Stonestreet Green Solar

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Outline Operational Surface Water Drainage Strategy (Tracked)

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1 Introduction

1.1 Introduction

1.1.1 SLR Consulting Limited ('SLR') has been appointed by EPL 001 Limited (the 'Applicant') to prepare an Outline Operational Surface Water Drainage Strategy ('Outline OSWDS') in support of the Development Consent Order ('DCO') application for Stonestreet Green Solar (the 'Project').

1.1.2 This Outline OSWDS has been prepared under the direction of a Technical Director of Hydrology at SLR who specialises in flood risk, drainage and associated planning matters.

1.1.3 The Site is within the administrative boundaries of Ashford Borough Council ('ABC') and Kent County Council ('KCC').

1.2 The Project

1.2.1 The Project comprises the construction, operation and maintenance, and decommissioning of solar photovoltaic ('PV') arrays and energy storage, together with associated infrastructure and an underground cable connection to the existing National Grid Sellindge Substation.

1.2.2 The Project will include a generating station (incorporating solar arrays) with a total capacity exceeding 50 megawatts ('MW'). The agreed grid connection for the Project will allow the export and import of up to 99.9 MW of electricity to the grid. The Project will connect to the existing National Grid Sellindge Substation via a new 132 kilovolt ('kV') substation constructed as part of the Project and cable connection under the Network Rail and High Speed 1 ('HS1') railway.

1.2.3 The location of the Project is shown on **Environmental Statement ('ES') Volume 3, Figure 1.1: Site Location Plan (Doc Ref. 5.3)**. The Project will be located within the Order limits (the land shown on the **Works Plans (Doc Ref. 2.3)** within which the Project can be carried out). The Order limits plan is provided as **ES Volume 3, Figure 1.2: Order Limits (Doc Ref. 5.3)**. Land within the Order limits is known as the 'Site'.

1.2.4 Areas where infrastructure development is proposed are identified by field numbers, which are shown on **ES Volume 3, Figure 2.1: Field Boundaries and Site Area Plan (Doc Ref. 5.3)**. The areas of the Site where infrastructure development is proposed are referred to as follows:

- South Western Area (Fields 1 to 9);
- Central Area (Fields 10 to 19 and 23 to 25);
- South Eastern Area (Fields 20 to 22);

- Northern Area (Fields 26 to 29);
- Project Substation (location of the Project Substation, in the north western section of Field 26);
- 'Cable Route Corridor' (export of electricity from the Project at 132kV via underground cables (the 'Grid Connection Cable') to the Sellindge Substation) and 'Cable Route Crossing' (use of an existing cable duct under the HS1 railway or through Horizontal Directional Drilling ('HDD') beneath HS1 for the Grid Connection Cable); and
- Sellindge Substation (location of the existing Sellindge Substation).

1.3 Document Structure

1.3.1 Following this introduction, this Outline OSWDS is structured as follows:

- Section 2: Site Appraisal;
- Section 3: Policy and Guidance;
- Section 4: Outline Surface Water Drainage Strategy; and
- Section 5: Conclusions.

2 Site Appraisal

2.1 Introduction

2.1.1 A full description of the hydrological context of the Site is provided in the Hydraulic Modelling Report ('HMR') within **ES Volume 4, Appendix 10.2: Flood Risk Assessment (Doc Ref. 5.4)**. A summary of the hydrological context relevant to this Outline OSWDS is provided below.

Land Use

2.1.2 The Site is situated in a largely rural area with the village of Aldington present immediately to the south. Areas of greenfield land across the Site are used predominantly for agriculture and arable farming. The Site is bound to the north by the HS1 railway line and to the east and west by arable fields.

Topography

2.1.3 Topographic data from on and around the Site, gathered using Light Detection and Ranging ('LiDAR') aerial photogrammetric techniques, has been downloaded from the Environment Agency open data website[1] and is included as **ES Volume 3, Figure 10.2: Site Topography (Doc Ref. 5.3)**. The data presented is a Digital Terrain Model ('DTM'). This is a bare earth model and thus excludes features such as built development and vegetation.

2.1.4 Ground levels locally are dominated by the local hydrology, particularly the East Stour River which flows in a westerly direction through the Site. The highest ground levels are present in the south and west of the Site due to a linear topographic ridge. The Goldwell Lane site entrance is situated on the crest of this ridge and has a maximum elevation of 76.0m Above Ordnance Datum ('AOD'). Lower ground levels are situated on and around watercourses. Field 19 is located in a low-lying area with ground levels falling to a Site minimum of 44.4m AOD.

2.1.5 Water levels in the East Stour River fall as it passes through the Site. Typically, in-channel water levels are around 1m lower than the immediately adjacent fields.

2.1.6 Ground levels in Field 26 fall from 61m AOD in the northwest of the Field to 47.6m AOD in the south of the Field on the northern bank of the East Stour River.

Hydrology

2.1.7 The East Stour River is an Environment Agency ('EA') Main River which flows from east to west through and away from the Site. Upstream of the Site, the East Stour River drains a catchment area of approximately 33.7km^2. The East Stour River on its approach to the Site is joined by a number of unnamed tributaries.

2.1.8 Unnamed Tributary 1 rises in Brabourne, 3.7km north of the Site. The channel flows in a south westerly direction towards the Site to discharge into the East Stour River via a culvert beneath the railway line, to the west of Sellindge Substation. Upstream of the Site, the channel drains a catchment area[2] of approximately 8.18km^2 of predominantly arable land and grassland with some rural settlements including Brabourne and Brabourne Lees.

2.1.9 Unnamed Tributary 2 flows in a south westerly direction towards the Site and discharges into the East Stour River via a culvert beneath the railway line immediately east of Sellindge Substation. Upstream of the confluence, Unnamed Tributary 2 drains a catchment area[2] of approximately 13.1km^2 of predominantly grassland and arable land with some smallholdings present throughout.

2.1.10 Unnamed Tributary 3 rises from a small woodland area (Burch's Rough) approximately 2km south east of the Site and flows in a north westerly direction through the Aldington Flood Storage Area ('AFSA') towards the East Stour River, joining at a confluence approximately 200m downstream of the Mill House impoundment. Unnamed Tributary 3 drains a total catchment area[2] of approximately 4.94km^2 which is predominantly undeveloped arable land, woodland areas and some small farm holdings.

2.1.11 The embankment of the AFSA is located along the East Stour River between the Northern Area and Central Area. Only limited flows are allowed to pass through the embankment with excess water backing up and filling the upstream flood storage area ('FSA'). Once the FSA is full water over tops the embankment via an engineered spillway and renter the channel and floodplain of the East Stour River.

2.1.12 The Main Rivers and Ordinary Watercourses on and in the vicinity of the Site are shown in **ES Volume 3, Figure 10.3: Local Hydrology (Doc Ref. 5.3)**.

Geology and Hydrogeology

Geology

2.1.13 The National Soils Resources Institute, Soilscapes website[3], indicates that soils across the Site comprise of *"Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils"; "Loamy and clayey floodplain soils with naturally high groundwater"* and *"Freely draining slightly acid but base-rich soils".*

2.1.14 British Geology Survey ('BGS') mapping[4] indicates that the area is predominantly underlain by the Weald Clay Formation (Mudstone). Outcrops of the Hythe Formation (Sandstone and Limestone) are present in the west, east and south of the Site bound by the Atherfield Clay Formation. Superficial deposits of Alluvium are identified around the East Stour River in correspondence with the loamy and clayey floodplain soils.

2.1.15 Mapping of the bedrock and superficial geology are presented in **ES Volume 3, Figures 10.5: Superficial Geology (Doc Ref. 5.3)** and **10.6: Bedrock Geology (Doc Ref. 5.3)**.

Hydrogeology

2.1.16 The Hythe Formation is classified as a "Principal" [5] aquifer system, which is defined as *"geology that exhibit high permeability and / or provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale".*

2.1.17 The remaining bedrock types locally are classified as unproductive aquifers which are rocks which have negligible significance for water supply.

2.1.18 The superficial Alluvium deposits are designated as a 'Secondary A' aquifer, defined as *"aquifers which comprise permeable layers that can support local water supplies and may form an important source of base flow to rivers".*

2.1.19 The Site is not located in a Source Protection Zone associated with groundwater abstractions.

Flood Risk

2.1.20 A detailed assessment of flood risk has been undertaken in support of the Project. This is contained in **ES Volume 4, Appendix 10.2: Flood Risk Assessment (Doc Ref. 5.4)**. This assessment, and the design of the Project, was supported by detailed hydraulic modelling of the East Stour River.

Fluvial Flood Risk

2.1.21 The Site lies in an area designated as Flood Zones 1, 2 and 3a and 3b. The more detailed modelling undertaken in support of the Project confirms that this mapping, which presents the undefended situation, is broadly accurate.

2.1.22 The detailed modelling also included defended scenarios that include the function of the AFSA. This work indicated that:

- All fields within the Northern Area as well as land along the Cable Route Corridor, the Cable Route Crossing and the Sellindge Substation are shown to be at risk of flooding from floodwaters impounded behind the AFSA embankment. Such flooding will occur fairly frequently and for any moderately severe event the AFSA will reach capacity resulting in deep flood water in some areas and over topping of the embankment spillway. No flooding is however predicted within the area of Field 26 where the Project Substation will be located.
- Within the Central Area, Fields 15, 16, 18, 19, 23 and 24 are shown to be at risk of inundation. During both the design flood event and the extreme 0.1% Annual Exceedance Probability ('AEP') flood event, flood depths within the Central Area are however shown to remain below 0.8m.
- No fluvial flooding is predicted in the South Western or South Eastern Areas.

Surface Water Flood Risk

2.1.23 With reference to the Long-Term Flood Risk[6] mapping, the risk of surface water flooding to the majority of the Site is shown to be 'Very Low' defined as 'a less than

0.1% AEP (1 in 1,000 chance) of flooding in any given year'. However, parts of the Site are shown to lie in areas considered to be at 'Low', 'Medium' and 'High' risk of surface water flooding.

2.1.24 A detailed review within **ES Volume 4, Appendix 10.2: Flood Risk Assessment (Doc Ref. 5.4)** concludes that the large majority of the areas of elevated surface water flood risk relate to area within the fluvial floodplain and flow that are progressing along the corridor of the East Stour River. The risk associated with this is best represented by the fluvial flood risk modelling discussed above.

2.1.25 In addition, the **ES Volume 4, Appendix 10.2: Flood Risk Assessment (Doc Ref. 5.4)** notes that as the Site sits on the downslope of a northwest to southeast topographic ridge off-Site flows discharge onto the Site are typically limited by small upgradient catchment areas.

2.1.26 Further management of surface water runoff from the Site is detailed within **Section 4** of this Outline OSWDS.

Existing Drainage Regime

2.1.27 The Site currently comprises undeveloped greenfield land and therefore any rainfall onto the Site is either infiltrated to ground or discharges overland in line with the local topography to the southeast and into the East Stour River.

2.1.28 Given the prevailing ground conditions, water infiltrating to the ground will mostly be stored in the shallow sub-surface, or conveyed towards the local channel as shallow interflow. Deeper infiltration will be limited, but will occur in some areas, particularly on the high ground to the south which is underlain by the more permeable Hythe formation.

3 Policy and Guidance

3.1 Introduction

3.1.1 This Outline OSWDS has been produced in accordance with the following policy and guidance:

- Overarching National Policy Statement ('NPS') for Energy (EN-1) (2023)[7];
- NPS for Renewable Energy Infrastructure (EN-3) (2023)[8];
- National Planning Policy Framework (2023)[9];
- Ashford Local Plan 203010, including Policy ENV9 - Sustainable Drainage;
- Ashford Sustainable Drainage Supplementary Planning Document (2010)[11];
- Guide for Masterplanning Sustainable Drainage into Developments, Kent County Council (2013)[12];
- Construction Industry Research and Information Association ('CIRIA') C753 The SuDS Manual (2015)[13]; and
- Department for Environment, Food and Rural Affairs ('DEFRA'), Sustainable Drainage Systems: Non-Statutory Technical Standards1[14].

3.2 Policy and Guidance

National Policy Statements

3.2.1 On 17 January 2024, NPS EN-1, NPS EN-3 and NPS EN-5[15] came into force. These NPSs are the relevant NPSs that have effect for the DCO application for the Project. Section 5.8 of NPS EN-1 relates to flood risk and sets out the requirements for an applicant's assessment.

3.2.2 While the primary basis for making decisions on applications for development consent is the relevant NPSs, other matters which the Secretary of State may consider to be important and relevant in decision making may include the development plan policies of the “Host” local authorities.

3.2.3 NPS EN-1 states in paragraph 4.1.12 that *“Other matters that the Secretary of State may consider both important and relevant to their decision-making may include Development Plan documents or other documents in the Local Development Framework”.* However, it must also be noted that paragraph 4.1.15 states that *“In the event of a conflict between these documents and an NPS, the NPS prevails for the purposes of Secretary of State decision making given the national significance of the infrastructure”*.

3.2.4 Paragraph 5.8.36 of NPS EN-1 also states:

“In determining an application for development consent, the Secretary of State should be satisfied that where relevant:

- *the application is supported by an appropriate FRA*
- *the Sequential Test has been applied and satisfied as part of site selection*
- *a sequential approach has been applied at the site level to minimise risk by directing the most vulnerable uses to areas of lowest flood risk*
- *the proposal is in line with any relevant national and local flood risk management strategy*
- *SuDS (as required in the next paragraph on National Standards) have been used unless there is clear evidence that their use would be inappropriate*
- *in flood risk areas the project is designed and constructed to remain safe and operational during its lifetime, without increasing flood risk elsewhere (subject to the exceptions set out in paragraph 5.8.42)*
- *the project includes safe access and escape routes where required, as part of an agreed emergency plan, and that any residual risk can be safely managed over the lifetime of the development*
- *land that is likely to be needed for present or future flood risk management infrastructure has been appropriately safeguarded from development to the extent that development would not prevent or hinder its construction, operation or maintenance"*

3.2.5 NPS EN-1 provides further guidance that *"the Development Consent Order, or any associated planning obligations, will need to make provision for appropriate operation and maintenance of any SuDS throughout the project's lifetime. Where this is secured through the adoption of any SuDS features, any necessary access rights to property will need to be granted."* (paragraph 5.8.38)

3.2.6 NPS EN-3 states in specific reference to Solar PV, *"Where access tracks need to be provided, permeable tracks should be used, and localised Sustainable Drainage Systems (SuDS), such as swales and infiltration trenches, should be used to control any run-off where recommended."* (paragraph 2.10.85)

3.2.7 Furthermore, paragraph 2.10.154 of NPS EN-3 states *"Water management is a critical component of site design for ground mount solar plants. Where previous management of the site has involved intensive agricultural practice, solar sites can deliver significant ecosystem services value in the form of drainage, flood attenuation, natural wetland habitat, and water quality management."*

3.2.8 Current national planning policy guidance and best practice, namely the National Planning Policy Framework ('NPPF') and Planning Practice Guidance ('PPG'), require development proposals in all Flood Zones to seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of SuDS.

3.2.9 The ABC Local Plan was adopted in February 2019, and includes a policy relating to Storm Water Management, as set out below.

"Policy ENV9 – Sustainable Drainage

All development should include appropriate sustainable drainage systems (SuDS) for the disposal of surface water, in order to avoid any increase in flood risk or adverse impact on water quality, and to mimic the drainage from the pre-developed site.

On greenfield sites, development should discharge at a maximum of 4l/s/ha, or 10% below current greenfield rates for the existing 1:100 storm event, whichever is lower. There must be no increase in discharge rate from less severe rainfall events, with evidence submitted to demonstrate this principle.

On Previously Developed Land, development must endeavour to achieve 4 l/s/ha runoff or seek to achieve 50% reduction of existing peak runoff rates for the site where existing discharge rates can be established.

On smaller sites (less than 0.25ha), development should achieve a maximum discharge of 2l/s.

Any SuDS scheme must demonstrate regard to the adopted Sustainable Drainage SPD and any subsequent revisions.

SuDS features should always be the preferred option and provided onsite wherever practicable.

All development proposals will be required to:

a) Ensure all new developments are designed to reduce the risk of flooding, and maximise environmental gain, such as: water quality, water resources, biodiversity, landscape and recreational open space;

b) Ensure that all new developments are designed to mitigate and adapt to the effects of climate change;

c) Lower runoff flow rates, reducing the impact of urbanisation on flooding;

d) Protect or enhance water quality. Incorporating appropriate pollution control measures, to ensure there are no adverse impacts on the water quality of receiving waters, both during construction and in operation;

e) Be sympathetic to the environmental setting and the needs of the local community;

f) Incorporate a SuDS scheme that is coherent with the surrounding landscape and/or townscape;

g) Provide a habitat for wildlife in urban watercourses; and encourage natural groundwater recharge (where appropriate);

h) Demonstrate that opportunities have been taken to integrate sustainable drainage with biodiversity enhancements through appropriately designed surface water systems, as well as contribute to amenity and open spaces;

i) Demonstrate that the first 5mm of any rainfall event can be accommodated and disposed of on-site; and,

j) Demonstrate that clear arrangements have been established for the operation and maintenance of the SuDS component for the lifetime of the development."

Guidance

3.2.10 The Ashford Sustainable Drainage Supplementary Planning Document ('SPD') was adopted in 2010 to support relevant sustainable drainage policies in the Core Strategy (now superseded by the Local Plan). The SPD provides guidance to help planning and development integrate surface water management into the proposed development. The guidance provided in the SPD compliments national and local drainage requirements published in The SuDS Manual (CIRIA Report C753))[13], and the Local Plan policy.

3.2.11 This is similarly the case with regards to the 'Guide for Master planning Sustainable Drainage into Developments' provided by KCC, in their role as the Lead Local Flood Authority ('LLFA').

3.2.12 Current best practice guidance document, The Sustainable Drainage System ('SuDS') Manual (CIRIA Report C753))[13], promotes sustainable water management through the use of SuDS. There are four main categories of SuDS which are referred to as the 'four pillars of SuDS design'.

3.2.13 The SuDS Manual identifies a hierarchy of SuDS for managing runoff, which is commonly referred to as a 'management train'. The hierarchy of techniques is identified as:

- Prevention – the use of good site design and housekeeping measures on individual sites to prevent runoff and pollution (e.g. minimise areas of hard standing).
- Source Control – control of runoff at or very near its source (such as the use of rainwater harvesting).
- Site Control – management of water from several sub-catchments (including routing water from roofs and car parks to one/several large soakaways for the whole Site).
- Regional Control – management of runoff from several sites, typically in a retention pond or wetland.

3.2.14 It is generally accepted that the implementation of SuDS, as opposed to conventional drainage systems, provides a number of benefits by:

- Reducing peak flows to watercourses or sewers and potentially reducing the risk of flooding downstream;
- Reducing the volumes and frequency of water flowing directly to watercourses or sewers from developed sites;
- Improving water quality over conventional surface water sewers by removing pollutants from diffuse pollutant sources;
- Improving amenity through the provision of public open spaces and providing biodiversity and wildlife habitat enhancements; and
- Replicating natural drainage patterns, including the recharge of groundwater so that base flows are maintained.

3.2.15 The non statutory technical standards for SuDS published by DEFRA contain guidance for the design, maintenance and operation of sustainable drainage systems. This includes systems to drain surface water from housing, non-residential or mixed-use developments for the lifetime of the developments.

3.3 Climate Change

3.3.1 In February 2016, the Environment Agency issued updated guidance on the impacts of climate change on flood risk in the UK to support the NPPF[16]. This was most recently updated in May 2022 and sets out that peak rainfall intensity, sea level, peak river flow, offshore wind speed and extreme wave heights are all expected to increase in the future as a result of climate change. Consideration of the changes to these parameters should use the allowances outlined below based on the anticipated lifetime of the development. Changes to peak fluvial flows is the only factor of direct relevance to this Outline OSWDS.

3.3.2 The guidance acknowledges that there is considerable uncertainty with respect to the absolute level of change that is likely to occur. As such, the document provides estimates of possible changes that reflect a range of different emission scenarios. Updates issued in December 2019 brought the advice in line with the finding of UK Climate Projections 2018.

3.3.3 For peak rainfall intensity the guidance states that for a development with a project end of development lifetime between 2061 and 2100 (in this instance, 2067), the central allowance for the 2070s epoch should be used to assess the impacts of climate change on surface water flood risk and similarly drainage design. As detailed in **Table 3.1**, this equates to an uplift of 20%. ~~A model run was also undertaken using~~Kent County Council however explicitly require that the ~~Upper End 45% climate change~~upper end allowance ~~due to~~is used for drainage design and therefore the ~~sensitivity~~allowance of 45% on the 1% AEP storm and 40% of the 3.3% AEP storm has been adopted for the Project~~ Substation and Inverter Stations to flooding~~.

Table 3.1: Peak Rainfall Intensity Allowance by Management Catchment

Management Catchment	Annual Exceedance Probability (%)	Allowance Category	Total potential change anticipated for the 2050s	Total potential change for the 2070s
Stour	3.3%	Upper End	40%	40%
		Central	20%	20%
	1%	Upper End	45%	45%
		Central	20%	20%

4 Outline Surface Water Drainage Strategy

4.1 Overview

4.1.1 This Outline OSWDS sets out principles and an outline design for managing storm water on the Site in line with best practice and the requirements of KCC, the LLFA for the area. This Outline OSWDS has been developed following consultation with KCC and reflects their comments raised through the DCO consultation process. Detail of their previous comments and how the Project responds to these are set out in **ES Volume 2, Chapter 10: Water Environment (Doc Ref. 5.2)**.

4.1.2 This Outline OSWDS considers the arrangements for managing storm water during the operational phase of the Project. Consideration of measures for managing storm water during construction and decommissioning are discussed in the **Outline Construction Environmental Management Plan ('Outline CEMP') (Doc Ref. 7.8)** and the **Outline Decommissioning Environmental Management Plan ('Outline DEMP') (Doc Ref. 7.12)**. Where appropriate consideration will however be given to delivering aspects of this Outline OSWDS at an early stage of construction to enhance pollution control during the construction phase.

4.1.3 This Outline OSWDS is intended to demonstrate that, given the nature and quantum of development proposed, it will be feasible to drain the Site in line with planning requirements using the proposed methodology.

4.1.4 The strategy focuses on three key areas of the Project. These are:

- the Project Substation for which an illustrative drainage design is presented in **Drawing 10.3.0001** in **Appendix B** ;
- the Inverter Stations (including BESS) for which a generic concept drainage design is presented in **Drawing 10.3.0002** in **Appendix B**; this design would be applied to each grouping; and
- the wider Site including the PV panel area (Work No.1) for which a concept layout showing drainage connectivity and the location of depression storage is provided in **Drawing 10.3.003** and across **Drawings 10.3.003A – 10.3.003L** in **Appendix B**.

4.1.5 While the proposed strategy follows required SuDS principles, in common with most drainage strategies put forward in support of planning applications, the drainage scheme presented here will be subject to any relevant consents and approval of the detailed design (secured by Requirement in the **Draft Development Consent Order (Doc Ref. 3.1)**). The potential consents are identified in the **Schedule of Other Consents and Licences (Doc Ref. 3.4)**.

4.1.6 The PV panel area (Work No.1) will comprise rows of PV panels affixed to a metal frame supported by piles driven into the ground, minimizing the footprint (see **ES Volume 2, Chapter 3: Project Description (Doc Ref. 5.2)** for further details). The panels will be mounted at a minimum height of 0.8m AOD from the ground, ascending to a maximum height of 3.5m AOD. Installation of the PV panels does not involve the introduction of hardstanding at ground level meaning the superficial cover for the PV panels area will remain the same as the baseline.

4.1.7 Additionally, the PV panels will have regular rainwater gaps to prevent water being concentrated along a single drip line. Rainfall landing on the PV panels will drain through rainwater gaps and infiltrate into the ground beneath and between each row of panels.

4.1.8 The landscaping and biodiversity works do not entail the addition of hardstanding ensuring that there will be no alteration to the baseline conditions in these areas.

4.2 Pre-Development Runoff Rates

4.2.1 Greenfield runoff rates for the Site have been estimated through application of the Revitalised Flood Hydrograph Model (ReFH2). ReFH2 is recommended by the Environment Agency as the methodology for estimating flood peaks and hydrographs for small catchments[17].

4.2.2 SLR's Standard Order of Procedure for calculating greenfield runoff rates at the Site is provided as **Appendix A**.

4.2.3 In addition to the Flood Estimation Handbook ('FEH') parameters (obtained from FEH webservice for 1km grid) the following parameters were incorporated:

- Project Substation Impermeable Area: 0.~~86ha~~788ha
- Inverter Station Impermeable Area: 0.097ha

4.2.4 The parameters obtained from FEH webservice have been reviewed with understanding of the local geological context and are considered suitable for the pre-development drained area. The greenfield runoff results are summarised in **Table 4.1** and the full results are included as **Appendix A**.

Table 4.1: Greenfield Runoff Rates

Annual Probability	Greenfield Runoff Rate (l/s/ha)	Project Substation Area Runoff Rate (l/s/0.~~86ha~~788ha)	Inverter Station Area Runoff Rate (l/s/0.097ha)
100%	4.00	3.~~4~~2	0.4
50%	4.50	3.~~9~~5	0.4
3.3%	9.40	~~8.1~~7.4	0.9
1%	12.00	~~10.3~~9.5	1.2

4.2.5 The 100% annual probability rainfall runoff rate of 4l/s/ha matches Kent County Councils guidance[12] which states that '*On greenfield sites, development should* *discharge at a maximum of 4l/s/ha, or 10% below current greenfield rates for the existing 1:100 storm event, whichever is lower*'. On this basis, runoff from developed areas will be restricted to 4l/s/ha, mimicking the 100% annual probability runoff rate for the area.

4.2.6 This results in a maximum permissible discharge rate of 3.2l/s for the Project Substation, and 0.4l/s for each Inverter Station.

4.3 Constraints on the Use of SuDS

Topography

Project Substation

4.3.1 Ground levels across Field 26 fall in a southerly direction towards the East Stour River. The Project Substation will be located in the north western corner of Field 26 on a level platform. SuDS features will need to be downgradient of the Project Substation to allow for a drainage scheme via gravity.

Other Infrastructure (including Inverter Stations)

4.3.2 More generally ground levels on the Site tend to slope towards the course of the East Stour River. Any features intended to receive runoff will need to be located downgradient of infrastructure.

Geology and Hydrogeology

Project Substation

4.3.3 The bedrock geology underneath Field 26 is predominantly clay which has low permeability and therefore would not support the discharge of surface water runoff to ground. Whilst there are more permeable alluvium deposits locally, groundwater flows are likely perched above the underlying clay aquitard. During periods of prolonged heavy rainfall or when the East Stour River is in flood, groundwater levels in the alluvium are likely shallow (in continuum with fluvial flood levels) and therefore not appropriate for infiltration of surface water flow.

Inverter Stations

4.3.4 SuDS Guidance published by KCC[12] requires that the first 5mm of any rainfall event is infiltrated to ground. Procedures must be in place to prevent discharge from the Site when necessary due to the potential for contamination following fire. Allowing flows to therefore discharge to ground at the source (i.e., through gravel subbases) is not appropriate.

Other Infrastructure

4.3.5 All other SuDS features will remain unlined to allow for the infiltration of the first 5mm of rainfall.

Hydrology

Project Substation

4.3.6 Field 26 is bound to the south by the East Stour River and to the east by Unnamed Tributary 1. There are two potential watercourses that surface water flows from the Site can reasonably discharge to dependant on the location of SuDS. These watercourses join at a confluence to the south of the Site and attenuation would be provided to greenfield rates to ensure that discharge rates into the local watercourse network do not exceed existing.

Other Infrastructure (including Inverter Stations)

4.3.7 The Project proposes a series of new ditches within hedgerows and filter drains which will improve connectivity through the Site and convey flow towards the East Stour River or its tributaries. Surface water runoff shed from other infrastructure could therefore be routed into the local watercourse network.

Flood Risk

4.3.8 SuDS features which are used for hydraulic control will all be located outside of the design flood extent.

4.3.9 The Flood Risk Assessment at **ES Volume 4, Appendix 10.2: Flood Risk Assessment (Doc Ref. 5.4)** concludes that the Project Substation and all Inverter Stations are located in areas not considered to be at risk of flooding under design flood conditions (1% AEP plus 55% climate change).

Pollution Control

Project Substation and Inverter Stations

4.3.10 Guidance exists relating to pollution control, associated with use of oil within transformers and water and foams[18] used to suppress fire in the event of a failure. To comply with this guidance direct infiltration from the Project Substation area and from the Inverter Stations will not be permitted and measures will be provided to ensure that flows can be contained and held back in these areas in the event of a pollution incident.

Other Infrastructure

4.3.11 Pollution control measures are not required for all other infrastructure within the Site.

4.4 Proposed Catchment Area Schedule

4.4.1 Based on the **Illustrative Project Layout** (see the **Illustrative Project Drawings - Not for Approval (Doc Ref. 2.6)**), the contributing catchment areas on-Site which require a positive drainage connection and flow control are:

- the Project Substation; and
- each of the Inverter Stations.

4.4.2 It is proposed that runoff shed from the Sellindge Substation extension works will tie into the existing drainage infrastructure. Rainfall onto all other areas of the Site will mimic the existing greenfield regime and infiltrate to ground or flow overland accordingly.

4.4.3 The Project will not result in new impermeable surfaces within any of the remaining areas of the Site. Rainfall on these areas, which include the area of PV arrays, will either infiltrate to ground or generate runoff at existing greenfield rates.

Project Substation

4.4.4 The contributing area of the Project Substation is 0.~~68ha~~788ha, however this will be split between impermeable development areas ~~and~~, gravel (permeable, but lined) compound~~. This~~ and areas for the proposed SuDS features. The breakdown between the ~~two~~ land use types is 1,870m² impermeable ~~and~~, 4,930m² permeable areas~~.~~ and 1,080m² for open SuDS features (swale).

Inverter Stations

4.4.5 The Inverter Stations which are distributed across the Site are of variable sizes however typical dimensions are approximately 0.097ha / 970m² with approximately 0.048ha / 485m² impermeable area. The remaining 0.048ha / 485m² is available within the Inverter Station footprint for permeable gravel cover (underlined to prevent infiltration).

4.5 Proposed Discharge Arrangement

4.5.1 With reference to the SuDS Manual, the hierarchy of preferred disposal options for surface water runoff from development sites in decreasing order of sustainability is as follows:

- Infiltration to Ground;
- Discharge to Surface Waters; and
- Discharge to Sewer.

4.5.2 **Table 4.2** summarises the suitability of disposal methods in the context of the Site and the Project. Based on the SuDS Manual drainage hierarchy and the site-specific suitability, discharging to surface water is the preferred approach as outlined in **Table 4.3**.

Table 4.2: Suitability of Surface Water Disposal Methods

Surface Water Disposal Method (in Order of Preference)	Suitability Description
Infiltration to Ground	Bedrock geology around the Project Substation comprises of unproductive clay which does not have sufficient permeability to support infiltration to ground.

Surface Water Disposal Method (in Order of Preference)	Suitability Description
	Groundwater flows in alluvium deposits locally are likely perched above the underlying clay aquitard and may be present at shallow depths during periods of fluvial flooding. On this basis, infiltration to ground is not achievable around the Project Substation. The Inverter Stations are located throughout the Site, including areas where more permeable geology prevails. In these areas infiltration may be possible; however concern about pollution control precludes direct infiltration from the Inverter Stations. Runoff which is shed from the PV panels will mimic the existing greenfield regime and infiltrate to ground where possible.
Surface Water Discharge	The East Stour River and tributaries of the main river are present within the Order limits. Surface water disposal into these watercourses is possible at the Site.
Sewer Discharge	Surface water sewers locally (if available) are likely routed along local road networks (i.e., raised above Field 26) and outfall into the East Stour River. Given that there are more preferred options for discharge this scenario has not been explored further.

4.5.3 It is envisaged that surface water runoff from the Project Substation and Inverter Stations will be routed into the surface water network within the Order limits.

4.5.4 Rainfall which is shed from the PV panels will mimic the existing regime and infiltrate to ground or flow overland into local watercourses.

4.5.5 Runoff from the Sellindge Substation extension works will tie into the existing surface water drainage system which likely outfalls into a watercourse.

4.6 Conceptual Surface Water Drainage Strategy

4.6.1 As outlined within paragraph 4.1.4, the strategy is based on the **Illustrative Project Layout (Illustrative Project Drawings - Not for Approval (Doc Ref. 2.6)**).

4.6.2 The conceptual surface water drainage strategy has been developed in such a way that the proposed drainage arrangements can be constructed and operated without adversely affecting the operation of the AFSA or the ability for the Environment Agency to access their assets. This is discussed in greater detail within **ES Volume 4, Appendix 10.4: AFSA Risk Assessment (Doc Ref. 5.4)**.

Project Substation

4.6.3 Runoff from the Project Substation will be attenuated and discharged to a tributary of the East Stour River for all events up to and including the 1% AEP with a 20% uplift to account for increases in peak rainfall intensity.

4.6.4 Runoff that is shed from impermeable areas within the Project Substation will discharge onto adjacent gravelled areas and percolate into the void space of the gravel.

4.6.5 The gravel compound will be lined and fitted with a penstock to prevent flow discharging to ground or onward towards a watercourse in the event of a pollution incident or contaminated firewater.

4.6.6 Flows will be partially restricted within the gravel by an orifice which will allow runoff via a number of rocky cascades (for energy dissipation) into a lined swale at the toe of the Project Substation platform.

4.6.7 Discharge from the swale will be restricted to the 100% annual probability greenfield runoff rate. These flows will pass into a shallow unlined wetland area located within the FSA (Field 26). There would be no uplift in ground level in this area (the FSA) as a result of the unlined wetland area. This is not required for hydraulic control and is being created for amenity, biodiversity and water quality benefit. Flows from the wetland area will overtop into a tributary of the East Stour River along the south eastern boundary of the Project Substation.

4.6.8 The wetland area also provides the benefit of creating additional storage within the Aldington Flood Storage Area. This effect is quantified in **ES Volume 4, Appendix 10.2: Flood Risk Assessment (Doc Ref. 5.4).** The final detailed design for this feature, and other small ecological ponds and scrapes, will ensure that there is a net increase in flood storage provided within the Aldington Flood Storage Area.

~~4.6.8~~4.6.9 The proposed approach for discharge surface runoff from the Project Substation avoids the need for engineering works to the East Stour River and will ensure that the outfall connection to the tributary is naturalised and sympathetic with any hard structures required (overflow weir for wetland) set back from the channel.

~~4.6.9~~4.6.10 For larger storms this system will provide a significant reduction in runoff rates from the Project Substation area. The wetland area provided within the FSA will also increase the volume of storage and further contribute towards alleviating downstream fluvial flood risk.

~~4.6.10~~4.6.11 The outline surface water drainage for the Project Substation is presented in **Drawing 10.3.001** in **Appendix B**.

Inverter Stations

~~4.6.11~~4.6.12 The Inverter Stations will comprise inverters, transformers and switchgear as well as BESS units. These will be located on concrete plinths surrounded by gravels. Runoff which is shed from the hard surfaces will percolate into the gravel which provide capacity to hold and slow flows prior to onward discharge.

4.6.124.6.13 The gravel compounds will be lined and fitted with a penstock to prevent flow discharging to the ground or watercourses in the event of a pollution incident or contaminated firewater.

4.6.134.6.14 Water within the gravels will be allowed to discharge through the surrounding raised bunding via a hydrobrake at a restricted rate of 1l/s. For major storms this restriction will ensure that there is no uplift in peak runoff rates. Achieving a greater restriction on the discharge rates from these areas would not be possible without creating a significant risk of blockage.0.4l/s.

4.6.144.6.15 A generic outline surface water drainage for a typical Inverter Station is presented in **Drawing 10.3.002** in **Appendix B.**

4.6.154.6.16 To allow for positive discharge from all of these areas a number of new ditches and filter drains will be constructed. The proposed alignment of these features is shown on **Drawings 10.3.003** and across **Drawings 10.3.003A – 10.3.003L** in **Appendix B**. The new ditches will be formed beneath proposed hedge lines where connectivity to the existing watercourse network is possible via gravity. These new ditches and filter drains will receive the attenuated flows from the Inverter Stations and will be unlined to encourage infiltration. These features will provide additional storage capacity for water within the Site whilst providing ecological enhancement in some areas.

4.6.164.6.17 The proposed approach for discharging stormwater runoff from the Inverter Stations avoids the need for engineering works to the East Stour River and will ensure that the outfall connection to existing waterbodies is naturalised and sympathetic with any hard structures required (pipe outlets) set back from the channel.

PV Panels

4.6.174.6.18 Following the 2022 Statutory Consultation, KCC's response stated *'The County Council recommends that the Operational Surface Water Plan (OSWP) considers not only how surface water from the ancillary structures will be dealt with, but how rainfall upon the solar arrays themselves will be managed. […] It is essential that runoff is not increased to safeguard neighbouring areas of land.'*

4.6.184.6.19 Storm water falling on the PV panels will discharge to the ground immediately beneath which will be vegetated. Careful land management will be used to retain and enhance natural vegetation such that storm water continues to be able to discharge into the soils at or immediately downgradient of the PV panels. This will recreate the natural runoff patterns and ensure no uplift in discharge from these areas.

4.6.194.6.20 Noting however the concerns raised by KCC, and also the Internal Drainage Board ('IDB'), depression storage features are proposed in areas down gradient of the PV panels throughout the Site. These will intercept any surface runoff from the land on around the PV panels and encourage infiltration and evaporation through formation of lush wetland habitat. These will help ensure that adverse impacts on Site runoff are avoided.

~~4.6.20~~4.6.21 The depression features will not have formal outfalls and once full, will overtop and discharge downgradient into the local ditch network. The depression storage will remain unlined to enhance runoff to ground where applicable. The depression storage has been located in downgradient areas where access is not required preventing the creation of saturated ground conditions in areas where vehicle access is required.

~~4.6.21~~4.6.22 As part of the process of detail design testing will be undertaken to confirm that the areas of depression storage, once constructed, will be free draining (i.e. water levels will drop to 50% of capacity within 24 hours) as a result of seepage and infiltration into the shallow alluvium and soils. In any locations where the test results indicate that this will not readily be achieved the depression storage design will be amended to ensure it is free draining. This will involve excavating a slot drain on the downgradient side of the depression which will be backfilled with permeable sand and gravel and turfed over. This will then provide a permeable preferential sub surface discharge route and allow water to gradually discharge at a seepage face on the undeveloped down gradient slope.

~~4.6.22~~4.6.23 Ensuring that all of the depression storage created is free draining will provide capacity for repeat storms and prevent longer term water logging and flooding and associated uplifts in runoff rates.

4.6.24 The depression storage also provides the function of offsetting minor losses in flood storage associated with the volume of the PV array frames. This effect is quantified in **ES Volume 4, Appendix 10.2: Flood Risk Assessment (Doc Ref. 5.4).** The final detailed design for these areas of depression storage will ensure that there is no net loss in flood storage in the area downstream of the Aldington Flood Storage Area.

~~4.6.23~~4.6.25 If infrastructure such as access routes are required through areas where waterlogging currently occurs due to the existing topography and geology, shallow filter drains will be installed. These would intercept runoff and shallow sub surface flows and route these via depression storage where water can infiltrate or over top into surface water features. The act of reducing water logging of the ground should mean that runoff rates during large winter storms are slightly reduced.

~~4.6.24~~4.6.26 A conceptual surface water drainage layout for the Site showing the location of the proposed depression storage is provided in **Drawings 10.3.0003** and **10.3.003A – 10.3.003I** in **Appendix B**. A detail showing the arrangement for ensuring that the depression storage areas are free draining is provided on **Drawing 011998.00001_002** in **Appendix B**.

SuDS Attenuation Storage

~~Project Substation~~

~~4.6.25~~4.6.27 Temporary storage volumes were estimated using Flow+[1]; an appropriate methodology for Planning and Masterplanning purposes.

[1] Flow+ v10.6.234, Causeway Technologies Ltd, Copyright 1988-2023

4.6.264.6.28 The FEH 22 rainfall model was used with a design standard return period of 1% AEP (1 in 100-year return period) plus an allowance for climate change as recommended within the NPPF and requested by KCC (applied as a 2045% uplift in peak rainfall intensity).

Project Substation

4.6.274.6.29 The following parameters have been incorporated into the modelling for the Project Substation:

- Impermeable Area: 0.68ha
- Contributing Area: 0.788ha (0.187ha impermeable, 0.493ha lined permeable/gravel compound and 0.108ha open SuDS)

Gravel Compound

- Cover Level: 56m56.0m AOD
- Invert Level: 55.6m5m AOD
- Porosity: 0.3
- Surface Area: 4,930m^2 (70.2m x 70.2m)
- Slope: 1:9999
- Orifice Outflow Control:
  - Design Depth: 0.5m
  - Diameter: 0.1m
  - Discharge Coefficient: 0.6

Swale

- Cover Level: 50.5m AOD
- Invert Level:49.5m AOD
- Base Area: 264m^2
- Top of Bank Area: 1,080m^2
- Hydrobrake Outflow Control:
  - Invert Level: 49.5m AOD
  - Design Depth: 1m
  - Design Flow: 3.2l/s

4.6.284.6.30 Outputs from the modelling are provided as **Appendix C** which demonstrate sufficient capacity in the gravel area of the compound and within the swale for all events up to and including the 1% AEP plus 2045% climate change whilst reducing flows to 3.2l/s; belowmimicking the 100% AEP greenfield runoff rate. A sensitivity check has also been undertaken on the 1% AEP plus 45% climate change whereby no flooding is predicted.

Inverter Stations

4.6.294.6.31 The average area for the Inverter Station is approximately 970m^2 with around half of this area consisting of infrastructure (containers) on concrete plinths andwith the remaining area isbeing the gravel compound. The concrete plinths will be raised 150mm above the gravel surface within the compound cover level.

4.6.32 Bunding around the Inverter Station, as well as raised ground along any other access points, will be watertight to 125mm above the gravel surface (i.e., standard kerb height), thus retaining exceedance flows to 125mm above the ground level. The 150mm freeboard provided for the concrete plinths will ensure all sensitive infrastructure will always remain flood free.

4.6.304.6.33 Flows discharging from the gravel will be restricted to the minimum possible rate of 1l0.4l/s using a Hydrobrake vortex flow control device. To achieve this a hydrobrake with an aperture of 0.027m will be required. BS8582:2013[19] confirms that controls <25 mm are possible if protected. In this instance all water will be draining via the gravel subbase which will provide protection and prevent material that could result in blockages migrating towards the flow control. Enhanced maintenance checks are also specified in Section 4.9 to further manage the risk of blockage at these outlets.

4.6.314.6.34 Temporary storage volumes for a typical Inverter Station dimension were estimated using Flow+1. Modelled parameters are summarised below.

- Impermeable Area: 0.097ha (485m^2 impermeable area, 485m^2 gravel surface)
- Cover Level: 100m100.125m AOD
- Invert Level: 99.4m5m AOD
- Gravel Depth: 0.6m5m
- Gravel Porosity: 0.3
- Surface Area: 485m^2 (22m x 22m)
- Slope: 1:1,000
- Porosity: 0.3
- Hydrobrake Outflow Control:
  - Invert Level: 99.4m5m AOD
  - Design Depth: 0.7m5m
  - Design Flow: 1l0.4l/s

Note: Cover levels and invert levels within the model outputs are indicative only and should be adjusted for the relevant cover and invert levels of each convertor station.

4.6.324.6.35 The Inverter Stations will each be individually explicitly modelled as part of the detailed surface water drainage design process.

4.6.334.6.36 Outputs from the modelling are provided as **Appendix D** which, and demonstrate sufficient capacity in the gravel compound that excess runoff will be retained within the Inverter Station for all events up to and including the 1% AEP plus ~~20~~45% climate change whilst reducing flows to ~~1~~l0.4l/s.

~~4.6.34~~4.6.37 ~~Whilst~~During a critical 1% AEP plus 45% climate change event, the ~~outflow rate of 1l/s is greater than~~model predicts that water will surcharge from the ~~equivalent greenfield rate for~~gravel compound resulting in standing water across the ~~proposed~~ Inverter Station ~~area, it~~platform to a depth of 0.085m. As stated above, all infrastructure will be raised 150mm above the gravel surface and so would not be ~~practical to reduce rates to below 1l/s due to the increased~~at risk of ~~blockage~~inundation.

PV ~~Array~~Arrays

~~4.6.35~~4.6.38 As discussed above the construction of the PV panels will not adversely impact runoff rates. As such, it is not possible to undertake drainage modelling to quantify changes and the associated required attenuation volumes from the PV panels.

~~4.6.36~~4.6.39 As set out in **Section 10.3** of **ES Volume 2, Chapter 10: Water Environment (Doc Ref. 5.2)** both KCC and the IDB have requested that measures are included to manage runoff off of the land where the PV panels will be installed. Depression storage will therefore be provided across the Site on the downslope of PV panels to intercept runoff from the land such that the Project should provide a small beneficial impact in terms of runoff rates progressing to the East Stour River. These measures are secured via this Outline OSWDS.

~~4.6.37~~4.6.40 The precise dimension for the depression storage will be determined at the detailed design stage on a location-by-location basis. Typical dimensions are however provided below:

- Basal Width: 0.5m
- Top of Bank Width: 3.5m
- Depth: 0.5m
- Cross Sectional Area: 1m^2

SuDS Performance

Project Substation and Inverter Stations

~~4.6.38~~4.6.41 The suite of SuDS features will provide attenuation of surface water runoff prior to discharge to surface water features around the Site. The design event of the 1% AEP plus ~~20~~45% climate change event has been used to inform the drainage design. ~~A sensitivity check has also been undertaken on the 45% Upper End climate change allowance.~~

~~4.6.39~~4.6.42 Results from the modelling are summarised below in **Table 4.3**, which ~~demonstrates~~demonstrate that there is sufficient capacity in the swale and gravel compound for the design ~~1% AEP plus 20% climate change event but also the~~ 1% AEP plus 45% climate change event.

Table 4.3: SuDS Performance

	Annual Exceedance Probability	Critical Event	Peak Water Depth (m)	Post Development Runoff Rate (l/s)	Maximum Volume (m^3)
Project Substation (compound)	1% plus 2045% climate change	14405760 min Summer	0.728480	3.2-	409.1717
Inverter Station		960 min Summer	0.444	1.0	62.8
Project Substation (swale)		14402160 min WinterSummer	0.832866	3.2	503.2538
Inverter Station		9602160 min Winter	0.566585	1.0.4	80.6114.2

4.6.404.6.43 Runoff rates during extreme events will be reduced for both the Project Substation and Inverter Station. This is summarised per rainfall event in **Table 4.4**. Under design event conditions, the surface water drainage will not increase runoff from the Project and instead offers a reduction in runoff of up to 5967%.

Table 4.4: Comparison of Pre and Post Development Runoff Rates

Annual Exceedance Probability (%)	Greenfield Runoff Rate (l/s)	Post Development Runoff Rate (l/s)	Reduction in Runoff Rate	
			l/s	%
Project Substation				
50%	3.5	2.7	0.8	23
503.3%	3.97.4	3.92	04.2	057
3.3% + 40% CC	8.17.4	43.2	3.94.2	4857
1%	10.39.5	43.2	6.13	5966
1% + 2045% CC	10.39.5	43.2	6.13	5966
Inverter Station				

50%	0.4	0.4	0	0
3.3%	0.9	0.4	0.5	56
3.3% + 40% CC	0.9	0.4	0.5	56
1%	1.2	0.4	0.8	67
1% + 45% CC	10.31.2	0.4.2	6.10.8	5967

Comparison is made for the 3.3% + 40% CC and 1% AEP+ 45% CC rainfall events using the present day AEP runoff rate.

4.6.414.6.44 In line with NPS EN-1, **Table 4.5** below provides comparison between the pre- development and post-development 6-hour runoff volumes from the Site. The modelling predicts a small increase in discharge volume (18.8m³4.4m³) during the 50% AEP but reductions of up to 4943% for rarer events.

Table 4.5: Comparison of Pre and Post Development 6-hour Runoff Volumes

Annual Exceedance Probability (%)	6-hour Greenfield Runoff Volume (m^3)	6-hour Post Development Runoff Volume (m^3)	Reduction in Runoff Volume	
			m^3	%
50%	52.859.9	71.664.3	-	-
3.3%	111.1126.8	99.789.8	11.437	1029
1%3.3% + 40% CC	146.1126.8	103.597.6	42.629.2	2923
1% + 20% CC	175.3166.4	104.395.6	7170.8	4143
1% + 45% CC	211.8166.4	107.8102.3	10464.1	4939

Comparison is made for the 3.3% + 40% CC and 1% AEP+ 45% CC rainfall events using the present day 6-hour AEP runoff volume.

SuDS Assessment of Water Quality

4.6.424.6.45 SuDS provide a number of water quality benefits, and the proposed surface water management strategy utilises gravel compounds for interception and attenuation of flows. A swale is provided to further attenuate flows from the Project Substation which outfalls into a wetland for water quality and biodiversity benefits.

4.6.434.6.46 The simple index method, as outlined within the SuDS Manual, provides a way of quantifying the benefit to water quality of the SuDS Management Train. The pollution hazard from the land use and the mitigation from the SuDS component are each assigned an index. The total mitigation index must be greater than the pollution hazard index for adequate treatment to be delivered.

Total SuDS mitigation index ≥ pollution hazard index

(for each contaminant type) (for each containment type)

~~4.6.44~~4.6.47 The total SuDS mitigation is the summation of the first components mitigation index and half the mitigation index of any subsequent component.

~~4.6.45~~4.6.48 With reference to the SuDS Manual, post-development surface water runoff generated from the scheme is considered to have a 'Low' Pollution Hazard Level respectively as presented in **Table 4.6**.

~~4.6.46~~4.6.49 It is envisaged that the Project Substation will be largely unmanned with access required for primarily maintenance purposes. Drainage assumptions are based on the conservative scenario of the Project Substation providing a pollution hazard level equivalent to low trafficked roads.

~~4.6.47~~4.6.50 Internal access tracks will be provided for maintenance and emergency access to the BESS located in Work No. 2 with a minimum width of 3.7m and a carrying load in compliance with Building Regulations and NFCC Guidance. The internal access tracks will be constructed using a 90% permeable grass-paving hardstanding surface with foundations with an approximate depth of 300mm. Published industry standard guidance does not explicitly state a pollution hazard level for Inverter Stations and therefore this is assumed to be equivalent to industrial or commercial roofs.

Table 4.6: Pollution Hazard Potential of the Project

Land Use	Pollution Hazard Level	Pollution Hazard Indices		
		Total Suspended Solids (TSS)	Metals	Hydro-Carbons
Project Substation *(low traffic roads)*	Low	0.5	0.4	0.4
Inverter Station *(Other roofs – industrial / commercial)*	Low	0.3	0.2	0.05

~~4.6.48~~4.6.51 The proposed drainage system is required to demonstrate sufficient treatment capability to manage the specified Pollution Hazard Indices.

~~4.6.49~~4.6.52 As discussed above it is proposed that flows from the Project Substation will discharge through the gravel subbase of the compound, into a swale which then outfalls into a wetland feature. This system will provide 3 tiers of treatment.

~~4.6.50~~4.6.53 Flows shed from the Inverter Station platform will percolate via the gravel subbase of the compound prior to discharge.

~~4.6.51~~4.6.54 The SuDS mitigation indices for the proposed SuDS features discussed are provided in **Table 4.7**. It is assumed that the gravel compounds will have the equivalent mitigation indices of an infiltration trench.

Table 4.7: SuDS Mitigation Indices for the Project

SuDS Component	Mitigation Indices		
	Total Suspended Solids (TSS)	Metals	Hydro-Carbons
Gravel Subbase (Infiltration Trench)	0.4	0.4	0.4
Swale	0.5	0.6	0.6
Wetland	0.8	0.8	0.8

~~4.6.52~~4.6.55 **Table 4.8** compares the SuDS Mitigation Indices, provided by the proposed 'Source Control', 'Conveyance' and 'Site Control' measures against the Pollution Hazard Indices.

Table 4.8: SuDS Performance: Water Quality Indices

Land Use	Pollution Hazard Indices	Pollution Hazard and SuDS Mitigation Indices Comparison					
		Total Suspended Solids (TSS)		Metals		Hydro-Carbons	
		Pollution Index	SuDS Mitigation Index	Pollution Index	SuDS Mitigation Index	Pollution Index	SuDS Mitigation Index
Substation *(low traffic roads)*	Low	0.5	1.05	0.4	1.1	0.4	1.1

Convertor Station *(Other roofs – industrial / commercial)*	Low	0.3	0.4	0.2	0.4	0.05	0.4

~~4.6.53~~4.6.56 As the SuDS Mitigation Index provided by the proposed SuDS measures are ≥ Pollution Hazard Index the water quality assessment criteria are satisfied for the Site.

4.7 SuDS Construction

4.7.1 A Requirement in the **Draft Development Consent Order (Doc Ref. 3.1)** requires that prior to the operation of the authorised development an OSWDS for the operation of the authorised development must be submitted to and approved by the local planning authority, in consultation with KCC.

4.7.2 The information developed and submitted for approval as part of the detailed drainage design will include:

- Topographic and intrusive survey data as necessary to support designs;
- Full construction engineering drawings;
- Supporting calculations; and
- Details (if appropriate) of how and why the details presented vary from the outline strategy detailed in this report.

4.7.3 Where required outfalls to ordinary watercourses will be subject to land drainage consent from the IDB or ordinary watercourse consent from KCC.

4.7.4 No outfalls to the River East Stour are required and as such there will be no need for a Flood Risk Activity Permit to facilitate the delivery of the proposed surface water drainage system.

4.7.5 The construction of the SuDS features detailed and discussed will be subject to the controls and methodology set out in the **Outline CEMP (Doc Ref. 7.8)**. Further details will ultimately be provided within the detailed CEMP(s).

4.8 Firewater Storage

4.8.1 There is a potential for risk of fire at the BESS Units and to a lesser degree for other infrastructure within the Inverter Stations and at the Project Substation. The BESS will be designed with multiple layers of protection to minimise the chances of a fire or thermal runaway. This will include integrated fire detection with automated suppression systems to deal with electrical fires.

4.8.2 Water and foams applied to and around this infrastructure to control such an occurrence (i.e. fire water) pose a potential source of pollutants. The Inverter Stations and Project Substations compounds will be constructed with an impermeable lining and with stormwater storage provided above this within a gravel subbase.

4.8.3 A control point / shut off valve will be provided on the storm water outfall so that polluted flows from this source can be retained within the platform areas. The automated suppression system will include measures that ensure that the valves are shut in the event of a fire. Facility will also exist for manually shutting valves in the event of a different kind of pollution incident.

4.8.4 Polluted water, such as could arise following a fire, would be retained within the platforms of both the Inverter Stations and the Project Substation. Significant storage volumes are provided within the concept design and at the detailed design stage checks will be made to confirm that sufficient storage is provided to contain likely volumes of polluted water. If necessary, the volume of water that could be contained within the platform could readily be increased by raising the bunded height.

4.8.5 Firewater collected and retained within the affected compound area would be pumped to tanker and removed from Site for treatment and disposal at a suitable licenced facility. Following a fire event, the drainage network will require an assessment to confirm the absence of any contaminants prior to the penstock being released. The Project operator will be responsible for conducting a controlled flushing of the drainage network prior to opening the shut off valve.

4.9 SuDS Operation and Maintenance

4.9.1 A full SuDS maintenance plan will be produced as part of the detailed drainage design for the Project and included within the detailed OSWDS. The precise requirements will depend on manufacture specifications of the final design.

4.9.2 Within the indicative layout **(Illustrative Project Drawings - Not for Approval (Doc Ref. 2.6))** a minimum of 3m wide corridors are provided alongside and to route each SuDS feature to facilitate access for maintenance throughout the lifetime of the development.

4.9.3 The maintenance of all SuDS features will be the responsibility of the undertaker or an associated third-party contractor. Maintenance and operation of the Sellindge Substation will be the responsibility of National Grid and/or UKPN.

4.9.4 An outline of the typical maintenance requirements of each proposed SuDS feature is provided below.

Gravel Compound

4.9.5 The anticipated maintenance and management for the gravel compounds associated with the surface water drainage system is outlined in **Table 4.9**.

Table 4.9: Typical Infiltration Trench / Gravel Compound Maintenance Requirements

Maintenance Schedule	Required Action	Minimum Frequency
Regular Maintenance	Remove litter (including leaf litter) and debris from drain surface, access chambers and pre-treatment devices	Monthly, or as required
	Inspect surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treatment systems, inlets, and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
Occasional Maintenance	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (e.g., NJUG, 2007[20] or BS 3998:2010[21])	As required
	Clear perforated pipework of blockages	As required

Swale and Depression Storage

4.9.6 The anticipated maintenance and management for the swale and depression storage associated with the surface water drainage system is outlined in **Table 4.10**.

Table 4.10: Typical Swale Maintenance Requirements

Maintenance Schedule	Required Action	Minimum Frequency
Regular Maintenance	Remove litter and debris	Monthly, or as required

Maintenance Schedule	Required Action	Minimum Frequency
	Cut grass to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly for first six months, then as required
	Inspect inlets and overflows for blockages, and clear if required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding > 48 hours	Monthly, or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish appropriate slit removal frequencies	As required or if bare soil is exposed over 10% or more of the swale treatment area
Occasional Maintenance	Reseed areas of poor vegetation growth, alter plan types to better suit conditions, if required	Annually
Remedial Actions	Repair erosion or other damage by re-turfing or reseeding	As required
	Relevel 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

Maintenance Schedule	Required Action	Minimum Frequency
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required

Wetland

4.9.7 The anticipated maintenance and management for the wetland associated with the surface water drainage system is outlined in **Table 4.11**.

Table 4.11: Typical Wetland Maintenance Requirements

Maintenance Schedule	Required Action	Minimum Frequency
Regular Maintenance	Remove litter and debris	Monthly
	Cut grass- public areas	Monthly (during growing season)
	Cut the meadow grass	Half yearly (spring- before nesting season, and autumn)
	Inspect marginal and bankside vegetation and remove nuisance plants	Monthly for first 12 months, then as required
	Inspect inlets, outlets, banksides, structures, pipework etc for evidence of blockage and/or physical damage	Monthly
	Inspect water body for signs of poor water quality	Monthly (May – October)
	Inspect silt accumulation rates in any forebay and in main body of the pond and establish appropriate removal frequencies, undertake contamination	Half yearly

Maintenance Schedule	Required Action	Minimum Frequency
	testing once some build up has occurred, to inform management and disposal options	
	Check any penstocks and other mechanical devices	Half yearly
	Hand cut submerged and emergent aquatic plants (at minimum 0.1m above pond base; include max 25% of pond surface)	Annually
	Remove 25% of bank vegetation from waters edge to a minimum of 1m above water level	Annually
	Tidy all dead growth (scrub clearance) before start of growing season (Note: tree maintenance is usually part of overall landscape management contract)	Annually
	Remove sediment from any forebay	Every 1-5 years, or as required
	Remove sediment and planting from one quadrant of the main body of ponds without sediment forebays	Every 5 years, or as required
Occasional Maintenance	Remove sediment from the main body of big ponds when the pool volume is reduced by 20%	With effective pre-treatment, this will only be required rarely, e.g., 25-50 years
Remedial Actions	Repair erosion or other damage	As required
	Replant, where necessary	As required

Maintenance Schedule	Required Action	Minimum Frequency
	Aerate pond when signs of eutrophication are detected	As required
	Realign rip-rap or repair other damage	As required
	Repair / rehabilitate inlets, outlets, and overflows	As required

Filter Drain

4.9.8 The anticipated maintenance and management for the filter drains provided on the Site as part of the surface water drainage system is outlined below in **Table 4.12**.

Table 4.12: Typical Maintenance Requirements for Filter Drain

Maintenance Schedule	Required Action	Minimum Frequency
Regular Maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly (or as required)
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treatment systems, inlets, perforated pipework and the silt trap for silt accumulation and establish appropriate silt removal frequencies	Six monthly

Maintenance Schedule	Required Action	Minimum Frequency
	Remove sediment from pre-treatment devices	Six monthly, or as required
Occasional Maintenance	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly, or as required
	Clear any pipework of blockages	As required

Outflow Controls

4.9.9 The anticipated maintenance and management for the outflows (hydrobrake and orifice) associated with the surface water drainage system is outlined in **Table 4.13**. These will be refined in accordance with the manufacturer's specification upon installation.

Table 4.13: Typical Maintenance Requirements for Outflow Controls

Maintenance Schedule	Required Action	Minimum Frequency
Regular Maintenance	Check smaller Hydrobreaks on Inverter Stations	Monthly
	Remove sedimentation that has become entrained into the outflow	Every 6 months or as required
Occasional Maintenance	Periodic measuring of the outflow bore size	Every 3 years
	Checking of the outflow for leakage issues	Annually

4.10 Exceedance

4.10.1 This section assesses events in exceedance of the Site drainage strategy, i.e., those with a probability of occurrence less than the drainage design of 1% AEP plus 45% climate change.

Project Substation

4.10.2 In the event of exceedance from the gravel compound within the Project Substation, flows would surcharge from the gravel resulting in shallow ponding. As this is a level compound, water levels would rise until flows overtopped the boundary wall and then would proceed in line with the local topography into the swale which will be at the toe the raised platform.

4.10.3 Exceedance from the swale would result in flows overtopping to the south east and discharging towards and into the wetland. The wetland is essentially designed to flood under extreme events and therefore exceedance of this would simply discharge south east into the adjacent East Stour tributary.

Inverter Stations

4.10.4 With regard to the Inverter Stations, any exceedance flows would rise within the gravel compound ~~first resulting in shallow ponding and then ultimately~~ and be retained above surface to ~~discharge towards the local~~a maximum depth of 0.125m. At this point, surface water ~~network~~would overtop the compound and flow overland towards surface water networks in line with the local topography.

4.10.5 All infrastructure within the Inverter Stations will be raised at least 150mm above the gravel surface and so would not be at risk of inundation.

PV Panels

~~4.10.5~~4.10.6 The exceedance flow pathways discussed mirror the natural flow pathways on and around the Site and direct flows towards the existing surface water network. No off-Site properties would be impacted by these flows and, as the PV panels will be raised, such flows would not affect the operation of the Project.

5 Conclusions

5.1.1 SLR has been appointed by the Applicant to provide an Outline OSWDS in support of the DCO application for the Project.

5.1.2 This Outline OSWDS has been developed to demonstrate that the requirements of national, regional, and local planning policy can be achieved at the Site given the nature and the quantum of development proposed. The drainage strategy has been devised following a review of local policy and having regard to consultation responses from KCC, the LLFA for the area.

Project Substation

5.1.3 The Project Substation will comprise a platform containing concrete plinths surrounded by a lined gravel substrate. Flows which are shed from impermeable structures will percolate into the void space of the gravels and a penstock, or other similar equivalent valve, will be provided so that discharge can be stopped in the event of a pollution incident.

5.1.4 Under normal conditions flows will discharge through a series of rocky cascades (for energy dissipation) into a swale at the toe of the platform. Discharge from the swale will outfall into a wetland at restricted rates of 3.2l/s (i.e., below the 100% AEP greenfield rate) before overtopping into a tributary of the East Stour River.

5.1.5 The swale and wetland areas have both been designed to enhance biodiversity and ensure that there is no adverse impact on water quality. In addition, the wetland area, which will be sited within the AFSA, will increase the capacity of fluvial flood storage available. This will therefore contribute to a small reduction in downstream flood risk.

Inverter Stations

5.1.6 The Inverter Stations, which will be distributed around the Site, will each be comprised of a small platform containing concrete plinths surrounded by a lined gravel substrate. Flows shed from the impermeable areas will percolate into the void space for attention, prior to discharge into a local ordinary watercourse at a peak rate of 1 l/s. A penstock, or other similar valve, will be provided at each Inverter Station so that discharge can be stopped in the event of a pollution incident.

5.1.7 This Outline OSWDS proposes a number of new ditches and filter drains to allow discharges from each Inverter Station to be converted into the existing surface water network. These features will be unlined and designed where possible to encourage infiltration and enhance biodiversity.

PV Panels

5.1.8 The construction of the PV panels should have a neutral impact on runoff rates on the Site. As requested by KCC, depression storage will however be provided around the Site downstream of areas of PV panels to intercept runoff from the land. This should result in a small beneficial reduction in runoff rates and the depression storage will introduce additional wet habitat areas around the Site and provide additional flood storage that more than offsets the are lost as a result of the PV panel frames.

5.1.9 In common with most drainage strategies put forward in support of planning applications, the strategy presented here will need to be subject to approval of the detailed design (as secured by Requirement in the **Draft Development Consent Order (Doc Ref. 3.1)**) and any relevant consents.

Appendix A: Greenfield Runoff Rates and Volumes

Standard Operating Procedure and Summary of Results ReFH2 Greenfield Runoff Analysis			
Prepared by:	[redacted]	Issue date:	21/08/2023
Approved by:	[redacted]	Version:	ISSUED v1
Project Title:	Stonestreet Green Solar	SLR Ref:	425.064837.00001

1 Introduction and background

This document sets out the Hydrology and Hydrogeology team's standard procedure for Greenfield Runoff Rate and Greenfield Runoff Volume analysis using the ReFH2 methodology.

References and further reading materials that may help determine which is the most suitable method for each site are outlined at the end of the document.

This document is designed to provide a step-by-step procedure to undertake any greenfield analysis using ReFH2. A summary of the results specific to the project is provided in Section 3 and Appended to this report.

2 RefH2 Methology

Data Import

1. Import the data file from the ReFH website[1]. If using Catchment Descriptors, select to use plot scale equations. Plot scale equations are automatically selected for Point Descriptors however for greenfield runoff calculations, point descriptors should be used.

Table-1: FEH CD ROM File Upload Parameters

Descriptor	Plot Scale Equations Selected (Y/N)
Point at 605897, 137543	Y

Catchment Area

2. If the catchment area is less than 0.5km^2, in line with SuDS guidance, greenfield runoff calculations should be estimated using an area of 0.5km^2 and rescaled to the size of the catchment (see Step 5).

1 Flood Estimation Handbook Web Service, UK Centre for Ecology & Hydrology, https://fehweb.ceh.ac.uk/Map

For catchment areas greater than 0.5km^2, the default catchment area can be used. As catchment rescaling Is not required, skip to Step 6.

Table-2: Catchment Scaling Requirements

Catchment / Drained Area	ReFH2 Input
<0.5km^2	0.5km^2
>0.5km2	Default catchment area (km^2)

Rainfall Parameters

3. On the design rainfall event tab, accept all of the initial defaults. Set the areal reduction factor to 1.0 to accept the default seasonality of a winter storm.

Table-3: ARF Adjustments

Initial ARF	Adjusted ARF
0.98	1.0

4. The modelling will then adjust the Time to Peak (Tp) and the Baseflow Lag (BL) in accordance with the catchment area of 0.5km^2 and ARF of 1.0.
   These modelled parameters are recorded below.

Table-4: Tp and BL for 0.5km^2 Catchment

Tp (hr)	BL
1.865	35.167

Rescaling

5. Reconfigure ReFH2 for the actual extent of the development area (<0.5km^2). In doing so, the ARF, Tp and BL values will automatically readjust. Therefore manually adjust ARF to remain as 1.0 and the Tp and BL parameters to those of the 0.5km^2 catchment area recorded in Table-4.

Extracting Greenfield Runoff Rates

6. Export peak flows for all return periods to derive greenfield runoff rates and print of the relevant PDF reports for the required rainfall events. Note that this step of the audit trail relates solely to greenfield runoff rates.
7. It is recommended that the project file is saved after step 4 and resaved under a different file name for step 8. This provides a succinct audit trail for Greenfield runoff calculations and greenfield runoff volume calculations.

Extracting Greenfield Runoff Volumes

The next step is to estimate the allowable greenfield runoff volume that can be discharges (at the greenfield flow rates) during an event. The runoff volume for a development site is typically the 1 in 100-year 6-hour duration event.

8. Reset the recommended duration on the rainfall page to 6 hours and set the timestep to 40 mins (9 timesteps) or 8mins (45 timesteps) . Export the 'as rural' results for all return periods. This provides greenfield volumes in m^3/s in each time step which can be converted by multiplying the total flow (m^3/s) in each time step by the number of seconds in that time step. Please ensure that the Tp and BI parameters are still correct, and the ARF is still set to 1 once the 6 hr event has been updated.

3 Summary of Results

The following tables summarise the greenfield runoff rates and greenfield runoff volumes undertaken as part of the ReFH2 analysis. These values will ultimately corroborate what is provided within the ReFH2 outputs.

Table -5: Greenfield Runoff Rates for 1ha per Return Period

Annual Exceedance Probability	Greenfield Rates (l/s)
100	4.0
50	4.5
3.3	9.4
1	12.0

Table -6: 6-Hour Greenfield Runoff Volumes for 1ha per Return Period

Annual Exceedance Probability	6-hour Greenfield Runoff Volume (m^3)
100	60
50	68
3.3	143
1	188

References & Guidance Documents

- [redacted]
- CIRIA C753 The SuDS Manual, 2015

UK Design Flood Estimation

Generated on 21 August 2023 11:57:56 by [redacted]
Printed from the ReFH2 Flood Modelling software package, version 4.0.8560.23190

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH2)

Site details

Checksum: 156C-0507

Site name: FEH_Point_Descriptors_605897_137543_v5_0_1

Easting: 605897

Northing: 137543

Country: England, Wales or Northern Ireland

Catchment Area (km^2): 0.01 [0.5]*

Using plot scale calculations: Yes

Model: 2.3

Site description: None

Model run: 1 year

Summary of results

Rainfall - FEH22 (mm):	18.65	Total runoff (ML):	0.04
Total Rainfall (mm):	12.32	Total flow (ML):	0.12
Peak Rainfall (mm):	2.40	Peak flow (m^3/s):	0.00

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH22)

Name	Value	User-defined?
Duration (hh:mm:ss)	03:15:00	No
Timestep (hh:mm:ss)	00:15:00	No
SCF (Seasonal correction factor)	0.66	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	No

Loss model parameters

Name	Value	User-defined?
Cini (mm)	112.57	No
Cmax (mm)	331.82	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	1.87 [1]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0	No
BL (hr)	35.17 [26.13]	Yes
BR	1.79	No

Urbanisation parameters

Name	Value	User-defined?
Sewer capacity (m^3/s)	0	No
Exporting drained area (km^2)	0	No
Urban area (km^2)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.4	No
Tp scaling factor	0.75	No
Depression storage depth (mm)	0.5	No

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m^3/s)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	0.2192	0.0000	0.0744	0.0000	0.000355	0.000355
00:15:00	0.3394	0.0000	0.1155	0.0000	0.000352	0.000357
00:30:00	0.5237	0.0000	0.1790	0.0000	0.00035	0.000372
00:45:00	0.8044	0.0000	0.2765	0.0001	0.000348	0.000406
01:00:00	1.2268	0.0000	0.4254	0.0001	0.000347	0.000471
01:15:00	1.8437	0.0000	0.6479	0.0002	0.000346	0.000582
01:30:00	2.4012	0.0000	0.8591	0.0004	0.000348	0.000765
01:45:00	1.8437	0.0000	0.6715	0.0007	0.000353	0.00105
02:00:00	1.2268	0.0000	0.4525	0.0011	0.000362	0.00143
02:15:00	0.8044	0.0000	0.2992	0.0015	0.000375	0.00188
02:30:00	0.5237	0.0000	0.1958	0.0020	0.000395	0.00236
02:45:00	0.3394	0.0000	0.1273	0.0024	0.00042	0.00283
03:00:00	0.2192	0.0000	0.0824	0.0028	0.00045	0.00328
03:15:00	0.0000	0.0000	0.0000	0.0032	0.000485	0.00365
03:30:00	0.0000	0.0000	0.0000	0.0034	0.000523	0.00389
03:45:00	0.0000	0.0000	0.0000	0.0034	0.000563	0.00397
04:00:00	0.0000	0.0000	0.0000	0.0033	0.000601	0.00392
04:15:00	0.0000	0.0000	0.0000	0.0031	0.000638	0.00377
04:30:00	0.0000	0.0000	0.0000	0.0029	0.000672	0.00357
04:45:00	0.0000	0.0000	0.0000	0.0026	0.000702	0.00333
05:00:00	0.0000	0.0000	0.0000	0.0023	0.000729	0.00308
05:15:00	0.0000	0.0000	0.0000	0.0021	0.000752	0.00283
05:30:00	0.0000	0.0000	0.0000	0.0018	0.000771	0.00261
05:45:00	0.0000	0.0000	0.0000	0.0016	0.000788	0.00241
06:00:00	0.0000	0.0000	0.0000	0.0014	0.000802	0.00224
06:15:00	0.0000	0.0000	0.0000	0.0013	0.000813	0.00208
06:30:00	0.0000	0.0000	0.0000	0.0011	0.000823	0.00193
06:45:00	0.0000	0.0000	0.0000	0.0010	0.00083	0.00178
07:00:00	0.0000	0.0000	0.0000	0.0008	0.000835	0.00164
07:15:00	0.0000	0.0000	0.0000	0.0007	0.000839	0.0015
07:30:00	0.0000	0.0000	0.0000	0.0005	0.00084	0.00136
07:45:00	0.0000	0.0000	0.0000	0.0004	0.00084	0.00123
08:00:00	0.0000	0.0000	0.0000	0.0003	0.000838	0.00111
08:15:00	0.0000	0.0000	0.0000	0.0002	0.000835	0.00101
08:30:00	0.0000	0.0000	0.0000	0.0001	0.000831	0.000938

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m^3/s)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
08:45:00	0.0000	0.0000	0.0000	0.0001	0.000826	0.000887
09:00:00	0.0000	0.0000	0.0000	0.0000	0.000821	0.000853
09:15:00	0.0000	0.0000	0.0000	0.0000	0.000816	0.00083
09:30:00	0.0000	0.0000	0.0000	0.0000	0.00081	0.000815
09:45:00	0.0000	0.0000	0.0000	0.0000	0.000804	0.000805
10:00:00	0.0000	0.0000	0.0000	0.0000	0.000799	0.000799
10:15:00	0.0000	0.0000	0.0000	0.0000	0.000793	0.000793
10:30:00	0.0000	0.0000	0.0000	0.0000	0.000787	0.000787
10:45:00	0.0000	0.0000	0.0000	0.0000	0.000782	0.000782
11:00:00	0.0000	0.0000	0.0000	0.0000	0.000776	0.000776
11:15:00	0.0000	0.0000	0.0000	0.0000	0.000771	0.000771
11:30:00	0.0000	0.0000	0.0000	0.0000	0.000765	0.000765
11:45:00	0.0000	0.0000	0.0000	0.0000	0.00076	0.00076
12:00:00	0.0000	0.0000	0.0000	0.0000	0.000754	0.000754
12:15:00	0.0000	0.0000	0.0000	0.0000	0.000749	0.000749
12:30:00	0.0000	0.0000	0.0000	0.0000	0.000744	0.000744
12:45:00	0.0000	0.0000	0.0000	0.0000	0.000738	0.000738
13:00:00	0.0000	0.0000	0.0000	0.0000	0.000733	0.000733
13:15:00	0.0000	0.0000	0.0000	0.0000	0.000728	0.000728
13:30:00	0.0000	0.0000	0.0000	0.0000	0.000723	0.000723
13:45:00	0.0000	0.0000	0.0000	0.0000	0.000718	0.000718
14:00:00	0.0000	0.0000	0.0000	0.0000	0.000713	0.000713
14:15:00	0.0000	0.0000	0.0000	0.0000	0.000708	0.000708
14:30:00	0.0000	0.0000	0.0000	0.0000	0.000703	0.000703
14:45:00	0.0000	0.0000	0.0000	0.0000	0.000698	0.000698
15:00:00	0.0000	0.0000	0.0000	0.0000	0.000693	0.000693
15:15:00	0.0000	0.0000	0.0000	0.0000	0.000688	0.000688
15:30:00	0.0000	0.0000	0.0000	0.0000	0.000683	0.000683
15:45:00	0.0000	0.0000	0.0000	0.0000	0.000678	0.000678
16:00:00	0.0000	0.0000	0.0000	0.0000	0.000673	0.000673
16:15:00	0.0000	0.0000	0.0000	0.0000	0.000669	0.000669
16:30:00	0.0000	0.0000	0.0000	0.0000	0.000664	0.000664
16:45:00	0.0000	0.0000	0.0000	0.0000	0.000659	0.000659
17:00:00	0.0000	0.0000	0.0000	0.0000	0.000654	0.000654
17:15:00	0.0000	0.0000	0.0000	0.0000	0.00065	0.00065
17:30:00	0.0000	0.0000	0.0000	0.0000	0.000645	0.000645

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m³/s)	Net Rain (mm)	Runoff (m³/s)	Baseflow (m³/s)	Total Flow (m³/s)
17:45:00	0.0000	0.0000	0.0000	0.0000	0.000641	0.000641
18:00:00	0.0000	0.0000	0.0000	0.0000	0.000636	0.000636
18:15:00	0.0000	0.0000	0.0000	0.0000	0.000632	0.000632
18:30:00	0.0000	0.0000	0.0000	0.0000	0.000627	0.000627
18:45:00	0.0000	0.0000	0.0000	0.0000	0.000623	0.000623
19:00:00	0.0000	0.0000	0.0000	0.0000	0.000618	0.000618
19:15:00	0.0000	0.0000	0.0000	0.0000	0.000614	0.000614
19:30:00	0.0000	0.0000	0.0000	0.0000	0.00061	0.00061
19:45:00	0.0000	0.0000	0.0000	0.0000	0.000605	0.000605
20:00:00	0.0000	0.0000	0.0000	0.0000	0.000601	0.000601
20:15:00	0.0000	0.0000	0.0000	0.0000	0.000597	0.000597
20:30:00	0.0000	0.0000	0.0000	0.0000	0.000592	0.000592
20:45:00	0.0000	0.0000	0.0000	0.0000	0.000588	0.000588
21:00:00	0.0000	0.0000	0.0000	0.0000	0.000584	0.000584
21:15:00	0.0000	0.0000	0.0000	0.0000	0.00058	0.00058
21:30:00	0.0000	0.0000	0.0000	0.0000	0.000576	0.000576
21:45:00	0.0000	0.0000	0.0000	0.0000	0.000572	0.000572
22:00:00	0.0000	0.0000	0.0000	0.0000	0.000568	0.000568
22:15:00	0.0000	0.0000	0.0000	0.0000	0.000564	0.000564
22:30:00	0.0000	0.0000	0.0000	0.0000	0.00056	0.00056
22:45:00	0.0000	0.0000	0.0000	0.0000	0.000556	0.000556
23:00:00	0.0000	0.0000	0.0000	0.0000	0.000552	0.000552
23:15:00	0.0000	0.0000	0.0000	0.0000	0.000548	0.000548
23:30:00	0.0000	0.0000	0.0000	0.0000	0.000544	0.000544
23:45:00	0.0000	0.0000	0.0000	0.0000	0.00054	0.00054
24:00:00	0.0000	0.0000	0.0000	0.0000	0.000536	0.000536
24:15:00	0.0000	0.0000	0.0000	0.0000	0.000532	0.000532
24:30:00	0.0000	0.0000	0.0000	0.0000	0.000529	0.000529
24:45:00	0.0000	0.0000	0.0000	0.0000	0.000525	0.000525
25:00:00	0.0000	0.0000	0.0000	0.0000	0.000521	0.000521
25:15:00	0.0000	0.0000	0.0000	0.0000	0.000518	0.000518
25:30:00	0.0000	0.0000	0.0000	0.0000	0.000514	0.000514
25:45:00	0.0000	0.0000	0.0000	0.0000	0.00051	0.00051
26:00:00	0.0000	0.0000	0.0000	0.0000	0.000507	0.000507
26:15:00	0.0000	0.0000	0.0000	0.0000	0.000503	0.000503
26:30:00	0.0000	0.0000	0.0000	0.0000	0.000499	0.000499

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m³/s)	Net Rain (mm)	Runoff (m³/s)	Baseflow (m³/s)	Total Flow (m³/s)
26:45:00	0.0000	0.0000	0.0000	0.0000	0.000496	0.000496
27:00:00	0.0000	0.0000	0.0000	0.0000	0.000492	0.000492
27:15:00	0.0000	0.0000	0.0000	0.0000	0.000489	0.000489
27:30:00	0.0000	0.0000	0.0000	0.0000	0.000485	0.000485
27:45:00	0.0000	0.0000	0.0000	0.0000	0.000482	0.000482
28:00:00	0.0000	0.0000	0.0000	0.0000	0.000479	0.000479
28:15:00	0.0000	0.0000	0.0000	0.0000	0.000475	0.000475
28:30:00	0.0000	0.0000	0.0000	0.0000	0.000472	0.000472
28:45:00	0.0000	0.0000	0.0000	0.0000	0.000469	0.000469
29:00:00	0.0000	0.0000	0.0000	0.0000	0.000465	0.000465
29:15:00	0.0000	0.0000	0.0000	0.0000	0.000462	0.000462
29:30:00	0.0000	0.0000	0.0000	0.0000	0.000459	0.000459
29:45:00	0.0000	0.0000	0.0000	0.0000	0.000455	0.000455
30:00:00	0.0000	0.0000	0.0000	0.0000	0.000452	0.000452
30:15:00	0.0000	0.0000	0.0000	0.0000	0.000449	0.000449
30:30:00	0.0000	0.0000	0.0000	0.0000	0.000446	0.000446
30:45:00	0.0000	0.0000	0.0000	0.0000	0.000443	0.000443
31:00:00	0.0000	0.0000	0.0000	0.0000	0.000439	0.000439
31:15:00	0.0000	0.0000	0.0000	0.0000	0.000436	0.000436
31:30:00	0.0000	0.0000	0.0000	0.0000	0.000433	0.000433
31:45:00	0.0000	0.0000	0.0000	0.0000	0.00043	0.00043
32:00:00	0.0000	0.0000	0.0000	0.0000	0.000427	0.000427
32:15:00	0.0000	0.0000	0.0000	0.0000	0.000424	0.000424
32:30:00	0.0000	0.0000	0.0000	0.0000	0.000421	0.000421
32:45:00	0.0000	0.0000	0.0000	0.0000	0.000418	0.000418
33:00:00	0.0000	0.0000	0.0000	0.0000	0.000415	0.000415
33:15:00	0.0000	0.0000	0.0000	0.0000	0.000412	0.000412
33:30:00	0.0000	0.0000	0.0000	0.0000	0.000409	0.000409
33:45:00	0.0000	0.0000	0.0000	0.0000	0.000406	0.000406
34:00:00	0.0000	0.0000	0.0000	0.0000	0.000404	0.000404
34:15:00	0.0000	0.0000	0.0000	0.0000	0.000401	0.000401
34:30:00	0.0000	0.0000	0.0000	0.0000	0.000398	0.000398
34:45:00	0.0000	0.0000	0.0000	0.0000	0.000395	0.000395
35:00:00	0.0000	0.0000	0.0000	0.0000	0.000392	0.000392
35:15:00	0.0000	0.0000	0.0000	0.0000	0.000389	0.000389
35:30:00	0.0000	0.0000	0.0000	0.0000	0.000387	0.000387

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m^3/s)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
35:45:00	0.0000	0.0000	0.0000	0.0000	0.000384	0.000384
36:00:00	0.0000	0.0000	0.0000	0.0000	0.000381	0.000381
36:15:00	0.0000	0.0000	0.0000	0.0000	0.000379	0.000379
36:30:00	0.0000	0.0000	0.0000	0.0000	0.000376	0.000376
36:45:00	0.0000	0.0000	0.0000	0.0000	0.000373	0.000373
37:00:00	0.0000	0.0000	0.0000	0.0000	0.000371	0.000371
37:15:00	0.0000	0.0000	0.0000	0.0000	0.000368	0.000368
37:30:00	0.0000	0.0000	0.0000	0.0000	0.000365	0.000365
37:45:00	0.0000	0.0000	0.0000	0.0000	0.000363	0.000363
38:00:00	0.0000	0.0000	0.0000	0.0000	0.00036	0.00036
38:15:00	0.0000	0.0000	0.0000	0.0000	0.000358	0.000358

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.47	No
BFIHOST19	0.42	No
PROPWET	0.34	No
SAAR (mm)	735	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on 21 August 2023 11:58:26 by [redacted]
Printed from the ReFH2 Flood Modelling software package, version 4.0.8560.23190

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH2)

Site details

Checksum: 156C-0507

Site name: FEH_Point_Descriptors_605897_137543_v5_0_1

Easting: 605897

Northing: 137543

Country: England, Wales or Northern Ireland

Catchment Area (km^2): 0.01 [0.5]*

Using plot scale calculations: Yes

Model: 2.3

Site description: None

Model run: 2 year

Summary of results

Rainfall - FEH22 (mm):	21.25	Total runoff (ML):	0.05
Total Rainfall (mm):	14.03	Total flow (ML):	0.14
Peak Rainfall (mm):	2.74	Peak flow (m³/s):	0.00

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH22)

Name	Value	User-defined?
Duration (hh:mm:ss)	03:15:00	No
Timestep (hh:mm:ss)	00:15:00	No
SCF (Seasonal correction factor)	0.66	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	No

Loss model parameters

Name	Value	User-defined?
Cini (mm)	112.57	No
Cmax (mm)	331.82	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	1.87 [1]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0	No
BL (hr)	35.17 [26.13]	Yes
BR	1.77	No

Urbanisation parameters

Name	Value	User-defined?
Sewer capacity (m^3/s)	0	No
Exporting drained area (km^2)	0	No
Urban area (km^2)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.4	No
Tp scaling factor	0.75	No
Depression storage depth (mm)	0.5	No

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m³/s)	Net Rain (mm)	Runoff (m³/s)	Baseflow (m³/s)	Total Flow (m³/s)
00:00:00	0.2497	0.0000	0.0848	0.0000	0.000355	0.000355
00:15:00	0.3866	0.0000	0.1317	0.0000	0.000352	0.000358
00:30:00	0.5966	0.0000	0.2041	0.0000	0.00035	0.000375
00:45:00	0.9164	0.0000	0.3156	0.0001	0.000348	0.000414
01:00:00	1.3976	0.0000	0.4861	0.0001	0.000347	0.000488
01:15:00	2.1003	0.0000	0.7416	0.0003	0.000347	0.000616
01:30:00	2.7355	0.0000	0.9858	0.0005	0.000349	0.000824
01:45:00	2.1003	0.0000	0.7722	0.0008	0.000355	0.00115
02:00:00	1.3976	0.0000	0.5212	0.0012	0.000365	0.00159
02:15:00	0.9164	0.0000	0.3450	0.0017	0.000381	0.0021
02:30:00	0.5966	0.0000	0.2259	0.0022	0.000403	0.00265
02:45:00	0.3866	0.0000	0.1470	0.0028	0.000432	0.0032
03:00:00	0.2497	0.0000	0.0952	0.0032	0.000466	0.00371
03:15:00	0.0000	0.0000	0.0000	0.0036	0.000506	0.00413
03:30:00	0.0000	0.0000	0.0000	0.0039	0.00055	0.00442
03:45:00	0.0000	0.0000	0.0000	0.0039	0.000595	0.00451
04:00:00	0.0000	0.0000	0.0000	0.0038	0.000639	0.00445
04:15:00	0.0000	0.0000	0.0000	0.0036	0.000681	0.00428
04:30:00	0.0000	0.0000	0.0000	0.0033	0.00072	0.00405
04:45:00	0.0000	0.0000	0.0000	0.0030	0.000755	0.00377
05:00:00	0.0000	0.0000	0.0000	0.0027	0.000785	0.00348
05:15:00	0.0000	0.0000	0.0000	0.0024	0.000812	0.0032
05:30:00	0.0000	0.0000	0.0000	0.0021	0.000834	0.00294
05:45:00	0.0000	0.0000	0.0000	0.0019	0.000853	0.00272
06:00:00	0.0000	0.0000	0.0000	0.0017	0.000869	0.00252
06:15:00	0.0000	0.0000	0.0000	0.0015	0.000883	0.00234
06:30:00	0.0000	0.0000	0.0000	0.0013	0.000894	0.00217
06:45:00	0.0000	0.0000	0.0000	0.0011	0.000902	0.002
07:00:00	0.0000	0.0000	0.0000	0.0009	0.000908	0.00183
07:15:00	0.0000	0.0000	0.0000	0.0008	0.000913	0.00167
07:30:00	0.0000	0.0000	0.0000	0.0006	0.000915	0.00152
07:45:00	0.0000	0.0000	0.0000	0.0005	0.000915	0.00137
08:00:00	0.0000	0.0000	0.0000	0.0003	0.000913	0.00123
08:15:00	0.0000	0.0000	0.0000	0.0002	0.00091	0.00112
08:30:00	0.0000	0.0000	0.0000	0.0001	0.000906	0.00103

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m³/s)	Net Rain (mm)	Runoff (m³/s)	Baseflow (m³/s)	Total Flow (m³/s)
08:45:00	0.0000	0.0000	0.0000	0.0001	0.0009	0.00097
09:00:00	0.0000	0.0000	0.0000	0.0000	0.000895	0.000931
09:15:00	0.0000	0.0000	0.0000	0.0000	0.000889	0.000905
09:30:00	0.0000	0.0000	0.0000	0.0000	0.000883	0.000889
09:45:00	0.0000	0.0000	0.0000	0.0000	0.000876	0.000877
10:00:00	0.0000	0.0000	0.0000	0.0000	0.00087	0.00087
10:15:00	0.0000	0.0000	0.0000	0.0000	0.000864	0.000864
10:30:00	0.0000	0.0000	0.0000	0.0000	0.000858	0.000858
10:45:00	0.0000	0.0000	0.0000	0.0000	0.000852	0.000852
11:00:00	0.0000	0.0000	0.0000	0.0000	0.000846	0.000846
11:15:00	0.0000	0.0000	0.0000	0.0000	0.00084	0.00084
11:30:00	0.0000	0.0000	0.0000	0.0000	0.000834	0.000834
11:45:00	0.0000	0.0000	0.0000	0.0000	0.000828	0.000828
12:00:00	0.0000	0.0000	0.0000	0.0000	0.000822	0.000822
12:15:00	0.0000	0.0000	0.0000	0.0000	0.000816	0.000816
12:30:00	0.0000	0.0000	0.0000	0.0000	0.00081	0.00081
12:45:00	0.0000	0.0000	0.0000	0.0000	0.000805	0.000805
13:00:00	0.0000	0.0000	0.0000	0.0000	0.000799	0.000799
13:15:00	0.0000	0.0000	0.0000	0.0000	0.000793	0.000793
13:30:00	0.0000	0.0000	0.0000	0.0000	0.000788	0.000788
13:45:00	0.0000	0.0000	0.0000	0.0000	0.000782	0.000782
14:00:00	0.0000	0.0000	0.0000	0.0000	0.000777	0.000777
14:15:00	0.0000	0.0000	0.0000	0.0000	0.000771	0.000771
14:30:00	0.0000	0.0000	0.0000	0.0000	0.000766	0.000766
14:45:00	0.0000	0.0000	0.0000	0.0000	0.00076	0.00076
15:00:00	0.0000	0.0000	0.0000	0.0000	0.000755	0.000755
15:15:00	0.0000	0.0000	0.0000	0.0000	0.000749	0.000749
15:30:00	0.0000	0.0000	0.0000	0.0000	0.000744	0.000744
15:45:00	0.0000	0.0000	0.0000	0.0000	0.000739	0.000739
16:00:00	0.0000	0.0000	0.0000	0.0000	0.000734	0.000734
16:15:00	0.0000	0.0000	0.0000	0.0000	0.000728	0.000728
16:30:00	0.0000	0.0000	0.0000	0.0000	0.000723	0.000723
16:45:00	0.0000	0.0000	0.0000	0.0000	0.000718	0.000718
17:00:00	0.0000	0.0000	0.0000	0.0000	0.000713	0.000713
17:15:00	0.0000	0.0000	0.0000	0.0000	0.000708	0.000708
17:30:00	0.0000	0.0000	0.0000	0.0000	0.000703	0.000703

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m³/s)	Net Rain (mm)	Runoff (m³/s)	Baseflow (m³/s)	Total Flow (m³/s)
17:45:00	0.0000	0.0000	0.0000	0.0000	0.000698	0.000698
18:00:00	0.0000	0.0000	0.0000	0.0000	0.000693	0.000693
18:15:00	0.0000	0.0000	0.0000	0.0000	0.000688	0.000688
18:30:00	0.0000	0.0000	0.0000	0.0000	0.000683	0.000683
18:45:00	0.0000	0.0000	0.0000	0.0000	0.000678	0.000678
19:00:00	0.0000	0.0000	0.0000	0.0000	0.000674	0.000674
19:15:00	0.0000	0.0000	0.0000	0.0000	0.000669	0.000669
19:30:00	0.0000	0.0000	0.0000	0.0000	0.000664	0.000664
19:45:00	0.0000	0.0000	0.0000	0.0000	0.000659	0.000659
20:00:00	0.0000	0.0000	0.0000	0.0000	0.000655	0.000655
20:15:00	0.0000	0.0000	0.0000	0.0000	0.00065	0.00065
20:30:00	0.0000	0.0000	0.0000	0.0000	0.000646	0.000646
20:45:00	0.0000	0.0000	0.0000	0.0000	0.000641	0.000641
21:00:00	0.0000	0.0000	0.0000	0.0000	0.000636	0.000636
21:15:00	0.0000	0.0000	0.0000	0.0000	0.000632	0.000632
21:30:00	0.0000	0.0000	0.0000	0.0000	0.000627	0.000627
21:45:00	0.0000	0.0000	0.0000	0.0000	0.000623	0.000623
22:00:00	0.0000	0.0000	0.0000	0.0000	0.000619	0.000619
22:15:00	0.0000	0.0000	0.0000	0.0000	0.000614	0.000614
22:30:00	0.0000	0.0000	0.0000	0.0000	0.00061	0.00061
22:45:00	0.0000	0.0000	0.0000	0.0000	0.000606	0.000606
23:00:00	0.0000	0.0000	0.0000	0.0000	0.000601	0.000601
23:15:00	0.0000	0.0000	0.0000	0.0000	0.000597	0.000597
23:30:00	0.0000	0.0000	0.0000	0.0000	0.000593	0.000593
23:45:00	0.0000	0.0000	0.0000	0.0000	0.000589	0.000589
24:00:00	0.0000	0.0000	0.0000	0.0000	0.000584	0.000584
24:15:00	0.0000	0.0000	0.0000	0.0000	0.00058	0.00058
24:30:00	0.0000	0.0000	0.0000	0.0000	0.000576	0.000576
24:45:00	0.0000	0.0000	0.0000	0.0000	0.000572	0.000572
25:00:00	0.0000	0.0000	0.0000	0.0000	0.000568	0.000568
25:15:00	0.0000	0.0000	0.0000	0.0000	0.000564	0.000564
25:30:00	0.0000	0.0000	0.0000	0.0000	0.00056	0.00056
25:45:00	0.0000	0.0000	0.0000	0.0000	0.000556	0.000556
26:00:00	0.0000	0.0000	0.0000	0.0000	0.000552	0.000552
26:15:00	0.0000	0.0000	0.0000	0.0000	0.000548	0.000548
26:30:00	0.0000	0.0000	0.0000	0.0000	0.000544	0.000544

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m³/s)	Net Rain (mm)	Runoff (m³/s)	Baseflow (m³/s)	Total Flow (m³/s)
26:45:00	0.0000	0.0000	0.0000	0.0000	0.00054	0.00054
27:00:00	0.0000	0.0000	0.0000	0.0000	0.000537	0.000537
27:15:00	0.0000	0.0000	0.0000	0.0000	0.000533	0.000533
27:30:00	0.0000	0.0000	0.0000	0.0000	0.000529	0.000529
27:45:00	0.0000	0.0000	0.0000	0.0000	0.000525	0.000525
28:00:00	0.0000	0.0000	0.0000	0.0000	0.000522	0.000522
28:15:00	0.0000	0.0000	0.0000	0.0000	0.000518	0.000518
28:30:00	0.0000	0.0000	0.0000	0.0000	0.000514	0.000514
28:45:00	0.0000	0.0000	0.0000	0.0000	0.000511	0.000511
29:00:00	0.0000	0.0000	0.0000	0.0000	0.000507	0.000507
29:15:00	0.0000	0.0000	0.0000	0.0000	0.000503	0.000503
29:30:00	0.0000	0.0000	0.0000	0.0000	0.0005	0.0005
29:45:00	0.0000	0.0000	0.0000	0.0000	0.000496	0.000496
30:00:00	0.0000	0.0000	0.0000	0.0000	0.000493	0.000493
30:15:00	0.0000	0.0000	0.0000	0.0000	0.000489	0.000489
30:30:00	0.0000	0.0000	0.0000	0.0000	0.000486	0.000486
30:45:00	0.0000	0.0000	0.0000	0.0000	0.000482	0.000482
31:00:00	0.0000	0.0000	0.0000	0.0000	0.000479	0.000479
31:15:00	0.0000	0.0000	0.0000	0.0000	0.000476	0.000476
31:30:00	0.0000	0.0000	0.0000	0.0000	0.000472	0.000472
31:45:00	0.0000	0.0000	0.0000	0.0000	0.000469	0.000469
32:00:00	0.0000	0.0000	0.0000	0.0000	0.000465	0.000465
32:15:00	0.0000	0.0000	0.0000	0.0000	0.000462	0.000462
32:30:00	0.0000	0.0000	0.0000	0.0000	0.000459	0.000459
32:45:00	0.0000	0.0000	0.0000	0.0000	0.000456	0.000456
33:00:00	0.0000	0.0000	0.0000	0.0000	0.000452	0.000452
33:15:00	0.0000	0.0000	0.0000	0.0000	0.000449	0.000449
33:30:00	0.0000	0.0000	0.0000	0.0000	0.000446	0.000446
33:45:00	0.0000	0.0000	0.0000	0.0000	0.000443	0.000443
34:00:00	0.0000	0.0000	0.0000	0.0000	0.00044	0.00044
34:15:00	0.0000	0.0000	0.0000	0.0000	0.000437	0.000437
34:30:00	0.0000	0.0000	0.0000	0.0000	0.000434	0.000434
34:45:00	0.0000	0.0000	0.0000	0.0000	0.00043	0.00043
35:00:00	0.0000	0.0000	0.0000	0.0000	0.000427	0.000427
35:15:00	0.0000	0.0000	0.0000	0.0000	0.000424	0.000424
35:30:00	0.0000	0.0000	0.0000	0.0000	0.000421	0.000421

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m^3/s)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
35:45:00	0.0000	0.0000	0.0000	0.0000	0.000418	0.000418
36:00:00	0.0000	0.0000	0.0000	0.0000	0.000415	0.000415
36:15:00	0.0000	0.0000	0.0000	0.0000	0.000412	0.000412
36:30:00	0.0000	0.0000	0.0000	0.0000	0.00041	0.00041
36:45:00	0.0000	0.0000	0.0000	0.0000	0.000407	0.000407
37:00:00	0.0000	0.0000	0.0000	0.0000	0.000404	0.000404
37:15:00	0.0000	0.0000	0.0000	0.0000	0.000401	0.000401
37:30:00	0.0000	0.0000	0.0000	0.0000	0.000398	0.000398
37:45:00	0.0000	0.0000	0.0000	0.0000	0.000395	0.000395
38:00:00	0.0000	0.0000	0.0000	0.0000	0.000392	0.000392
38:15:00	0.0000	0.0000	0.0000	0.0000	0.00039	0.00039
38:30:00	0.0000	0.0000	0.0000	0.0000	0.000387	0.000387
38:45:00	0.0000	0.0000	0.0000	0.0000	0.000384	0.000384
39:00:00	0.0000	0.0000	0.0000	0.0000	0.000381	0.000381
39:15:00	0.0000	0.0000	0.0000	0.0000	0.000379	0.000379
39:30:00	0.0000	0.0000	0.0000	0.0000	0.000376	0.000376
39:45:00	0.0000	0.0000	0.0000	0.0000	0.000373	0.000373
40:00:00	0.0000	0.0000	0.0000	0.0000	0.000371	0.000371
40:15:00	0.0000	0.0000	0.0000	0.0000	0.000368	0.000368
40:30:00	0.0000	0.0000	0.0000	0.0000	0.000366	0.000366
40:45:00	0.0000	0.0000	0.0000	0.0000	0.000363	0.000363
41:00:00	0.0000	0.0000	0.0000	0.0000	0.00036	0.00036
41:15:00	0.0000	0.0000	0.0000	0.0000	0.000358	0.000358

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.47	No
BFIHOST19	0.42	No
PROPWET	0.34	No
SAAR (mm)	735	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on 21 August 2023 11:58:50 by [redacted]
Printed from the ReFH2 Flood Modelling software package, version 4.0.8560.23190

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH2)

Site details

Checksum: 156C-0507

Site name: FEH_Point_Descriptors_605897_137543_v5_0_1

Easting: 605897

Northing: 137543

Country: England, Wales or Northern Ireland

Catchment Area (km^2): 0.01 [0.5]*

Using plot scale calculations: Yes

Model: 2.3

Site description: None

Model run: 30 year

Summary of results

Rainfall - FEH22 (mm):	43.83	Total runoff (ML):	0.11
Total Rainfall (mm):	28.95	Total flow (ML):	0.29
Peak Rainfall (mm):	5.64	Peak flow (m^3/s):	0.01

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH22)

Name	Value	User-defined?
Duration (hh:mm:ss)	03:15:00	No
Timestep (hh:mm:ss)	00:15:00	No
SCF (Seasonal correction factor)	0.66	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	No

Loss model parameters

Name	Value	User-defined?
Cini (mm)	112.57	No
Cmax (mm)	331.82	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	1.87 [1]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0	No
BL (hr)	35.17 [26.13]	Yes
BR	1.61	No

Urbanisation parameters

Name	Value	User-defined?
Sewer capacity (m^3/s)	0	No
Exporting drained area (km^2)	0	No
Urban area (km^2)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.4	No
Tp scaling factor	0.75	No
Depression storage depth (mm)	0.5	No

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m^3/s)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	0.5151	0.0000	0.1751	0.0000	0.000355	0.000355
00:15:00	0.7977	0.0000	0.2728	0.0000	0.000352	0.000364
00:30:00	1.2309	0.0000	0.4247	0.0001	0.00035	0.000402
00:45:00	1.8907	0.0000	0.6613	0.0001	0.000349	0.000486
01:00:00	2.8834	0.0000	1.0292	0.0003	0.000349	0.000642
01:15:00	4.3333	0.0000	1.5939	0.0006	0.000351	0.000911
01:30:00	5.6438	0.0000	2.1607	0.0010	0.000358	0.00135
01:45:00	4.3333	0.0000	1.7242	0.0017	0.00037	0.00205
02:00:00	2.8834	0.0000	1.1786	0.0026	0.000392	0.00299
02:15:00	1.8907	0.0000	0.7865	0.0037	0.000425	0.00411
02:30:00	1.2309	0.0000	0.5178	0.0048	0.000471	0.0053
02:45:00	0.7977	0.0000	0.3380	0.0060	0.000529	0.0065
03:00:00	0.5151	0.0000	0.2193	0.0070	0.0006	0.00763
03:15:00	0.0000	0.0000	0.0000	0.0079	0.000681	0.00858
03:30:00	0.0000	0.0000	0.0000	0.0085	0.000769	0.00922
03:45:00	0.0000	0.0000	0.0000	0.0086	0.000861	0.00945
04:00:00	0.0000	0.0000	0.0000	0.0084	0.000952	0.00933
04:15:00	0.0000	0.0000	0.0000	0.0079	0.00104	0.00897
04:30:00	0.0000	0.0000	0.0000	0.0073	0.00112	0.00846
04:45:00	0.0000	0.0000	0.0000	0.0067	0.00119	0.00786
05:00:00	0.0000	0.0000	0.0000	0.0060	0.00125	0.00722
05:15:00	0.0000	0.0000	0.0000	0.0053	0.00131	0.00659
05:30:00	0.0000	0.0000	0.0000	0.0047	0.00136	0.00602
05:45:00	0.0000	0.0000	0.0000	0.0041	0.0014	0.00553
06:00:00	0.0000	0.0000	0.0000	0.0037	0.00143	0.00509
06:15:00	0.0000	0.0000	0.0000	0.0032	0.00146	0.00468
06:30:00	0.0000	0.0000	0.0000	0.0028	0.00148	0.0043
06:45:00	0.0000	0.0000	0.0000	0.0024	0.0015	0.00393
07:00:00	0.0000	0.0000	0.0000	0.0021	0.00152	0.00357
07:15:00	0.0000	0.0000	0.0000	0.0017	0.00153	0.00322
07:30:00	0.0000	0.0000	0.0000	0.0013	0.00154	0.00288
07:45:00	0.0000	0.0000	0.0000	0.0010	0.00154	0.00255
08:00:00	0.0000	0.0000	0.0000	0.0007	0.00154	0.00225
08:15:00	0.0000	0.0000	0.0000	0.0005	0.00153	0.002
08:30:00	0.0000	0.0000	0.0000	0.0003	0.00153	0.00181

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m^3/s)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
08:45:00	0.0000	0.0000	0.0000	0.0002	0.00152	0.00168
09:00:00	0.0000	0.0000	0.0000	0.0001	0.00151	0.00159
09:15:00	0.0000	0.0000	0.0000	0.0000	0.0015	0.00154
09:30:00	0.0000	0.0000	0.0000	0.0000	0.00149	0.0015
09:45:00	0.0000	0.0000	0.0000	0.0000	0.00148	0.00148
10:00:00	0.0000	0.0000	0.0000	0.0000	0.00147	0.00147
10:15:00	0.0000	0.0000	0.0000	0.0000	0.00146	0.00146
10:30:00	0.0000	0.0000	0.0000	0.0000	0.00145	0.00145
10:45:00	0.0000	0.0000	0.0000	0.0000	0.00144	0.00144
11:00:00	0.0000	0.0000	0.0000	0.0000	0.00143	0.00143
11:15:00	0.0000	0.0000	0.0000	0.0000	0.00142	0.00142
11:30:00	0.0000	0.0000	0.0000	0.0000	0.00141	0.00141
11:45:00	0.0000	0.0000	0.0000	0.0000	0.0014	0.0014
12:00:00	0.0000	0.0000	0.0000	0.0000	0.00139	0.00139
12:15:00	0.0000	0.0000	0.0000	0.0000	0.00138	0.00138
12:30:00	0.0000	0.0000	0.0000	0.0000	0.00137	0.00137
12:45:00	0.0000	0.0000	0.0000	0.0000	0.00136	0.00136
13:00:00	0.0000	0.0000	0.0000	0.0000	0.00135	0.00135
13:15:00	0.0000	0.0000	0.0000	0.0000	0.00134	0.00134
13:30:00	0.0000	0.0000	0.0000	0.0000	0.00133	0.00133
13:45:00	0.0000	0.0000	0.0000	0.0000	0.00132	0.00132
14:00:00	0.0000	0.0000	0.0000	0.0000	0.00131	0.00131
14:15:00	0.0000	0.0000	0.0000	0.0000	0.0013	0.0013
14:30:00	0.0000	0.0000	0.0000	0.0000	0.00129	0.00129
14:45:00	0.0000	0.0000	0.0000	0.0000	0.00128	0.00128
15:00:00	0.0000	0.0000	0.0000	0.0000	0.00127	0.00127
15:15:00	0.0000	0.0000	0.0000	0.0000	0.00126	0.00126
15:30:00	0.0000	0.0000	0.0000	0.0000	0.00126	0.00126
15:45:00	0.0000	0.0000	0.0000	0.0000	0.00125	0.00125
16:00:00	0.0000	0.0000	0.0000	0.0000	0.00124	0.00124
16:15:00	0.0000	0.0000	0.0000	0.0000	0.00123	0.00123
16:30:00	0.0000	0.0000	0.0000	0.0000	0.00122	0.00122
16:45:00	0.0000	0.0000	0.0000	0.0000	0.00121	0.00121
17:00:00	0.0000	0.0000	0.0000	0.0000	0.0012	0.0012
17:15:00	0.0000	0.0000	0.0000	0.0000	0.00119	0.00119
17:30:00	0.0000	0.0000	0.0000	0.0000	0.00119	0.00119

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m^3/s)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
17:45:00	0.0000	0.0000	0.0000	0.0000	0.00118	0.00118
18:00:00	0.0000	0.0000	0.0000	0.0000	0.00117	0.00117
18:15:00	0.0000	0.0000	0.0000	0.0000	0.00116	0.00116
18:30:00	0.0000	0.0000	0.0000	0.0000	0.00115	0.00115
18:45:00	0.0000	0.0000	0.0000	0.0000	0.00114	0.00114
19:00:00	0.0000	0.0000	0.0000	0.0000	0.00114	0.00114
19:15:00	0.0000	0.0000	0.0000	0.0000	0.00113	0.00113
19:30:00	0.0000	0.0000	0.0000	0.0000	0.00112	0.00112
19:45:00	0.0000	0.0000	0.0000	0.0000	0.00111	0.00111
20:00:00	0.0000	0.0000	0.0000	0.0000	0.0011	0.0011
20:15:00	0.0000	0.0000	0.0000	0.0000	0.0011	0.0011
20:30:00	0.0000	0.0000	0.0000	0.0000	0.00109	0.00109
20:45:00	0.0000	0.0000	0.0000	0.0000	0.00108	0.00108
21:00:00	0.0000	0.0000	0.0000	0.0000	0.00107	0.00107
21:15:00	0.0000	0.0000	0.0000	0.0000	0.00107	0.00107
21:30:00	0.0000	0.0000	0.0000	0.0000	0.00106	0.00106
21:45:00	0.0000	0.0000	0.0000	0.0000	0.00105	0.00105
22:00:00	0.0000	0.0000	0.0000	0.0000	0.00104	0.00104
22:15:00	0.0000	0.0000	0.0000	0.0000	0.00104	0.00104
22:30:00	0.0000	0.0000	0.0000	0.0000	0.00103	0.00103
22:45:00	0.0000	0.0000	0.0000	0.0000	0.00102	0.00102
23:00:00	0.0000	0.0000	0.0000	0.0000	0.00101	0.00101
23:15:00	0.0000	0.0000	0.0000	0.0000	0.00101	0.00101
23:30:00	0.0000	0.0000	0.0000	0.0000	0.001	0.001
23:45:00	0.0000	0.0000	0.0000	0.0000	0.000993	0.000993
24:00:00	0.0000	0.0000	0.0000	0.0000	0.000986	0.000986
24:15:00	0.0000	0.0000	0.0000	0.0000	0.000979	0.000979
24:30:00	0.0000	0.0000	0.0000	0.0000	0.000972	0.000972
24:45:00	0.0000	0.0000	0.0000	0.0000	0.000965	0.000965
25:00:00	0.0000	0.0000	0.0000	0.0000	0.000959	0.000959
25:15:00	0.0000	0.0000	0.0000	0.0000	0.000952	0.000952
25:30:00	0.0000	0.0000	0.0000	0.0000	0.000945	0.000945
25:45:00	0.0000	0.0000	0.0000	0.0000	0.000938	0.000938
26:00:00	0.0000	0.0000	0.0000	0.0000	0.000932	0.000932
26:15:00	0.0000	0.0000	0.0000	0.0000	0.000925	0.000925
26:30:00	0.0000	0.0000	0.0000	0.0000	0.000918	0.000918

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m^3/s)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
26:45:00	0.0000	0.0000	0.0000	0.0000	0.000912	0.000912
27:00:00	0.0000	0.0000	0.0000	0.0000	0.000906	0.000906
27:15:00	0.0000	0.0000	0.0000	0.0000	0.000899	0.000899
27:30:00	0.0000	0.0000	0.0000	0.0000	0.000893	0.000893
27:45:00	0.0000	0.0000	0.0000	0.0000	0.000886	0.000886
28:00:00	0.0000	0.0000	0.0000	0.0000	0.00088	0.00088
28:15:00	0.0000	0.0000	0.0000	0.0000	0.000874	0.000874
28:30:00	0.0000	0.0000	0.0000	0.0000	0.000868	0.000868
28:45:00	0.0000	0.0000	0.0000	0.0000	0.000862	0.000862
29:00:00	0.0000	0.0000	0.0000	0.0000	0.000855	0.000855
29:15:00	0.0000	0.0000	0.0000	0.0000	0.000849	0.000849
29:30:00	0.0000	0.0000	0.0000	0.0000	0.000843	0.000843
29:45:00	0.0000	0.0000	0.0000	0.0000	0.000837	0.000837
30:00:00	0.0000	0.0000	0.0000	0.0000	0.000831	0.000831
30:15:00	0.0000	0.0000	0.0000	0.0000	0.000826	0.000826
30:30:00	0.0000	0.0000	0.0000	0.0000	0.00082	0.00082
30:45:00	0.0000	0.0000	0.0000	0.0000	0.000814	0.000814
31:00:00	0.0000	0.0000	0.0000	0.0000	0.000808	0.000808
31:15:00	0.0000	0.0000	0.0000	0.0000	0.000802	0.000802
31:30:00	0.0000	0.0000	0.0000	0.0000	0.000797	0.000797
31:45:00	0.0000	0.0000	0.0000	0.0000	0.000791	0.000791
32:00:00	0.0000	0.0000	0.0000	0.0000	0.000786	0.000786
32:15:00	0.0000	0.0000	0.0000	0.0000	0.00078	0.00078
32:30:00	0.0000	0.0000	0.0000	0.0000	0.000774	0.000774
32:45:00	0.0000	0.0000	0.0000	0.0000	0.000769	0.000769
33:00:00	0.0000	0.0000	0.0000	0.0000	0.000763	0.000763
33:15:00	0.0000	0.0000	0.0000	0.0000	0.000758	0.000758
33:30:00	0.0000	0.0000	0.0000	0.0000	0.000753	0.000753
33:45:00	0.0000	0.0000	0.0000	0.0000	0.000747	0.000747
34:00:00	0.0000	0.0000	0.0000	0.0000	0.000742	0.000742
34:15:00	0.0000	0.0000	0.0000	0.0000	0.000737	0.000737
34:30:00	0.0000	0.0000	0.0000	0.0000	0.000732	0.000732
34:45:00	0.0000	0.0000	0.0000	0.0000	0.000726	0.000726
35:00:00	0.0000	0.0000	0.0000	0.0000	0.000721	0.000721
35:15:00	0.0000	0.0000	0.0000	0.0000	0.000716	0.000716
35:30:00	0.0000	0.0000	0.0000	0.0000	0.000711	0.000711

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m³/s)	Net Rain (mm)	Runoff (m³/s)	Baseflow (m³/s)	Total Flow (m³/s)
35:45:00	0.0000	0.0000	0.0000	0.0000	0.000706	0.000706
36:00:00	0.0000	0.0000	0.0000	0.0000	0.000701	0.000701
36:15:00	0.0000	0.0000	0.0000	0.0000	0.000696	0.000696
36:30:00	0.0000	0.0000	0.0000	0.0000	0.000691	0.000691
36:45:00	0.0000	0.0000	0.0000	0.0000	0.000686	0.000686
37:00:00	0.0000	0.0000	0.0000	0.0000	0.000681	0.000681
37:15:00	0.0000	0.0000	0.0000	0.0000	0.000677	0.000677
37:30:00	0.0000	0.0000	0.0000	0.0000	0.000672	0.000672
37:45:00	0.0000	0.0000	0.0000	0.0000	0.000667	0.000667
38:00:00	0.0000	0.0000	0.0000	0.0000	0.000662	0.000662
38:15:00	0.0000	0.0000	0.0000	0.0000	0.000658	0.000658
38:30:00	0.0000	0.0000	0.0000	0.0000	0.000653	0.000653
38:45:00	0.0000	0.0000	0.0000	0.0000	0.000648	0.000648
39:00:00	0.0000	0.0000	0.0000	0.0000	0.000644	0.000644
39:15:00	0.0000	0.0000	0.0000	0.0000	0.000639	0.000639
39:30:00	0.0000	0.0000	0.0000	0.0000	0.000635	0.000635
39:45:00	0.0000	0.0000	0.0000	0.0000	0.00063	0.00063
40:00:00	0.0000	0.0000	0.0000	0.0000	0.000626	0.000626
40:15:00	0.0000	0.0000	0.0000	0.0000	0.000621	0.000621
40:30:00	0.0000	0.0000	0.0000	0.0000	0.000617	0.000617
40:45:00	0.0000	0.0000	0.0000	0.0000	0.000612	0.000612
41:00:00	0.0000	0.0000	0.0000	0.0000	0.000608	0.000608
41:15:00	0.0000	0.0000	0.0000	0.0000	0.000604	0.000604
41:30:00	0.0000	0.0000	0.0000	0.0000	0.0006	0.0006
41:45:00	0.0000	0.0000	0.0000	0.0000	0.000595	0.000595
42:00:00	0.0000	0.0000	0.0000	0.0000	0.000591	0.000591
42:15:00	0.0000	0.0000	0.0000	0.0000	0.000587	0.000587
42:30:00	0.0000	0.0000	0.0000	0.0000	0.000583	0.000583
42:45:00	0.0000	0.0000	0.0000	0.0000	0.000579	0.000579
43:00:00	0.0000	0.0000	0.0000	0.0000	0.000575	0.000575
43:15:00	0.0000	0.0000	0.0000	0.0000	0.00057	0.00057
43:30:00	0.0000	0.0000	0.0000	0.0000	0.000566	0.000566
43:45:00	0.0000	0.0000	0.0000	0.0000	0.000562	0.000562
44:00:00	0.0000	0.0000	0.0000	0.0000	0.000558	0.000558
44:15:00	0.0000	0.0000	0.0000	0.0000	0.000554	0.000554
44:30:00	0.0000	0.0000	0.0000	0.0000	0.000551	0.000551

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m³/s)	Net Rain (mm)	Runoff (m³/s)	Baseflow (m³/s)	Total Flow (m³/s)
44:45:00	0.0000	0.0000	0.0000	0.0000	0.000547	0.000547
45:00:00	0.0000	0.0000	0.0000	0.0000	0.000543	0.000543
45:15:00	0.0000	0.0000	0.0000	0.0000	0.000539	0.000539
45:30:00	0.0000	0.0000	0.0000	0.0000	0.000535	0.000535
45:45:00	0.0000	0.0000	0.0000	0.0000	0.000531	0.000531
46:00:00	0.0000	0.0000	0.0000	0.0000	0.000528	0.000528
46:15:00	0.0000	0.0000	0.0000	0.0000	0.000524	0.000524
46:30:00	0.0000	0.0000	0.0000	0.0000	0.00052	0.00052
46:45:00	0.0000	0.0000	0.0000	0.0000	0.000516	0.000516
47:00:00	0.0000	0.0000	0.0000	0.0000	0.000513	0.000513
47:15:00	0.0000	0.0000	0.0000	0.0000	0.000509	0.000509
47:30:00	0.0000	0.0000	0.0000	0.0000	0.000506	0.000506
47:45:00	0.0000	0.0000	0.0000	0.0000	0.000502	0.000502
48:00:00	0.0000	0.0000	0.0000	0.0000	0.000498	0.000498
48:15:00	0.0000	0.0000	0.0000	0.0000	0.000495	0.000495
48:30:00	0.0000	0.0000	0.0000	0.0000	0.000491	0.000491
48:45:00	0.0000	0.0000	0.0000	0.0000	0.000488	0.000488
49:00:00	0.0000	0.0000	0.0000	0.0000	0.000484	0.000484
49:15:00	0.0000	0.0000	0.0000	0.0000	0.000481	0.000481
49:30:00	0.0000	0.0000	0.0000	0.0000	0.000478	0.000478
49:45:00	0.0000	0.0000	0.0000	0.0000	0.000474	0.000474
50:00:00	0.0000	0.0000	0.0000	0.0000	0.000471	0.000471
50:15:00	0.0000	0.0000	0.0000	0.0000	0.000467	0.000467
50:30:00	0.0000	0.0000	0.0000	0.0000	0.000464	0.000464
50:45:00	0.0000	0.0000	0.0000	0.0000	0.000461	0.000461
51:00:00	0.0000	0.0000	0.0000	0.0000	0.000458	0.000458
51:15:00	0.0000	0.0000	0.0000	0.0000	0.000454	0.000454
51:30:00	0.0000	0.0000	0.0000	0.0000	0.000451	0.000451
51:45:00	0.0000	0.0000	0.0000	0.0000	0.000448	0.000448
52:00:00	0.0000	0.0000	0.0000	0.0000	0.000445	0.000445
52:15:00	0.0000	0.0000	0.0000	0.0000	0.000442	0.000442
52:30:00	0.0000	0.0000	0.0000	0.0000	0.000439	0.000439
52:45:00	0.0000	0.0000	0.0000	0.0000	0.000435	0.000435
53:00:00	0.0000	0.0000	0.0000	0.0000	0.000432	0.000432
53:15:00	0.0000	0.0000	0.0000	0.0000	0.000429	0.000429
53:30:00	0.0000	0.0000	0.0000	0.0000	0.000426	0.000426

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m^3/s)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
53:45:00	0.0000	0.0000	0.0000	0.0000	0.000423	0.000423
54:00:00	0.0000	0.0000	0.0000	0.0000	0.00042	0.00042
54:15:00	0.0000	0.0000	0.0000	0.0000	0.000417	0.000417
54:30:00	0.0000	0.0000	0.0000	0.0000	0.000414	0.000414
54:45:00	0.0000	0.0000	0.0000	0.0000	0.000411	0.000411
55:00:00	0.0000	0.0000	0.0000	0.0000	0.000408	0.000408
55:15:00	0.0000	0.0000	0.0000	0.0000	0.000406	0.000406
55:30:00	0.0000	0.0000	0.0000	0.0000	0.000403	0.000403
55:45:00	0.0000	0.0000	0.0000	0.0000	0.0004	0.0004
56:00:00	0.0000	0.0000	0.0000	0.0000	0.000397	0.000397
56:15:00	0.0000	0.0000	0.0000	0.0000	0.000394	0.000394
56:30:00	0.0000	0.0000	0.0000	0.0000	0.000391	0.000391
56:45:00	0.0000	0.0000	0.0000	0.0000	0.000389	0.000389
57:00:00	0.0000	0.0000	0.0000	0.0000	0.000386	0.000386
57:15:00	0.0000	0.0000	0.0000	0.0000	0.000383	0.000383
57:30:00	0.0000	0.0000	0.0000	0.0000	0.00038	0.00038
57:45:00	0.0000	0.0000	0.0000	0.0000	0.000378	0.000378
58:00:00	0.0000	0.0000	0.0000	0.0000	0.000375	0.000375
58:15:00	0.0000	0.0000	0.0000	0.0000	0.000372	0.000372
58:30:00	0.0000	0.0000	0.0000	0.0000	0.00037	0.00037
58:45:00	0.0000	0.0000	0.0000	0.0000	0.000367	0.000367
59:00:00	0.0000	0.0000	0.0000	0.0000	0.000365	0.000365
59:15:00	0.0000	0.0000	0.0000	0.0000	0.000362	0.000362
59:30:00	0.0000	0.0000	0.0000	0.0000	0.000359	0.000359
59:45:00	0.0000	0.0000	0.0000	0.0000	0.000357	0.000357

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.47	No
BFIHOST19	0.42	No
PROPWET	0.34	No
SAAR (mm)	735	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on 21 August 2023 11:59:17 by [redacted]
Printed from the ReFH2 Flood Modelling software package, version 4.0.8560.23190

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH2)

Site details

Checksum: 156C-0507

Site name: FEH_Point_Descriptors_605897_137543_v5_0_1

Easting: 605897

Northing: 137543

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.01 [0.5]*

Using plot scale calculations: Yes

Model: 2.3

Site description: None

Model run: 100 year

Summary of results

Rainfall - FEH22 (mm):	54.58	Total runoff (ML):	0.14
Total Rainfall (mm):	36.04	Total flow (ML):	0.36
Peak Rainfall (mm):	7.03	Peak flow (m³/s):	0.01

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH22)

Name	Value	User-defined?
Duration (hh:mm:ss)	03:15:00	No
Timestep (hh:mm:ss)	00:15:00	No
SCF (Seasonal correction factor)	0.66	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	No

Loss model parameters

Name	Value	User-defined?
Cini (mm)	112.57	No
Cmax (mm)	331.82	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	1.87 [1]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0	No
BL (hr)	35.17 [26.13]	Yes
BR	1.54	No

Urbanisation parameters

Name	Value	User-defined?
Sewer capacity (m^3/s)	0	No
Exporting drained area (km^2)	0	No
Urban area (km^2)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.4	No
Tp scaling factor	0.75	No
Depression storage depth (mm)	0.5	No

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m³/s)	Net Rain (mm)	Runoff (m³/s)	Baseflow (m³/s)	Total Flow (m³/s)
00:00:00	0.6414	0.0000	0.2182	0.0000	0.000355	0.000355
00:15:00	0.9933	0.0000	0.3404	0.0000	0.000352	0.000366
00:30:00	1.5328	0.0000	0.5311	0.0001	0.00035	0.000415
00:45:00	2.3544	0.0000	0.8295	0.0002	0.000349	0.000521
01:00:00	3.5905	0.0000	1.2972	0.0004	0.00035	0.000716
01:15:00	5.3960	0.0000	2.0226	0.0007	0.000353	0.00105
01:30:00	7.0278	0.0000	2.7658	0.0012	0.000361	0.00161
01:45:00	5.3960	0.0000	2.2246	0.0021	0.000377	0.00248
02:00:00	3.5905	0.0000	1.5289	0.0033	0.000404	0.00369
02:15:00	2.3544	0.0000	1.0236	0.0047	0.000444	0.0051
02:30:00	1.5328	0.0000	0.6754	0.0061	0.0005	0.00663
02:45:00	0.9933	0.0000	0.4414	0.0076	0.000571	0.00817
03:00:00	0.6414	0.0000	0.2867	0.0090	0.000657	0.00961
03:15:00	0.0000	0.0000	0.0000	0.0101	0.000757	0.0108
03:30:00	0.0000	0.0000	0.0000	0.0108	0.000865	0.0117
03:45:00	0.0000	0.0000	0.0000	0.0110	0.000978	0.012
04:00:00	0.0000	0.0000	0.0000	0.0107	0.00109	0.0118
04:15:00	0.0000	0.0000	0.0000	0.0102	0.0012	0.0114
04:30:00	0.0000	0.0000	0.0000	0.0094	0.00129	0.0107
04:45:00	0.0000	0.0000	0.0000	0.0086	0.00138	0.00996
05:00:00	0.0000	0.0000	0.0000	0.0077	0.00146	0.00913
05:15:00	0.0000	0.0000	0.0000	0.0068	0.00153	0.00831
05:30:00	0.0000	0.0000	0.0000	0.0060	0.00159	0.00758
05:45:00	0.0000	0.0000	0.0000	0.0053	0.00164	0.00695
06:00:00	0.0000	0.0000	0.0000	0.0047	0.00168	0.00638
06:15:00	0.0000	0.0000	0.0000	0.0041	0.00172	0.00586
06:30:00	0.0000	0.0000	0.0000	0.0036	0.00175	0.00537
06:45:00	0.0000	0.0000	0.0000	0.0031	0.00177	0.0049
07:00:00	0.0000	0.0000	0.0000	0.0026	0.00179	0.00444
07:15:00	0.0000	0.0000	0.0000	0.0022	0.00181	0.00399
07:30:00	0.0000	0.0000	0.0000	0.0017	0.00182	0.00355
07:45:00	0.0000	0.0000	0.0000	0.0013	0.00182	0.00313
08:00:00	0.0000	0.0000	0.0000	0.0009	0.00182	0.00275
08:15:00	0.0000	0.0000	0.0000	0.0006	0.00181	0.00242
08:30:00	0.0000	0.0000	0.0000	0.0004	0.00181	0.00217

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m^3/s)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
08:45:00	0.0000	0.0000	0.0000	0.0002	0.0018	0.00201
09:00:00	0.0000	0.0000	0.0000	0.0001	0.00179	0.0019
09:15:00	0.0000	0.0000	0.0000	0.0001	0.00177	0.00182
09:30:00	0.0000	0.0000	0.0000	0.0000	0.00176	0.00178
09:45:00	0.0000	0.0000	0.0000	0.0000	0.00175	0.00175
10:00:00	0.0000	0.0000	0.0000	0.0000	0.00174	0.00174
10:15:00	0.0000	0.0000	0.0000	0.0000	0.00173	0.00173
10:30:00	0.0000	0.0000	0.0000	0.0000	0.00171	0.00171
10:45:00	0.0000	0.0000	0.0000	0.0000	0.0017	0.0017
11:00:00	0.0000	0.0000	0.0000	0.0000	0.00169	0.00169
11:15:00	0.0000	0.0000	0.0000	0.0000	0.00168	0.00168
11:30:00	0.0000	0.0000	0.0000	0.0000	0.00166	0.00166
11:45:00	0.0000	0.0000	0.0000	0.0000	0.00165	0.00165
12:00:00	0.0000	0.0000	0.0000	0.0000	0.00164	0.00164
12:15:00	0.0000	0.0000	0.0000	0.0000	0.00163	0.00163
12:30:00	0.0000	0.0000	0.0000	0.0000	0.00162	0.00162
12:45:00	0.0000	0.0000	0.0000	0.0000	0.00161	0.00161
13:00:00	0.0000	0.0000	0.0000	0.0000	0.0016	0.0016
13:15:00	0.0000	0.0000	0.0000	0.0000	0.00158	0.00158
13:30:00	0.0000	0.0000	0.0000	0.0000	0.00157	0.00157
13:45:00	0.0000	0.0000	0.0000	0.0000	0.00156	0.00156
14:00:00	0.0000	0.0000	0.0000	0.0000	0.00155	0.00155
14:15:00	0.0000	0.0000	0.0000	0.0000	0.00154	0.00154
14:30:00	0.0000	0.0000	0.0000	0.0000	0.00153	0.00153
14:45:00	0.0000	0.0000	0.0000	0.0000	0.00152	0.00152
15:00:00	0.0000	0.0000	0.0000	0.0000	0.00151	0.00151
15:15:00	0.0000	0.0000	0.0000	0.0000	0.0015	0.0015
15:30:00	0.0000	0.0000	0.0000	0.0000	0.00149	0.00149
15:45:00	0.0000	0.0000	0.0000	0.0000	0.00148	0.00148
16:00:00	0.0000	0.0000	0.0000	0.0000	0.00146	0.00146
16:15:00	0.0000	0.0000	0.0000	0.0000	0.00145	0.00145
16:30:00	0.0000	0.0000	0.0000	0.0000	0.00144	0.00144
16:45:00	0.0000	0.0000	0.0000	0.0000	0.00143	0.00143
17:00:00	0.0000	0.0000	0.0000	0.0000	0.00142	0.00142
17:15:00	0.0000	0.0000	0.0000	0.0000	0.00141	0.00141
17:30:00	0.0000	0.0000	0.0000	0.0000	0.0014	0.0014

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m^3/s)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
17:45:00	0.0000	0.0000	0.0000	0.0000	0.00139	0.00139
18:00:00	0.0000	0.0000	0.0000	0.0000	0.00138	0.00138
18:15:00	0.0000	0.0000	0.0000	0.0000	0.00137	0.00137
18:30:00	0.0000	0.0000	0.0000	0.0000	0.00136	0.00136
18:45:00	0.0000	0.0000	0.0000	0.0000	0.00135	0.00135
19:00:00	0.0000	0.0000	0.0000	0.0000	0.00135	0.00135
19:15:00	0.0000	0.0000	0.0000	0.0000	0.00134	0.00134
19:30:00	0.0000	0.0000	0.0000	0.0000	0.00133	0.00133
19:45:00	0.0000	0.0000	0.0000	0.0000	0.00132	0.00132
20:00:00	0.0000	0.0000	0.0000	0.0000	0.00131	0.00131
20:15:00	0.0000	0.0000	0.0000	0.0000	0.0013	0.0013
20:30:00	0.0000	0.0000	0.0000	0.0000	0.00129	0.00129
20:45:00	0.0000	0.0000	0.0000	0.0000	0.00128	0.00128
21:00:00	0.0000	0.0000	0.0000	0.0000	0.00127	0.00127
21:15:00	0.0000	0.0000	0.0000	0.0000	0.00126	0.00126
21:30:00	0.0000	0.0000	0.0000	0.0000	0.00125	0.00125
21:45:00	0.0000	0.0000	0.0000	0.0000	0.00124	0.00124
22:00:00	0.0000	0.0000	0.0000	0.0000	0.00124	0.00124
22:15:00	0.0000	0.0000	0.0000	0.0000	0.00123	0.00123
22:30:00	0.0000	0.0000	0.0000	0.0000	0.00122	0.00122
22:45:00	0.0000	0.0000	0.0000	0.0000	0.00121	0.00121
23:00:00	0.0000	0.0000	0.0000	0.0000	0.0012	0.0012
23:15:00	0.0000	0.0000	0.0000	0.0000	0.00119	0.00119
23:30:00	0.0000	0.0000	0.0000	0.0000	0.00118	0.00118
23:45:00	0.0000	0.0000	0.0000	0.0000	0.00118	0.00118
24:00:00	0.0000	0.0000	0.0000	0.0000	0.00117	0.00117
24:15:00	0.0000	0.0000	0.0000	0.0000	0.00116	0.00116
24:30:00	0.0000	0.0000	0.0000	0.0000	0.00115	0.00115
24:45:00	0.0000	0.0000	0.0000	0.0000	0.00114	0.00114
25:00:00	0.0000	0.0000	0.0000	0.0000	0.00113	0.00113
25:15:00	0.0000	0.0000	0.0000	0.0000	0.00113	0.00113
25:30:00	0.0000	0.0000	0.0000	0.0000	0.00112	0.00112
25:45:00	0.0000	0.0000	0.0000	0.0000	0.00111	0.00111
26:00:00	0.0000	0.0000	0.0000	0.0000	0.0011	0.0011
26:15:00	0.0000	0.0000	0.0000	0.0000	0.00109	0.00109
26:30:00	0.0000	0.0000	0.0000	0.0000	0.00109	0.00109

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m^3/s)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
26:45:00	0.0000	0.0000	0.0000	0.0000	0.00108	0.00108
27:00:00	0.0000	0.0000	0.0000	0.0000	0.00107	0.00107
27:15:00	0.0000	0.0000	0.0000	0.0000	0.00106	0.00106
27:30:00	0.0000	0.0000	0.0000	0.0000	0.00106	0.00106
27:45:00	0.0000	0.0000	0.0000	0.0000	0.00105	0.00105
28:00:00	0.0000	0.0000	0.0000	0.0000	0.00104	0.00104
28:15:00	0.0000	0.0000	0.0000	0.0000	0.00103	0.00103
28:30:00	0.0000	0.0000	0.0000	0.0000	0.00103	0.00103
28:45:00	0.0000	0.0000	0.0000	0.0000	0.00102	0.00102
29:00:00	0.0000	0.0000	0.0000	0.0000	0.00101	0.00101
29:15:00	0.0000	0.0000	0.0000	0.0000	0.00101	0.00101
29:30:00	0.0000	0.0000	0.0000	0.0000	0.000998	0.000998
29:45:00	0.0000	0.0000	0.0000	0.0000	0.000991	0.000991
30:00:00	0.0000	0.0000	0.0000	0.0000	0.000984	0.000984
30:15:00	0.0000	0.0000	0.0000	0.0000	0.000977	0.000977
30:30:00	0.0000	0.0000	0.0000	0.0000	0.00097	0.00097
30:45:00	0.0000	0.0000	0.0000	0.0000	0.000963	0.000963
31:00:00	0.0000	0.0000	0.0000	0.0000	0.000956	0.000956
31:15:00	0.0000	0.0000	0.0000	0.0000	0.000949	0.000949
31:30:00	0.0000	0.0000	0.0000	0.0000	0.000943	0.000943
31:45:00	0.0000	0.0000	0.0000	0.0000	0.000936	0.000936
32:00:00	0.0000	0.0000	0.0000	0.0000	0.000929	0.000929
32:15:00	0.0000	0.0000	0.0000	0.0000	0.000923	0.000923
32:30:00	0.0000	0.0000	0.0000	0.0000	0.000916	0.000916
32:45:00	0.0000	0.0000	0.0000	0.0000	0.00091	0.00091
33:00:00	0.0000	0.0000	0.0000	0.0000	0.000903	0.000903
33:15:00	0.0000	0.0000	0.0000	0.0000	0.000897	0.000897
33:30:00	0.0000	0.0000	0.0000	0.0000	0.000891	0.000891
33:45:00	0.0000	0.0000	0.0000	0.0000	0.000884	0.000884
34:00:00	0.0000	0.0000	0.0000	0.0000	0.000878	0.000878
34:15:00	0.0000	0.0000	0.0000	0.0000	0.000872	0.000872
34:30:00	0.0000	0.0000	0.0000	0.0000	0.000866	0.000866
34:45:00	0.0000	0.0000	0.0000	0.0000	0.00086	0.00086
35:00:00	0.0000	0.0000	0.0000	0.0000	0.000853	0.000853
35:15:00	0.0000	0.0000	0.0000	0.0000	0.000847	0.000847
35:30:00	0.0000	0.0000	0.0000	0.0000	0.000841	0.000841

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m^3/s)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
35:45:00	0.0000	0.0000	0.0000	0.0000	0.000835	0.000835
36:00:00	0.0000	0.0000	0.0000	0.0000	0.00083	0.00083
36:15:00	0.0000	0.0000	0.0000	0.0000	0.000824	0.000824
36:30:00	0.0000	0.0000	0.0000	0.0000	0.000818	0.000818
36:45:00	0.0000	0.0000	0.0000	0.0000	0.000812	0.000812
37:00:00	0.0000	0.0000	0.0000	0.0000	0.000806	0.000806
37:15:00	0.0000	0.0000	0.0000	0.0000	0.000801	0.000801
37:30:00	0.0000	0.0000	0.0000	0.0000	0.000795	0.000795
37:45:00	0.0000	0.0000	0.0000	0.0000	0.000789	0.000789
38:00:00	0.0000	0.0000	0.0000	0.0000	0.000784	0.000784
38:15:00	0.0000	0.0000	0.0000	0.0000	0.000778	0.000778
38:30:00	0.0000	0.0000	0.0000	0.0000	0.000773	0.000773
38:45:00	0.0000	0.0000	0.0000	0.0000	0.000767	0.000767
39:00:00	0.0000	0.0000	0.0000	0.0000	0.000762	0.000762
39:15:00	0.0000	0.0000	0.0000	0.0000	0.000756	0.000756
39:30:00	0.0000	0.0000	0.0000	0.0000	0.000751	0.000751
39:45:00	0.0000	0.0000	0.0000	0.0000	0.000746	0.000746
40:00:00	0.0000	0.0000	0.0000	0.0000	0.00074	0.00074
40:15:00	0.0000	0.0000	0.0000	0.0000	0.000735	0.000735
40:30:00	0.0000	0.0000	0.0000	0.0000	0.00073	0.00073
40:45:00	0.0000	0.0000	0.0000	0.0000	0.000725	0.000725
41:00:00	0.0000	0.0000	0.0000	0.0000	0.00072	0.00072
41:15:00	0.0000	0.0000	0.0000	0.0000	0.000714	0.000714
41:30:00	0.0000	0.0000	0.0000	0.0000	0.000709	0.000709
41:45:00	0.0000	0.0000	0.0000	0.0000	0.000704	0.000704
42:00:00	0.0000	0.0000	0.0000	0.0000	0.000699	0.000699
42:15:00	0.0000	0.0000	0.0000	0.0000	0.000694	0.000694
42:30:00	0.0000	0.0000	0.0000	0.0000	0.00069	0.00069
42:45:00	0.0000	0.0000	0.0000	0.0000	0.000685	0.000685
43:00:00	0.0000	0.0000	0.0000	0.0000	0.00068	0.00068
43:15:00	0.0000	0.0000	0.0000	0.0000	0.000675	0.000675
43:30:00	0.0000	0.0000	0.0000	0.0000	0.00067	0.00067
43:45:00	0.0000	0.0000	0.0000	0.0000	0.000665	0.000665
44:00:00	0.0000	0.0000	0.0000	0.0000	0.000661	0.000661
44:15:00	0.0000	0.0000	0.0000	0.0000	0.000656	0.000656
44:30:00	0.0000	0.0000	0.0000	0.0000	0.000651	0.000651

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m³/s)	Net Rain (mm)	Runoff (m³/s)	Baseflow (m³/s)	Total Flow (m³/s)
44:45:00	0.0000	0.0000	0.0000	0.0000	0.000647	0.000647
45:00:00	0.0000	0.0000	0.0000	0.0000	0.000642	0.000642
45:15:00	0.0000	0.0000	0.0000	0.0000	0.000638	0.000638
45:30:00	0.0000	0.0000	0.0000	0.0000	0.000633	0.000633
45:45:00	0.0000	0.0000	0.0000	0.0000	0.000629	0.000629
46:00:00	0.0000	0.0000	0.0000	0.0000	0.000624	0.000624
46:15:00	0.0000	0.0000	0.0000	0.0000	0.00062	0.00062
46:30:00	0.0000	0.0000	0.0000	0.0000	0.000615	0.000615
46:45:00	0.0000	0.0000	0.0000	0.0000	0.000611	0.000611
47:00:00	0.0000	0.0000	0.0000	0.0000	0.000607	0.000607
47:15:00	0.0000	0.0000	0.0000	0.0000	0.000602	0.000602
47:30:00	0.0000	0.0000	0.0000	0.0000	0.000598	0.000598
47:45:00	0.0000	0.0000	0.0000	0.0000	0.000594	0.000594
48:00:00	0.0000	0.0000	0.0000	0.0000	0.00059	0.00059
48:15:00	0.0000	0.0000	0.0000	0.0000	0.000586	0.000586
48:30:00	0.0000	0.0000	0.0000	0.0000	0.000581	0.000581
48:45:00	0.0000	0.0000	0.0000	0.0000	0.000577	0.000577
49:00:00	0.0000	0.0000	0.0000	0.0000	0.000573	0.000573
49:15:00	0.0000	0.0000	0.0000	0.0000	0.000569	0.000569
49:30:00	0.0000	0.0000	0.0000	0.0000	0.000565	0.000565
49:45:00	0.0000	0.0000	0.0000	0.0000	0.000561	0.000561
50:00:00	0.0000	0.0000	0.0000	0.0000	0.000557	0.000557
50:15:00	0.0000	0.0000	0.0000	0.0000	0.000553	0.000553
50:30:00	0.0000	0.0000	0.0000	0.0000	0.000549	0.000549
50:45:00	0.0000	0.0000	0.0000	0.0000	0.000545	0.000545
51:00:00	0.0000	0.0000	0.0000	0.0000	0.000541	0.000541
51:15:00	0.0000	0.0000	0.0000	0.0000	0.000538	0.000538
51:30:00	0.0000	0.0000	0.0000	0.0000	0.000534	0.000534
51:45:00	0.0000	0.0000	0.0000	0.0000	0.00053	0.00053
52:00:00	0.0000	0.0000	0.0000	0.0000	0.000526	0.000526
52:15:00	0.0000	0.0000	0.0000	0.0000	0.000523	0.000523
52:30:00	0.0000	0.0000	0.0000	0.0000	0.000519	0.000519
52:45:00	0.0000	0.0000	0.0000	0.0000	0.000515	0.000515
53:00:00	0.0000	0.0000	0.0000	0.0000	0.000512	0.000512
53:15:00	0.0000	0.0000	0.0000	0.0000	0.000508	0.000508
53:30:00	0.0000	0.0000	0.0000	0.0000	0.000504	0.000504

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m³/s)	Net Rain (mm)	Runoff (m³/s)	Baseflow (m³/s)	Total Flow (m³/s)
53:45:00	0.0000	0.0000	0.0000	0.0000	0.000501	0.000501
54:00:00	0.0000	0.0000	0.0000	0.0000	0.000497	0.000497
54:15:00	0.0000	0.0000	0.0000	0.0000	0.000494	0.000494
54:30:00	0.0000	0.0000	0.0000	0.0000	0.00049	0.00049
54:45:00	0.0000	0.0000	0.0000	0.0000	0.000487	0.000487
55:00:00	0.0000	0.0000	0.0000	0.0000	0.000483	0.000483
55:15:00	0.0000	0.0000	0.0000	0.0000	0.00048	0.00048
55:30:00	0.0000	0.0000	0.0000	0.0000	0.000476	0.000476
55:45:00	0.0000	0.0000	0.0000	0.0000	0.000473	0.000473
56:00:00	0.0000	0.0000	0.0000	0.0000	0.00047	0.00047
56:15:00	0.0000	0.0000	0.0000	0.0000	0.000466	0.000466
56:30:00	0.0000	0.0000	0.0000	0.0000	0.000463	0.000463
56:45:00	0.0000	0.0000	0.0000	0.0000	0.00046	0.00046
57:00:00	0.0000	0.0000	0.0000	0.0000	0.000457	0.000457
57:15:00	0.0000	0.0000	0.0000	0.0000	0.000453	0.000453
57:30:00	0.0000	0.0000	0.0000	0.0000	0.00045	0.00045
57:45:00	0.0000	0.0000	0.0000	0.0000	0.000447	0.000447
58:00:00	0.0000	0.0000	0.0000	0.0000	0.000444	0.000444
58:15:00	0.0000	0.0000	0.0000	0.0000	0.000441	0.000441
58:30:00	0.0000	0.0000	0.0000	0.0000	0.000437	0.000437
58:45:00	0.0000	0.0000	0.0000	0.0000	0.000434	0.000434
59:00:00	0.0000	0.0000	0.0000	0.0000	0.000431	0.000431
59:15:00	0.0000	0.0000	0.0000	0.0000	0.000428	0.000428
59:30:00	0.0000	0.0000	0.0000	0.0000	0.000425	0.000425
59:45:00	0.0000	0.0000	0.0000	0.0000	0.000422	0.000422
60:00:00	0.0000	0.0000	0.0000	0.0000	0.000419	0.000419
60:15:00	0.0000	0.0000	0.0000	0.0000	0.000416	0.000416
60:30:00	0.0000	0.0000	0.0000	0.0000	0.000413	0.000413
60:45:00	0.0000	0.0000	0.0000	0.0000	0.00041	0.00041
61:00:00	0.0000	0.0000	0.0000	0.0000	0.000407	0.000407
61:15:00	0.0000	0.0000	0.0000	0.0000	0.000405	0.000405
61:30:00	0.0000	0.0000	0.0000	0.0000	0.000402	0.000402
61:45:00	0.0000	0.0000	0.0000	0.0000	0.000399	0.000399
62:00:00	0.0000	0.0000	0.0000	0.0000	0.000396	0.000396
62:15:00	0.0000	0.0000	0.0000	0.0000	0.000393	0.000393
62:30:00	0.0000	0.0000	0.0000	0.0000	0.00039	0.00039

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m^3/s)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
62:45:00	0.0000	0.0000	0.0000	0.0000	0.000388	0.000388
63:00:00	0.0000	0.0000	0.0000	0.0000	0.000385	0.000385
63:15:00	0.0000	0.0000	0.0000	0.0000	0.000382	0.000382
63:30:00	0.0000	0.0000	0.0000	0.0000	0.000379	0.000379
63:45:00	0.0000	0.0000	0.0000	0.0000	0.000377	0.000377
64:00:00	0.0000	0.0000	0.0000	0.0000	0.000374	0.000374
64:15:00	0.0000	0.0000	0.0000	0.0000	0.000371	0.000371
64:30:00	0.0000	0.0000	0.0000	0.0000	0.000369	0.000369
64:45:00	0.0000	0.0000	0.0000	0.0000	0.000366	0.000366
65:00:00	0.0000	0.0000	0.0000	0.0000	0.000364	0.000364
65:15:00	0.0000	0.0000	0.0000	0.0000	0.000361	0.000361
65:30:00	0.0000	0.0000	0.0000	0.0000	0.000359	0.000359

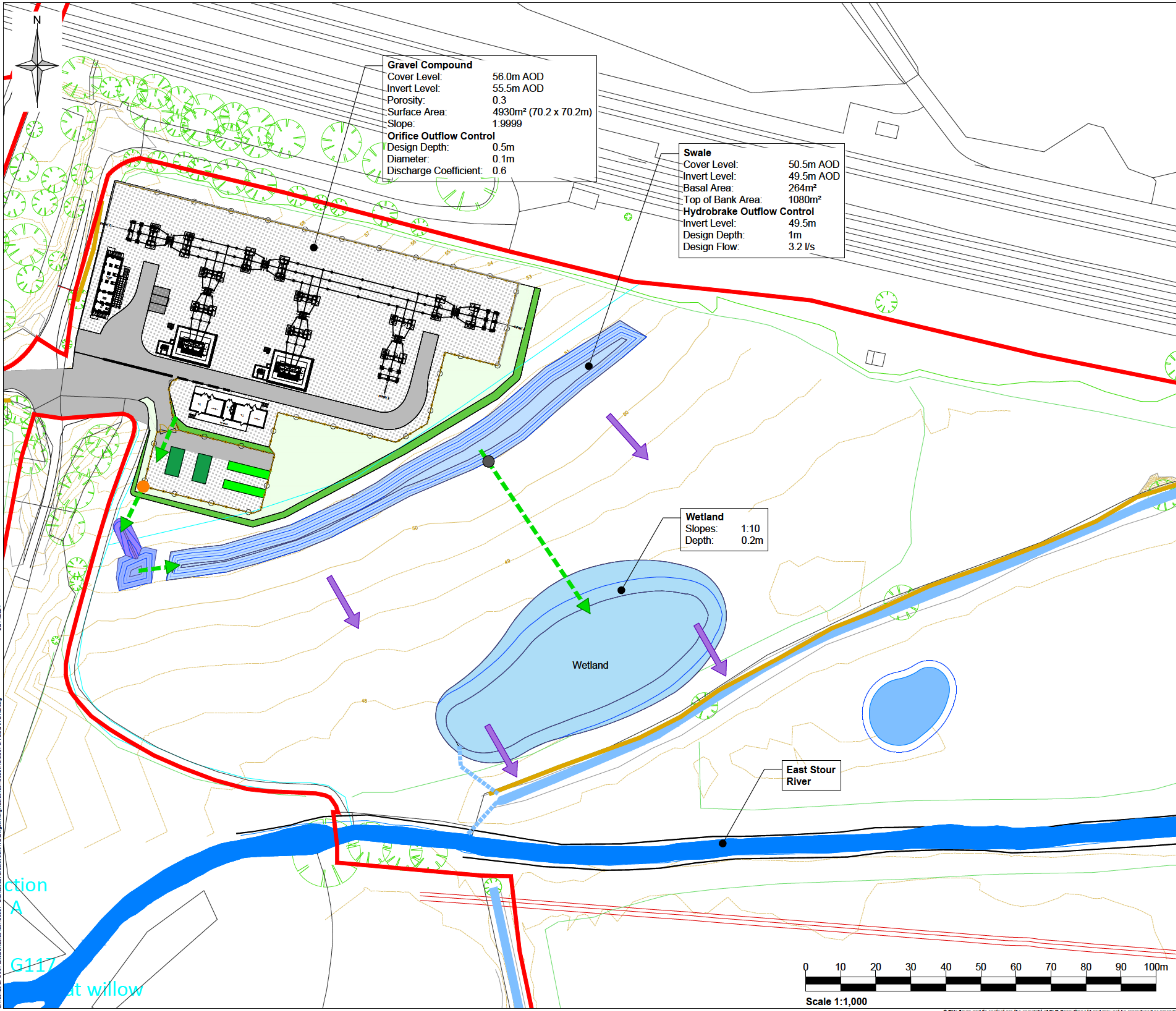
Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.47	No
BFIHOST19	0.42	No
PROPWET	0.34	No
SAAR (mm)	735	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

Appendix B: Conceptual Surface Water Drainage Strategy Drawings



Legend:

- Site Boundary
- Substation Gravel Compound (Control)
- Substation Hardstand (source)
- Storage Container
- Internal / Private Substation
- Existing watercourse
- Swale
- Cascade
- Attenuation Pond
- Piped Connection
- Orifice Outflow Control
- Hydrobrake Outflow Control
- Exceedance Flow Route

Rev	Amendments	Date	By	Chk	Auth
1	Level changes	25.11.24	AB	CN	DW

SLR

www.slrconsulting.com

Client
Evolution Power

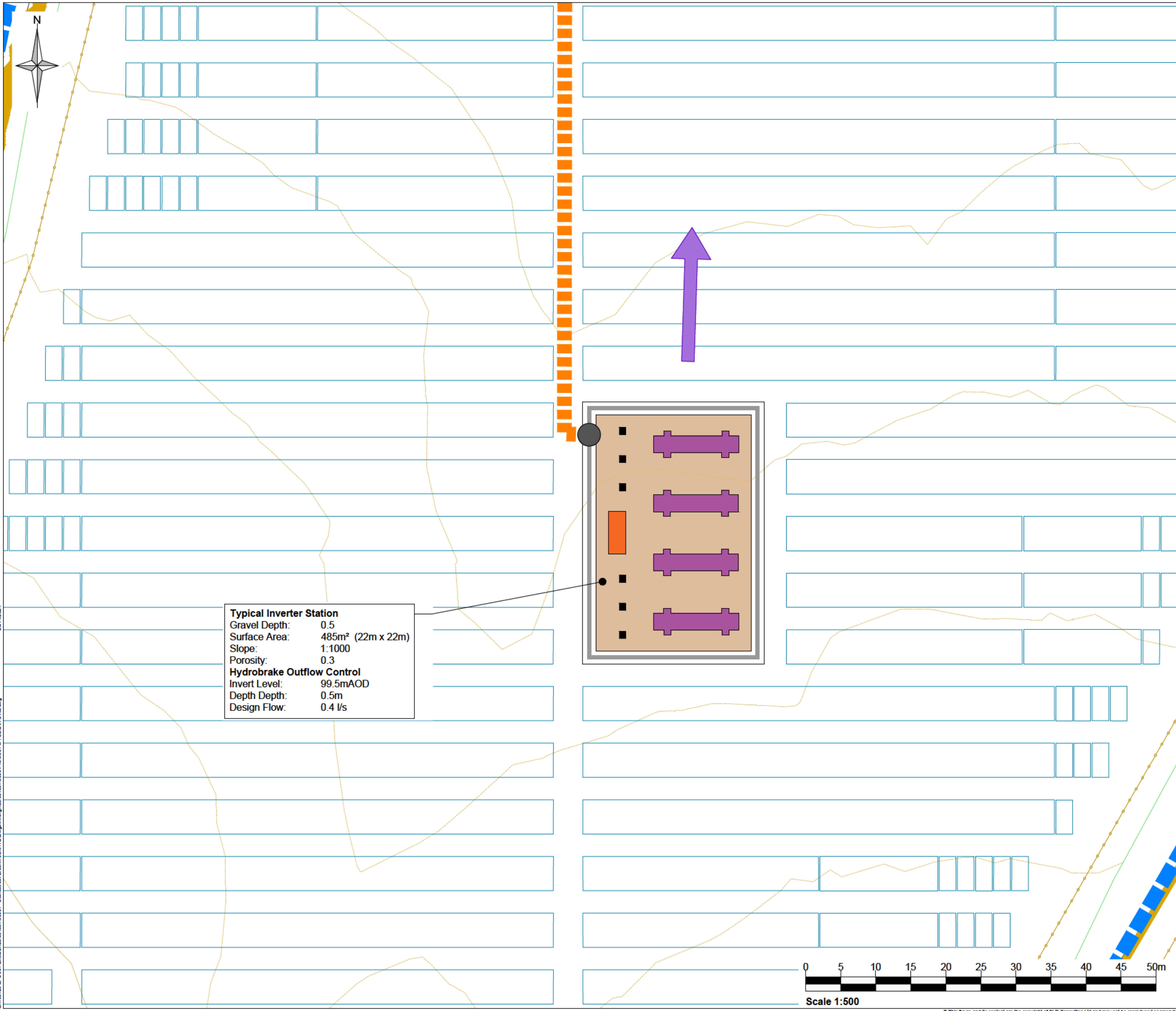
Project
Stonestreet Green Solar Green Solar

Figure Title
Project Substation Surface Water Layout

Scale	SLR Project No.
1:1000 @ A3	427.064837.0001

Designed	Drawn	Checked	Authorised
CN	TS	CN	DW
Date: Mar 2024	Date: Mar 2024	Date: Mar 2024	Date: Mar 2024

Drawing Number	Rev.
10.3.001	0



Legend:

- Gravel Sub Base
- DC - DC Converter
- Battery Storage
- Existing Drainage Ditch
- Filter Drain
- Hydrobrake Outflow Control
- Exceedance Flow Route

Rev	Amendments	Date	By	Chk	Auth
1	Parameters amended	25.11.24	AB	CN	DW

SLR

www.slrconsulting.com

Client: Evolution Power

Project: Stonestreet Green Solar Green Solar

Figure Title: Inverter Station Surface Water Layout

Scale	SLR Project No.
1:500 @ A3	427.064837.0001

Designed	Drawn	Checked	Authorised
CN	TS	CN	DW
Date: Mar 2024	Date: Mar 2024	Date: Mar 2024	Date: Mar 2024

Drawing Number	Rev.
10.3.002	0

Appendix C: Project Substation Drainage Modelling

This Appendix was updated in November 2024

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	4.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
Swale	0.108	4.00	50.500	1200	34.125	62.375	1.000
1			48.000	1200	64.727	40.635	1.000
Car Park	0.680	4.00	56.000	1200	27.631	65.168	0.500

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
Swale	34.125	62.375	50.500	1.000	1200	1	1.000	49.500	150
						0	1.001	49.500	300
1	64.727	40.635	48.000	1.000	1200	1	1.001	47.000	300
Car Park	27.631	65.168	56.000	0.500	1200	0	1.000	55.500	150

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	20.0
Summer CV	1.000	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	240	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
30	20	0	0
30	40	0	0
100	0	0	0
100	20	0	0
100	45	0	0

Node Swale Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Downstream Link	1.001	Sump Available	✓
Replaces Downstream Link	x	Product Number	CTL-SHE-0085-3200-1000-3200
Invert Level (m)	49.500	Min Outlet Diameter (m)	0.100
Design Depth (m)	1.000	Min Node Diameter (mm)	1200
Design Flow (l/s)	3.2		

Node Car Park Online Orifice Control

Flap Valve	x	Invert Level (m)	55.500	Diameter (m)	0.065
Downstream Link	1.000	Design Depth (m)	0.500	Discharge Coefficient	0.600
Replaces Downstream Link	x	Design Flow (l/s)	5.0		

Node Swale Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	49.500
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	264.0	0.0	1.000	1080.0	0.0

Node Car Park Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	55.500	Slope (1:X)	9999.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.600
Safety Factor	1.0	Width (m)	70.200	Inf Depth (m)	
Porosity	0.30	Length (m)	70.200		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	109.086	30.867
2 year 15 minute winter	76.551	30.867
2 year 30 minute summer	70.092	19.834
2 year 30 minute winter	49.188	19.834
2 year 60 minute summer	46.607	12.317
2 year 60 minute winter	30.965	12.317
2 year 120 minute summer	33.047	8.733
2 year 120 minute winter	21.956	8.733
2 year 180 minute summer	26.711	6.874
2 year 180 minute winter	17.363	6.874
2 year 240 minute summer	21.632	5.717
2 year 240 minute winter	14.372	5.717
2 year 360 minute summer	16.807	4.325
2 year 360 minute winter	10.925	4.325
2 year 480 minute summer	13.280	3.509
2 year 480 minute winter	8.823	3.509
2 year 600 minute summer	10.872	2.974
2 year 600 minute winter	7.429	2.974
2 year 720 minute summer	9.676	2.593
2 year 720 minute winter	6.503	2.593
2 year 960 minute summer	7.929	2.088

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 960 minute winter	5.252	2.088
2 year 1440 minute summer	5.748	1.540
2 year 1440 minute winter	3.863	1.540
2 year 2160 minute summer	4.150	1.147
2 year 2160 minute winter	2.859	1.147
2 year 2880 minute summer	3.504	0.939
2 year 2880 minute winter	2.355	0.939
2 year 4320 minute summer	2.768	0.724
2 year 4320 minute winter	1.823	0.724
2 year 5760 minute summer	2.387	0.611
2 year 5760 minute winter	1.545	0.611
2 year 7200 minute summer	2.122	0.541
2 year 7200 minute winter	1.370	0.541
2 year 8640 minute summer	1.937	0.494
2 year 8640 minute winter	1.250	0.494
2 year 10080 minute summer	1.802	0.460
2 year 10080 minute winter	1.163	0.460
30 year 15 minute summer	268.121	75.869
30 year 15 minute winter	188.155	75.869
30 year 30 minute summer	174.998	49.518
30 year 30 minute winter	122.805	49.518
30 year 60 minute summer	117.023	30.926
30 year 60 minute winter	77.747	30.926
30 year 120 minute summer	72.436	19.143
30 year 120 minute winter	48.125	19.143
30 year 180 minute summer	55.572	14.300
30 year 180 minute winter	36.123	14.300
30 year 240 minute summer	43.784	11.571
30 year 240 minute winter	29.089	11.571
30 year 360 minute summer	33.116	8.522
30 year 360 minute winter	21.526	8.522
30 year 480 minute summer	25.905	6.846
30 year 480 minute winter	17.211	6.846
30 year 600 minute summer	21.110	5.774
30 year 600 minute winter	14.423	5.774
30 year 720 minute summer	18.744	5.024
30 year 720 minute winter	12.597	5.024
30 year 960 minute summer	15.325	4.036
30 year 960 minute winter	10.152	4.036
30 year 1440 minute summer	11.089	2.972
30 year 1440 minute winter	7.452	2.972
30 year 2160 minute summer	7.906	2.185
30 year 2160 minute winter	5.447	2.185
30 year 2880 minute summer	6.555	1.757
30 year 2880 minute winter	4.405	1.757
30 year 4320 minute summer	4.947	1.293
30 year 4320 minute winter	3.258	1.293
30 year 5760 minute summer	4.088	1.047
30 year 5760 minute winter	2.646	1.047
30 year 7200 minute summer	3.506	0.894
30 year 7200 minute winter	2.263	0.894
30 year 8640 minute summer	3.098	0.790

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year 8640 minute winter	2.000	0.790
30 year 10080 minute summer	2.803	0.715
30 year 10080 minute winter	1.809	0.715
30 year +20% CC 15 minute summer	321.745	91.043
30 year +20% CC 15 minute winter	225.786	91.043
30 year +20% CC 30 minute summer	209.997	59.422
30 year +20% CC 30 minute winter	147.366	59.422
30 year +20% CC 60 minute summer	140.427	37.111
30 year +20% CC 60 minute winter	93.296	37.111
30 year +20% CC 120 minute summer	86.923	22.971
30 year +20% CC 120 minute winter	57.750	22.971
30 year +20% CC 180 minute summer	66.686	17.161
30 year +20% CC 180 minute winter	43.348	17.161
30 year +20% CC 240 minute summer	52.541	13.885
30 year +20% CC 240 minute winter	34.907	13.885
30 year +20% CC 360 minute summer	39.740	10.226
30 year +20% CC 360 minute winter	25.832	10.226
30 year +20% CC 480 minute summer	31.086	8.215
30 year +20% CC 480 minute winter	20.653	8.215
30 year +20% CC 600 minute summer	25.331	6.929
30 year +20% CC 600 minute winter	17.308	6.929
30 year +20% CC 720 minute summer	22.493	6.028
30 year +20% CC 720 minute winter	15.117	6.028
30 year +20% CC 960 minute summer	18.390	4.843
30 year +20% CC 960 minute winter	12.182	4.843
30 year +20% CC 1440 minute summer	13.307	3.566
30 year +20% CC 1440 minute winter	8.943	3.566
30 year +20% CC 2160 minute summer	9.487	2.622
30 year +20% CC 2160 minute winter	6.537	2.622
30 year +20% CC 2880 minute summer	7.866	2.108
30 year +20% CC 2880 minute winter	5.287	2.108
30 year +20% CC 4320 minute summer	5.936	1.552
30 year +20% CC 4320 minute winter	3.909	1.552
30 year +20% CC 5760 minute summer	4.906	1.256
30 year +20% CC 5760 minute winter	3.175	1.256
30 year +20% CC 7200 minute summer	4.207	1.073
30 year +20% CC 7200 minute winter	2.715	1.073
30 year +20% CC 8640 minute summer	3.718	0.949
30 year +20% CC 8640 minute winter	2.400	0.949
30 year +20% CC 10080 minute summer	3.364	0.858
30 year +20% CC 10080 minute winter	2.171	0.858
30 year +40% CC 15 minute summer	375.369	106.217
30 year +40% CC 15 minute winter	263.417	106.217
30 year +40% CC 30 minute summer	244.997	69.326
30 year +40% CC 30 minute winter	171.927	69.326
30 year +40% CC 60 minute summer	163.832	43.296
30 year +40% CC 60 minute winter	108.846	43.296
30 year +40% CC 120 minute summer	101.411	26.800
30 year +40% CC 120 minute winter	67.375	26.800
30 year +40% CC 180 minute summer	77.800	20.021
30 year +40% CC 180 minute winter	50.572	20.021
30 year +40% CC 240 minute summer	61.298	16.199

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year +40% CC 240 minute winter	40.725	16.199
30 year +40% CC 360 minute summer	46.363	11.931
30 year +40% CC 360 minute winter	30.137	11.931
30 year +40% CC 480 minute summer	36.267	9.584
30 year +40% CC 480 minute winter	24.095	9.584
30 year +40% CC 600 minute summer	29.553	8.084
30 year +40% CC 600 minute winter	20.193	8.084
30 year +40% CC 720 minute summer	26.242	7.033
30 year +40% CC 720 minute winter	17.636	7.033
30 year +40% CC 960 minute summer	21.455	5.650
30 year +40% CC 960 minute winter	14.212	5.650
30 year +40% CC 1440 minute summer	15.525	4.161
30 year +40% CC 1440 minute winter	10.433	4.161
30 year +40% CC 2160 minute summer	11.068	3.059
30 year +40% CC 2160 minute winter	7.626	3.059
30 year +40% CC 2880 minute summer	9.177	2.460
30 year +40% CC 2880 minute winter	6.168	2.460
30 year +40% CC 4320 minute summer	6.926	1.811
30 year +40% CC 4320 minute winter	4.561	1.811
30 year +40% CC 5760 minute summer	5.724	1.465
30 year +40% CC 5760 minute winter	3.705	1.465
30 year +40% CC 7200 minute summer	4.908	1.252
30 year +40% CC 7200 minute winter	3.168	1.252
30 year +40% CC 8640 minute summer	4.338	1.107
30 year +40% CC 8640 minute winter	2.800	1.107
30 year +40% CC 10080 minute summer	3.925	1.001
30 year +40% CC 10080 minute winter	2.533	1.001
100 year 15 minute summer	335.925	95.055
100 year 15 minute winter	235.737	95.055
100 year 30 minute summer	221.228	62.600
100 year 30 minute winter	155.248	62.600
100 year 60 minute summer	148.574	39.264
100 year 60 minute winter	98.709	39.264
100 year 120 minute summer	90.464	23.907
100 year 120 minute winter	60.102	23.907
100 year 180 minute summer	69.180	17.802
100 year 180 minute winter	44.969	17.802
100 year 240 minute summer	54.648	14.442
100 year 240 minute winter	36.307	14.442
100 year 360 minute summer	41.917	10.787
100 year 360 minute winter	27.247	10.787
100 year 480 minute summer	33.394	8.825
100 year 480 minute winter	22.186	8.825
100 year 600 minute summer	27.697	7.576
100 year 600 minute winter	18.924	7.576
100 year 720 minute summer	25.000	6.700
100 year 720 minute winter	16.801	6.700
100 year 960 minute summer	21.026	5.537
100 year 960 minute winter	13.928	5.537
100 year 1440 minute summer	15.729	4.216
100 year 1440 minute winter	10.571	4.216
100 year 2160 minute summer	11.378	3.145

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year 2160 minute winter	7.840	3.145
100 year 2880 minute summer	9.419	2.524
100 year 2880 minute winter	6.330	2.524
100 year 4320 minute summer	6.972	1.823
100 year 4320 minute winter	4.592	1.823
100 year 5760 minute summer	5.631	1.441
100 year 5760 minute winter	3.644	1.441
100 year 7200 minute summer	4.702	1.199
100 year 7200 minute winter	3.034	1.199
100 year 8640 minute summer	4.052	1.034
100 year 8640 minute winter	2.615	1.034
100 year 10080 minute summer	3.579	0.913
100 year 10080 minute winter	2.310	0.913
100 year +20% CC 15 minute summer	403.109	114.066
100 year +20% CC 15 minute winter	282.884	114.066
100 year +20% CC 30 minute summer	265.474	75.120
100 year +20% CC 30 minute winter	186.298	75.120
100 year +20% CC 60 minute summer	178.289	47.117
100 year +20% CC 60 minute winter	118.451	47.117
100 year +20% CC 120 minute summer	108.557	28.688
100 year +20% CC 120 minute winter	72.122	28.688
100 year +20% CC 180 minute summer	83.016	21.363
100 year +20% CC 180 minute winter	53.963	21.363
100 year +20% CC 240 minute summer	65.577	17.330
100 year +20% CC 240 minute winter	43.568	17.330
100 year +20% CC 360 minute summer	50.300	12.944
100 year +20% CC 360 minute winter	32.697	12.944
100 year +20% CC 480 minute summer	40.073	10.590
100 year +20% CC 480 minute winter	26.624	10.590
100 year +20% CC 600 minute summer	33.237	9.091
100 year +20% CC 600 minute winter	22.709	9.091
100 year +20% CC 720 minute summer	29.999	8.040
100 year +20% CC 720 minute winter	20.162	8.040
100 year +20% CC 960 minute summer	25.231	6.644
100 year +20% CC 960 minute winter	16.713	6.644
100 year +20% CC 1440 minute summer	18.875	5.059
100 year +20% CC 1440 minute winter	12.685	5.059
100 year +20% CC 2160 minute summer	13.654	3.773
100 year +20% CC 2160 minute winter	9.408	3.773
100 year +20% CC 2880 minute summer	11.303	3.029
100 year +20% CC 2880 minute winter	7.596	3.029
100 year +20% CC 4320 minute summer	8.367	2.188
100 year +20% CC 4320 minute winter	5.510	2.188
100 year +20% CC 5760 minute summer	6.757	1.730
100 year +20% CC 5760 minute winter	4.373	1.730
100 year +20% CC 7200 minute summer	5.642	1.439
100 year +20% CC 7200 minute winter	3.641	1.439
100 year +20% CC 8640 minute summer	4.862	1.240
100 year +20% CC 8640 minute winter	3.138	1.240
100 year +20% CC 10080 minute summer	4.295	1.096
100 year +20% CC 10080 minute winter	2.772	1.096
100 year +45% CC 15 minute summer	487.091	137.830

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +45% CC 15 minute winter	341.818	137.830
100 year +45% CC 30 minute summer	320.781	90.770
100 year +45% CC 30 minute winter	225.110	90.770
100 year +45% CC 60 minute summer	215.432	56.932
100 year +45% CC 60 minute winter	143.128	56.932
100 year +45% CC 120 minute summer	131.173	34.665
100 year +45% CC 120 minute winter	87.148	34.665
100 year +45% CC 180 minute summer	100.312	25.814
100 year +45% CC 180 minute winter	65.205	25.814
100 year +45% CC 240 minute summer	79.239	20.941
100 year +45% CC 240 minute winter	52.644	20.941
100 year +45% CC 360 minute summer	60.780	15.641
100 year +45% CC 360 minute winter	39.508	15.641
100 year +45% CC 480 minute summer	48.421	12.796
100 year +45% CC 480 minute winter	32.170	12.796
100 year +45% CC 600 minute summer	40.161	10.985
100 year +45% CC 600 minute winter	27.440	10.985
100 year +45% CC 720 minute summer	36.249	9.715
100 year +45% CC 720 minute winter	24.362	9.715
100 year +45% CC 960 minute summer	30.487	8.028
100 year +45% CC 960 minute winter	20.195	8.028
100 year +45% CC 1440 minute summer	22.808	6.113
100 year +45% CC 1440 minute winter	15.328	6.113
100 year +45% CC 2160 minute summer	16.498	4.560
100 year +45% CC 2160 minute winter	11.368	4.560
100 year +45% CC 2880 minute summer	13.658	3.660
100 year +45% CC 2880 minute winter	9.179	3.660
100 year +45% CC 4320 minute summer	10.110	2.643
100 year +45% CC 4320 minute winter	6.658	2.643
100 year +45% CC 5760 minute summer	8.164	2.090
100 year +45% CC 5760 minute winter	5.284	2.090
100 year +45% CC 7200 minute summer	6.817	1.739
100 year +45% CC 7200 minute winter	4.400	1.739
100 year +45% CC 8640 minute summer	5.875	1.499
100 year +45% CC 8640 minute winter	3.792	1.499
100 year +45% CC 10080 minute summer	5.190	1.324
100 year +45% CC 10080 minute winter	3.349	1.324

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.95%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
2880 minute summer	Swale	1920	49.628	0.128	3.1	40.9105	0.0000	OK
2880 minute summer	1	1920	47.021	0.021	2.7	0.0000	0.0000	OK
1440 minute summer	Car Park	960	55.611	0.111	10.9	161.6945	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m^3)	Discharge Vol (m^3)
2880 minute summer	Swale	1.001	1	2.7	1.260	0.010	0.0854	260.8
1440 minute summer	Car Park	1.000	Swale	2.5	0.460	0.028	0.2096	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.95%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2160 minute summer	Swale	2220	49.798	0.298	5.5	115.9845	0.0000	OK
2160 minute summer	1	2220	47.023	0.023	3.2	0.0000	0.0000	OK
1440 minute summer	Car Park	1020	55.719	0.219	20.9	323.4357	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
2160 minute summer	Swale	1.001	1	3.2	1.328	0.011	0.0963	293.3
1440 minute summer	Car Park	1.000	Swale	3.8	0.537	0.043	0.2390	

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.95%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2880 minute summer	Swale	3060	49.901	0.401	5.9	172.9019	0.0000	SURCHARGED
960 minute summer	1	1110	47.023	0.023	3.2	0.0000	0.0000	OK
1440 minute summer	Car Park	1020	55.765	0.265	25.1	393.6389	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
2880 minute summer	Swale	1.001	1	3.2	1.329	0.011	0.0964	397.4
1440 minute summer	Car Park	1.000	Swale	4.3	0.497	0.048	0.2406	

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.95%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
4320 minute summer	Swale	4380	50.014	0.514	5.8	245.0651	0.0000	SURCHARGED
600 minute summer	1	735	47.023	0.023	3.2	0.0000	0.0000	OK
1440 minute summer	Car Park	1050	55.813	0.313	29.3	464.8029	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
4320 minute summer	Swale	1.001	1	3.2	1.329	0.011	0.0964	591.7
1440 minute summer	Car Park	1.000	Swale	4.7	0.517	0.053	0.2419	

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.95%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2880 minute summer	Swale	3120	50.020	0.520	6.7	249.2259	0.0000	SURCHARGED
720 minute summer	1	825	47.023	0.023	3.2	0.0000	0.0000	OK
2160 minute summer	Car Park	1500	55.819	0.319	21.5	474.8326	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
2880 minute summer	Swale	1.001	1	3.2	1.329	0.011	0.0964	408.3
2160 minute summer	Car Park	1.000	Swale	4.7	0.548	0.054	0.2421	

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.95%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
4320 minute summer	Swale	4560	50.201	0.701	6.7	387.8610	0.0000	FLOOD RISK
480 minute summer	1	576	47.023	0.023	3.2	0.0000	0.0000	OK
2160 minute summer	Car Park	1500	55.890	0.390	25.8	580.8398	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
4320 minute summer	Swale	1.001	1	3.2	1.329	0.011	0.0964	585.6
2160 minute summer	Car Park	1.000	Swale	5.3	0.480	0.060	0.2439	

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.95%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
5760 minute summer	Swale	6000	50.366	0.866	6.9	537.7109	0.0000	FLOOD RISK
240 minute summer	1	448	47.023	0.023	3.2	0.0000	0.0000	OK
2160 minute summer	Car Park	1560	55.980	0.480	31.2	716.8559	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
5760 minute summer	Swale	1.001	1	3.2	1.329	0.011	0.0964	795.4
2160 minute summer	Car Park	1.000	Swale	5.9	0.498	0.067	0.2459	

Appendix D: Inverter Station Drainage Modelling

This Appendix was updated in November 2024

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	4.00	Include Intermediate Ground	x
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
2	0.097	4.00	100.125	22.338	65.554	0.625

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m^3/ha)	20.0
Summer CV	1.000	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	240	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
30	20	0	0
30	40	0	0
100	0	0	0
100	20	0	0
100	45	0	0

Node 2 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	99.500	Product Number	CTL-SHE-0034-4000-0500-4000
Design Depth (m)	0.500	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	0.4	Min Node Diameter (mm)	1200

Node 2 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	99.500	Slope (1:X)	1000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.500
Safety Factor	2.0	Width (m)	22.000	Inf Depth (m)	
Porosity	0.30	Length (m)	22.000		

Node 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	100.000
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	485.0	0.0	0.125	485.0	0.0

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	109.086	30.867
2 year 15 minute winter	76.551	30.867
2 year 30 minute summer	70.092	19.834
2 year 30 minute winter	49.188	19.834
2 year 60 minute summer	46.607	12.317
2 year 60 minute winter	30.965	12.317
2 year 120 minute summer	33.047	8.733
2 year 120 minute winter	21.956	8.733
2 year 180 minute summer	26.711	6.874
2 year 180 minute winter	17.363	6.874
2 year 240 minute summer	21.632	5.717
2 year 240 minute winter	14.372	5.717
2 year 360 minute summer	16.807	4.325
2 year 360 minute winter	10.925	4.325
2 year 480 minute summer	13.280	3.509
2 year 480 minute winter	8.823	3.509
2 year 600 minute summer	10.872	2.974
2 year 600 minute winter	7.429	2.974
2 year 720 minute summer	9.676	2.593
2 year 720 minute winter	6.503	2.593
2 year 960 minute summer	7.929	2.088
2 year 960 minute winter	5.252	2.088
2 year 1440 minute summer	5.748	1.540
2 year 1440 minute winter	3.863	1.540
2 year 2160 minute summer	4.150	1.147
2 year 2160 minute winter	2.859	1.147
2 year 2880 minute summer	3.504	0.939
2 year 2880 minute winter	2.355	0.939
2 year 4320 minute summer	2.768	0.724
2 year 4320 minute winter	1.823	0.724
2 year 5760 minute summer	2.387	0.611
2 year 5760 minute winter	1.545	0.611
2 year 7200 minute summer	2.122	0.541
2 year 7200 minute winter	1.370	0.541
2 year 8640 minute summer	1.937	0.494
2 year 8640 minute winter	1.250	0.494
2 year 10080 minute summer	1.802	0.460
2 year 10080 minute winter	1.163	0.460
30 year 15 minute summer	268.121	75.869
30 year 15 minute winter	188.155	75.869
30 year 30 minute summer	174.998	49.518
30 year 30 minute winter	122.805	49.518
30 year 60 minute summer	117.023	30.926
30 year 60 minute winter	77.747	30.926
30 year 120 minute summer	72.436	19.143
30 year 120 minute winter	48.125	19.143
30 year 180 minute summer	55.572	14.300
30 year 180 minute winter	36.123	14.300

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year 240 minute summer	43.784	11.571
30 year 240 minute winter	29.089	11.571
30 year 360 minute summer	33.116	8.522
30 year 360 minute winter	21.526	8.522
30 year 480 minute summer	25.905	6.846
30 year 480 minute winter	17.211	6.846
30 year 600 minute summer	21.110	5.774
30 year 600 minute winter	14.423	5.774
30 year 720 minute summer	18.744	5.024
30 year 720 minute winter	12.597	5.024
30 year 960 minute summer	15.325	4.036
30 year 960 minute winter	10.152	4.036
30 year 1440 minute summer	11.089	2.972
30 year 1440 minute winter	7.452	2.972
30 year 2160 minute summer	7.906	2.185
30 year 2160 minute winter	5.447	2.185
30 year 2880 minute summer	6.555	1.757
30 year 2880 minute winter	4.405	1.757
30 year 4320 minute summer	4.947	1.293
30 year 4320 minute winter	3.258	1.293
30 year 5760 minute summer	4.088	1.047
30 year 5760 minute winter	2.646	1.047
30 year 7200 minute summer	3.506	0.894
30 year 7200 minute winter	2.263	0.894
30 year 8640 minute summer	3.098	0.790
30 year 8640 minute winter	2.000	0.790
30 year 10080 minute summer	2.803	0.715
30 year 10080 minute winter	1.809	0.715
30 year +20% CC 15 minute summer	321.745	91.043
30 year +20% CC 15 minute winter	225.786	91.043
30 year +20% CC 30 minute summer	209.997	59.422
30 year +20% CC 30 minute winter	147.366	59.422
30 year +20% CC 60 minute summer	140.427	37.111
30 year +20% CC 60 minute winter	93.296	37.111
30 year +20% CC 120 minute summer	86.923	22.971
30 year +20% CC 120 minute winter	57.750	22.971
30 year +20% CC 180 minute summer	66.686	17.161
30 year +20% CC 180 minute winter	43.348	17.161
30 year +20% CC 240 minute summer	52.541	13.885
30 year +20% CC 240 minute winter	34.907	13.885
30 year +20% CC 360 minute summer	39.740	10.226
30 year +20% CC 360 minute winter	25.832	10.226
30 year +20% CC 480 minute summer	31.086	8.215
30 year +20% CC 480 minute winter	20.653	8.215
30 year +20% CC 600 minute summer	25.331	6.929
30 year +20% CC 600 minute winter	17.308	6.929
30 year +20% CC 720 minute summer	22.493	6.028
30 year +20% CC 720 minute winter	15.117	6.028
30 year +20% CC 960 minute summer	18.390	4.843
30 year +20% CC 960 minute winter	12.182	4.843
30 year +20% CC 1440 minute summer	13.307	3.566
30 year +20% CC 1440 minute winter	8.943	3.566

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year +20% CC 2160 minute summer	9.487	2.622
30 year +20% CC 2160 minute winter	6.537	2.622
30 year +20% CC 2880 minute summer	7.866	2.108
30 year +20% CC 2880 minute winter	5.287	2.108
30 year +20% CC 4320 minute summer	5.936	1.552
30 year +20% CC 4320 minute winter	3.909	1.552
30 year +20% CC 5760 minute summer	4.906	1.256
30 year +20% CC 5760 minute winter	3.175	1.256
30 year +20% CC 7200 minute summer	4.207	1.073
30 year +20% CC 7200 minute winter	2.715	1.073
30 year +20% CC 8640 minute summer	3.718	0.949
30 year +20% CC 8640 minute winter	2.400	0.949
30 year +20% CC 10080 minute summer	3.364	0.858
30 year +20% CC 10080 minute winter	2.171	0.858
30 year +40% CC 15 minute summer	375.369	106.217
30 year +40% CC 15 minute winter	263.417	106.217
30 year +40% CC 30 minute summer	244.997	69.326
30 year +40% CC 30 minute winter	171.927	69.326
30 year +40% CC 60 minute summer	163.832	43.296
30 year +40% CC 60 minute winter	108.846	43.296
30 year +40% CC 120 minute summer	101.411	26.800
30 year +40% CC 120 minute winter	67.375	26.800
30 year +40% CC 180 minute summer	77.800	20.021
30 year +40% CC 180 minute winter	50.572	20.021
30 year +40% CC 240 minute summer	61.298	16.199
30 year +40% CC 240 minute winter	40.725	16.199
30 year +40% CC 360 minute summer	46.363	11.931
30 year +40% CC 360 minute winter	30.137	11.931
30 year +40% CC 480 minute summer	36.267	9.584
30 year +40% CC 480 minute winter	24.095	9.584
30 year +40% CC 600 minute summer	29.553	8.084
30 year +40% CC 600 minute winter	20.193	8.084
30 year +40% CC 720 minute summer	26.242	7.033
30 year +40% CC 720 minute winter	17.636	7.033
30 year +40% CC 960 minute summer	21.455	5.650
30 year +40% CC 960 minute winter	14.212	5.650
30 year +40% CC 1440 minute summer	15.525	4.161
30 year +40% CC 1440 minute winter	10.433	4.161
30 year +40% CC 2160 minute summer	11.068	3.059
30 year +40% CC 2160 minute winter	7.626	3.059
30 year +40% CC 2880 minute summer	9.177	2.460
30 year +40% CC 2880 minute winter	6.168	2.460
30 year +40% CC 4320 minute summer	6.926	1.811
30 year +40% CC 4320 minute winter	4.561	1.811
30 year +40% CC 5760 minute summer	5.724	1.465
30 year +40% CC 5760 minute winter	3.705	1.465
30 year +40% CC 7200 minute summer	4.908	1.252
30 year +40% CC 7200 minute winter	3.168	1.252
30 year +40% CC 8640 minute summer	4.338	1.107
30 year +40% CC 8640 minute winter	2.800	1.107
30 year +40% CC 10080 minute summer	3.925	1.001
30 year +40% CC 10080 minute winter	2.533	1.001

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year 15 minute summer	335.925	95.055
100 year 15 minute winter	235.737	95.055
100 year 30 minute summer	221.228	62.600
100 year 30 minute winter	155.248	62.600
100 year 60 minute summer	148.574	39.264
100 year 60 minute winter	98.709	39.264
100 year 120 minute summer	90.464	23.907
100 year 120 minute winter	60.102	23.907
100 year 180 minute summer	69.180	17.802
100 year 180 minute winter	44.969	17.802
100 year 240 minute summer	54.648	14.442
100 year 240 minute winter	36.307	14.442
100 year 360 minute summer	41.917	10.787
100 year 360 minute winter	27.247	10.787
100 year 480 minute summer	33.394	8.825
100 year 480 minute winter	22.186	8.825
100 year 600 minute summer	27.697	7.576
100 year 600 minute winter	18.924	7.576
100 year 720 minute summer	25.000	6.700
100 year 720 minute winter	16.801	6.700
100 year 960 minute summer	21.026	5.537
100 year 960 minute winter	13.928	5.537
100 year 1440 minute summer	15.729	4.216
100 year 1440 minute winter	10.571	4.216
100 year 2160 minute summer	11.378	3.145
100 year 2160 minute winter	7.840	3.145
100 year 2880 minute summer	9.419	2.524
100 year 2880 minute winter	6.330	2.524
100 year 4320 minute summer	6.972	1.823
100 year 4320 minute winter	4.592	1.823
100 year 5760 minute summer	5.631	1.441
100 year 5760 minute winter	3.644	1.441
100 year 7200 minute summer	4.702	1.199
100 year 7200 minute winter	3.034	1.199
100 year 8640 minute summer	4.052	1.034
100 year 8640 minute winter	2.615	1.034
100 year 10080 minute summer	3.579	0.913
100 year 10080 minute winter	2.310	0.913
100 year +20% CC 15 minute summer	403.109	114.066
100 year +20% CC 15 minute winter	282.884	114.066
100 year +20% CC 30 minute summer	265.474	75.120
100 year +20% CC 30 minute winter	186.298	75.120
100 year +20% CC 60 minute summer	178.289	47.117
100 year +20% CC 60 minute winter	118.451	47.117
100 year +20% CC 120 minute summer	108.557	28.688
100 year +20% CC 120 minute winter	72.122	28.688
100 year +20% CC 180 minute summer	83.016	21.363
100 year +20% CC 180 minute winter	53.963	21.363
100 year +20% CC 240 minute summer	65.577	17.330
100 year +20% CC 240 minute winter	43.568	17.330
100 year +20% CC 360 minute summer	50.300	12.944
100 year +20% CC 360 minute winter	32.697	12.944

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +20% CC 480 minute summer	40.073	10.590
100 year +20% CC 480 minute winter	26.624	10.590
100 year +20% CC 600 minute summer	33.237	9.091
100 year +20% CC 600 minute winter	22.709	9.091
100 year +20% CC 720 minute summer	29.999	8.040
100 year +20% CC 720 minute winter	20.162	8.040
100 year +20% CC 960 minute summer	25.231	6.644
100 year +20% CC 960 minute winter	16.713	6.644
100 year +20% CC 1440 minute summer	18.875	5.059
100 year +20% CC 1440 minute winter	12.685	5.059
100 year +20% CC 2160 minute summer	13.654	3.773
100 year +20% CC 2160 minute winter	9.408	3.773
100 year +20% CC 2880 minute summer	11.303	3.029
100 year +20% CC 2880 minute winter	7.596	3.029
100 year +20% CC 4320 minute summer	8.367	2.188
100 year +20% CC 4320 minute winter	5.510	2.188
100 year +20% CC 5760 minute summer	6.757	1.730
100 year +20% CC 5760 minute winter	4.373	1.730
100 year +20% CC 7200 minute summer	5.642	1.439
100 year +20% CC 7200 minute winter	3.641	1.439
100 year +20% CC 8640 minute summer	4.862	1.240
100 year +20% CC 8640 minute winter	3.138	1.240
100 year +20% CC 10080 minute summer	4.295	1.096
100 year +20% CC 10080 minute winter	2.772	1.096
100 year +45% CC 15 minute summer	487.091	137.830
100 year +45% CC 15 minute winter	341.818	137.830
100 year +45% CC 30 minute summer	320.781	90.770
100 year +45% CC 30 minute winter	225.110	90.770
100 year +45% CC 60 minute summer	215.432	56.932
100 year +45% CC 60 minute winter	143.128	56.932
100 year +45% CC 120 minute summer	131.173	34.665
100 year +45% CC 120 minute winter	87.148	34.665
100 year +45% CC 180 minute summer	100.312	25.814
100 year +45% CC 180 minute winter	65.205	25.814
100 year +45% CC 240 minute summer	79.239	20.941
100 year +45% CC 240 minute winter	52.644	20.941
100 year +45% CC 360 minute summer	60.780	15.641
100 year +45% CC 360 minute winter	39.508	15.641
100 year +45% CC 480 minute summer	48.421	12.796
100 year +45% CC 480 minute winter	32.170	12.796
100 year +45% CC 600 minute summer	40.161	10.985
100 year +45% CC 600 minute winter	27.440	10.985
100 year +45% CC 720 minute summer	36.249	9.715
100 year +45% CC 720 minute winter	24.362	9.715
100 year +45% CC 960 minute summer	30.487	8.028
100 year +45% CC 960 minute winter	20.195	8.028
100 year +45% CC 1440 minute summer	22.808	6.113
100 year +45% CC 1440 minute winter	15.328	6.113
100 year +45% CC 2160 minute summer	16.498	4.560
100 year +45% CC 2160 minute winter	11.368	4.560
100 year +45% CC 2880 minute summer	13.658	3.660
100 year +45% CC 2880 minute winter	9.179	3.660

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +45% CC 4320 minute summer	10.110	2.643
100 year +45% CC 4320 minute winter	6.658	2.643
100 year +45% CC 5760 minute summer	8.164	2.090
100 year +45% CC 5760 minute winter	5.284	2.090
100 year +45% CC 7200 minute summer	6.817	1.739
100 year +45% CC 7200 minute winter	4.400	1.739
100 year +45% CC 8640 minute summer	5.875	1.499
100 year +45% CC 8640 minute winter	3.792	1.499
100 year +45% CC 10080 minute summer	5.190	1.324
100 year +45% CC 10080 minute winter	3.349	1.324

Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute winter	2	540	99.645	0.145	2.0	19.8651	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
600 minute winter	2	Hydro-Brake®	0.4	15.3

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute winter	2	705	99.822	0.322	3.4	46.1853	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
720 minute winter	2	Hydro-Brake®	0.4	17.1

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	2	930	99.906	0.406	3.3	58.6612	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
960 minute winter	2	Hydro-Brake®	0.4	22.7

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	2	1380	99.980	0.480	2.8	69.5214	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
1440 minute winter	2	Hydro-Brake®	0.4	33.1

Results for 100 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	2	1380	99.989	0.489	2.8	70.8609	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
1440 minute winter	2	Hydro-Brake®	0.4	33.3

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2160 minute winter	2	1980	100.035	0.535	2.5	89.8492	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
2160 minute winter	2	Hydro-Brake®	0.4	49.2

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2160 minute winter	2	2100	100.085	0.585	3.1	114.2258	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
2160 minute winter	2	Hydro-Brake®	0.4	51.3

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