	0.0812	0.0000	OK
120 minute winter	77	90	334.538	0.038	45.3	0.0000	0.0000	OK
120 minute winter	78	90	332.900	0.100	72.0	1.0506	0.0000	OK
120 minute winter	79	90	332.783	0.106	79.4	0.1080	0.0000	OK
120 minute winter	80	92	332.737	0.120	101.5	0.3451	0.0000	OK
120 minute winter	81	92	332.660	0.136	128.1	0.4228	0.0000	OK
120 minute winter	82	92	332.594	0.137	141.2	0.1976	0.0000	OK
120 minute winter	83	92	332.465	0.100	202.1	0.1578	0.0000	OK
120 minute winter	84	94	331.445	0.124	586.8	0.0159	0.0000	OK
120 minute winter	85	90	349.166	0.082	112.2	2.0950	0.0000	OK
120 minute winter	86	90	347.744	0.060	132.0	0.2722	0.0000	OK
120 minute winter	87	90	346.061	0.077	170.9	0.6871	0.0000	OK
120 minute winter	88	90	344.665	0.081	223.1	0.9620	0.0000	OK
120 minute winter	89	90	343.179	0.095	258.1	0.7627	0.0000	OK
120 minute winter	90	90	340.119	0.135	344.6	2.6621	0.0000	OK
120 minute winter	91	90	339.643	0.159	596.3	9.1595	0.0000	OK
120 minute winter	92	90	338.229	0.145	630.3	1.1297	0.0000	OK
120 minute winter	93	90	336.636	0.136	649.7	0.6034	0.0000	OK
120 minute winter	94	92	330.444	0.205	1329.5	2.9592	0.0000	OK
120 minute winter	95	92	328.051	0.313	1354.1	1.1812	0.0000	OK
120 minute winter	96	92	327.417	0.179	1501.6	4.0427	0.0000	OK
120 minute winter	97	92	319.059	0.321	1582.4	3.9796	0.0000	OK
1440 minute winter	98	1470	322.342	0.804	128.8	4100.7140	0.0000	SURCHARGED
1440 minute winter	99	1470	322.342	0.992	5.9	1.7537	0.0000	SURCHARGED
120 minute winter	100	90	320.453	0.039	57.4	0.4179	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	76	8.006	77	45.3	2.804	0.044	0.3488	
120 minute winter	77	8.007	83	45.3	1.789	0.026	0.3697	
120 minute winter	78	9.000	79	72.0	0.694	0.019	6.4006	
120 minute winter	79	9.001	80	79.3	0.677	0.021	3.5438	
120 minute winter	80	9.002	81	101.5	0.733	0.027	6.4296	
120 minute winter	81	9.003	82	128.1	0.845	0.034	5.1271	
120 minute winter	82	9.004	83	141.2	1.129	0.037	5.7614	
120 minute winter	83	8.008	84	202.1	1.746	0.019	7.6034	
120 minute winter	84	5.014	94	586.8	2.982	0.028	3.7391	
120 minute winter	85	10.000	86	112.2	2.217	0.022	3.4173	
120 minute winter	86	10.001	87	131.9	2.724	0.014	1.1029	
120 minute winter	87	10.002	88	170.9	2.942	0.021	1.5980	
120 minute winter	88	10.003	89	223.1	3.318	0.023	1.3891	
120 minute winter	89	10.004	90	258.1	2.655	0.032	5.8723	
120 minute winter	90	10.005	91	344.5	2.491	0.063	2.8833	
120 minute winter	91	10.006	92	596.2	4.101	0.085	5.2266	
120 minute winter	92	10.007	93	630.3	4.875	0.071	3.2643	
120 minute winter	93	10.008	94	649.6	5.270	0.064	8.9620	
120 minute winter	94	5.015	95	1329.5	4.015	0.149	13.3689	
120 minute winter	95	5.016	96	1354.1	4.449	0.343	12.7433	
120 minute winter	96	5.017	97	1501.5	4.806	0.112	19.4540	
120 minute winter	97	5.018	103	1582.4	3.666	0.393	9.9599	
1440 minute winter	98	11.000	99	5.9	0.174	0.025	16.3332	
1440 minute winter	99	11.001	100	4.1	1.146	0.008	0.3774	
120 minute winter	100	11.002	101	57.4	2.094	0.006	0.4127	

Results for 200 year +42% CC Critical Storm Duration. Lowest mass balance: 99.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	101	90	319.462	0.048	61.4	0.0385	0.0000	OK
120 minute winter	102	90	318.796	0.082	65.6	0.0691	0.0000	OK
120 minute winter	103	92	318.727	0.289	1907.3	11.4826	0.0000	OK
120 minute winter	104	92	317.540	0.302	1935.4	1.3014	0.0000	OK
120 minute winter	105	92	315.432	0.193	1993.0	1.7015	0.0000	OK
120 minute winter	106	92	309.437	0.198	2045.8	1.6040	0.0000	OK
120 minute winter	107	92	301.316	0.277	2103.7	2.4532	0.0000	OK
120 minute winter	108	92	299.282	0.295	2187.2	1.0811	0.0000	OK
120 minute winter	109	82	321.989	0.004	1.9	0.0019	0.0000	OK
120 minute winter	110	88	320.696	0.010	6.1	0.0092	0.0000	OK
120 minute winter	111	90	317.895	0.010	9.3	0.0069	0.0000	OK
120 minute winter	112	90	314.702	0.017	17.4	0.0316	0.0000	OK
120 minute winter	113	90	313.025	0.039	45.9	0.2533	0.0000	OK
120 minute winter	114	90	312.535	0.049	58.7	0.1420	0.0000	OK
120 minute winter	115	90	311.586	0.100	87.1	0.6464	0.0000	OK
120 minute winter	116	90	311.460	0.107	98.0	0.2123	0.0000	OK
120 minute winter	117	90	311.377	0.112	108.0	0.1766	0.0000	OK
120 minute winter	118	92	311.312	0.114	127.9	0.3295	0.0000	OK
120 minute winter	119	92	311.103	0.117	170.1	1.1317	0.0000	OK
120 minute winter	120	92	310.607	0.121	200.5	0.8413	0.0000	OK
120 minute winter	121	92	310.141	0.155	245.6	1.5968	0.0000	OK
120 minute winter	122	92	309.739	0.153	277.2	1.1048	0.0000	OK
120 minute winter	123	90	322.000	0.015	8.1	0.0268	0.0000	OK
120 minute winter	124	90	321.015	0.030	23.0	0.1012	0.0000	OK
120 minute winter	125	90	320.023	0.038	53.5	0.2612	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	101	11.003	102	61.4	1.359	0.009	0.8629	
120 minute winter	102	11.004	103	65.6	1.021	0.023	1.1595	
120 minute winter	103	5.019	104	1907.3	4.657	0.311	16.3173	
120 minute winter	104	5.020	105	1935.5	6.293	0.299	18.8789	
120 minute winter	105	5.021	106	1993.0	9.363	0.132	7.0098	
120 minute winter	106	5.022	107	2045.8	7.100	0.139	13.9531	
120 minute winter	107	5.023	108	2103.7	5.423	0.283	17.9986	
120 minute winter	108	1.023	108_OUT	2187.2	5.362	0.324	9.0336	11072.5
120 minute winter	109	12.000	110	1.9	0.535	0.000	0.0350	
120 minute winter	110	12.001	111	6.1	1.211	0.001	0.1488	
120 minute winter	111	12.002	112	9.3	1.286	0.001	0.1091	
120 minute winter	112	12.003	113	17.4	1.062	0.002	0.2723	
120 minute winter	113	12.004	114	45.9	1.661	0.006	0.3174	
120 minute winter	114	12.005	115	58.7	1.094	0.009	1.7289	
120 minute winter	115	12.006	116	87.0	1.041	0.035	2.2222	
120 minute winter	116	12.007	117	98.0	1.084	0.039	1.5885	
120 minute winter	117	12.008	118	108.0	1.142	0.043	1.2588	
120 minute winter	118	12.009	119	127.9	1.306	0.045	3.2273	
120 minute winter	119	12.010	120	170.1	1.665	0.048	5.0567	
120 minute winter	120	12.011	121	200.5	1.593	0.051	5.0616	
120 minute winter	121	12.012	122	245.7	1.657	0.083	8.4287	
120 minute winter	122	12.013	139	277.2	0.702	0.082	34.3150	
120 minute winter	123	13.000	124	8.1	0.645	0.001	0.3168	
120 minute winter	124	13.001	125	23.0	1.136	0.004	0.7294	
120 minute winter	125	13.002	126	53.4	2.079	0.006	1.5425	

Results for 200 year +42% CC Critical Storm Duration. Lowest mass balance: 99.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	126	90	316.030	0.045	68.3	0.1526	0.0000	OK
120 minute winter	127	90	314.550	0.065	76.7	0.1239	0.0000	OK
120 minute winter	128	92	314.040	0.053	80.4	0.0449	0.0000	OK
120 minute winter	129	90	322.593	0.008	4.6	0.0078	0.0000	OK
120 minute winter	130	90	320.000	0.015	10.7	0.0207	0.0000	OK
120 minute winter	131	90	318.009	0.023	28.2	0.0938	0.0000	OK
120 minute winter	132	90	314.026	0.041	34.9	0.0616	0.0000	OK
120 minute winter	133	90	313.565	0.079	43.9	0.1633	0.0000	OK
120 minute winter	134	92	313.433	0.048	45.3	0.0154	0.0000	OK
120 minute winter	135	92	313.307	0.121	133.1	0.2032	0.0000	OK
120 minute winter	136	90	313.205	0.119	220.4	2.3797	0.0000	OK
120 minute winter	137	92	312.647	0.161	283.7	2.3285	0.0000	OK
120 minute winter	138	92	312.100	0.113	330.9	1.2252	0.0000	OK
120 minute winter	139	92	309.312	0.426	608.2	0.0000	0.0000	OK
1440 minute winter	140	1470	322.689	0.822	133.4	4253.7640	0.0000	SURCHARGED
1440 minute winter	141	1470	322.689	1.057	11.5	1.8674	0.0000	SURCHARGED
1440 minute summer	142	300	312.370	0.014	4.1	0.0000	0.0000	OK
120 minute winter	143	90	312.357	0.036	32.1	0.1802	0.0000	OK
120 minute winter	144	90	310.841	0.034	52.8	0.1370	0.0000	OK
1440 minute winter	145	1440	322.674	0.631	87.9	2697.6830	0.0000	SURCHARGED
1440 minute winter	146	1440	322.674	1.149	8.3	2.0300	0.0000	SURCHARGED
120 minute winter	147	90	309.192	0.035	56.1	0.0000	0.0000	OK
120 minute winter	148	90	306.808	0.051	71.0	0.1182	0.0000	OK
120 minute winter	149	90	305.345	0.088	118.3	0.6511	0.0000	OK
120 minute winter	150	90	308.613	0.127	88.4	2.5555	0.0000	OK

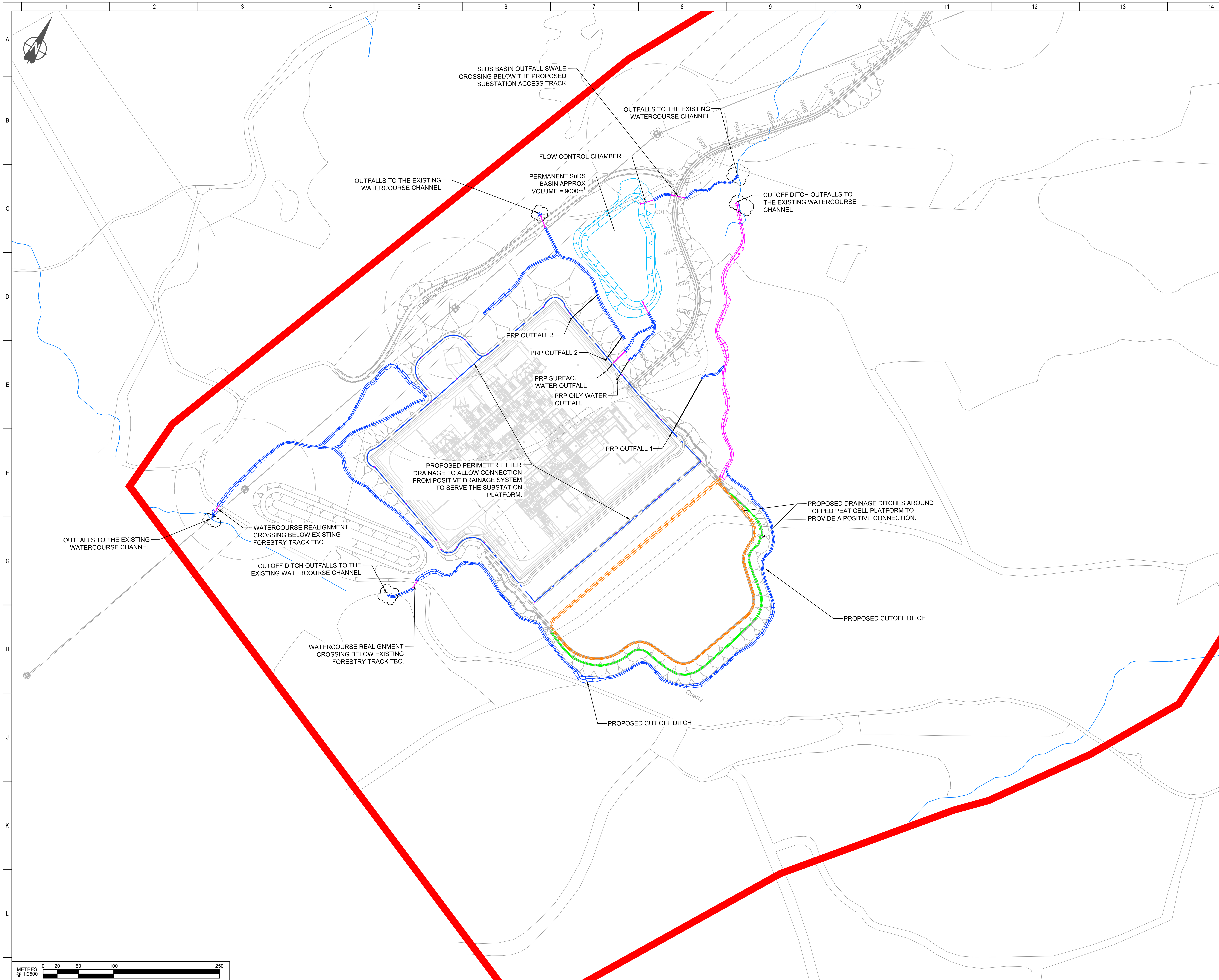
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	126	13.003	127	68.3	1.880	0.008	0.9487	
120 minute winter	127	13.004	128	76.7	1.920	0.015	0.9236	
120 minute winter	128	13.005	135	80.4	1.210	0.011	1.2999	
120 minute winter	129	14.000	130	4.6	0.772	0.000	0.1316	
120 minute winter	130	14.001	131	10.7	1.003	0.001	0.3228	
120 minute winter	131	14.002	132	28.2	1.478	0.003	0.8143	
120 minute winter	132	14.003	133	34.8	0.863	0.007	0.9518	
120 minute winter	133	14.004	134	43.9	1.006	0.022	1.4058	
120 minute winter	134	14.005	135	45.3	0.712	0.009	0.6720	
120 minute winter	135	13.006	136	133.1	1.288	0.051	1.8804	
120 minute winter	136	13.007	137	220.3	1.710	0.049	4.8924	
120 minute winter	137	13.008	138	283.7	2.270	0.084	6.8573	
120 minute winter	138	13.009	139	331.0	0.950	0.045	30.2969	
120 minute winter	139	12.014	139_OUT	607.6	2.352	0.653	2.3642	2751.4
1440 minute winter	140	15.000	141	11.5	0.200	0.044	17.1956	
1440 minute winter	141	15.001	142	4.1	2.382	0.002	0.0668	
1440 minute summer	142	15.002	143	4.1	0.580	0.001	0.0249	
120 minute winter	143	15.003	144	32.1	1.519	0.005	1.1260	
120 minute winter	144	15.004	147	52.8	2.617	0.005	0.3145	
1440 minute winter	145	16.000	146	8.3	0.228	0.052	8.8856	
1440 minute winter	146	16.001	147	4.1	2.802	0.004	0.0883	
120 minute winter	147	15.005	148	56.1	2.097	0.005	0.6607	
120 minute winter	148	15.006	149	71.0	1.448	0.010	1.8493	
120 minute winter	149	15.007	154	118.3	1.455	0.027	1.6519	
120 minute winter	150	17.000	151	88.4	1.130	0.060	3.9651	

Results for 200 year +42% CC Critical Storm Duration. Lowest mass balance: 99.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	151	90	308.470	0.070	109.4	0.2877	0.0000	OK
120 minute winter	152	90	307.351	0.065	123.6	0.2101	0.0000	OK
120 minute winter	153	92	305.568	0.082	130.6	0.1310	0.0000	OK
120 minute winter	154	90	305.071	0.114	319.5	1.2684	0.0000	OK
120 minute winter	155	92	303.359	0.388	319.4	0.0000	0.0000	OK
120 minute winter	156	94	303.029	0.072	357.6	0.0000	0.0000	OK
120 minute winter	157	92	301.683	0.089	326.4	0.0000	0.0000	OK
120 minute winter	108_OUT	92	298.477	0.295	2187.2	0.0000	0.0000	OK
120 minute winter	139_OUT	92	309.260	0.426	607.6	0.0000	0.0000	OK
120 minute winter	157_OUT	92	300.254	0.088	319.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	151	17.001	152	109.4	2.304	0.018	1.7191	
120 minute winter	152	17.002	153	123.6	2.338	0.016	1.8990	
120 minute winter	153	17.003	154	130.6	2.138	0.024	1.0797	
120 minute winter	154	15.008	155	319.4	1.014	0.046	18.7532	
120 minute winter	155	15.009	156	357.6	3.171	0.746	1.1523	
120 minute winter	156	15.010	157	326.4	5.516	0.019	0.3343	
120 minute winter	157	15.011	157_OUT	319.2	4.720	0.028	0.9117	1555.0

Appendix 7 Proposed Drainage Drawings



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NOTES:

1. The proposals shown on this drawing have been determined from topographical survey information provided by others
2. Site layout based on drawing Fasnakyle - Site D alternative Siemens BAM layout
3. Substation layout based on S345-SEL-V00-XX-M3-C-5001.rvt.
4. Design proposals shown are preliminary and subject to detailed design.
5. All dimensions in mm unless stated otherwise.
6. Refer to design decision log for assumptions associated with proposed design.
7. Tie-in locations to existing watercourse channels to be confirmed.
8. The contractor shall check all dimensions on site and report any difference to the designer.
9. All levels are in metres (m) above ordnance datum unless stated otherwise.
10. Services to be confirmed to allow for co-ordination.
11. Existing drainage unknown and to be confirmed.
12. Site constraints from underground HV cables and access to OHL to be confirmed
13. Refer to drawings - BING4-LT521-SEBAM-DRAI-ZZ-D-C-0151, BING4-LT521-SEBAM-DRAI-ZZ-D-C-0152 & BING4-LT521-SEBAM-DRAI-ZZ-D-C-0153 for access track drainage design
14. Temporary drainage not shown for clarity. Please refer to drawing - BING4-LT521-SEBAM-DRAI-ZZ-D-C-0195

LEGEND:

- Proposed Ditch - Type A
- Proposed Ditch - Type B
- Proposed Swale - Type C (700x700 min)
- Proposed Swale Type D (500x500 min)
- Filter Drain
- Pipe/Culvert
- Suds Basin
- Chamber
- Headwall
- Existing ditch / watercourse

REV:	DATE:	DRWN:	CHKD:	APPVD:	DESCRIPTION:
P02	28/10/25	CMcL	RD	RJM	ISSUED FOR PLANNING
P01	23/10/25	CMcL	RD	RJM	ISSUED FOR PLANNING

STATUS: S5 ISSUED FOR FINAL REVIEW

CONTRACTOR:

Joint Venture Substation Delivery Framework

CLIENT:

PROJECT: LT521 - BINGALLY 400kV SUBSTATION

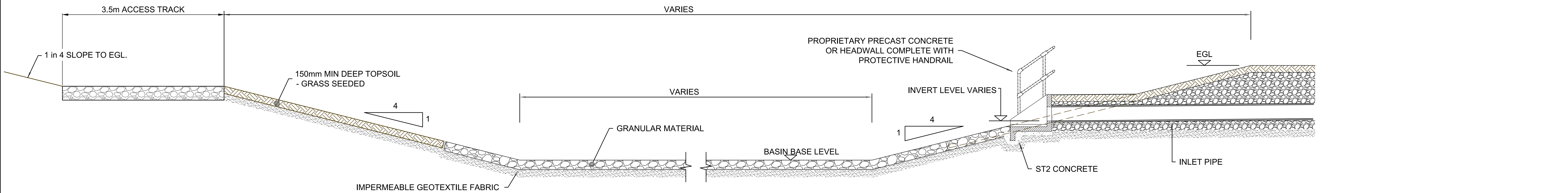
PROJECT NUMBER: BING4-LT521 | LOCATION: BINGALLY

TITLE: PROPOSED PERMANENT DRAINAGE LAYOUT - SUBSTATION

DRAWN:	C.McLaughlin	ENG CHECK:	R.Duncan
DESIGNER:	A.Peters	COORDINATION:	R.Duncan
SCALE :	1:2500	APPROVED:	R.Minto
DATE OF FIRST ISSUE:	04/02/2025	SECURITY:	

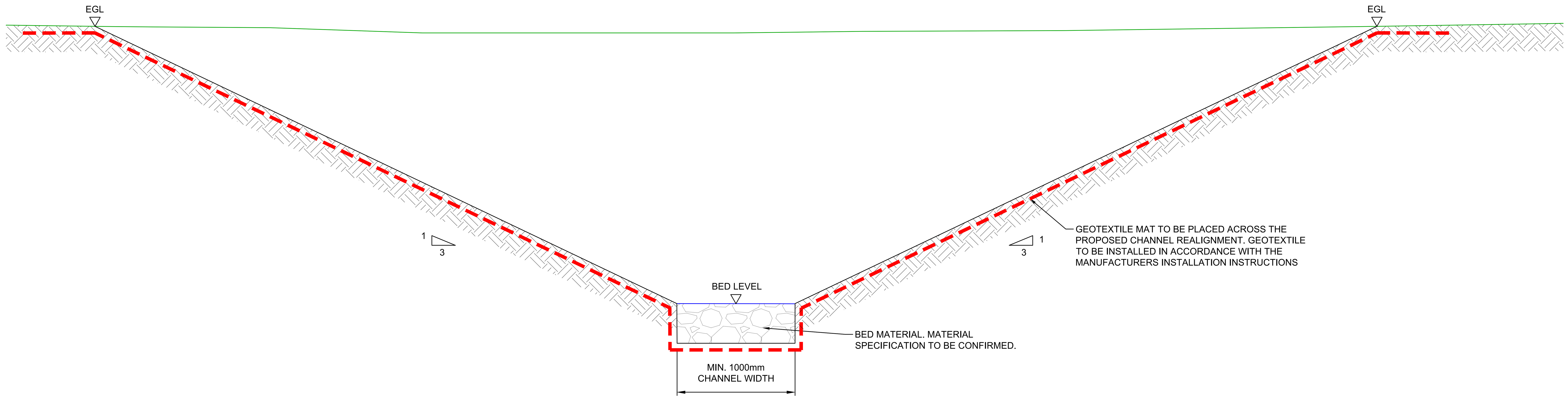
ORIGINATOR DRAWING NUMBER: BING4-LT521-SEBAM-DRAI-ZZ-D-C-0190 | SHEET No: 1 of 1

CLIENT DRAWING NUMBER: BING4-LT521-SEBAM-DRAI-ZZ-D-C-0190 | REV. No: P02



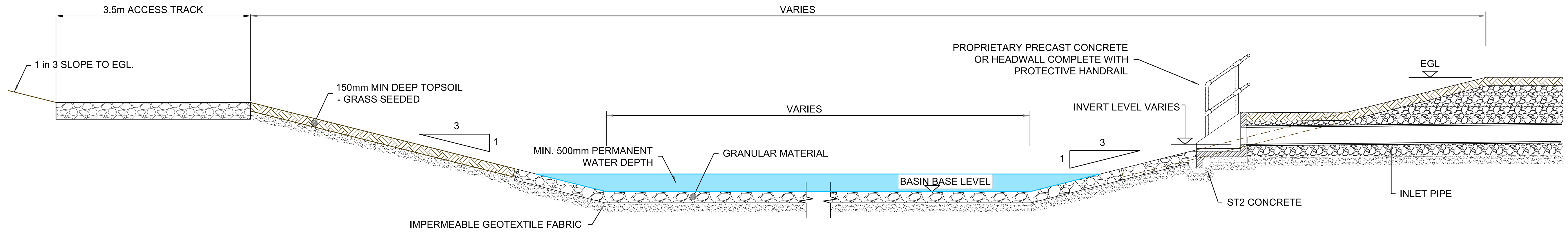
TYPICAL CROSS-SECTION THROUGH SUDS BASIN

SCALE 1:50



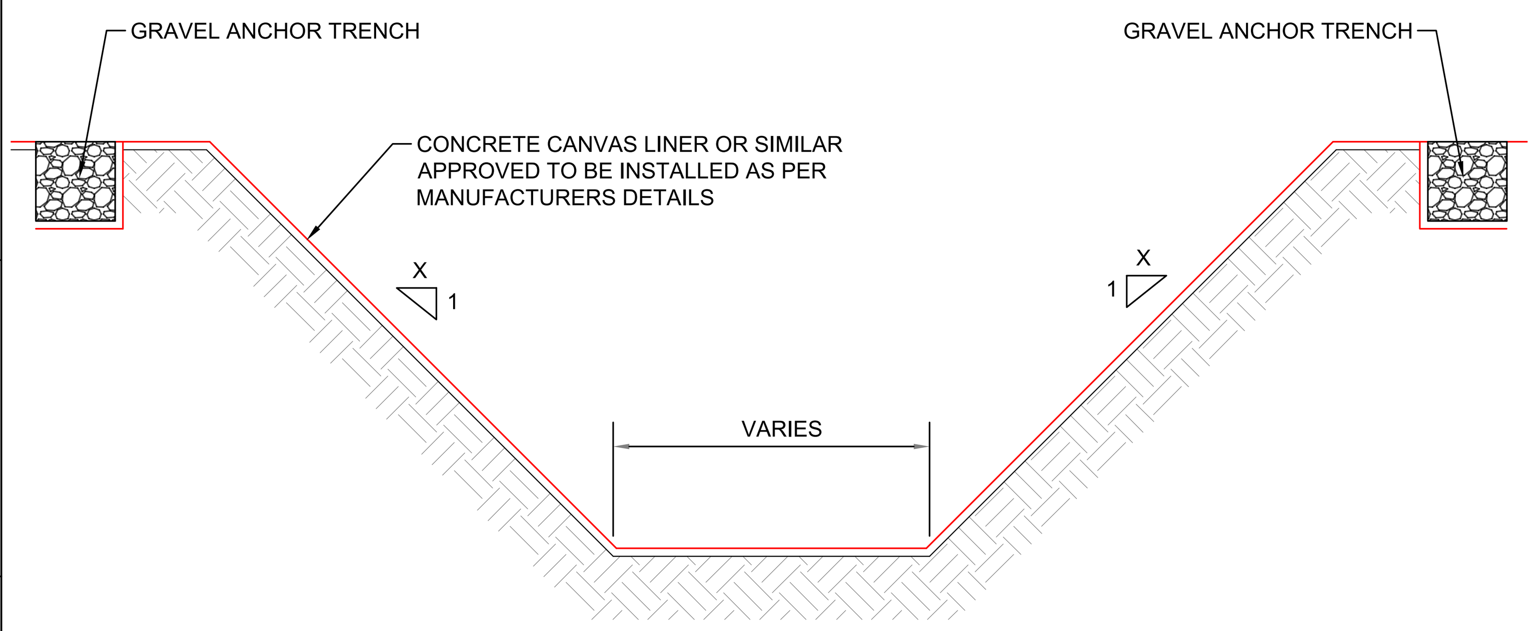
TYPICAL SECTION THROUGH WATERCOURSE REALIGNMENT CHANNEL

SCALE 1:20



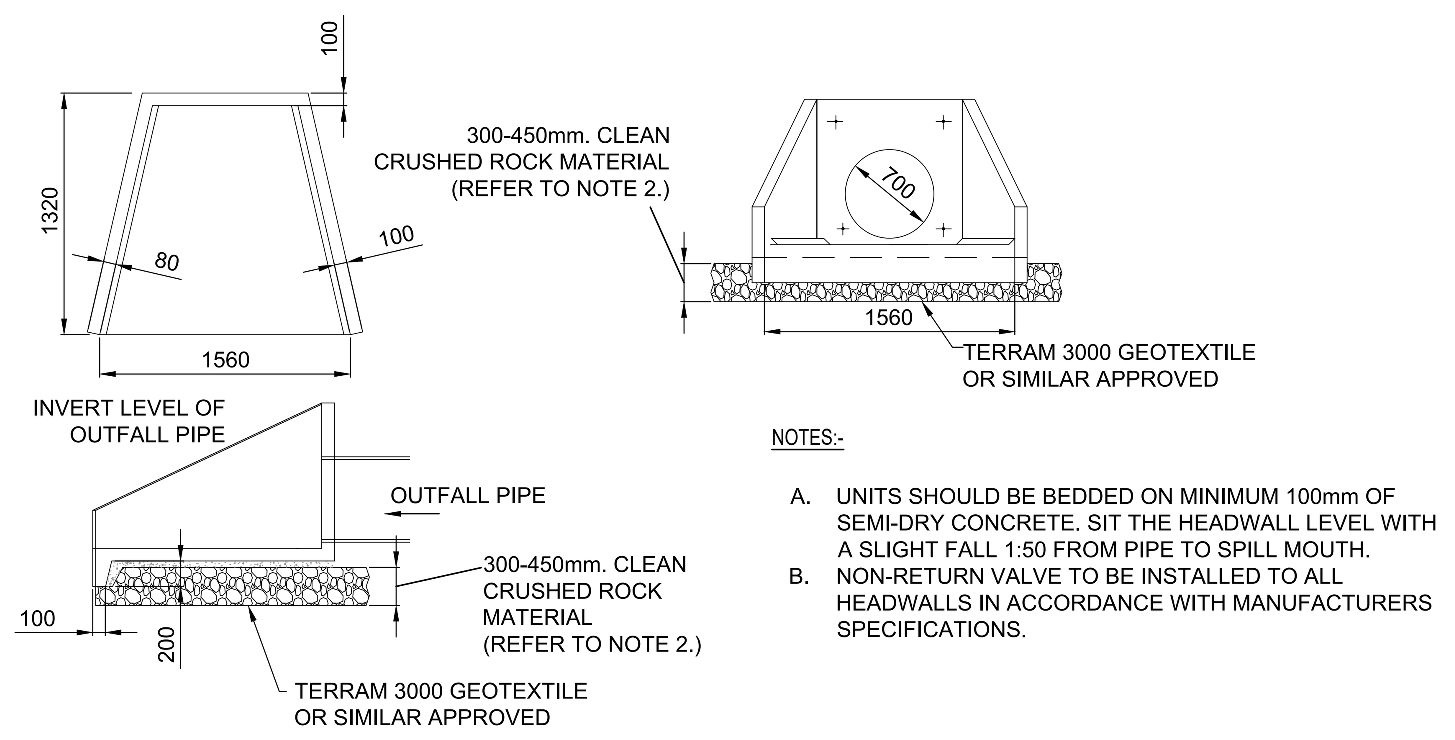
TYPICAL CROSS-SECTION THROUGH SETTLEMENT LAGOONS

SCALE 1:50



DITCH

SCALE 1:20

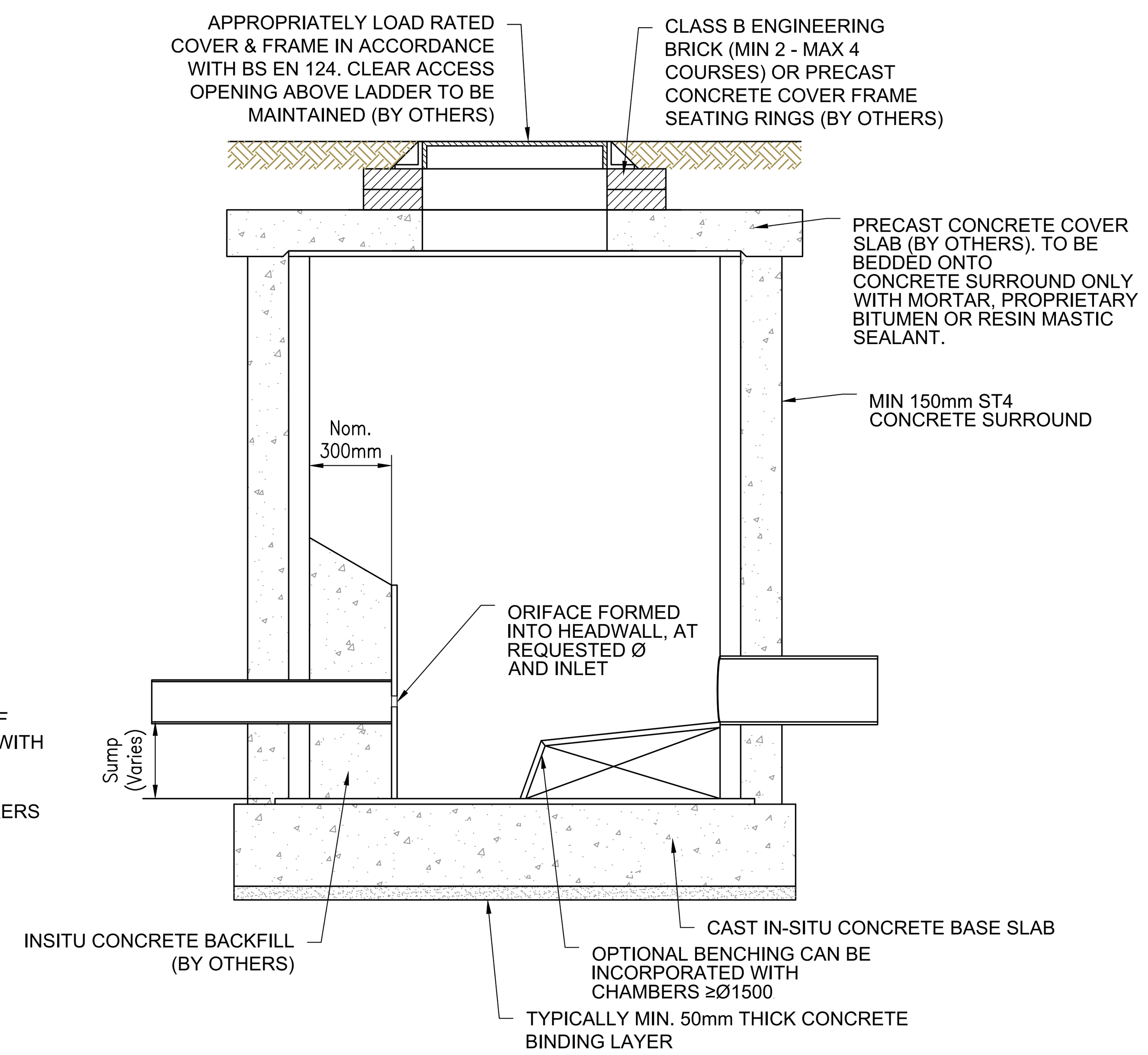


NOTES:-

A. UNITS SHOULD BE BEDDED ON MINIMUM 100mm OF SEMI-DRY CONCRETE. SIT THE HEADWALL LEVEL WITH A SLIGHT FALL 1:50 FROM PIPE TO SPILL MOUTH.
B. NON-RETURN VALVE TO BE INSTALLED TO ALL HEADWALLS IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS.

TYPICAL PRECAST HEADWALL / OUTFALL DETAIL-ALTHON (OR SIMILAR APPROVED)

(SCALE 1:50)



TYPICAL ORIFACE FLOW CONTROL CHAMBER

(SCALE 1:20)

METRES @ 1:50 — 0, 0.5, 1, 2, 5
METRES @ 1:20 — 0, 0.2, 0.5, 1, 2

NOTES

1. The proposals shown on this drawing have been determined from topographical survey information provided by others
2. Site layout based on drawing Fasnakyle - Site D alternative Siemens BAM layout
3. Substation layout based on S345-SEL-V00-XX-M3-C-5001.rvt.
4. Design proposals shown are preliminary and subject to detailed design.
5. All dimensions in mm unless stated otherwise.
6. Refer to design decision log for assumptions associated with proposed design.
7. Tie-in locations to existing watercourse to be confirmed.
8. The contractor shall check all dimensions on site and report any difference to the designer.
9. All levels are in metres (m) above ordnance datum unless stated otherwise.
10. Services to be confirmed to allow for coordination.
11. Existing drainage unknown and to be confirmed.
12. Site constraints from underground HV cables and access to OHL to be confirmed.
13. For permanent drainage layout drawing refer to BING4-LT521-SEBAM-DRAI-ZZ-D-C-0150.
14. Suds features may require to be lined if contamination identified by ground investigations.
15. Details are indicative only.
16. Proposed layout is for estimated costing purposes only. All drainage elements will be finalised and sized at detailed design.
17. All ditches are assumed to be lined for the purposes of the interim costing estimate drawings. Final details to be confirmed at detailed design stage.

REV:	DATE:	DRWN:	CHKD:	APPVD:	DESCRIPTION:
P01	23/10/25	CMcL	RD	RJM	ISSUED FOR PLANNING

STATUS: S5 ISSUED FOR FINAL REVIEW

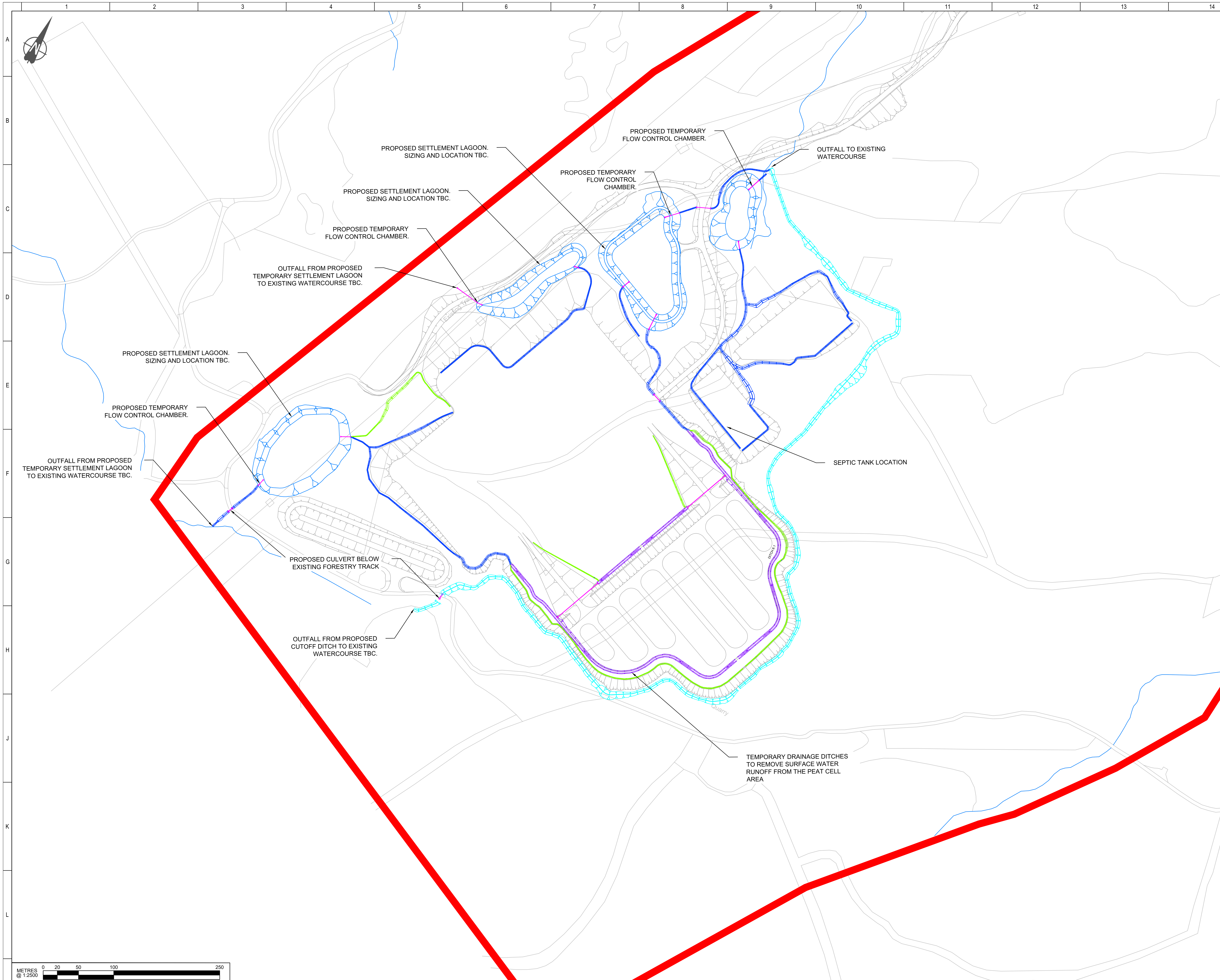
CONTRACTOR:

Joint Venture Substation Delivery Framework

CLIENT:

PROJECT: LT521 - BINGALLY 400kV SUBSTATION

PROJECT NUMBER: BING4-LT521	LOCATION: BINGALLY
TITLE: PROPOSED DRAINAGE DETAILS	
DRAWN: C.McLaughlin	ENG CHECK: R.Duncan
DESIGNER: A.Peters	COORDINATION: R.Duncan
SCALE : 1:2500	APPROVED: R.Minto
DATE OF FIRST ISSUE: 06/02/2025	SECURITY:
ORIGINATOR DRAWING NUMBER: BING4-LT521-SEBAM-DRAI-ZZ-D-C-0194	SHEET No: 1 of 1
CLIENT DRAWING NUMBER: BING4-LT521-SEBAM-DRAI-ZZ-D-C-0194	REV. No: P01



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NOTES:

1. The proposals shown on this drawing have been determined from topographical survey information provided by others
2. Site layout based on drawing Fasnakyle - Site D alternative Siemens BAM layout
3. Substation layout based on S345-SEL-V00-XX-M3-C-5001.rvt.
4. Design proposals shown are preliminary and subject to detailed design.
5. All dimensions in mm unless stated otherwise.
6. Refer to design decision log for assumptions associated with proposed design.
7. Tie-in locations to existing watercourse channels to be confirmed.
8. The contractor shall check all dimensions on site and report any difference to the designer.
9. All levels are in metres (m) above ordnance datum unless stated otherwise.
10. Services to be confirmed to allow for co-ordination.
11. Existing drainage unknown and to be confirmed.
12. Site constraints from underground HV cables and access to OHL to be confirmed
13. Refer to drawings - BING4-LT521-SEBAM-DRAI-ZZ-D-C-0151, BING4-LT521-SEBAM-DRAI-ZZ-D-C-0152 & BING4-LT521-SEBAM-DRAI-ZZ-D-C-0153 for access track drainage design
14. Permanent drainage not shown for clarity. Please refer to drawing - BING4-LT521-SEBAM-DRAI-ZZ-D-C-0190
15. Proposed layout is for estimated costing purposes only. All drainage elements will be finalised and sized at detailed design.
16. All ditches are assumed to be lined for the purposes of the interim costing estimate drawings. Final details to be confirmed at detailed design stage.

LEGEND:

- Proposed Cut off ditch
- Proposed ditch - Type A
- Proposed ditch - Type B
- Proposed ditch - Type C
- Drainage culvert
- Temporary settlement lagoons
- Flow control
- Headwall
- Existing ditch / watercourse

REV:	DATE:	DRWN:	CHKD:	APPVD:	DESCRIPTION:
P02	28/10/25	CMcL	RD	RJM	ISSUED FOR PLANNING
P01	23/10/25	CMcL	RD	RJM	ISSUED FOR PLANNING

STATUS: S5 ISSUED FOR FINAL REVIEW

CONTRACTOR:

Joint Venture
Substation Delivery Framework

CLIENT:

PROJECT: LT521 - BINGALLY 400kV SUBSTATION

PROJECT NUMBER: BING4-LT521 | LOCATION: BINGALLY

TITLE: PROPOSED TEMPORARY DRAINAGE LAYOUT - SUBSTATION

DRAWN:	C.McLaughlin	ENG CHECK:	R.Duncan
DESIGNER:	A.Peters	COORDINATION:	R.Duncan
SCALE :	1:2500	APPROVED:	R.Minto
DATE OF FIRST ISSUE:	28/10/2025	SECURITY:	

ORIGINATOR DRAWING NUMBER: BING4-LT521-SEBAM-DRAI-ZZ-D-C-0195 | SHEET No: 1 of 1

CLIENT DRAWING NUMBER: BING4-LT521-SEBAM-DRAI-ZZ-D-C-0195 | REV. No: P02