MORGAN AND MORECAMBE OFFSHORE WIND FARMS: TRANSMISSION ASSETS

Outline Operational Drainage Management Plan

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Glossary

Term	Meaning
Annual Exceedance Probability	Probability of a rainfall event occurring each year (e.g. a 1% AEP event has a 1 in 100 probability of occurrence each year)
Applicants	Morgan Offshore Wind Limited (Morgan OWL) and Morecambe Offshore Windfarm Ltd (Morecambe OWL).
Climate change	A change in global or regional climate patterns, in particular a change apparent from the mid to late 20th century onwards and attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels.
Flood Risk Assessment	A flood risk assessment is an assessment of the risk of flooding from all flood mechanisms, including the identification of flood mitigation measures, in order to satisfy the requirements of the National Planning Policy Framework and Planning Practice Guidance.
Greenfield Runoff Rate	Estimate runoff rate from an undeveloped site
Lead Local Flood Authority	County councils and unitary authorities who lead in managing local flood risks (i.e. risks of flooding from surface water, ground water and ordinary (smaller) watercourses). This includes ensuring co-operation between the Risk Management Authorities in their area.
Local Authority	A body empowered by law to exercise various statutory functions for a particular area of the United Kingdom. This includes County Councils, District Councils and County Borough Councils.
Main Rivers	Larger rivers and streams which the Environment Agency carries out maintenance, improvement or construction work on to manage flood risk, as designated under the Water Resources Act 1991.
Mean High Water Springs	Spring tides are monthly tides when the tidal range is at its highest. Mean High Water Springs is the average throughout the year of two successive high waters, during a 24-hour period in each month when the range of the tide is at its greatest.
Ordinary Watercourses	Watercourses (such as a river, stream, ditch, cut, sluice, dyke or non-public sewer) that are not designated a Main River under the Water Resources Act 1991. Responsibility for management lies with the Lead Local Flood Authority, or Internal Drainage Board for some watercourses where there is an Internal Drainage District.
Policy	A set of decisions by governments and other political actors to influence, change, or frame a problem or issue that has been recognized as in the political realm by policy makers and/or the wider public.
QBAR	Mean annual maximum flow rate from a rural catchment (approximately a 1 in 2 year event)
Return Period	Probability of the event occurring each year, the same as annual probability (e.g. a 1 in 100 year return period is the same as a 1% AP event)
Runoff	Runoff occurs when there is more water than land can absorb. The excess liquid flows across the surface of the land.

Term	Meaning
Substation	Part of an electrical transmission and distribution system. Substations transform voltage from high to low, or the reverse by means of electrical transformers.
Sustainable Drainage Systems (SuDS)	Water management methods aiming to align modern drainage systems with natural water processes. Key pillars of SuDS are water quality, water quantity, amenity and biodiversity.
Transmission Assets	The offshore export cables, landfall and onshore infrastructure required to connect the Morgan Offshore Wind Project and the Morecambe Offshore Windfarm to the National Grid.

Acronyms

Acronym	Meaning
AEP	Annual Exceedance Probability
BGS	British Geological Survey
CIRIA	Construction Industry Research and Information Association
DEFRA	Department for Environment, Food & Rural Affairs
EA	Environment Agency
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment
IDB	Internal Drainage Board
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
MHWS	Mean High Water Springs
NPPF	National Planning Policy Framework
SAAR	Standard-period Average Annual Rainfall
SuDS	Sustainable Drainage Systems

Units

Unit	Description
%	Percentage
Ha	Hectares
km^2	Square kilometres
l/s	Litres per second
l/s/ha	Litres per second, per hectare

m^2	Square Metre
m^3	Cubic Metre

1 Outline Operational Drainage Management Plan

1.1 Background

1.1.1 Introduction

1.1.1.1 This document forms the Outline Operational Drainage Management Plan prepared for the Morgan and Morecambe Offshore Wind Farms: Transmission Assets (referred to hereafter as 'the Transmission Assets').

1.1.1.2 The Outline Operational Drainage Management Plan has been updated for Deadline 4 in response to Lancashire County Council Lead Local Flood Authority request noted within the Statement of Common Ground (document reference: S_D1_6.1/F02), and the Examining Authority's request at the Issue Specific Hearing 2 to make reference to the recent National Standards for Sustainable Drainage Systems (Department for Environment, Food & Rural Affairs (DEFRA), 2025) within the Outline Operational Drainage Management Plan.

1.1.2 Project overview

1.1.2.1 Morgan Offshore Wind Limited (Morgan OWL), a joint venture between ~~bp Alternative Energy Investments Ltd (bp~~JERA Nex bp (JNbp) and Energie Baden-Württemberg AG (EnBW), is developing the Morgan Offshore Wind Project. The Morgan Offshore Wind Project is a proposed wind farm in the east Irish Sea.

1.1.2.2 Morecambe Offshore Windfarm Ltd (Morecambe OWL), ~~a joint venture between Zero-E Offshore Wind S.L.U. (Spain) (a Cobra group company) (Cobra) and Flotation Energy Ltd,~~owned by Copenhagen Infrastructure Partners' (CIP) fifth flagship fund, Copenhagen Infrastructure V (CI V), is developing the Morecambe Offshore Windfarm, also located in the east Irish Sea.

1.1.2.3 The purpose of the Transmission Assets is to connect the Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets (referred to collectively as the 'Generation Assets') to the National Grid.

1.1.2.4 Morgan OWL and Morecambe OWL (the Applicants), are jointly developing a single consent application for transmission assets associated with each of the offshore wind farms, including offshore export cable corridors to landfall and co-ordinated onshore export cable corridors to each of the two onshore substation(s), and onward connection to the National Grid at Penwortham, Lancashire.

1.1.2.5 The key components of the Transmission Assets include offshore elements, landfall and onshore elements. Details of the activities and infrastructure associated with the Transmission Assets are set out in Volume 1, Chapter 3: Project Description of the Environmental Statement (ES) (document reference F1.3).

1.1.2.6 This Outline Operational Drainage Management Plan has been developed for the following onshore elements of Transmission Assets, landwards of Mean High Water Springs:

- Onshore substations – where the permanent onshore electrical substation infrastructure and connections to the onshore export cables are proposed to be located, including associated permanent infrastructure.

1.1.2.7 These onshore substations are located within the Onshore Order Limits, as shown on Figure 1.1b (see Volume 1: Figures of the ES) (document reference F1.6).

1.1.3 Purpose of the Outline Operational Drainage Management Plan

1.1.3.1 This Outline Operational Drainage Management Plan demonstrates how the increases in impermeable surfaces, predicted impacts of climate change, and the resultant increases in surface water runoff will be mitigated.

1.1.3.2 This Outline Operational Drainage Management Plan references the following documents:

- Infiltration Test Report: Land East of Lower Lane, Freckleton (Northern Site), Subadra, July 2024
- Infiltration Test Report: Land East of Lower Lane, Freckleton (Southern Site), Subadra, August 2024
- Morgan and Morecambe Offshore Wind Farms: Transmission Assets Environmental Statement. Volume 3, Annex 2.3: Flood Risk Assessment (September 2024)

1.1.4 Structure of this document

1.1.4.1 This document is set out as follows:

- Section 1.1: presents an introduction to the Outline Operational Drainage Management Plan.
- Section 1.2: includes the site description, including site levels, geology, proximity to watercourses etc.
- Section 1.3: details the ground investigation used to inform the outline operational drainage management plan.
- Section 1.4: includes a summary of the operational drainage at the onshore substations
- Section 1.5: provides information in ~~regards~~regard to water quality during the operational phase of the project
- Section 1.6: presents the conclusions.

1.1.5 Implementation

1.1.5.1 Following the granting of consent for the Transmission Assets, detailed Operational Drainage Management Plans will be prepared on behalf of Morgan OWL and/or Morecambe OWL, prior to commencement of the relevant stage of works and will follow the principles established in this Outline Operational Drainage Management Plan. The detailed Operational Drainage Management Plans will require approval by the relevant planning authority following consultation with relevant stakeholders. The Applicants and all relevant appointed contractors will be responsible for the implementation of the detailed Operational Drainage Management Plans.

1.1.5.2 The Applicants have committed to implementation of detailed Operational Drainage Management Plans via the following commitment, CoT11 (see Volume 1, Annex 5.3: Commitments Register, document reference F1.5.3), and is secured by inclusion of Requirement 20 of the draft Development Consent Order (DCO) (document reference C1) Schedules 2A & 2B. Below sets out the requirement wording for Project A (Project B's requirement mirror those of Project A for this requirement and are, therefore, not repeated):

1.1.5.3 20.—(1) Work No. 21A must not commence until, for that work, an operational drainage management plan (in accordance with the outline operational drainage management plan) has, been submitted to and approved by Lancashire County Council and in consultation with the Environment Agency as appropriate. The operational drainage management plan must be substantially in accordance with the principles set out in the outline operational drainage management plan.

(2)The operational drainage management plan must be implemented in accordance with the approved details, prior to final commissioning of Work No. 21A.

The Transmission Assets may adopt a staged approach to the approval of DCO requirements. This will enable requirements to be approved in part or in whole, prior to the commencement of the relevant stage of works in accordance with whether staged approach is to be taken to the delivery of the each of the offshore wind farms.

1.1.5.4 For onshore (landward of MHWS) and intertidal works (between MLWS and MHWS), this approach will be governed by the inclusion of Requirement 3 within the draft DCO, which requires notification to be submitted to the relevant planning authority/authorities detailing whether Project A or Project B relevant works will be constructed in a single stage; or in two or more stages to be approved prior to the commencement of the authorised development.

1.2 Existing Site Assessment

1.2.1 Site Description - Morgan Substation

1.2.1.1 The Morgan substation site is located between Kirkham and Freckleton, directly to the south of the A583 Kirkham Bypass. HM Prison Kirkham is to the north west of the site and Newton-with-Scales is to the east.

1.2.1.2 Public bridleway BW0505016 runs from Lower Lane, Hall Cross, located to the west of the of the site, and connects to other public rights of way to the north of Freckleton. It runs adjacent to the full western extent of the site. Dow Brook runs adjacent to the eastern extent of the site.

1.2.1.3 The site is an irregular shape, set by field boundaries and Dow Brook, and is used for cattle grazing. It gently slopes in an easterly direction, from approximately 16 m AOD at its highest point down towards Dow Brook which is approximately 6 m AOD.

1.2.1.4 The British Geological Survey (BGS) website indicates that superficial deposits of Diamicton underlain by Mudstone bedrock is present at the Morgan Substation site.

1.2.2 Site Description - Morecambe Substation

1.2.2.1 The Morecambe onshore substation site is located to the south of the Morgan onshore substation site, east of Lower Lane and to the north of Freckleton. A public bridleway and Dow Brook run to the east of the site. The land at the Morecambe onshore substation site is relatively flat at between 9 to 12 m AOD. The Morecambe onshore substation will be located within a single compound. Temporary construction compounds will be located west and northwest of the substation site to facilitate construction of the substation.

1.2.2.2 The British Geological Survey (BGS) website indicates that superficial deposits of Diamicton underlain by Mudstone bedrock is present at the Morecambe Substation site.

1.2.3 Local Watercourses

1.2.3.1 The Dow Brook, which is an Environment Agency ‘Main River’, is located to the immediate east of the Morgan substation site and to the southeast of the Morecambe substation site.

1.2.3.2 There are also several Ordinary Watercourses and drainage ditches in the local area

1.2.3.3 Figure 1.1 and Figure 1.2 show the indicative substation site boundaries and the proximity to Dow Brook, on the Environment Agency’s Flood Map for Planning.

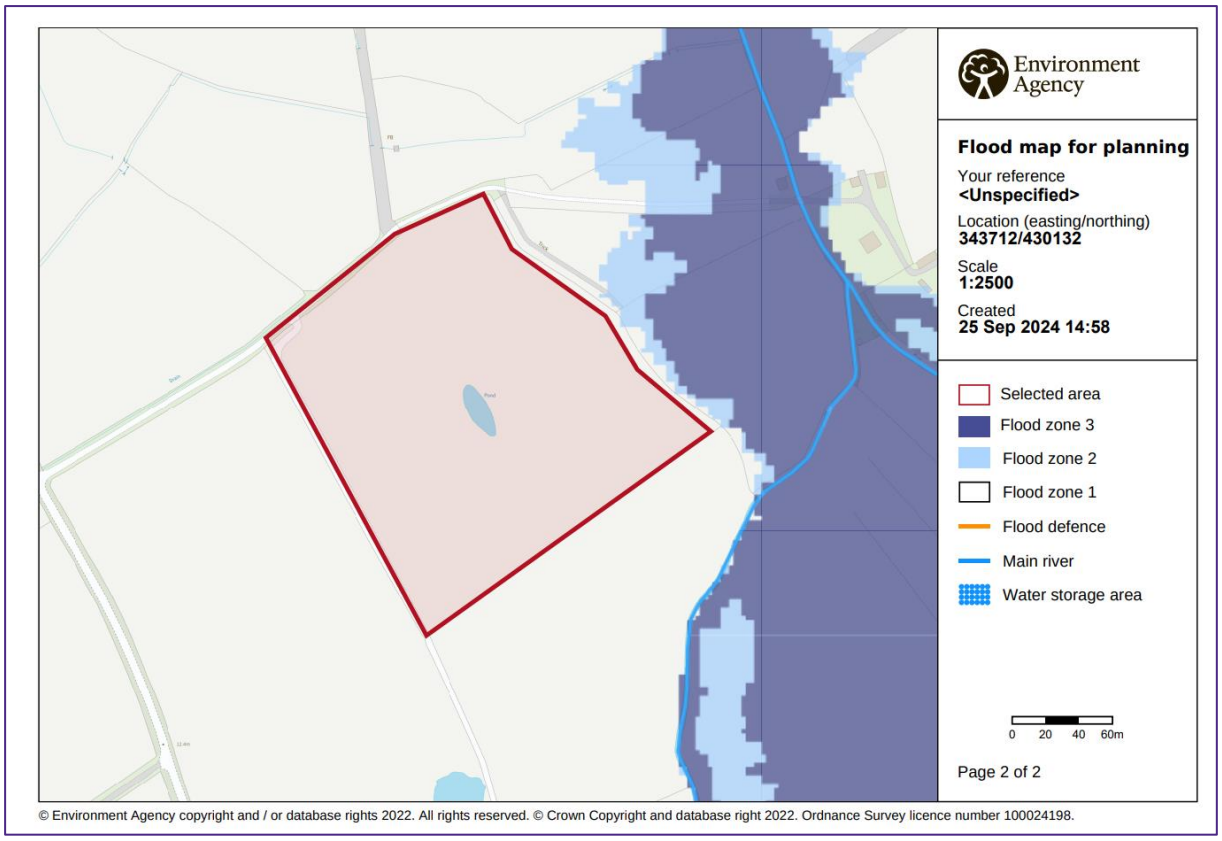

Figure 1.1: Flood Map for Planning –in relation to the approximate location of the Morecambe Onshore Substation

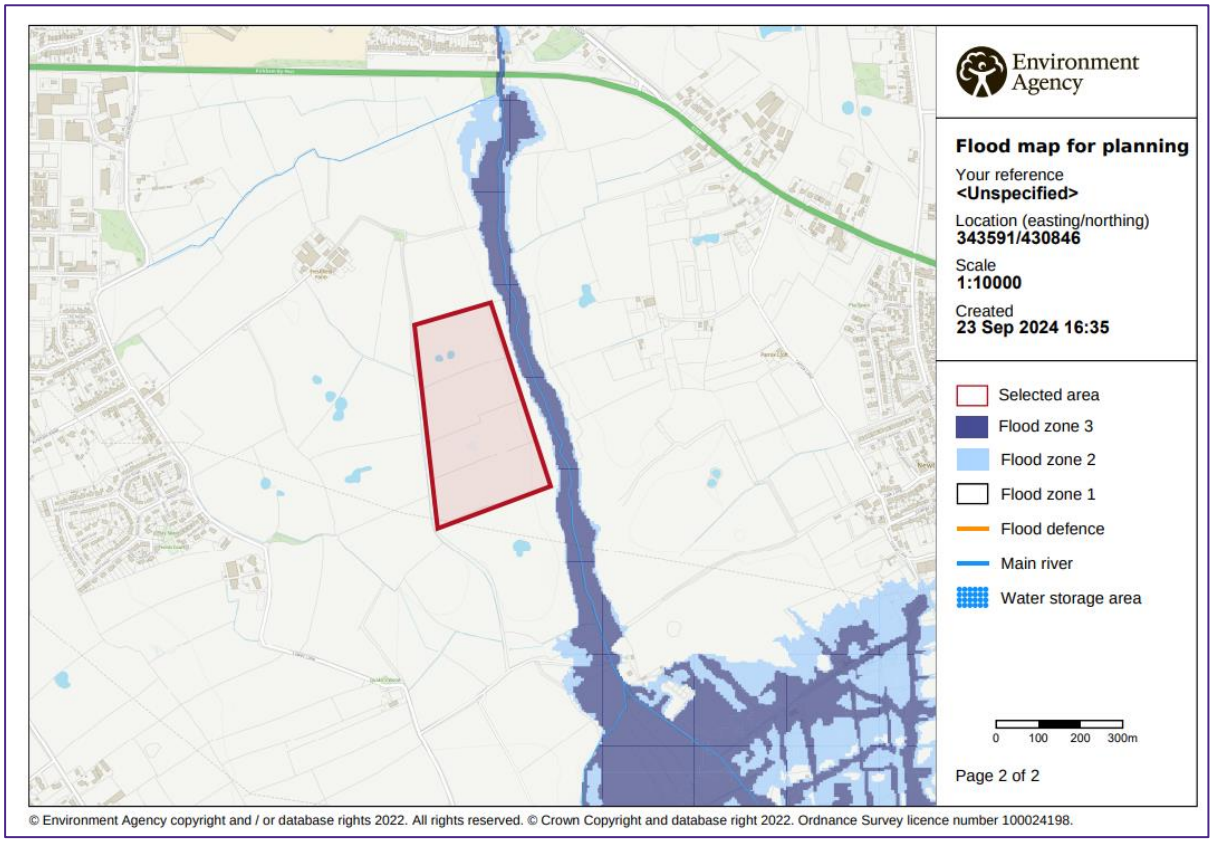

Figure 1.2: Flood Map for Planning – in relation to the approximate location of the Morgan Onshore Substation Permanent area

1.3 Ground Investigation

1.3.1 Morgan Site Infiltration Testing

1.3.1.1 Subadra Consulting Ltd attended the Morgan substation site in July 2024 and excavated two test pits. One test pit (at the northern end of the site) was excavated to 0.60m depth, and the second test pit (at the southern end of the site) was excavated to 2.0m. The infiltration tests were carried out to BRE 365 standard (which means three fills and drains are required). Figure 1.3 shows the test pit locations.

Figure 1.3: Morgan Site Test Pit Locations

1.3.1.2 Observations during the testing recorded a layer of Made Ground (comprising clayey sand with rootlets) to 0.3m depth, with Till (comprising firm grey sandy clay) below this, in both test pits. No groundwater was recorded in either pit.

1.3.1.3 Both test pits were filled and very little infiltration was observed in either pit over a duration of 4 hours. Given the first fill showed very little infiltration and it was not possible to complete the second or third fills, it was considered that the BRE 365 infiltration testing failed. Table 1.1 sets out the details of the test.

Table 1.1: Summary of Infiltration Test Results (from Infiltration Test Report – Land East of Lower Lane, Freckleton (Subadra, July 2024)

Location	Test Pit Dimensions L x W x D (m)	Soil Infiltration Rate (m/sec)			Observations
		First Fill	Second Fill	Third Fill	
TP001	1.3m x 0.35m x 0.6m	Infiltration too slow to complete first fill or provide interpolation. Soil infiltration highly likely to be <10^{-7}m/sec			Water level fell 1mm in 4 hours
TP002	1.3m x 0.35m x 2.01m				Water level fell 6mm in 4 hours

1.3.1.4 Although it was not possible to derive an infiltration rate from the test results, the engineer attending the site noted that the infiltration rate would likely be less than 10^{-7}m/s, which indicates a very low rate. This was due to there being negligible movement in the test pit, and rates greater than 10^{-7}m/s would show some movement over the testing period. Therefore, the use of infiltration for surface water drainage is not considered to be viable on the Morgan substation site.

1.3.1 Morecambe Site Infiltration Testing

1.3.1.1 Subadra Consulting Ltd attended the Morecambe substation site in August 2024 and excavated two test pits. One test pit (at the northern end of the site) was excavated to 0.60m depth, and the second test pit (at the southern end of the site) was excavated to 2.0m. The infiltration tests were carried out to BRE 365 standard (which means three fills and drains are required). Figure 1.4 shows the test pit locations.

Figure 1.4: Morecambe Test Pit Locations

1.3.1.2 Observations during the testing recorded a layer of Made Ground (comprising clayey sand with rootlets) to 0.10m depth, with Till (comprising firm brown sandy clay) below this, in both test pits. No groundwater was recorded in either pit.

1.3.1.3 Both test pits were filled and very little infiltration was observed in either pit over a duration of 4 hours. Given the first fill showed very little infiltration and it was not possible to complete the second or third fills, it was considered that the BRE 365 infiltration testing failed. Table 1.2 sets out the details of the test.

Table 1.2: Summary of Infiltration Test Results (from Infiltration Test Report – Land East of Lower Lane, Freckleton (Subadra, August 2024)

Location	Test Pit Dimensions L x W x D (m)	Soil Infiltration Rate (m/sec)			Observations
		First Fill	Second Fill	Third Fill	
TP001	0.9m x 0.35m x 0.61m	Infiltration too slow to complete first fill or provide interpolation. Soil infiltration highly likely to be $<10^{-7}$m/sec			Water level fell 33mm in 4 hours, with only 3mm of movement in the last hour
TP002	1.0m x 0.35m x 2.0m				Water level fell by 10mm in 5 hours, with no recorded movement in the last 3 hours.

1.4 Operational Drainage

1.4.1 Sustainable Drainage Systems

Under the requirements of the NPPF and associated guidance and National Policy Statements, surface water runoff generated from hardstanding areas of developments, need to be attenuated, so that the peak rate of surface water runoff discharged is no greater than the QBAR rate.

1.4.1.1 The use of Sustainable Drainage Systems (SuDS) in sustainable water management is promoted through the National Planning Policy Framework and associated planning policy guidance. Additional best practice guidance is provided in The SuDS Manual (CIRIA C753). These documents identify a hierarchy of techniques:

- 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); and
- Regional Control – management of runoff from several sites, typically in a detention pond or wetland.

1.4.1.2 The implementation of SuDS as opposed to conventional drainage systems, can provide multiple 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.
- Reducing potable water demand through rainwater harvesting;
- Improving amenity through the provision of public open spaces and wildlife habitat; and,
- Replicating natural drainage patterns, including the recharge of groundwater so that base flows are maintained.

1.4.2 SuDs at the Onshore Substations

1.4.2.1 SuDS components should be designed to accommodate and dispose of runoff from storms, without causing flooding to properties up to and including the 1% AEP (1 in 100 year) event, including an allowance for the current predicted impacts of climate change, as specified in the 'Sustainable drainage systems: non-statutory technical standards', published by the Department for Environment, Food & Rural Affairs (DEFRA) (2015).

1.4.2.2 Under the requirements of the 'Sustainable drainage systems: non-statutory technical standards', published by the ~~Department for Environment, Food & Rural Affairs (DEFRA)~~DEFRA (2015), it states that where practicable, peak surface water discharge rates should be limited to as close to the pre-development (greenfield) surface water runoff rate as possible.

1.4.2.3 The National Standards for Sustainable Drainage Systems (SuDS) was published by the DEFRA in June 2025. There are seven standards – the hierarchy standard (standard 1) which relates to the final runoff destination; and fixed standards (standards 2 to 7) which state the minimum design criteria that all surface water drainage systems should satisfy and how they should be built, maintained and operated.

1.4.2.4 The National Standards for SuDS acknowledges that there may be specific circumstances or constraints (such as type of development, location or size) which mean that it is not possible to deliver one or more of the standards. Where a standard cannot be delivered under specific circumstances, justification should be developed in consultation with the approving body.

1.4.2.5 The seven standards listed within the National Standards for SuDs are set out in the Table below:

Table 1.3: The seven standards of the National Standards for SuDS (Adapted from DEFRA, 2025)

Standard	Requirement
Standard 1: Runoff Destinations	Requires that runoff from a development shall be discharged to the following final destinations, to the maximum extent practicable, in accordance with the below hierarchy: • priority 1: collected for non-potable use • priority 2: infiltrated to ground • priority 3: discharged to an above ground surface water body • priority 4: discharged to a surface water sewer, or another piped surface water drainage system • priority 5: discharged to a combined sewer
Standard 2: Management of Everyday Rainfall (Interception)	Evidence shall be provided that the approach to managing runoff from 'everyday' rainfall has been developed alongside and in support of the management of runoff quality (standard 4) and the delivery of amenity and biodiversity benefits (standards 5 and 6)
Standard 3: Management of Extreme Rainfall and Flooding	Evidence that the 'SuDS approach' addresses the management of development runoff during extreme rainfall, including allowances for climate change and urban creep.
Standard 4: Water Quality	Apply a 'SuDS approach' that protects surface waters, groundwater and coastal waters by managing the quality of the surface water runoff to adequately address water quality risks from the development.
Standard 5: Amenity	A 'SuDS approach' shall be adopted that maximises benefits for amenity through the creation of multi-functional places and landscapes.
Standard 6: Biodiversity	A 'SuDS approach' shall be adopted to ensure the surface water drainage system maximises biodiversity benefits throughout the development lifecycle
Standard 7: Design of Drainage for Construction, Operational, Maintenance, Decommissioning and Structural Integrity	A 'SuDS approach' shall be adopted to ensure that surface water drainage systems are designed so they can be easily and safely constructed, operated and maintained taking account of the need to minimise negative impacts on natural resources and the environment.

1.4.2.6 The National Standards for Sustainable Drainage Systems have been considered for the proposed development and highlighted where relevant. However, given this is an Outline Operational Drainage Management Plan, design parameters have not yet been fixed, which means that some of the standards cannot be demonstrated until detailed design stage. Thus, these standards will be incorporated into the Detailed Operational Drainage Management Plan, at detailed design stage.

~~1.4.2.3~~1.4.2.7 The only above ground, permanent structures associated with the Transmission Assets are the onshore substations. These permanent elements are the focus of this Outline Operational Drainage Management Plan

~~1.4.2.4~~1.4.2.8 The proposed onshore substations should utilise SuDS unless there are practical reasons for not doing so. The onshore substation drainage systems should aim to manage surface water runoff as close to its source as possible. Drainage should be designed and implemented in ways that deliver other policy objectives, including water use efficiency and quality, biodiversity, amenity, and recreation.

~~1.4.2.5~~1.4.2.9 The DEFRA Report entitled 'Rainfall Runoff Management for Developments' (DEFRA, 2013) recommends that the design principle is to limit the runoff for events of similar frequency of occurrence to the same peak rate of runoff as that which takes place from greenfield sites. However, there are two situations where the greenfield flow rate is not actually applied to define the limiting discharge rates:

- The limit of discharges based on QBAR that are less than 1 l/s/ha for permeable sites, as this is seen as being an unreasonable requirement (producing very large storage volumes). QBAR is then set to 1 l/s/ha;
- Small sites which would require impractically small controls to achieve the required flow rates, i.e. where these are calculated to be less than 5 l/s.

~~1.4.2.6~~1.4.2.10 To limit flows as close as possible to the respective greenfield runoff rates, the use of orifice plates is recommended. Sub-chapter 20.5 section c) of The SuDS Manual (C753) (CIRIA, 2015) specifies that the minimum diameter outflow control for orifice plates for permeable paving can be 20mm – due to the runoff flowing through a 6-20mm clean crushed stone aggregate, trapping all objects greater than 20mm in diameter. The orifice plates should also be provided with a filter mesh and the manhole access cover sealed. For rainfall from areas that do not pass through permeable paving, typical guidance is to use a 50mm orifice plate, or similar flow control.

~~1.4.2.7~~1.4.2.11 The management of surface water has been considered with respect to the SuDS hierarchy and site constraints, in Table 1.4 (as detailed in The SUDS Manual (C753) (CIRIA, 2015) Section 3.2.3). This is also in line with 'Standard 1: Runoff Destinations' of the National Standards for Sustainable Drainage Systems (DEFRA, 2025).

Table 1.4: The SuDS Hierarchy (Adapted from The SUDS Manual (C753) (CIRIA, 2015), Section 3.2.3)

Hierarchy (most preferred first)	Anticipated to be suitable?	Comment
1. Store rainwater for later use	No	The proposed development is for the electricity substations, and there is not anticipated to be any demand for rainwater harvesting.

Hierarchy (most preferred first)	Anticipated to be suitable?	Comment
2. Discharge to the ground (infiltration)	No	Infiltration tests at both of the onshore substation sites failed to achieve three fills (as per BRE365 guidance), which indicates that infiltration is not likely to be suitable to manage surface water runoff at either site, at this time.
3. Discharge to Surface Water (watercourse, lake, canal, etc.)	Yes	Surface water from the onshore substation sites is proposed to discharge via controlled outfalls into the Dow Brook (subject to LLFA and Environment Agency consent, as appropriate)
4. Discharge to Surface Water Sewer, Highway Drain or another Drainage System	No	Discharge to a watercourse has a higher position on the drainage hierarchy and therefore takes precedent over these methods.
5. Discharge to Combined Sewer		
6. Discharge to Foul Sewer		

~~1.4.2.8~~1.4.2.12 According to the SuDS hierarchy above, the most suitable discharge method and location for surface water from the onshore substation sites is to the Dow Brook, which is a 'Main River' close to the sites. A new headwall may be required on the watercourse at a suitable point to form the outfall at each of the onshore substation sites.

~~1.4.2.9~~1.4.2.13 The various SuDS methods have been considered in relation to site-specific constraints. Table 1.5 outlines the constraints and opportunities associated with the use of each of the SuDS components in accordance with the hierarchical approach outlined in The SuDS Manual (C753) (CIRIA, 2015). It indicates which of these components could and could not be incorporated within the design, based upon site-specific criteria. The site-specific constraints for each of the onshore substation sites are the same.

Table 1.5: SuDS Selection Matrix

SuDS Component	Description	Constraints and Opportunities	Anticipated to be suitable?
Infiltrating SuDS	Infiltration can contribute to reducing runoff rates and volumes while supporting baseflow and groundwater recharge processes. The suitability and infiltration rate depends on the permeability of the surrounding soils.	Infiltration tests confirmed geology of Made Ground and Clay, which is likely to have resulted in very slow infiltration rates and failure to drain the first fill. In addition, the underlying geology of Till has low permeability. Estimated infiltration rate is less than 1 x 10-7m/s, and further ground investigation will be carried out to substantiate this assumption, prior to construction.	No
Filter Drains and Filter Strips	Filter drains are shallow trenches filled with stone gravel that create temporary subsurface storage for the attenuation, conveyance and filtration of surface water runoff. Filter strips are uniformly graded and gently sloping strips of grass or dense vegetation, designed to treat runoff from adjacent impermeable areas by promoting sedimentation, filtration and infiltration.	Can be utilised where possible but may be limited by spatial constraints.	Yes
Pervious Surfaces	Pervious surfaces can be used in combination with aggregate sub-base and/or geocellular/modular storage to attenuate and/or infiltrate runoff from surrounding surfaces and roofs. Liners can be used where ground conditions are not suitable for infiltration.	Permeable paving could be provided within suitable hardstanding areas to provide attenuation for runoff, rather than infiltration. A clear zone for the provision of utility services should be allowed for outside of the permeable paving.	Yes
Green and Blue Roofs	Green Roofs provide areas of visual benefit, ecological value, enhanced building performance and the reduction of surface water runoff. They are generally more costly to install and maintain than conventional roofs but can provide many long-term benefits and reduce the on-site storage volumes.	The volume of surface water attenuation which can be achieved through the use of green roofs is likely to be limited. Given the nature of the onshore substations it is unlikely that extensive roof areas will be available to provide this element.	No
Rainwater Harvesting	Rainwater Harvesting is the collection of rainwater runoff for use. It can be collected from roofs or other impermeable areas, stored, treated (where required) and then used as a supply of water for domestic, commercial and industrial properties.	The proposed development is for an electricity substation, and there is not anticipated to be any demand for rainwater harvesting.	No

SuDS Component	Description	Constraints and Opportunities	Anticipated to be suitable?
Swales	Swales are designed to convey, treat and attenuate surface water runoff and provide aesthetic and biodiversity benefits. They can replace conventional pipework as a means of conveying runoff; however space constraints of some sites can make it difficult incorporating them into the design.	Can be utilised where possible but may be limited by spatial constraints. This is more likely to be appropriate around the periphery of the onshore substation platform.	Yes
Rills and Channels	Rills and Channels keep runoff on the surface and convey runoff along the surface to downstream SuDS components. They can be incorporated into the design to provide a visually appealing method of conveyance. They also provide effectiveness in pre-treatment removal of silts.	At this outline stage, it is not possible to determine the exact composition of each feature. However, given the type of development, it is unlikely that rills and channels will be included.	No
Bioretention Systems	Bioretention systems can reduce runoff rates and volumes and treat pollution through the use of engineer soils and vegetation. They are particularly effective in delivering interception but can also be an attractive landscape feature whilst providing habitat and biodiversity.	At this outline stage, it is not possible to determine the exact composition of each feature. However, bioretention systems may be included as a water quality measure.	Yes
Retention Ponds and Wetlands	Ponds and Wetlands are features with a permanent pool of water that provide both attenuation and treatment of surface water runoff. They enhance treatment processes and have great amenity and biodiversity benefits. Often a flow control system at the outfall controls the rates of discharge for a range of water levels during storm events.	Water attenuation feature(s) which may include features such as a pond, has been included in this outline plan under drainage design to attenuate and help filter runoff prior to discharge to the nearby watercourse.	Yes
Detention Basins	Detention Basins are landscaped depressions that are usually dry, except during and immediately following storm events, and can be used as a recreational or other amenity facility. They are generally appropriate to manage high volumes of surface water from larger sites, such as a neighbourhood.	If a pond is not viable, then a detention basin can be used. This could offer the same attenuation volumes and could remain dry during the drier weather.	Yes
Geo-cellular Systems	Attenuation storage tanks are used to create a below-ground void space for the temporary storage of surface water before infiltration, controlled release or use. The inherent flexibility in size and shape means they can be tailored to suit the specific characteristics and requirements of any site.	If necessary, these could be provided to complement the other SuDS solutions. However, these should only be used should there be insufficient attenuation storage available through the use of other measures.	Yes

SuDS Component	Description	Constraints and Opportunities	Anticipated to be suitable?
Proprietary Treatment Systems	Proprietary treatment systems are manufactured products that remove specific pollutants from surface water runoff. They are especially useful where site constraints preclude the use of other methods and can be useful in reducing the maintenance requirements of downstream SuDS.	At this outline stage, it is not possible to determine the exact composition of each feature. However, proprietary treatment systems may be included as a water quality measure.	Yes

~~1.4.2.10~~1.4.2.14 Given the considerations above and the nature of the proposed development, it is recommended that runoff from the onshore substation sites will be directed to include water attenuation(s) which may take the form of including ponds. The ponds would store and help to filter the runoff before it is discharged. The final outfalls will be to the Dow Brook to the east of each of the onshore substation sites.

~~1.4.2.11~~1.4.2.15 It is possible that other SuDS components can be included in the final drainage design to complement the ponds. However, the final plans have not yet been produced. Therefore, the outline drainage design has assumed that all of the runoff from the proposed development will be stored in the ponds. This will result in a maximum design scenario as it will determine the maximum storage volume that might be required in the pond.

1.4.3 Climate Change Allowances

1.4.3.1 Surface water (pluvial) climate change allowances are determined by the predicted increase in peak rainfall intensity. These are defined by regional variations, which are based on a series of management catchments. Management catchments are sub-catchments of river basin districts, as set out by the Environment Agency in the guidance 'Peak rainfall climate change allowances by management catchment', (May 2022), on the gov.uk website.

1.4.3.2 The proposed substation sites are both located within the Ribble Management Catchment. Table 1.6 presents the Peak Rainfall Intensity climate change allowances for the Ribble Management Catchment.

Table 1.6: Peak Rainfall Intensity Allowance

Management catchment name	Allowance category	Total potential change anticipated for '2050s' (2040-2060)	Total potential change anticipated for '2070s' (2061-2125)
Ribble	Upper Estimate	40%	50%
	Central Estimate	25%	35%

1.4.3.3 It is understood that the two proposed onshore substations are expected to have an operational lifetime of 35 years.

1.4.3.4 Guidance on peak rainfall intensity climate change published on the Gov.Uk website states:

'For development with a lifetime between 2061 and 2100, …use the central allowance for the 2070s epoch (2061 to 2125).'

This means that a **35%** climate change allowance would be appropriate for the proposed drainage systems serving the onshore substations, for the 1 in 100 year (1% AEP) event. It is noted in 'Standard 3: Management of Extreme Rainfall and Flooding' of the National

Standards for Sustainable Drainage Systems (DEFRA, 2025) that the Upper End Allowance shall be used for the relevant epoch based on the design lifetime of the proposed development. Therefore, during the detailed design stage, the Upper End Allowance of 50% climate change will be applied. The increase in climate change allowance can be managed through the design of the attenuation features, e.g. by increasing the surface area of the ponds or making them deeper, to ensure the additional capacity is provided.

1.4.3.5 With reference to the Gov.Uk website, a climate change allowance of 30% has been applied to the 1 in 30 year (3.3% AEP) event. Greenfield Runoff Rates

Morgan Substation

1.4.3.6 Greenfield runoff rates were estimated using the ICP SuDS method within the MicroDrainage software.

1.4.3.7 The following parameters were used in the greenfield runoff calculations:

- Impermeable Area: 1 hectare
- Soil Factor (global soils index): 0.45
- Standard-period Average Annual Rainfall (SAAR) (mm): 900
- Urban: 0
- Region Number: 10

1.4.3.8 It is understood that the Morgan Substation development platform area is a maximum of 8.0 ha.

1.4.3.9 Of this 8.0 ha, it is assumed that 60% would form the impermeable area. In addition, the surface area of the water attenuation pond has been included in the assessment as it is considered to be impermeable, to account for the rainfall falling directly onto the pond. The total impermeable area will be **5.58 ha**, as shown in Table 1.7.

Table 1.7: Morgan Substation Impermeable Areas

Development Platform Area	60% Impermeable Area	Pond Surface Area	Total Impermeable Area
8 ha	4.8 ha	0.78 ha	5.58 ha

1.4.3.10 Table 1.8 sets out the greenfield runoff rates for the proposed development impermeable area of 5.58 ha. It also includes, for comparison, the 1 ha greenfield runoff rates. The ICP SuDS output from MicroDrainage has been included in Appendix A.

Table 1.8: Greenfield Runoff Rates

Return Period	Greenfield Rate (l/s) 1ha	Greenfield Rate (l/s) 4.8ha + Pond Area of 0.78ha (Total Impermeable area: 5.58 ha)
1 year	5.1	28.4
2 year (QBAR)	5.9	32.9
30 year	10.0	55.8
100 year	12.3	68.6

1.4.3.11 Assuming 60% impermeable area plus the pond area which would be 0.78 ha, this would result in a QBAR rate of **32.9 l/s**.

1.4.3.12 It is necessary to account for a 35% increase in climate change when estimating the required storage volume.

1.4.3.13 At this outline stage, it has been assumed that all the runoff from the impermeable areas will be attenuated in a large pond located in the lower lying area to the southeast of the substation platform. 'Standard 6: Biodiversity' has been considered in the selection of the attenuation feature, as the provision of a pond will help to support biodiversity at the site taking into account measures to discourage flocking birds from gathering in line with the Outline Wildlife Hazard Management Plan which is Appendix E of the Outline Ecological Management Plan (document reference J6/F04). Further opportunities to provide biodiversity measures through additional SuDS features will be explored during detailed design.

~~1.4.3.13~~1.4.3.14 'Standard 2: Management of Everyday Rainfall (Interception)' of the National Standards for Sustainable Drainage Systems (DEFRA, 2025) requires evidence to demonstrate that the first 5mm of rainfall do not result in runoff from the site to surface waters. At outline stage, it is not possible to deliver this standard as final plans have not been fixed and the drainage system has been based on assumed impermeable area. However, this element will be included in the Detailed Operational Drainage Management Plan.

~~1.4.3.14~~1.4.3.15 The pond would have a controlled outfall to the Dow Brook, which is located to the immediate east. At this stage, the invert level of the receiving watercourse is unknown but it has been assumed that a gravity connection is possible.

~~1.4.3.15~~1.4.3.16 The pond was designed in MicroDrainage Source Control, based on FEH 22 rainfall data. The FEH 22 details are included in Appendix B. The pond details are as follows:

- Surface Area: 7,799 m^2
- Depth: 1.60 m
- Top of Bank: 8.50 m AOD

- Bed Level: 6.90 m AOD
- 1:3 Side Slope

~~1.4.3.16~~1.4.3.17 A Hydrobrake Optimum flow control device has been modelled on the outfall, which will control the discharge rate from all events to the QBAR rate of 32.9 l/s. The maximum attenuation volume required in a 1 in 100 year (+35%CC) event is **4,523m^3**. It is anticipated that this can be accommodated in the proposed pond with no flooding of the system. This is in line with 'Standard 3: Management of Extreme Rainfall and Flooding' of the National Standards for Sustainable Drainage Systems (DEFRA, 2025) which requires the 1 in 100 year runoff rates to a surface water body to be controlled to prevent flood risk increasing elsewhere.

~~1.4.3.17~~1.4.3.18 All parts of the surface water network should drain via a Downstream Defender (or similar pollution control device), which will collect debris and filter the runoff prior to it entering the pond.

~~1.4.3.18~~1.4.3.19 The MicroDrainage Source Control results for the 1 in 2 year (+35%CC), 1 in 30 year (+35%CC) and 1 in 100 year (+35%CC) are included in Appendix B and the outline drainage plan is included in Appendix B.

~~1.4.3.19~~1.4.3.20 In the unlikely event of the pond (or equivalent water attenuation feature) capacity becoming exceeded and overtopping, it is anticipated that surface water would continue to follow the lower lying land to the east of the substation platform and flow into the Dow Brook. It is highly unlikely that exceedance flows would result in a significant flood risk to people or property, given the area is largely undeveloped. Given the low probability of an exceedance event occurring, this is considered a residual risk. Exceedance arrows have been added to the drainage plan in Appendix B which indicate the direction of flow in this event.

1.4.3.21 It is noted that the proposed use of a pond to attenuate the runoff along with planting of trees/vegetation at various locations will help to achieve Standard 5 of the National Standards for Sustainable Drainage Systems (DEFRA, 2025), by providing landscaping and visual benefits. This element will be further demonstrated in the Detailed Operational Drainage Management Plan at detailed design stage.

Morecambe Substation

~~1.4.3.20~~1.4.3.22 Greenfield runoff rates were estimated using the ICP SuDS method within the MicroDrainage software.

~~1.4.3.21~~1.4.3.23 It is understood that the Morecambe Substation development platform area is 3.0 ha.

~~1.4.3.22~~1.4.3.24 Of this 3.0 ha, it is assumed that 60% would form the impermeable area. In addition, the surface area of the attenuation pond has been included in the assessment as it is considered to be

impermeable, to account for the rainfall falling directly onto the pond. The total impermeable area will be **2.3 ha**, as shown in Table 1.9.

Table 1.9: Morecambe Substation Impermeable Areas

Development Platform Area	60% Impermeable Area	Pond Surface Area	Total Impermeable Area
3 ha	1.8 ha	0.5 ha	2.3 ha

~~1.4.3.23~~1.4.3.25 ~~Table 1.9Table 1.7~~Table 1.8 sets out the greenfield runoff rates for the proposed development impermeable area of 2.3 ha. It also includes, for comparison, the 1 ha greenfield runoff rates. The ICP SuDS output from MicroDrainage has been included in Appendix A.

Table 1.10: Greenfield Runoff Rates

Return Period	Greenfield Rate (l/s) 1ha	Greenfield Rate (l/s) 1.8ha + Pond Area of 0.5ha (Total Impermeable area: 2.3 ha)
1 year	5.1	11.7
2 year (QBAR)	5.9	13.6
30 year	10.0	23.0
100 year	12.3	28.3

~~1.4.3.24~~1.4.3.26 As shown in Table 1.10, the QBAR greenfield runoff rate for the Morecambe substation site has been estimated to be 5.9 l/s/ha. Assuming 60% impermeable area (an area of 1.8 ha) plus the pond area which would be 0.5 ha, this would result in a QBAR rate of **13.6 l/s**.

~~1.4.3.25~~1.4.3.27 It is necessary to account for a 35% increase in climate change when estimating the required storage volume.

1.4.3.28 At this outline stage, it has been assumed that all the runoff from the impermeable areas will be attenuated in a large pond located in the area to the northeast of the substation platform. 'Standard 6: Biodiversity' has been considered in the selection of the attenuation feature, as the pond design will help to support biodiversity at the site taking into account measures to discourage flocking birds from gathering in line with the Outline Wildlife Hazard Management Plan which is Appendix E of the Outline Ecological Management Plan (document reference J6/F04). Further opportunities to provide biodiversity measures through additional SuDS features will be explored during detailed design.

1.4.3.29 'Standard 2: Management of Everyday Rainfall (Interception)' of the National Standards for Sustainable Drainage Systems (DEFRA, 2025) requires evidence to demonstrate that the first 5mm of rainfall do not

result in runoff from the site to surface waters. This element will be demonstrated in the Detailed Operational Drainage Management Plan at detailed design stage when the final design parameters are fixed.

~~1.4.3.26~~

~~1.4.3.27~~1.4.3.30 The pond would have a controlled outfall to the Dow Brook, which is located to the east. At this stage, the invert level of the receiving watercourse is unknown but it has been assumed that a gravity connection is possible.

~~1.4.3.28~~1.4.3.31 The pond was designed in MicroDrainage Source Control, based on FEH 22 rainfall data. The FEH 22 details are included in Appendix C. The pond details are as follows:

- Surface Area: 5,008 m^2
- Depth: 1.50 m
- Top of Bank: 8.40 m AOD
- Bed Level: 6.90 m AOD
- 1:3 Side Slopes

~~1.4.3.29~~1.4.3.32 A Hydrobrake Optimum flow control device is proposed on the outfall, which will control the discharge rate from all events to the QBAR rate of 13.6 l/s. The maximum attenuation volume required in a 1 in 100 year (+35%CC) event is **1,869m^3.** This can be accommodated in the proposed pond with no flooding of the system.

1.4.3.33 This is in line with 'Standard 3: Management of Extreme Rainfall and Flooding' of the National Standards for Sustainable Drainage Systems which requires the 1 in 100 year runoff rates to a surface water body to be controlled to prevent flood risk increasing elsewhere.

~~1.4.3.30~~1.4.3.34 All parts of the surface water network should drain via a Downstream Defender (or similar pollution control device), which will collect debris and filter the runoff prior to it entering the pond.

~~1.4.3.31~~1.4.3.35 The MicroDrainage Source Control results for the 1 in 2 year (+35%CC), 1 in 30 year (+35%CC) and 1 in 100 year (+35%CC) are included in Appendix C and the outline drainage plan is included in Appendix C.

~~1.4.3.32~~1.4.3.36 In the unlikely event of the pond capacity becoming exceeded and overtopping, it is anticipated that surface water would continue to follow the lower lying land to the southeast of the substation platform and flow into the Dow Brook. It is highly unlikely that exceedance flows would result in a significant flood risk to people or property, given the area is largely undeveloped. Given the low probability of an exceedance event occurring, this is considered a residual risk. Exceedance arrows have been added to the drainage plan in Appendix C to indicate the direction of flow in this event.

1.4.3.37 It is noted that the proposed use of a pond to attenuate the runoff along with planting of trees/vegetation at various locations will help to achieve Standard 5 of the National Standards for Sustainable Drainage Systems (DEFRA, 2025), by providing landscaping and visual benefits. This

element will be further demonstrated in the Detailed Operational Drainage Management Plan at detailed design stage.

1.5 Water Quality

1.5.1.1 Surface water runoff from impermeable surfaces can mobilise debris and pollution into drainage systems and watercourses. To mitigate this risk, a treatment train of SuDS can be used to improve the quality of surface water discharged from a site. This has the added benefit of helping to protect the downstream receiving watercourse.

1.5.1.2 The drainage system has been designed to meet the water quality requirements set out by Table 26.2 of the CIRIA SuDS Manual C753 which sets out the specific pollution hazard indices for various land uses.

1.5.1.3 As specific indices for substation sites are not included, it is considered suitable to use the values for '*Sites with heavy pollution (e.g. haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways.*'

1.5.1.4 This is because there is likely to be oil and other chemicals stored and used onsite. The Pollution Hazard Indices are summarised in Table 1.11.

Table 1.11: Summary of Pollution Hazard Indices (Extracted from CIRIA SuDS Manual C753 Simple Index Approach Tool)

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured	High	0.80	0.80	0.90

1.5.1.5 Mitigation measures such as bunds and interceptors will be included in the designs for each of the onshore substations to manage accidental spillages; further details on the mitigation measures and any further opportunities to include SuDS components in the surface water drainage design will be included in the detailed surface water drainage design.

1.5.1.6 However, using the assumption that the only SuDS measure included within the design is the attenuation pond and a Downstream Defender or similar on the inflow to the pond (or equivalent water attenuation feature), the pollution mitigation shown in Table 1.12 would apply.

Table 1.12: SuDS Component Pollution Mitigation (Extracted and adapted from the CIRIA SuDS Manual C753 Simple Index Approach Tool)

SuDS Component	Pollution Mitigation Indices		
	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Downstream Defender (or similar)	0.70	0.60	0.70
Pond or Wetland	(0.70)/2 = 0.35	(0.70)/2 = 0.35	(0.50)/2 = 0.25
Requirement	**1.05**	**0.95**	**0.95**
Outcome	**Acceptable**	**Acceptable**	**Acceptable**

1.5.1.7 The pollutant mitigation measures would be sufficient to manage the pollution hazards in this case, therefore the inclusion of an attenuation pond as a SuDS measure is considered to be acceptable.

1.5.1.8 The water quality assessment and identification of hazards and mitigation outlines above delivers Standard 4: Water Quality of the National Standards for Sustainable Drainage Systems.

1.5.1.9 It is noted that 'Standard 7: Design of Drainage for Construction, Operation, Maintenance, Decommissioning and Structural Integrity' cannot be delivered as part of the Outline Operational Drainage Management Plan as the fixed plans and final drainage elements have not been confirmed. This information will be provided as part of the Detailed Operational Drainage Management Plan to be submitted at detailed design stage.

~~1.5.1.8~~1.5.1.10 The Lancashire County Council Sustainable Drainage (SuDS) Pro-Forma will be completed separately for the Morgan and Morecambe substations as part of the full application post-consent/ prior to construction.

1.6 Conclusions

1.6.1.1 This document forms the Outline Operational Drainage Management Plan prepared for the Morgan and Morecambe Offshore Wind Farms: Transmission Assets.

1.6.1.2 The only permanent above ground, onshore elements that would require consideration of the management of surface water runoff, would be from the two proposed onshore substations. Therefore, the focus of this Outline Operational Drainage Management Plan is on the management of runoff from these areas only.

1.6.1.3 Infiltration testing confirmed that neither the Morgan nor the Morecambe substation sites had good drainage potential. This means that infiltration is not considered to be a viable approach for the management of surface water runoff from either of the onshore substation sites at this time.

1.6.1.4 On this basis, a water attenuation and discharge strategy is recommended. Final layout plans for the onshore substation platform are not yet available. Therefore it is assumed, for the purpose of the outline drainage design, a worst-case 60% of the onshore substation platforms would comprise impermeable areas. In addition, the surface areas of the proposed water attenuation features/ponds have been included within the impermeable area. A 35% allowance for climate change has also been applied.

1.6.1.5 Detailed Operational Drainage Management plan(s) will be developed post consent, and will be in accordance with this outline drainage strategy, in order to achieve a QBAR discharge via water attenuation feature(s) which may comprise ponds or detention basins, to Dow Brook.

1.6.1.6 Greenfield runoff rates for each of the sites were estimated using the ICP SuDS method. It is proposed that the runoff from each site is controlled to the equivalent QBAR runoff rate for the proposed impermeable areas, for all events up to and including the 1% AEP (1 in 100 year) event, including an allowance for climate change.

1.6.1.7 The flow control device in each case is a Hydrobrake Optimum. It is currently assumed that a gravity connection from the pond to the Dow Brook is possible. Should this not be the case a pump may be required on the outfall from the pond in the event that the invert level for the receiving watercourse is higher than the base of the pond. The receiving watercourse (the Dow Brook) top of banks and bed level at the location of the proposed headwall should be surveyed prior to detailed design, to inform the detailed drainage design. A Downstream Defender or similar pollution interceptor will be included on the inflow to the pond, to filter and remove debris and hydrocarbons from the runoff.

1.6.1.8 MicroDrainage Source Control was used to calculate the required storage volume for each of the onshore substation sites, assuming that water attenuation features in the form of ponds are the only SuDS components which would be included. This provides a reasonable worst-case for the maximum size of the ponds. The FEH 22 rainfall

data was used in the design of the ponds. The MicroDrainage results and an indicative outline drainage design plan are provided as appendices to this document. The Source Control model confirms that the ponds have been sized to accommodate surface water up to and including a 1 in 100 year (+40%CC) storm event with no flooding occurring.

1.6.1.9 In an exceedance event, if the capacity of either attenuation pond was exceeded, it is likely that surface water would follow the local topography and pass to the east of each substation platform, eventually flowing into the Dow Brook.

1.6.1.10 With regards to water quality, comparison with the CIRIA Pollution Hazard Indices demonstrates that the inclusion of a pond alone would be sufficient to manage the pollutants leaving the onshore substation sites.

1.7 References

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Appendix A: Greenfield Runoff Rates 1 Hectare

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	1.000	Urban	0.000
SAAR (mm)	900	Region Number	Region 10

Results	**l/s**
QBAR Rural	5.9
QBAR Urban	5.9
Q100 years	12.3
Q1 year	5.1
Q30 years	10.0
Q100 years	12.3

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Appendix B: Morgan Substation – MicroDrainage Source Control Results and Outline Drainage Plan

Morgan Site – FEH 22 Data

VERSION "FEH Web Version 1.0.0 exported at 14:08:46 GMT Tue 06-Aug-24

Parameters

Rainfall model= FEH22

Calculation type= Design rainfall

Calculation mode= For a point

Calculation location= Point GB 343581 430940 SD 43581 30940

Fixed duration= no

Annual maximum= yes

Duration hours	Duration d	2 year rainf	5 year rainf	10 year rai	20 year rai	30 year rai	50 year rai	75 year rai	100 year ra	150 year ra	200 year ra	500 year ra
0.25	0.010417	7.32	11.36	14.22	16.95	18.55	20.61	22.27	23.48	25.24	26.53	30.93
0.5	0.020833	9.52	14.83	18.62	22.3	24.5	27.29	29.59	31.29	33.83	35.64	41.81
0.75	0.03125	10.9	17.01	21.32	25.64	28.24	31.57	34.25	36.21	39.18	41.32	48.64
1	0.041667	11.96	18.61	23.36	28.14	30.98	34.67	37.7	39.91	43.13	45.51	53.65
1.25	0.052083	13.19	20.17	25.13	30.13	33.07	36.93	40.1	42.42	45.77	48.26	56.86
1.5	0.0625	14.41	21.6	26.67	31.79	34.81	38.76	42.02	44.41	47.87	50.45	59.4
1.75	0.072917	15.57	22.89	28.04	33.23	36.31	40.32	43.65	46.09	49.64	52.29	61.55
2	0.083333	16.64	24.05	29.26	34.51	37.63	41.7	45.08	47.57	51.2	53.91	63.43
2.25	0.09375	17.51	25.05	30.34	35.68	38.86	43	46.45	48.99	52.72	55.51	65.32
2.5	0.104167	18.3	25.97	31.32	36.75	39.97	44.18	47.69	50.29	54.12	56.98	67.07
2.75	0.114583	19.03	26.8	32.23	37.73	41	45.27	48.84	51.5	55.41	58.33	68.69
3	0.125	19.7	27.58	33.07	38.63	41.95	46.28	49.91	52.61	56.61	59.6	70.2
3.25	0.135417	20.33	28.3	33.85	39.48	42.84	47.23	50.91	53.66	57.73	60.79	71.62
3.5	0.145833	20.92	28.97	34.58	40.26	43.67	48.11	51.85	54.64	58.79	61.9	72.96
3.75	0.15625	21.47	29.6	35.26	41	44.45	48.95	52.73	55.56	59.78	62.96	74.23
4	0.166667	22	30.2	35.91	41.7	45.18	49.74	53.57	56.44	60.73	63.96	75.43
4.25	0.177083	22.49	30.76	36.52	42.36	45.87	50.48	54.37	57.27	61.62	64.9	76.57
4.5	0.1875	22.95	31.29	37.1	42.98	46.52	51.19	55.12	58.06	62.47	65.8	77.65
4.75	0.197917	23.39	31.8	37.65	43.57	47.14	51.86	55.84	58.82	63.28	66.65	78.69
5	0.208333	23.81	32.28	38.18	44.13	47.74	52.51	56.53	59.54	64.05	67.47	79.67
5.25	0.21875	24.22	32.73	38.68	44.67	48.3	53.12	57.19	60.23	64.79	68.25	80.62
5.5	0.229167	24.6	33.17	39.15	45.18	48.84	53.71	57.82	60.89	65.5	69.01	81.53
5.75	0.239583	24.97	33.59	39.61	45.68	49.36	54.28	58.42	61.53	66.19	69.73	82.4
6	0.25	25.32	34	40.05	46.15	49.86	54.82	59.01	62.14	66.85	70.42	83.24
6.25	0.260417	25.66	34.39	40.47	46.61	50.34	55.34	59.56	62.72	67.48	71.1	84.04
6.5	0.270833	25.99	34.76	40.87	47.05	50.81	55.84	60.1	63.29	68.09	71.75	84.82
6.75	0.28125	26.3	35.12	41.26	47.47	51.25	56.32	60.61	63.83	68.69	72.38	85.58
7	0.291667	26.61	35.46	41.63	47.88	51.69	56.79	61.11	64.36	69.26	72.99	86.3
7.25	0.302083	26.9	35.8	41.99	48.28	52.11	57.24	61.59	64.86	69.81	73.58	87
7.5	0.3125	27.19	36.12	42.34	48.66	52.51	57.68	62.06	65.36	70.35	74.15	87.68
7.75	0.322917	27.46	36.44	42.68	49.03	52.9	58.1	62.51	65.83	70.87	74.7	88.34
8	0.333333	27.73	36.74	43	49.39	53.28	58.51	62.95	66.3	71.37	75.24	88.98
8.25	0.34375	27.99	37.04	43.32	49.74	53.65	58.91	63.38	66.75	71.86	75.76	89.59
8.5	0.354167	28.24	37.33	43.63	50.08	54.01	59.3	63.79	67.18	72.34	76.27	90.19
8.75	0.364583	28.49	37.61	43.93	50.41	54.36	59.67	64.19	67.61	72.8	76.76	90.78
9	0.375	28.73	37.88	44.22	50.73	54.7	60.04	64.59	68.02	73.26	77.24	91.34
9.25	0.385417	28.96	38.14	44.51	51.05	55.03	60.39	64.97	68.42	73.7	77.71	91.89
9.5	0.395833	29.19	38.4	44.79	51.35	55.36	60.74	65.34	68.82	74.12	78.16	92.43
9.75	0.40625	29.41	38.66	45.06	51.65	55.67	61.08	65.7	69.2	74.54	78.61	92.95
10	0.416667	29.62	38.9	45.33	51.94	55.98	61.41	66.06	69.58	74.95	79.04	93.46
10.25	0.427083	29.84	39.14	45.58	52.22	56.28	61.74	66.4	69.94	75.35	79.46	93.96
10.5	0.4375	30.04	39.38	45.84	52.5	56.57	62.05	66.74	70.3	75.74	79.87	94.44
10.75	0.447917	30.24	39.61	46.08	52.77	56.86	62.36	67.07	70.65	76.12	80.28	94.91
11	0.458333	30.44	39.83	46.33	53.04	57.14	62.66	67.4	70.99	76.49	80.67	95.38
11.25	0.46875	30.64	40.06	46.56	53.3	57.41	62.96	67.71	71.32	76.85	81.06	95.83
11.5	0.479167	30.82	40.27	46.8	53.55	57.68	63.25	68.02	71.65	77.21	81.43	96.27
11.75	0.489583	31.01	40.48	47.03	53.8	57.95	63.53	68.33	71.97	77.56	81.8	96.7
12	0.5	31.19	40.69	47.25	54.04	58.2	63.81	68.63	72.29	77.9	82.16	97.12
12.25	0.510417	31.37	40.89	47.47	54.28	58.45	64.08	68.92	72.6	78.23	82.51	97.53
12.5	0.520833	31.54	41.09	47.69	54.51	58.7	64.34	69.2	72.9	78.55	82.85	97.92
12.75	0.53125	31.71	41.29	47.9	54.73	58.94	64.6	69.48	73.2	78.87	83.18	98.31
13	0.541667	31.88	41.48	48.11	54.96	59.17	64.86	69.76	73.49	79.18	83.51	98.69
13.25	0.552083	32.04	41.67	48.31	55.18	59.4	65.11	70.03	73.77	79.48	83.83	99.07
13.5	0.5625	32.21	41.85	48.51	55.39	59.63	65.35	70.29	74.05	79.78	84.14	99.43
13.75	0.572917	32.37	42.03	48.71	55.6	59.85	65.6	70.56	74.33	80.08	84.45	99.79
14	0.583333	32.52	42.21	48.91	55.81	60.07	65.83	70.81	74.6	80.37	84.75	100.15
14.25	0.59375	32.68	42.39	49.1	56.01	60.29	66.07	71.06	74.87	80.65	85.05	100.49
14.5	0.604167	32.83	42.56	49.29	56.21	60.5	66.3	71.31	75.13	80.93	85.35	100.83
14.75	0.614583	32.98	42.73	49.47	56.41	60.71	66.52	71.56	75.39	81.2	85.63	101.17
15	0.625	33.13	42.9	49.66	56.61	60.91	66.75	71.8	75.64	81.48	85.92	101.5
15.25	0.635417	33.27	43.07	49.84	56.8	61.12	66.97	72.04	75.89	81.74	86.2	101.82

15.5	0.645833	33.42	43.23	50.02	56.99	61.32	67.18	72.27	76.14	82	86.47	102.14
15.75	0.65625	33.56	43.39	50.19	57.18	61.51	67.4	72.5	76.38	82.26	86.74	102.45
16	0.666667	33.7	43.55	50.36	57.36	61.71	67.61	72.72	76.62	82.52	87.01	102.76
16.25	0.677083	33.84	43.71	50.54	57.54	61.9	67.82	72.95	76.85	82.77	87.27	103.06
16.5	0.6875	33.97	43.87	50.7	57.72	62.09	68.02	73.17	77.09	83.01	87.53	103.36
16.75	0.697917	34.11	44.02	50.87	57.9	62.27	68.22	73.38	77.31	83.26	87.79	103.65
17	0.708333	34.24	44.17	51.03	58.07	62.46	68.42	73.6	77.54	83.5	88.04	103.94
17.25	0.71875	34.37	44.32	51.2	58.25	62.64	68.62	73.81	77.76	83.73	88.29	104.23
17.5	0.729167	34.5	44.47	51.36	58.42	62.82	68.81	74.02	77.98	83.97	88.53	104.51
17.75	0.739583	34.63	44.61	51.51	58.58	63	69	74.22	78.2	84.2	88.77	104.79
18	0.75	34.76	44.76	51.67	58.75	63.17	69.19	74.43	78.41	84.43	89.01	105.06
18.25	0.760417	34.89	44.9	51.82	58.91	63.34	69.38	74.62	78.62	84.65	89.25	105.33
18.5	0.770833	35.02	45.04	51.97	59.08	63.52	69.56	74.82	78.82	84.87	89.48	105.6
18.75	0.78125	35.14	45.18	52.12	59.24	63.68	69.75	75.01	79.02	85.09	89.71	105.86
19	0.791667	35.26	45.31	52.27	59.4	63.85	69.93	75.2	79.22	85.3	89.94	106.11
19.25	0.802083	35.39	45.45	52.42	59.55	64.02	70.11	75.39	79.42	85.52	90.16	106.37
19.5	0.8125	35.51	45.58	52.56	59.71	64.18	70.28	75.58	79.61	85.73	90.38	106.62
19.75	0.822917	35.63	45.72	52.7	59.86	64.34	70.46	75.77	79.81	85.94	90.6	106.87
20	0.833333	35.75	45.85	52.84	60.02	64.5	70.63	75.95	80	86.14	90.82	107.12
20.25	0.84375	35.87	45.98	52.99	60.17	64.66	70.8	76.13	80.19	86.35	91.03	107.36
20.5	0.854167	35.99	46.11	53.12	60.32	64.82	70.97	76.31	80.37	86.55	91.25	107.6
20.75	0.864583	36.1	46.24	53.26	60.47	64.98	71.14	76.49	80.56	86.75	91.46	107.84
21	0.875	36.22	46.36	53.4	60.61	65.13	71.31	76.66	80.74	86.95	91.67	108.08
21.25	0.885417	36.33	46.49	53.53	60.76	65.29	71.47	76.84	80.92	87.14	91.87	108.31
21.5	0.895833	36.45	46.62	53.67	60.9	65.44	71.64	77.01	81.1	87.34	92.08	108.54
21.75	0.90625	36.56	46.74	53.8	61.05	65.59	71.8	77.18	81.28	87.53	92.28	108.77
22	0.916667	36.67	46.86	53.93	61.19	65.74	71.96	77.35	81.46	87.72	92.48	109
22.25	0.927083	36.79	46.99	54.06	61.33	65.89	72.12	77.52	81.63	87.91	92.68	109.22
22.5	0.9375	36.9	47.11	54.19	61.47	66.03	72.28	77.68	81.8	88.09	92.87	109.44
22.75	0.947917	37.01	47.23	54.32	61.61	66.18	72.43	77.85	81.97	88.28	93.07	109.66
23	0.958333	37.12	47.35	54.45	61.75	66.32	72.59	78.01	82.14	88.46	93.26	109.88
23.25	0.96875	37.22	47.47	54.58	61.89	66.47	72.74	78.17	82.31	88.64	93.45	110.1
23.5	0.979167	37.33	47.58	54.7	62.02	66.61	72.89	78.33	82.48	88.82	93.64	110.31
23.75	0.989583	37.44	47.7	54.83	62.16	66.75	73.04	78.49	82.64	89	93.83	110.52
24	1	37.55	47.82	54.95	62.29	66.89	73.19	78.65	82.81	89.18	94.02	110.73
24.25	1.010417	37.65	47.93	55.08	62.42	67.03	73.34	78.8	82.97	89.35	94.2	110.94
24.5	1.020833	37.75	48.05	55.2	62.55	67.16	73.48	78.95	83.12	89.52	94.37	111.14
24.75	1.03125	37.86	48.16	55.32	62.68	67.3	73.63	79.11	83.28	89.69	94.55	111.34
25	1.041667	37.96	48.27	55.44	62.81	67.43	73.77	79.26	83.44	89.85	94.72	111.53
25.25	1.052083	38.06	48.39	55.56	62.94	67.57	73.91	79.4	83.59	90.02	94.9	111.73
25.5	1.0625	38.16	48.5	55.68	63.06	67.7	74.05	79.55	83.75	90.18	95.07	111.93
25.75	1.072917	38.26	48.61	55.8	63.19	67.83	74.19	79.7	83.9	90.35	95.24	112.12
26	1.083333	38.36	48.72	55.91	63.32	67.96	74.33	79.84	84.05	90.51	95.41	112.31
26.25	1.09375	38.46	48.83	56.03	63.44	68.09	74.46	79.99	84.2	90.67	95.58	112.5
26.5	1.104167	38.56	48.94	56.15	63.56	68.22	74.6	80.13	84.35	90.83	95.75	112.69
26.75	1.114583	38.66	49.05	56.26	63.69	68.35	74.74	80.28	84.5	90.99	95.91	112.88
27	1.125	38.76	49.16	56.38	63.81	68.47	74.87	80.42	84.65	91.15	96.08	113.07
27.25	1.135417	38.86	49.26	56.49	63.93	68.6	75	80.56	84.8	91.3	96.24	113.25
27.5	1.145833	38.96	49.37	56.61	64.05	68.73	75.14	80.7	84.94	91.46	96.4	113.44
27.75	1.15625	39.05	49.48	56.72	64.17	68.85	75.27	80.84	85.09	91.61	96.57	113.62
28	1.166667	39.15	49.58	56.83	64.29	68.98	75.4	80.98	85.23	91.77	96.73	113.8
28.25	1.177083	39.24	49.69	56.94	64.41	69.1	75.53	81.11	85.37	91.92	96.89	113.98
28.5	1.1875	39.34	49.8	57.05	64.53	69.22	75.66	81.25	85.52	92.07	97.05	114.16
28.75	1.197917	39.43	49.9	57.17	64.65	69.34	75.79	81.39	85.66	92.22	97.2	114.34
29	1.208333	39.53	50	57.28	64.77	69.47	75.92	81.52	85.8	92.37	97.36	114.52
29.25	1.21875	39.62	50.11	57.39	64.88	69.59	76.05	81.66	85.94	92.52	97.52	114.7
29.5	1.229167	39.72	50.21	57.5	65	69.71	76.17	81.79	86.08	92.67	97.67	114.87
29.75	1.239583	39.81	50.31	57.6	65.12	69.83	76.3	81.92	86.22	92.82	97.82	115.05
30	1.25	39.9	50.42	57.71	65.23	69.95	76.43	82.05	86.36	92.97	97.98	115.22
30.25	1.260417	40	50.52	57.82	65.34	70.07	76.55	82.19	86.49	93.11	98.13	115.4
30.5	1.270833	40.09	50.62	57.93	65.46	70.18	76.67	82.32	86.63	93.26	98.28	115.57
30.75	1.28125	40.18	50.72	58.03	65.57	70.3	76.8	82.45	86.77	93.4	98.43	115.74
31	1.291667	40.27	50.82	58.14	65.69	70.42	76.92	82.58	86.9	93.55	98.58	115.91
31.25	1.302083	40.36	50.92	58.25	65.8	70.54	77.04	82.71	87.04	93.69	98.73	116.08
31.5	1.3125	40.45	51.02	58.35	65.91	70.65	77.17	82.83	87.17	93.83	98.88	116.25
31.75	1.322917	40.54	51.12	58.46	66.02	70.77	77.29	82.96	87.3	93.97	99.03	116.41
32	1.333333	40.63	51.22	58.56	66.13	70.88	77.41	83.09	87.44	94.11	99.18	116.58
32.25	1.34375	40.72	51.32	58.67	66.24	71	77.53	83.22	87.57	94.25	99.32	116.75
32.5	1.354167	40.81	51.42	58.77	66.35	71.11	77.65	83.34	87.7	94.39	99.47	116.91
32.75	1.364583	40.9	51.51	58.87	66.46	71.22	77.77	83.47	87.83	94.53	99.61	117.08

33	1.375	40.99	51.61	58.98	66.57	71.34	77.89	83.59	87.96	94.67	99.76	117.24
33.25	1.385417	41.08	51.71	59.08	66.68	71.45	78	83.72	88.09	94.81	99.9	117.4
33.5	1.395833	41.16	51.81	59.18	66.79	71.56	78.12	83.84	88.22	94.94	100.04	117.57
33.75	1.40625	41.25	51.9	59.28	66.9	71.67	78.24	83.96	88.35	95.08	100.18	117.73
34	1.416667	41.34	52	59.39	67.01	71.78	78.36	84.09	88.47	95.22	100.33	117.89
34.25	1.427083	41.43	52.09	59.49	67.11	71.89	78.47	84.21	88.6	95.35	100.47	118.05
34.5	1.4375	41.51	52.19	59.59	67.22	72.01	78.59	84.33	88.73	95.49	100.61	118.21
34.75	1.447917	41.6	52.28	59.69	67.33	72.12	78.7	84.45	88.85	95.62	100.75	118.37
35	1.458333	41.69	52.38	59.79	67.43	72.22	78.82	84.57	88.98	95.75	100.89	118.52
35.25	1.46875	41.77	52.47	59.89	67.54	72.33	78.93	84.69	89.11	95.89	101.02	118.68
35.5	1.479167	41.86	52.57	59.99	67.64	72.44	79.05	84.81	89.23	96.02	101.16	118.84
35.75	1.489583	41.94	52.66	60.09	67.75	72.55	79.16	84.93	89.35	96.15	101.3	118.99
36	1.5	42.03	52.75	60.19	67.85	72.66	79.27	85.05	89.48	96.28	101.44	119.15
36.25	1.510417	42.11	52.85	60.28	67.96	72.77	79.38	85.17	89.6	96.41	101.57	119.31
36.5	1.520833	42.2	52.94	60.38	68.06	72.87	79.5	85.29	89.72	96.54	101.71	119.46
36.75	1.53125	42.28	53.03	60.48	68.16	72.98	79.61	85.4	89.85	96.67	101.84	119.61
37	1.541667	42.36	53.13	60.58	68.27	73.09	79.72	85.52	89.97	96.8	101.98	119.77
37.25	1.552083	42.45	53.22	60.68	68.37	73.19	79.83	85.64	90.09	96.93	102.11	119.92
37.5	1.5625	42.53	53.31	60.77	68.47	73.3	79.94	85.75	90.21	97.06	102.24	120.07
37.75	1.572917	42.61	53.4	60.87	68.57	73.4	80.05	85.87	90.33	97.18	102.38	120.22
38	1.583333	42.7	53.49	60.96	68.67	73.51	80.16	85.98	90.45	97.31	102.51	120.37
38.25	1.59375	42.78	53.58	61.06	68.78	73.61	80.27	86.1	90.57	97.44	102.64	120.52
38.5	1.604167	42.86	53.67	61.16	68.88	73.72	80.38	86.21	90.69	97.56	102.77	120.67
38.75	1.614583	42.94	53.76	61.25	68.98	73.82	80.49	86.33	90.81	97.69	102.91	120.82
39	1.625	43.03	53.85	61.35	69.08	73.92	80.6	86.44	90.93	97.82	103.04	120.97
39.25	1.635417	43.11	53.94	61.44	69.18	74.03	80.7	86.55	91.05	97.94	103.17	121.12
39.5	1.645833	43.19	54.03	61.54	69.28	74.13	80.81	86.67	91.16	98.07	103.3	121.27
39.75	1.65625	43.27	54.12	61.63	69.38	74.23	80.92	86.78	91.28	98.19	103.43	121.42
40	1.666667	43.35	54.21	61.73	69.48	74.34	81.03	86.89	91.4	98.31	103.55	121.56
40.25	1.677083	43.43	54.3	61.82	69.58	74.44	81.13	87	91.51	98.44	103.68	121.71
40.5	1.6875	43.51	54.39	61.91	69.67	74.54	81.24	87.12	91.63	98.56	103.81	121.85
40.75	1.697917	43.59	54.48	62.01	69.77	74.64	81.34	87.23	91.75	98.68	103.94	122
41	1.708333	43.67	54.57	62.1	69.87	74.74	81.45	87.34	91.86	98.8	104.06	122.15
41.25	1.71875	43.76	54.66	62.19	69.97	74.84	81.55	87.45	91.98	98.93	104.19	122.29
41.5	1.729167	43.83	54.74	62.28	70.07	74.94	81.66	87.56	92.09	99.05	104.32	122.43
41.75	1.739583	43.91	54.83	62.38	70.16	75.04	81.76	87.67	92.21	99.17	104.44	122.58
42	1.75	43.99	54.92	62.47	70.26	75.14	81.87	87.78	92.32	99.29	104.57	122.72
42.25	1.760417	44.07	55.01	62.56	70.36	75.24	81.97	87.89	92.43	99.41	104.69	122.86
42.5	1.770833	44.15	55.09	62.65	70.45	75.34	82.08	88	92.55	99.53	104.82	123.01
42.75	1.78125	44.23	55.18	62.74	70.55	75.44	82.18	88.1	92.66	99.65	104.94	123.15
43	1.791667	44.31	55.27	62.83	70.65	75.54	82.28	88.21	92.77	99.77	105.07	123.29
43.25	1.802083	44.39	55.35	62.93	70.74	75.64	82.39	88.32	92.88	99.89	105.19	123.43
43.5	1.8125	44.47	55.44	63.02	70.84	75.74	82.49	88.43	93	100	105.31	123.57
43.75	1.822917	44.55	55.52	63.11	70.93	75.84	82.59	88.54	93.11	100.12	105.44	123.71
44	1.833333	44.62	55.61	63.2	71.03	75.93	82.69	88.64	93.22	100.24	105.56	123.85
44.25	1.84375	44.7	55.7	63.29	71.12	76.03	82.79	88.75	93.33	100.36	105.68	123.99
44.5	1.854167	44.78	55.78	63.38	71.22	76.13	82.9	88.86	93.44	100.47	105.8	124.13
44.75	1.864583	44.86	55.87	63.47	71.31	76.23	83	88.96	93.55	100.59	105.93	124.27
45	1.875	44.93	55.95	63.56	71.41	76.32	83.1	89.07	93.66	100.71	106.05	124.41
45.25	1.885417	45.01	56.04	63.65	71.5	76.42	83.2	89.17	93.77	100.82	106.17	124.55
45.5	1.895833	45.09	56.12	63.73	71.59	76.52	83.3	89.28	93.88	100.94	106.29	124.69
45.75	1.90625	45.17	56.21	63.82	71.69	76.61	83.4	89.38	93.99	101.05	106.41	124.82
46	1.916667	45.24	56.29	63.91	71.78	76.71	83.5	89.49	94.1	101.17	106.53	124.96
46.25	1.927083	45.32	56.37	64	71.87	76.8	83.6	89.59	94.21	101.28	106.65	125.1
46.5	1.9375	45.4	56.46	64.09	71.97	76.9	83.7	89.7	94.32	101.4	106.77	125.23
46.75	1.947917	45.47	56.54	64.18	72.06	76.99	83.8	89.8	94.43	101.51	106.89	125.37
47	1.958333	45.55	56.62	64.26	72.15	77.09	83.9	89.91	94.53	101.63	107.01	125.51
47.25	1.96875	45.62	56.71	64.35	72.24	77.18	84	90.01	94.64	101.74	107.12	125.64
47.5	1.979167	45.7	56.79	64.44	72.34	77.28	84.09	90.11	94.75	101.85	107.24	125.78
47.75	1.989583	45.77	56.87	64.53	72.43	77.37	84.19	90.22	94.86	101.97	107.36	125.91
48	2	45.85	56.96	64.61	72.52	77.47	84.29	90.32	94.96	102.08	107.48	126.05
48.25	2.010417	45.93	57.04	64.7	72.61	77.56	84.39	90.42	95.07	102.2	107.6	126.18
48.5	2.020833	46.01	57.13	64.79	72.71	77.66	84.49	90.53	95.18	102.31	107.72	126.32
48.75	2.03125	46.08	57.21	64.88	72.8	77.76	84.59	90.63	95.29	102.42	107.84	126.46
49	2.041667	46.16	57.3	64.97	72.89	77.85	84.69	90.74	95.4	102.54	107.96	126.6
49.25	2.052083	46.24	57.38	65.06	72.99	77.95	84.79	90.84	95.51	102.65	108.08	126.74
49.5	2.0625	46.31	57.46	65.15	73.08	78.05	84.89	90.95	95.61	102.77	108.19	126.87
49.75	2.072917	46.39	57.55	65.24	73.17	78.14	84.99	91.05	95.72	102.88	108.31	127.01
50	2.083333	46.47	57.63	65.32	73.26	78.24	85.09	91.15	95.83	102.99	108.43	127.15
50.25	2.09375	46.54	57.71	65.41	73.36	78.33	85.19	91.26	95.94	103.11	108.55	127.28

50.5	2.104167	46.62	57.8	65.5	73.45	78.43	85.29	91.36	96.04	103.22	108.67	127.42
50.75	2.114583	46.69	57.88	65.59	73.54	78.52	85.39	91.46	96.15	103.33	108.78	127.55
51	2.125	46.77	57.96	65.67	73.63	78.62	85.49	91.57	96.26	103.44	108.9	127.69
51.25	2.135417	46.85	58.05	65.76	73.73	78.71	85.59	91.67	96.36	103.56	109.02	127.83
51.5	2.145833	46.92	58.13	65.85	73.82	78.81	85.69	91.77	96.47	103.67	109.14	127.96
51.75	2.15625	47	58.21	65.94	73.91	78.9	85.78	91.87	96.58	103.78	109.25	128.1
52	2.166667	47.07	58.3	66.02	74	78.99	85.88	91.98	96.68	103.89	109.37	128.23
52.25	2.177083	47.15	58.38	66.11	74.09	79.09	85.98	92.08	96.79	104	109.49	128.36
52.5	2.1875	47.22	58.46	66.2	74.18	79.18	86.08	92.18	96.89	104.12	109.6	128.5
52.75	2.197917	47.3	58.54	66.28	74.27	79.28	86.17	92.28	97	104.23	109.72	128.63
53	2.208333	47.37	58.62	66.37	74.36	79.37	86.27	92.38	97.1	104.34	109.83	128.77
53.25	2.21875	47.45	58.71	66.46	74.45	79.46	86.37	92.48	97.21	104.45	109.95	128.9
53.5	2.229167	47.52	58.79	66.54	74.54	79.56	86.47	92.59	97.31	104.56	110.07	129.03
53.75	2.239583	47.6	58.87	66.63	74.63	79.65	86.56	92.69	97.42	104.67	110.18	129.17
54	2.25	47.67	58.95	66.71	74.72	79.74	86.66	92.79	97.52	104.78	110.3	129.3
54.25	2.260417	47.75	59.03	66.8	74.81	79.83	86.76	92.89	97.63	104.89	110.41	129.43
54.5	2.270833	47.82	59.11	66.88	74.9	79.93	86.85	92.99	97.73	105	110.53	129.57
54.75	2.28125	47.9	59.2	66.97	74.99	80.02	86.95	93.09	97.83	105.11	110.64	129.7
55	2.291667	47.97	59.28	67.06	75.08	80.11	87.05	93.19	97.94	105.22	110.75	129.83
55.25	2.302083	48.04	59.36	67.14	75.17	80.2	87.14	93.29	98.04	105.33	110.87	129.96
55.5	2.3125	48.12	59.44	67.23	75.26	80.3	87.24	93.39	98.14	105.43	110.98	130.09
55.75	2.322917	48.19	59.52	67.31	75.35	80.39	87.33	93.49	98.25	105.54	111.1	130.23
56	2.333333	48.27	59.6	67.4	75.44	80.48	87.43	93.59	98.35	105.65	111.21	130.36
56.25	2.34375	48.34	59.68	67.48	75.53	80.57	87.52	93.69	98.45	105.76	111.32	130.49
56.5	2.354167	48.41	59.76	67.56	75.62	80.66	87.62	93.79	98.56	105.87	111.44	130.62
56.75	2.364583	48.49	59.84	67.65	75.71	80.75	87.71	93.89	98.66	105.98	111.55	130.75
57	2.375	48.56	59.92	67.73	75.79	80.84	87.81	93.98	98.76	106.09	111.66	130.88
57.25	2.385417	48.63	60	67.82	75.88	80.94	87.9	94.08	98.86	106.19	111.77	131.01
57.5	2.395833	48.71	60.08	67.9	75.97	81.03	88	94.18	98.96	106.3	111.89	131.14
57.75	2.40625	48.78	60.16	67.99	76.06	81.12	88.09	94.28	99.07	106.41	112	131.27
58	2.416667	48.85	60.24	68.07	76.15	81.21	88.19	94.38	99.17	106.52	112.11	131.4
58.25	2.427083	48.93	60.32	68.15	76.23	81.3	88.28	94.48	99.27	106.62	112.22	131.53
58.5	2.4375	49	60.4	68.24	76.32	81.39	88.38	94.58	99.37	106.73	112.34	131.66
58.75	2.447917	49.07	60.48	68.32	76.41	81.48	88.47	94.67	99.47	106.84	112.45	131.79
59	2.458333	49.14	60.56	68.4	76.5	81.57	88.56	94.77	99.57	106.94	112.56	131.92
59.25	2.46875	49.22	60.64	68.49	76.58	81.66	88.66	94.87	99.67	107.05	112.67	132.05
59.5	2.479167	49.29	60.72	68.57	76.67	81.75	88.75	94.97	99.78	107.16	112.78	132.18
59.75	2.489583	49.36	60.79	68.65	76.76	81.84	88.84	95.06	99.88	107.26	112.89	132.31
60	2.5	49.43	60.87	68.74	76.84	81.93	88.94	95.16	99.98	107.37	113	132.43
60.25	2.510417	49.51	60.95	68.82	76.93	82.02	89.03	95.26	100.08	107.47	113.11	132.56
60.5	2.520833	49.58	61.03	68.9	77.02	82.11	89.12	95.35	100.18	107.58	113.22	132.69
60.75	2.53125	49.65	61.11	68.98	77.1	82.2	89.22	95.45	100.28	107.69	113.34	132.82
61	2.541667	49.72	61.19	69.07	77.19	82.29	89.31	95.55	100.38	107.79	113.45	132.95
61.25	2.552083	49.79	61.27	69.15	77.28	82.38	89.4	95.64	100.48	107.9	113.56	133.08
61.5	2.5625	49.87	61.34	69.23	77.36	82.46	89.5	95.74	100.58	108	113.67	133.2
61.75	2.572917	49.94	61.42	69.31	77.45	82.55	89.59	95.84	100.68	108.11	113.78	133.33
62	2.583333	50.01	61.5	69.4	77.54	82.64	89.68	95.93	100.78	108.21	113.89	133.46
62.25	2.59375	50.08	61.58	69.48	77.62	82.73	89.77	96.03	100.88	108.32	114	133.59
62.5	2.604167	50.15	61.66	69.56	77.71	82.82	89.87	96.13	100.98	108.42	114.1	133.71
62.75	2.614583	50.22	61.73	69.64	77.79	82.91	89.96	96.22	101.07	108.53	114.21	133.84
63	2.625	50.29	61.81	69.72	77.88	83	90.05	96.32	101.17	108.63	114.32	133.97
63.25	2.635417	50.37	61.89	69.8	77.96	83.08	90.14	96.41	101.27	108.74	114.43	134.09
63.5	2.645833	50.44	61.97	69.89	78.05	83.17	90.23	96.51	101.37	108.84	114.54	134.22
63.75	2.65625	50.51	62.05	69.97	78.14	83.26	90.32	96.6	101.47	108.94	114.65	134.35
64	2.666667	50.58	62.12	70.05	78.22	83.35	90.42	96.7	101.57	109.05	114.76	134.47
64.25	2.677083	50.65	62.2	70.13	78.31	83.44	90.51	96.79	101.67	109.15	114.87	134.6
64.5	2.6875	50.72	62.28	70.21	78.39	83.52	90.6	96.89	101.77	109.25	114.98	134.72
64.75	2.697917	50.79	62.35	70.29	78.48	83.61	90.69	96.98	101.86	109.36	115.08	134.85
65	2.708333	50.86	62.43	70.37	78.56	83.7	90.78	97.08	101.96	109.46	115.19	134.98
65.25	2.71875	50.93	62.51	70.45	78.65	83.79	90.87	97.17	102.06	109.57	115.3	135.1
65.5	2.729167	51	62.58	70.54	78.73	83.87	90.96	97.27	102.16	109.67	115.41	135.23
65.75	2.739583	51.07	62.66	70.62	78.81	83.96	91.05	97.36	102.26	109.77	115.52	135.35
66	2.75	51.14	62.74	70.7	78.9	84.05	91.14	97.46	102.35	109.87	115.62	135.48
66.25	2.760417	51.21	62.81	70.78	78.98	84.13	91.23	97.55	102.45	109.98	115.73	135.6
66.5	2.770833	51.28	62.89	70.86	79.07	84.22	91.32	97.65	102.55	110.08	115.84	135.73
66.75	2.78125	51.35	62.97	70.94	79.15	84.31	91.41	97.74	102.64	110.18	115.95	135.85
67	2.791667	51.42	63.04	71.02	79.24	84.39	91.51	97.83	102.74	110.28	116.05	135.98
67.25	2.802083	51.49	63.12	71.1	79.32	84.48	91.6	97.93	102.84	110.39	116.16	136.1
67.5	2.8125	51.56	63.2	71.18	79.4	84.57	91.69	98.02	102.94	110.49	116.27	136.22
67.75	2.822917	51.63	63.27	71.26	79.49	84.65	91.78	98.11	103.03	110.59	116.37	136.35

68	2.833333	51.7	63.35	71.34	79.57	84.74	91.86	98.21	103.13	110.69	116.48	136.47
68.25	2.84375	51.77	63.42	71.42	79.65	84.83	91.95	98.3	103.23	110.8	116.59	136.6
68.5	2.854167	51.84	63.5	71.5	79.74	84.91	92.04	98.39	103.32	110.9	116.7	136.72
68.75	2.864583	51.91	63.58	71.58	79.82	85	92.13	98.49	103.42	111	116.8	136.84
69	2.875	51.98	63.65	71.66	79.9	85.08	92.22	98.58	103.52	111.1	116.91	136.97
69.25	2.885417	52.05	63.73	71.74	79.99	85.17	92.31	98.67	103.61	111.2	117.01	137.09
69.5	2.895833	52.12	63.8	71.82	80.07	85.26	92.4	98.77	103.71	111.3	117.12	137.22
69.75	2.90625	52.19	63.88	71.89	80.15	85.34	92.49	98.86	103.8	111.41	117.23	137.34
70	2.916667	52.26	63.95	71.97	80.24	85.43	92.58	98.95	103.9	111.51	117.33	137.46
70.25	2.927083	52.33	64.03	72.05	80.32	85.51	92.67	99.05	104	111.61	117.44	137.58
70.5	2.9375	52.4	64.1	72.13	80.4	85.6	92.76	99.14	104.09	111.71	117.54	137.71
70.75	2.947917	52.47	64.18	72.21	80.48	85.68	92.85	99.23	104.19	111.81	117.65	137.83
71	2.958333	52.54	64.26	72.29	80.57	85.77	92.94	99.32	104.28	111.91	117.76	137.95
71.25	2.96875	52.6	64.33	72.37	80.65	85.85	93.02	99.41	104.38	112.01	117.86	138.08
71.5	2.979167	52.67	64.41	72.45	80.73	85.94	93.11	99.51	104.47	112.11	117.97	138.2
71.75	2.989583	52.74	64.48	72.53	80.81	86.02	93.2	99.6	104.57	112.21	118.07	138.32
72	3	52.81	64.55	72.61	80.9	86.11	93.29	99.69	104.66	112.31	118.18	138.44
72.25	3.010417	52.88	64.63	72.68	80.98	86.19	93.38	99.78	104.76	112.41	118.28	138.57
72.5	3.020833	52.95	64.7	72.76	81.06	86.28	93.47	99.88	104.85	112.51	118.39	138.69
72.75	3.03125	53.02	64.78	72.84	81.14	86.36	93.55	99.97	104.95	112.61	118.49	138.81
73	3.041667	53.08	64.85	72.92	81.23	86.45	93.64	100.06	105.04	112.71	118.6	138.93
73.25	3.052083	53.15	64.93	73	81.31	86.53	93.73	100.15	105.14	112.81	118.7	139.05
73.5	3.0625	53.22	65	73.08	81.39	86.62	93.82	100.24	105.23	112.91	118.81	139.18
73.75	3.072917	53.29	65.08	73.15	81.47	86.7	93.91	100.33	105.33	113.01	118.91	139.3
74	3.083333	53.36	65.15	73.23	81.55	86.78	93.99	100.42	105.42	113.11	119.01	139.42
74.25	3.09375	53.43	65.23	73.31	81.63	86.87	94.08	100.52	105.52	113.21	119.12	139.54
74.5	3.104167	53.49	65.3	73.39	81.72	86.95	94.17	100.61	105.61	113.31	119.22	139.66
74.75	3.114583	53.56	65.37	73.47	81.8	87.04	94.26	100.7	105.71	113.41	119.33	139.78
75	3.125	53.63	65.45	73.54	81.88	87.12	94.34	100.79	105.8	113.51	119.43	139.9
75.25	3.135417	53.7	65.52	73.62	81.96	87.2	94.43	100.88	105.89	113.61	119.53	140.03
75.5	3.145833	53.77	65.6	73.7	82.04	87.29	94.52	100.97	105.99	113.71	119.64	140.15
75.75	3.15625	53.83	65.67	73.78	82.12	87.37	94.61	101.06	106.08	113.81	119.74	140.27
76	3.166667	53.9	65.74	73.85	82.2	87.46	94.69	101.15	106.18	113.91	119.85	140.39
76.25	3.177083	53.97	65.82	73.93	82.28	87.54	94.78	101.24	106.27	114.01	119.95	140.51
76.5	3.1875	54.04	65.89	74.01	82.37	87.62	94.87	101.33	106.36	114.11	120.05	140.63
76.75	3.197917	54.11	65.96	74.09	82.45	87.71	94.95	101.42	106.46	114.2	120.16	140.75
77	3.208333	54.17	66.04	74.16	82.53	87.79	95.04	101.51	106.55	114.3	120.26	140.87
77.25	3.21875	54.24	66.11	74.24	82.61	87.87	95.13	101.6	106.64	114.4	120.36	140.99
77.5	3.229167	54.31	66.18	74.32	82.69	87.96	95.21	101.7	106.74	114.5	120.47	141.11
77.75	3.239583	54.38	66.26	74.39	82.77	88.04	95.3	101.79	106.83	114.6	120.57	141.23
78	3.25	54.44	66.33	74.47	82.85	88.12	95.39	101.88	106.92	114.7	120.67	141.35
78.25	3.260417	54.51	66.4	74.55	82.93	88.2	95.47	101.97	107.02	114.8	120.78	141.47
78.5	3.270833	54.58	66.48	74.62	83.01	88.29	95.56	102.06	107.11	114.89	120.88	141.59
78.75	3.28125	54.64	66.55	74.7	83.09	88.37	95.65	102.15	107.2	114.99	120.98	141.71
79	3.291667	54.71	66.62	74.78	83.17	88.45	95.73	102.24	107.3	115.09	121.09	141.83
79.25	3.302083	54.78	66.7	74.85	83.25	88.54	95.82	102.32	107.39	115.19	121.19	141.95
79.5	3.3125	54.85	66.77	74.93	83.33	88.62	95.9	102.41	107.48	115.29	121.29	142.07
79.75	3.322917	54.91	66.84	75.01	83.41	88.7	95.99	102.5	107.57	115.39	121.39	142.19
80	3.333333	54.98	66.92	75.08	83.49	88.78	96.08	102.59	107.67	115.48	121.5	142.31
80.25	3.34375	55.05	66.99	75.16	83.57	88.87	96.16	102.68	107.76	115.58	121.6	142.43
80.5	3.354167	55.11	67.06	75.24	83.65	88.95	96.25	102.77	107.85	115.68	121.7	142.55
80.75	3.364583	55.18	67.13	75.31	83.73	89.03	96.33	102.86	107.95	115.78	121.8	142.67
81	3.375	55.25	67.21	75.39	83.81	89.11	96.42	102.95	108.04	115.87	121.91	142.79
81.25	3.385417	55.31	67.28	75.47	83.89	89.2	96.51	103.04	108.13	115.97	122.01	142.91
81.5	3.395833	55.38	67.35	75.54	83.97	89.28	96.59	103.13	108.22	116.07	122.11	143.03
81.75	3.40625	55.45	67.42	75.62	84.05	89.36	96.68	103.22	108.31	116.17	122.21	143.15
82	3.416667	55.51	67.5	75.69	84.13	89.44	96.76	103.31	108.41	116.26	122.31	143.26
82.25	3.427083	55.58	67.57	75.77	84.21	89.52	96.85	103.4	108.5	116.36	122.42	143.38
82.5	3.4375	55.65	67.64	75.85	84.29	89.61	96.93	103.49	108.59	116.46	122.52	143.5
82.75	3.447917	55.71	67.71	75.92	84.37	89.69	97.02	103.57	108.68	116.56	122.62	143.62
83	3.458333	55.78	67.79	76	84.45	89.77	97.1	103.66	108.77	116.65	122.72	143.74
83.25	3.46875	55.85	67.86	76.07	84.53	89.85	97.19	103.75	108.87	116.75	122.82	143.86
83.5	3.479167	55.91	67.93	76.15	84.61	89.93	97.27	103.84	108.96	116.85	122.92	143.98
83.75	3.489583	55.98	68	76.22	84.68	90.01	97.36	103.93	109.05	116.94	123.03	144.1
84	3.5	56.05	68.07	76.3	84.76	90.1	97.44	104.02	109.14	117.04	123.13	144.21
84.25	3.510417	56.11	68.15	76.38	84.84	90.18	97.53	104.11	109.23	117.14	123.23	144.33
84.5	3.520833	56.18	68.22	76.45	84.92	90.26	97.61	104.2	109.33	117.23	123.33	144.45
84.75	3.53125	56.24	68.29	76.53	85	90.34	97.7	104.28	109.42	117.33	123.43	144.57
85	3.541667	56.31	68.36	76.6	85.08	90.42	97.78	104.37	109.51	117.43	123.53	144.69
85.25	3.552083	56.38	68.43	76.68	85.16	90.5	97.87	104.46	109.6	117.52	123.63	144.8

85.5	3.5625	56.44	68.51	76.75	85.24	90.58	97.95	104.55	109.69	117.62	123.73	144.92
85.75	3.572917	56.51	68.58	76.83	85.32	90.67	98.04	104.64	109.78	117.72	123.84	145.04
86	3.583333	56.57	68.65	76.9	85.39	90.75	98.12	104.72	109.87	117.81	123.94	145.16
86.25	3.59375	56.64	68.72	76.98	85.47	90.83	98.21	104.81	109.96	117.91	124.04	145.28
86.5	3.604167	56.71	68.79	77.05	85.55	90.91	98.29	104.9	110.06	118.01	124.14	145.39
86.75	3.614583	56.77	68.86	77.13	85.63	90.99	98.38	104.99	110.15	118.1	124.24	145.51
87	3.625	56.84	68.93	77.2	85.71	91.07	98.46	105.08	110.24	118.2	124.34	145.63
87.25	3.635417	56.9	69.01	77.28	85.79	91.15	98.54	105.16	110.33	118.29	124.44	145.75
87.5	3.645833	56.97	69.08	77.35	85.86	91.23	98.63	105.25	110.42	118.39	124.54	145.87
87.75	3.65625	57.03	69.15	77.43	85.94	91.31	98.71	105.34	110.51	118.49	124.64	145.98
88	3.666667	57.1	69.22	77.5	86.02	91.39	98.8	105.43	110.6	118.58	124.74	146.1
88.25	3.677083	57.17	69.29	77.58	86.1	91.47	98.88	105.52	110.69	118.68	124.84	146.22
88.5	3.6875	57.23	69.36	77.65	86.18	91.56	98.97	105.6	110.78	118.77	124.94	146.34
88.75	3.697917	57.3	69.43	77.73	86.26	91.64	99.05	105.69	110.87	118.87	125.04	146.45
89	3.708333	57.36	69.5	77.8	86.33	91.72	99.13	105.78	110.96	118.97	125.15	146.57
89.25	3.71875	57.43	69.58	77.88	86.41	91.8	99.22	105.87	111.05	119.06	125.25	146.69
89.5	3.729167	57.49	69.65	77.95	86.49	91.88	99.3	105.95	111.15	119.16	125.35	146.8
89.75	3.739583	57.56	69.72	78.03	86.57	91.96	99.39	106.04	111.24	119.25	125.45	146.92
90	3.75	57.62	69.79	78.1	86.65	92.04	99.47	106.13	111.33	119.35	125.55	147.04
90.25	3.760417	57.69	69.86	78.17	86.72	92.12	99.55	106.22	111.42	119.44	125.65	147.16
90.5	3.770833	57.75	69.93	78.25	86.8	92.2	99.64	106.3	111.51	119.54	125.75	147.27
90.75	3.78125	57.82	70	78.32	86.88	92.28	99.72	106.39	111.6	119.63	125.85	147.39
91	3.791667	57.88	70.07	78.4	86.96	92.36	99.8	106.48	111.69	119.73	125.95	147.51
91.25	3.802083	57.95	70.14	78.47	87.03	92.44	99.89	106.56	111.78	119.83	126.05	147.62
91.5	3.8125	58.01	70.21	78.55	87.11	92.52	99.97	106.65	111.87	119.92	126.15	147.74
91.75	3.822917	58.08	70.28	78.62	87.19	92.6	100.05	106.74	111.96	120.02	126.25	147.86
92	3.833333	58.14	70.35	78.69	87.27	92.68	100.14	106.82	112.05	120.11	126.35	147.97
92.25	3.84375	58.21	70.43	78.77	87.34	92.76	100.22	106.91	112.14	120.21	126.45	148.09
92.5	3.854167	58.27	70.5	78.84	87.42	92.84	100.3	107	112.23	120.3	126.55	148.21
92.75	3.864583	58.34	70.57	78.92	87.5	92.92	100.39	107.09	112.32	120.4	126.65	148.32
93	3.875	58.4	70.64	78.99	87.58	93	100.47	107.17	112.41	120.49	126.75	148.44
93.25	3.885417	58.47	70.71	79.06	87.65	93.08	100.55	107.26	112.5	120.59	126.85	148.56
93.5	3.895833	58.53	70.78	79.14	87.73	93.16	100.64	107.35	112.59	120.68	126.94	148.67
93.75	3.90625	58.6	70.85	79.21	87.81	93.24	100.72	107.43	112.68	120.78	127.04	148.79
94	3.916667	58.66	70.92	79.28	87.88	93.32	100.8	107.52	112.77	120.87	127.14	148.91
94.25	3.927083	58.73	70.99	79.36	87.96	93.4	100.89	107.61	112.86	120.97	127.24	149.02
94.5	3.9375	58.79	71.06	79.43	88.04	93.48	100.97	107.69	112.95	121.06	127.34	149.14
94.75	3.947917	58.86	71.13	79.51	88.12	93.56	101.05	107.78	113.04	121.16	127.44	149.25
95	3.958333	58.92	71.2	79.58	88.19	93.63	101.13	107.86	113.13	121.25	127.54	149.37
95.25	3.96875	58.99	71.27	79.65	88.27	93.71	101.22	107.95	113.21	121.35	127.64	149.49
95.5	3.979167	59.05	71.34	79.73	88.35	93.79	101.3	108.04	113.3	121.44	127.74	149.6
95.75	3.989583	59.12	71.41	79.8	88.42	93.87	101.38	108.12	113.39	121.54	127.84	149.72
96	4	59.18	71.48	79.87	88.5	93.95	101.47	108.21	113.48	121.63	127.94	149.83

1000 year r	10000 year rainfall (mm)
34.57	50.05
47.01	69.28
54.84	81.48
60.6	90.33
64.29	95.5
67.19	99.41
69.64	102.64
71.79	105.42
73.94	108.23
75.92	110.8
77.76	113.16
79.47	115.34
81.08	117.38
82.6	119.28
84.03	121.06
85.39	122.75
86.67	124.32
87.89	125.81
89.06	127.23
90.17	128.57
91.23	129.86
92.24	131.08
93.22	132.25
94.16	133.37
95.05	134.45
95.91	135.48
96.74	136.48
97.55	137.43
98.32	138.35
99.06	139.24
99.79	140.11
100.48	140.94
101.16	141.74
101.82	142.53
102.45	143.28
103.07	144.02
103.67	144.73
104.26	145.43
104.83	146.11
105.38	146.77
105.92	147.41
106.45	148.03
106.96	148.64
107.47	149.24
107.96	149.82
108.43	150.39
108.9	150.94
109.36	151.49
109.8	152.01
110.23	152.52
110.65	153.02
111.07	153.52
111.47	154
111.87	154.47
112.26	154.94
112.64	155.39
113.02	155.84
113.39	156.28
113.75	156.71
114.11	157.14
114.46	157.55

114.8	157.97
115.14	158.37
115.48	158.77
115.81	159.16
116.13	159.55
116.45	159.93
116.76	160.31
117.07	160.68
117.38	161.04
117.68	161.4
117.98	161.76
118.27	162.11
118.56	162.46
118.84	162.8
119.12	163.14
119.4	163.47
119.68	163.81
119.95	164.13
120.22	164.46
120.48	164.78
120.74	165.1
121	165.41
121.26	165.72
121.51	166.03
121.77	166.33
122.02	166.64
122.26	166.93
122.51	167.23
122.75	167.52
122.99	167.82
123.23	168.1
123.46	168.39
123.69	168.67
123.93	168.96
124.15	169.23
124.37	169.5
124.59	169.77
124.81	170.03
125.02	170.3
125.24	170.56
125.45	170.82
125.66	171.07
125.87	171.33
126.08	171.58
126.28	171.83
126.49	172.08
126.69	172.33
126.89	172.58
127.09	172.82
127.29	173.07
127.49	173.31
127.68	173.55
127.88	173.79
128.07	174.03
128.27	174.27
128.46	174.5
128.65	174.74
128.84	174.97
129.03	175.2
129.22	175.43
129.4	175.66
129.59	175.89
129.77	176.12
129.96	176.34
130.14	176.57
130.32	176.79
130.5	177.01
130.68	177.24
130.86	177.46
131.04	177.68

131.22	177.9
131.4	178.11
131.57	178.33
131.75	178.55
131.92	178.76
132.1	178.98
132.27	179.19
132.44	179.4
132.61	179.62
132.78	179.83
132.95	180.04
133.12	180.25
133.29	180.45
133.46	180.66
133.63	180.87
133.8	181.08
133.96	181.28
134.13	181.49
134.29	181.69
134.46	181.89
134.62	182.1
134.78	182.3
134.95	182.5
135.11	182.7
135.27	182.9
135.43	183.1
135.59	183.3
135.75	183.5
135.91	183.69
136.07	183.89
136.23	184.09
136.39	184.28
136.54	184.48
136.7	184.67
136.86	184.87
137.01	185.06
137.17	185.25
137.32	185.45
137.48	185.64
137.63	185.83
137.79	186.02
137.94	186.21
138.09	186.4
138.25	186.59
138.4	186.78
138.55	186.97
138.7	187.16
138.85	187.34
139	187.53
139.15	187.72
139.3	187.9
139.45	188.09
139.6	188.28
139.75	188.46
139.9	188.65
140.05	188.83
140.19	189.01
140.34	189.2
140.49	189.38
140.63	189.56
140.78	189.74
140.93	189.93
141.08	190.12
141.23	190.31
141.38	190.49
141.53	190.68
141.68	190.87
141.83	191.05
141.98	191.24
142.13	191.42

142.28	191.61
142.42	191.79
142.57	191.98
142.72	192.16
142.87	192.35
143.01	192.53
143.16	192.71
143.31	192.9
143.45	193.08
143.6	193.26
143.75	193.44
143.89	193.63
144.04	193.81
144.18	193.99
144.33	194.17
144.47	194.35
144.62	194.53
144.76	194.71
144.9	194.89
145.05	195.07
145.19	195.25
145.34	195.43
145.48	195.61
145.62	195.79
145.76	195.97
145.91	196.15
146.05	196.32
146.19	196.5
146.33	196.68
146.48	196.86
146.62	197.04
146.76	197.21
146.9	197.39
147.04	197.57
147.18	197.74
147.32	197.92
147.46	198.1
147.61	198.27
147.75	198.45
147.89	198.62
148.03	198.8
148.17	198.97
148.31	199.15
148.44	199.32
148.58	199.5
148.72	199.67
148.86	199.85
149	200.02
149.14	200.19
149.28	200.37
149.42	200.54
149.55	200.71
149.69	200.89
149.83	201.06
149.97	201.23
150.11	201.41
150.24	201.58
150.38	201.75
150.52	201.92
150.65	202.09
150.79	202.27
150.93	202.44
151.07	202.61
151.2	202.78
151.34	202.95
151.47	203.12
151.61	203.29
151.75	203.46
151.88	203.64
152.02	203.81

152.15	203.98
152.29	204.15
152.42	204.32
152.56	204.49
152.69	204.66
152.83	204.83
152.96	204.99
153.1	205.16
153.23	205.33
153.37	205.5
153.5	205.67
153.64	205.84
153.77	206.01
153.9	206.18
154.04	206.35
154.17	206.51
154.31	206.68
154.44	206.85
154.57	207.02
154.71	207.19
154.84	207.35
154.97	207.52
155.11	207.69
155.24	207.85
155.37	208.02
155.5	208.19
155.64	208.36
155.77	208.52
155.9	208.69
156.03	208.86
156.17	209.02
156.3	209.19
156.43	209.36
156.56	209.52
156.69	209.69
156.83	209.85
156.96	210.02
157.09	210.19
157.22	210.35
157.35	210.52
157.48	210.68
157.62	210.85
157.75	211.01
157.88	211.18
158.01	211.34
158.14	211.51
158.27	211.67
158.4	211.84
158.53	212
158.66	212.17
158.79	212.33
158.92	212.5
159.05	212.66
159.18	212.82
159.31	212.99
159.45	213.15
159.58	213.32
159.71	213.48
159.84	213.64
159.96	213.81
160.09	213.97
160.22	214.14
160.35	214.3
160.48	214.46
160.61	214.63
160.74	214.79
160.87	214.95
161	215.12
161.13	215.28
161.26	215.44

161.39	215.61
161.52	215.77
161.65	215.93
161.78	216.09
161.91	216.26
162.03	216.42
162.16	216.58
162.29	216.74
162.42	216.91
162.55	217.07
162.68	217.23
162.81	217.39
162.93	217.56
163.06	217.72
163.19	217.88
163.32	218.04
163.45	218.2
163.58	218.37
163.7	218.53
163.83	218.69
163.96	218.85
164.09	219.01
164.22	219.18
164.34	219.34
164.47	219.5
164.6	219.66
164.73	219.82
164.85	219.98
164.98	220.14
165.11	220.31
165.24	220.47
165.37	220.63
165.49	220.79
165.62	220.95
165.75	221.11
165.87	221.27
166	221.43
166.13	221.59
166.26	221.76
166.38	221.92
166.51	222.08
166.64	222.24
166.77	222.4

Summary of Results for 2 year Return Period (+35%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	7.007	0.107	8.9	627.6	O K
30 min Summer	7.037	0.137	13.7	810.5	O K
60 min Summer	7.069	0.169	19.2	1002.8	O K
120 min Summer	7.121	0.221	27.3	1312.0	O K
180 min Summer	7.149	0.249	30.7	1485.8	O K
240 min Summer	7.168	0.268	31.1	1599.8	O K
360 min Summer	7.189	0.289	31.5	1729.3	O K
480 min Summer	7.200	0.300	31.7	1798.7	O K
600 min Summer	7.207	0.307	31.8	1844.2	O K
720 min Summer	7.212	0.312	31.9	1874.9	O K
960 min Summer	7.217	0.317	31.9	1905.1	O K
1440 min Summer	7.218	0.318	31.9	1912.5	O K
2160 min Summer	7.212	0.312	31.9	1872.7	O K
2880 min Summer	7.203	0.303	31.7	1815.6	O K
4320 min Summer	7.184	0.284	31.4	1701.2	O K
5760 min Summer	7.168	0.268	31.1	1601.0	O K
15 min Winter	7.007	0.107	8.9	627.8	O K
30 min Winter	7.037	0.137	13.7	811.0	O K
60 min Winter	7.070	0.170	19.3	1004.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	45.474	0.0	359.9	30
30 min Summer	29.617	0.0	514.4	45
60 min Summer	18.636	0.0	842.3	72
120 min Summer	12.638	0.0	1194.3	130
180 min Summer	9.871	0.0	1424.4	186
240 min Summer	8.211	0.0	1594.6	244
360 min Summer	6.250	0.0	1837.1	360
480 min Summer	5.113	0.0	2011.5	418
600 min Summer	4.358	0.0	2145.8	482
720 min Summer	3.817	0.0	2255.2	546
960 min Summer	3.082	0.0	2421.2	678
1440 min Summer	2.278	0.0	2651.1	952
2160 min Summer	1.691	0.0	3235.0	1364
2880 min Summer	1.380	0.0	3509.2	1760
4320 min Summer	1.054	0.0	3961.5	2520
5760 min Summer	0.882	0.0	4634.9	3280
15 min Winter	45.474	0.0	359.9	30
30 min Winter	29.617	0.0	514.4	44
60 min Winter	18.636	0.0	842.3	72

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Summary of Results for 2 year Return Period (+35%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
120 min Winter	7.121	0.221	27.4	1316.0	O K
180 min Winter	7.150	0.250	30.7	1492.6	O K
240 min Winter	7.169	0.269	31.1	1608.5	O K
360 min Winter	7.191	0.291	31.5	1740.6	O K
480 min Winter	7.201	0.301	31.7	1804.3	O K
600 min Winter	7.206	0.306	31.8	1837.1	O K
720 min Winter	7.210	0.310	31.8	1861.3	O K
960 min Winter	7.212	0.312	31.9	1872.3	O K
1440 min Winter	7.206	0.306	31.8	1834.9	O K
2160 min Winter	7.189	0.289	31.5	1731.4	O K
2880 min Winter	7.171	0.271	31.2	1623.2	O K
4320 min Winter	7.143	0.243	30.3	1451.9	O K
5760 min Winter	7.125	0.225	27.9	1340.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
120 min Winter	12.638	0.0	1194.3	128
180 min Winter	9.871	0.0	1424.4	184
240 min Winter	8.211	0.0	1594.6	240
360 min Winter	6.250	0.0	1837.1	350
480 min Winter	5.113	0.0	2011.8	454
600 min Winter	4.358	0.0	2146.3	492
720 min Winter	3.817	0.0	2256.0	566
960 min Winter	3.082	0.0	2422.6	720
1440 min Winter	2.278	0.0	2654.2	1020
2160 min Winter	1.691	0.0	3235.9	1444
2880 min Winter	1.380	0.0	3510.5	1848
4320 min Winter	1.054	0.0	3964.2	2596
5760 min Winter	0.882	0.0	4635.3	3344

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 343581 430940 SD 43581 30940
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	5760
Climate Change %	+35

Time Area Diagram

Total Area (ha) 5.580

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	1.395	4	8	1.395	8	12	1.395	12	16	1.395

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Model Details

Storage is Online Cover Level (m) 8.500

Tank or Pond Structure

Invert Level (m) 6.900

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	5822.0	1.600	7799.0	1.610	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0240-3290-1500-3290
Design Head (m)	1.500
Design Flow (l/s)	32.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	240
Invert Level (m)	6.900
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	32.8	Kick-Flo®	1.030	27.4
Flush-Flo™	0.473	32.8	Mean Flow over Head Range	-	28.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.9	1.200	29.5	3.000	45.8	7.000	69.1
0.200	24.3	1.400	31.8	3.500	49.4	7.500	71.5
0.300	31.7	1.600	33.9	4.000	52.7	8.000	73.7
0.400	32.6	1.800	35.8	4.500	55.8	8.500	76.0
0.500	32.8	2.000	37.7	5.000	58.7	9.000	78.1
0.600	32.5	2.200	39.5	5.500	61.5	9.500	80.2
0.800	31.4	2.400	41.2	6.000	64.1		
1.000	28.4	2.600	42.8	6.500	66.7		

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Summary of Results for 30 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	7.122	0.222	27.5	1323.4	O K
30 min Summer	7.190	0.290	31.5	1734.7	O K
60 min Summer	7.260	0.360	32.4	2169.8	O K
120 min Summer	7.326	0.426	32.7	2582.6	O K
180 min Summer	7.364	0.464	32.8	2824.5	O K
240 min Summer	7.389	0.489	32.8	2986.1	O K
360 min Summer	7.419	0.519	32.8	3178.5	O K
480 min Summer	7.434	0.534	32.8	3277.7	O K
600 min Summer	7.442	0.542	32.8	3323.6	O K
720 min Summer	7.443	0.543	32.8	3334.3	O K
960 min Summer	7.442	0.542	32.8	3324.5	O K
1440 min Summer	7.433	0.533	32.8	3270.0	O K
2160 min Summer	7.415	0.515	32.8	3150.6	O K
2880 min Summer	7.394	0.494	32.8	3019.9	O K
4320 min Summer	7.356	0.456	32.8	2778.8	O K
5760 min Summer	7.323	0.423	32.7	2567.5	O K
15 min Winter	7.122	0.222	27.5	1323.7	O K
30 min Winter	7.190	0.290	31.5	1735.8	O K
60 min Winter	7.260	0.360	32.4	2171.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	96.460	0.0	960.6	30
30 min Summer	63.700	0.0	1332.4	44
60 min Summer	40.274	0.0	1998.1	74
120 min Summer	24.460	0.0	2452.1	132
180 min Summer	18.178	0.0	2742.5	190
240 min Summer	14.684	0.0	2956.3	248
360 min Summer	10.803	0.0	3258.8	366
480 min Summer	8.658	0.0	3472.0	484
600 min Summer	7.277	0.0	3633.0	602
720 min Summer	6.305	0.0	3758.7	708
960 min Summer	5.014	0.0	3938.2	808
1440 min Summer	3.623	0.0	4124.1	1052
2160 min Summer	2.624	0.0	5067.9	1456
2880 min Summer	2.098	0.0	5384.8	1856
4320 min Summer	1.555	0.0	5904.6	2652
5760 min Summer	1.272	0.0	6717.8	3456
15 min Winter	96.460	0.0	960.6	30
30 min Winter	63.700	0.0	1332.4	44
60 min Winter	40.274	0.0	1998.1	72

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Summary of Results for 30 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
120 min Winter	7.326	0.426	32.7	2584.2	O K
180 min Winter	7.364	0.464	32.8	2826.0	O K
240 min Winter	7.389	0.489	32.8	2987.5	O K
360 min Winter	7.419	0.519	32.8	3179.2	O K
480 min Winter	7.434	0.534	32.8	3278.3	O K
600 min Winter	7.442	0.542	32.8	3325.2	O K
720 min Winter	7.444	0.544	32.8	3338.2	O K
960 min Winter	7.438	0.538	32.8	3303.4	O K
1440 min Winter	7.423	0.523	32.8	3205.5	O K
2160 min Winter	7.392	0.492	32.8	3007.8	O K
2880 min Winter	7.359	0.459	32.8	2795.6	O K
4320 min Winter	7.298	0.398	32.6	2411.9	O K
5760 min Winter	7.247	0.347	32.3	2091.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
120 min Winter	24.460	0.0	2452.2	130
180 min Winter	18.178	0.0	2742.8	186
240 min Winter	14.684	0.0	2956.9	244
360 min Winter	10.803	0.0	3259.9	358
480 min Winter	8.658	0.0	3473.8	472
600 min Winter	7.277	0.0	3635.8	584
720 min Winter	6.305	0.0	3762.6	694
960 min Winter	5.014	0.0	3944.9	892
1440 min Winter	3.623	0.0	4141.7	1104
2160 min Winter	2.624	0.0	5070.3	1556
2880 min Winter	2.098	0.0	5389.1	1992
4320 min Winter	1.555	0.0	5916.6	2812
5760 min Winter	1.272	0.0	6718.9	3576

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 343581 430940 SD 43581 30940
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	5760
Climate Change %	+30

Time Area Diagram

Total Area (ha) 5.580

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	1.395	4	8	1.395	8	12	1.395	12	16	1.395

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Model Details

Storage is Online Cover Level (m) 8.500

Tank or Pond Structure

Invert Level (m) 6.900

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	5822.0	1.600	7799.0	1.610	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0240-3290-1500-3290
Design Head (m)	1.500
Design Flow (l/s)	32.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	240
Invert Level (m)	6.900
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	32.8	Kick-Flo®	1.030	27.4
Flush-Flo™	0.473	32.8	Mean Flow over Head Range	-	28.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.9	1.200	29.5	3.000	45.8	7.000	69.1
0.200	24.3	1.400	31.8	3.500	49.4	7.500	71.5
0.300	31.7	1.600	33.9	4.000	52.7	8.000	73.7
0.400	32.6	1.800	35.8	4.500	55.8	8.500	76.0
0.500	32.8	2.000	37.7	5.000	58.7	9.000	78.1
0.600	32.5	2.200	39.5	5.500	61.5	9.500	80.2
0.800	31.4	2.400	41.2	6.000	64.1		
1.000	28.4	2.600	42.8	6.500	66.7		

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Summary of Results for 100 year Return Period (+35%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	7.190	0.290	31.5	1739.9	O K
30 min Summer	7.282	0.382	32.5	2308.6	O K
60 min Summer	7.379	0.479	32.8	2921.3	O K
120 min Summer	7.457	0.557	32.8	3425.2	O K
180 min Summer	7.504	0.604	32.8	3730.0	O K
240 min Summer	7.536	0.636	32.8	3942.2	O K
360 min Summer	7.578	0.678	32.8	4216.9	O K
480 min Summer	7.602	0.702	32.8	4374.1	O K
600 min Summer	7.615	0.715	32.8	4464.2	O K
720 min Summer	7.622	0.722	32.8	4510.7	O K
960 min Summer	7.624	0.724	32.8	4520.4	O K
1440 min Summer	7.610	0.710	32.8	4430.7	O K
2160 min Summer	7.586	0.686	32.8	4270.9	O K
2880 min Summer	7.562	0.662	32.8	4110.1	O K
4320 min Summer	7.517	0.617	32.8	3815.9	O K
5760 min Summer	7.477	0.577	32.8	3556.0	O K
15 min Winter	7.191	0.291	31.5	1740.3	O K
30 min Winter	7.282	0.382	32.5	2309.4	O K
60 min Winter	7.379	0.479	32.8	2921.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	126.792	0.0	1327.2	30
30 min Summer	84.483	0.0	1809.6	45
60 min Summer	53.879	0.0	2714.9	74
120 min Summer	32.110	0.0	3245.4	132
180 min Summer	23.675	0.0	3584.2	192
240 min Summer	19.049	0.0	3833.9	250
360 min Summer	13.982	0.0	4185.9	368
480 min Summer	11.188	0.0	4419.7	486
600 min Summer	9.393	0.0	4581.5	606
720 min Summer	8.133	0.0	4692.3	724
960 min Summer	6.465	0.0	4799.2	960
1440 min Summer	4.658	0.0	4677.1	1178
2160 min Summer	3.356	0.0	6482.7	1544
2880 min Summer	2.671	0.0	6842.1	1956
4320 min Summer	1.962	0.0	7378.0	2768
5760 min Summer	1.596	0.0	8443.6	3576
15 min Winter	126.792	0.0	1327.2	30
30 min Winter	84.483	0.0	1809.6	44
60 min Winter	53.879	0.0	2715.0	72

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Summary of Results for 100 year Return Period (+35%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
120 min Winter	7.457	0.557	32.8	3425.8	O K
180 min Winter	7.504	0.604	32.8	3730.1	O K
240 min Winter	7.536	0.636	32.8	3941.8	O K
360 min Winter	7.578	0.678	32.8	4215.8	O K
480 min Winter	7.601	0.701	32.8	4372.4	O K
600 min Winter	7.615	0.715	32.8	4462.2	O K
720 min Winter	7.622	0.722	32.8	4509.2	O K
960 min Winter	7.624	0.724	32.8	4523.1	O K
1440 min Winter	7.603	0.703	32.8	4383.7	O K
2160 min Winter	7.570	0.670	32.8	4162.3	O K
2880 min Winter	7.533	0.633	32.8	3917.9	O K
4320 min Winter	7.461	0.561	32.8	3448.6	O K
5760 min Winter	7.396	0.496	32.8	3031.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
120 min Winter	32.110	0.0	3245.7	130
180 min Winter	23.675	0.0	3584.9	188
240 min Winter	19.049	0.0	3834.9	246
360 min Winter	13.982	0.0	4188.2	362
480 min Winter	11.188	0.0	4423.6	476
600 min Winter	9.393	0.0	4587.7	592
720 min Winter	8.133	0.0	4701.7	704
960 min Winter	6.465	0.0	4818.3	926
1440 min Winter	4.658	0.0	4727.3	1296
2160 min Winter	3.356	0.0	6486.9	1632
2880 min Winter	2.671	0.0	6850.4	2084
4320 min Winter	1.962	0.0	7409.0	2944
5760 min Winter	1.596	0.0	8445.6	3752

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 343581 430940 SD 43581 30940
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	5760
Climate Change %	+35

Time Area Diagram

Total Area (ha) 5.580

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.395	4	8	1.395	8	12	1.395	12	16	1.395

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Model Details

Storage is Online Cover Level (m) 8.500

Tank or Pond Structure

Invert Level (m) 6.900

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	5822.0	1.600	7799.0	1.610	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0240-3290-1500-3290
Design Head (m)	1.500
Design Flow (l/s)	32.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	240
Invert Level (m)	6.900
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	32.8	Kick-Flo®	1.030	27.4
Flush-Flo™	0.473	32.8	Mean Flow over Head Range	-	28.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.9	1.200	29.5	3.000	45.8	7.000	69.1
0.200	24.3	1.400	31.8	3.500	49.4	7.500	71.5
0.300	31.7	1.600	33.9	4.000	52.7	8.000	73.7
0.400	32.6	1.800	35.8	4.500	55.8	8.500	76.0
0.500	32.8	2.000	37.7	5.000	58.7	9.000	78.1
0.600	32.5	2.200	39.5	5.500	61.5	9.500	80.2
0.800	31.4	2.400	41.2	6.000	64.1		
1.000	28.4	2.600	42.8	6.500	66.7		

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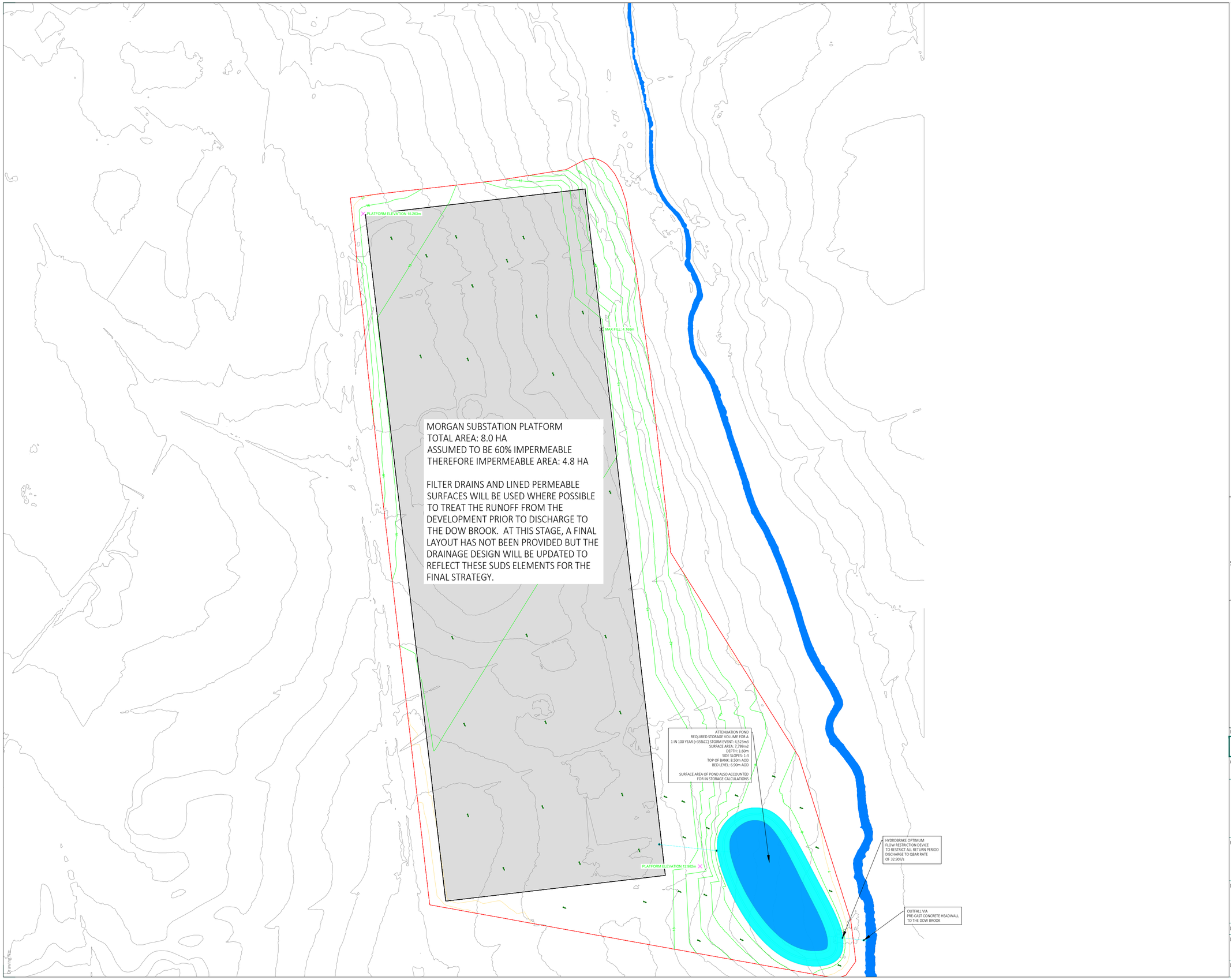

1. GENERAL
(i) WORK TO FIGURED DIMENSIONS ONLY.
(ii) THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTURAL DRAWINGS, DETAILED SPECIFICATIONS WHERE APPLICABLE AND ALL ASSOCIATED DRAWINGS IN THIS SERIES.
(iii) ANY DISCREPANCY ON THIS DRAWING IS TO BE REPORTED IMMEDIATELY TO THE COMPANY FOR CLARIFICATION.
(iv) THE CONTRACTOR IS RESPONSIBLE FOR ALL TEMPORARY WORKS AND FOR THE STABILITY OF THE WORKS IN PROGRESS.
2. DRAINAGE GENERAL
(i) ALL FOUL AND STORM WATER DRAINS WHICH ARE NOT TO BE ADOPTED AS PUBLIC SEWERS UNDER A SECTION 104 AGREEMENT MUST BE CONSTRUCTED IN ACCORDANCE WITH THE BUILDING REGULATIONS, BS EN 752 AND WHERE APPROPRIATE THE RELEVANT AGREEMENT CERTIFICATES.
(ii) MANHOLES, GULLIES, GULLY CONNECTIONS, SEWERS AND OTHER SEWERAGE STRUCTURES INTENDED TO CONVEY SURFACE WATER ARE TO BE CONSTRUCTED IN ACCORDANCE WITH THE WATER AUTHORITIES ASSOCIATION SPECIFICATION 'SEWERS FOR ADOPTION' 6TH EDITION AND RELEVANT COUNCIL DESIGN GUIDE.
(iii) ALL CONCRETE USED IN DRAINAGE WORKS TO COMPLY WITH BRE DIGEST 363 FOR CLASS 2 SULPHATE CONDITIONS.
3. MANHOLE COVERS AND FRAMES
(i) MANHOLE COVERS TO BE CLASS D400 IN HIGHWAYS, CLASS B125 IN FOOTWAYS AND VERGES, CLASS A15 IN NON-TRAFFICKED AREAS.
(ii) MANHOLE COVER AND FRAME TO BE BEDDED AND SURROUNDED IN 1:3 MORTAR.
4. MANHOLE RINGS, COVER SLABS & TAPERS
(i) PRECAST CONCRETE MANHOLE UNITS SHALL COMPLY WITH THE REQUIREMENTS OF BS 5911. THE RELEVANT ABSORPTION TESTS REQUIRED SHALL BE CARRIED OUT ON A SAMPLE OF THOSE RINGS AND SLABS USED UNLESS A CERTIFICATE OF TESTING IS SUPPLIED BY THE MANUFACTURER. COVER SLABS SITUATED UNDER CARRIAGEWAYS OR TRAFFICKED AREAS SHALL BE HEAVY DUTY AND THOSE ELSEWHERE SHALL BE LIGHT DUTY. MANHOLE UNITS SHALL BE COMPLETE WITH STEP IRONS IF REQUIRED.
5. PIPES
(i) PLASTIC PIPES SHALL BE OF UNPLASTICISED POLYVINYL CHLORIDE (UPVC) COMPLYING WITH THE REQUIREMENTS OF BS EN 1401.
(ii) CONCRETE PIPES SHALL BE SPUN BY A CENTRIFUGAL PROCESS OR BE VERTICALLY PRESSED. THEY SHALL POSSESS SELF INVERTING SOCKETS AND SHALL COMPLY WITH WITH THE REQUIREMENTS OF AND BE TESTED IN ACCORDANCE WITH BS 5911.
(iii) SOLID WALL CONCENTRIC EXTERNAL RIB-REINFORCED UNPLASTICISED PVC PIPE SHALL COMPLY WITH ASTM A978.
(iv) ALL VITRIFIED CLAY PIPES TO BE IN ACCORDFANCE WITH BS EN 295.
(v) ALL PIPE CONNECTIONS TO MHS AND CATCH PITS TO HAVE MIN 600MM ROCKER PIPE AS CLOSE AS PRACTICABLE TO CHAMBER WALL.
6. GULLY GRATES & FRAMES
(i) GULLY GRATES AND FRAMES FOR CARRIAGEWAY GULLIES SHALL COMPLY WITH BS EN 142. GULLIES SHALL BE PATTERN GB4-325 FOR ROADS BELOW 50 DV AND PATTERN GA2-450 FOR ROADS ABOVE 50 DV. GULLY GRATES AND FRAMES FOR KERB SIDE GULLIES SHALL BE PATTERN GK-115 FOR ROADS BELOW 50 DV AND GK-165 FOR ROADS ABOVE 50 DV. CURVED BAR GULLY GRATES SHALL BE USED IN ROADS WHERE THE GRADIENT EXCEEDS 4%.

WARNING!

WORKING ON LIVE DRAINAGE INFRASTRUCTURE AND IN CONFINED SPACES MUST BE UNDERTAKEN IN ACCORDANCE WITH AN APPROPRIATE RISK ASSESSMENT.

PRIOR TO OCCUPATION OF THE DEVELOPMENT A CCTV DRAINAGE SURVEY AND INSPECTION OF THE INSTALLED DRAINAGE ASSETS MUST BE UNDERTAKEN TO CONFIRM THAT THE SYSTEM HAS BEEN CONSTRUCTED PROPERLY. ANY DEFECTS IN THE SYSTEM SHALL BE REPAIRED PRIOR TO OCCUPATION OF THE DEVELOPMENT.

LEGEND

- PRIVATE SURFACE WATER DRAIN
- TYPE 2 MANHOLE
- PROPOSED IMPERMEABLE AREA
- OVERLAND FLOW

REV	DATE	BY	CKD	APPD	DESCRIPTION

PRELIMINARY DRAWING
FOR INFORMATION ONLY. NOT FOR CONSTRUCTION.

Client
BP/FLOTATION ENERGY

Royal HaskoningDHV
Enhancing Society Together
RHDHV | 2nd Floor | 15 Bermonsdey Square| London |SE1 3UN|
www.royalhaskoningdhv.com

Project
MORGAN SUBSTATION SITE

Drawing
OUTLINE SURFACE WATER DRAINAGE STRATEGY

Drawn by: Date: 16/09/24

Drawing No. PC1165- 3500
Revision B

Drawing Scale: 1:2500

Drawing NTS

Appendix C: Morecambe Substation – MicroDrainage Source Control Results and Outline Drainage Plan

Morecambe Site – FEH 22 Data

VERSION "FEH Web Version 1.0.0 exported at 14:11:26 GMT Tue 06-Aug-24

Parameters

Rainfall model= FEH22

Calculation type= Design rainfall

Calculation mode= For a point

Calculation location= Point GB 343678 430016 SD 43678 30016

Fixed duration= no

Annual maximum= yes

Duration hours	Duration d	2 year rainf	5 year rainf	10 year rai	20 year rai	30 year rai	50 year rai	75 year rai	100 year ra	150 year ra	200 year ra	500 year ra
0.25	0.010417	7.35	11.39	14.25	17.01	18.6	20.67	22.33	23.53	25.34	26.64	31.06
0.5	0.020833	9.55	14.85	18.65	22.36	24.56	27.32	29.65	31.38	33.92	35.73	41.92
0.75	0.03125	10.88	17.01	21.35	25.68	28.25	31.58	34.26	36.23	39.25	41.42	48.7
1	0.041667	11.96	18.61	23.36	28.16	31	34.69	37.72	39.93	43.17	45.55	53.69
1.25	0.052083	13.2	20.17	25.13	30.14	33.09	36.95	40.12	42.43	45.81	48.3	56.92
1.5	0.0625	14.41	21.6	26.68	31.8	34.84	38.79	42.05	44.43	47.91	50.49	59.47
1.75	0.072917	15.56	22.89	28.04	33.25	36.33	40.36	43.68	46.11	49.69	52.35	61.63
2	0.083333	16.62	24.06	29.26	34.53	37.66	41.75	45.11	47.59	51.25	53.97	63.52
2.25	0.09375	17.48	25.06	30.35	35.7	38.89	43.04	46.48	49.02	52.77	55.57	65.42
2.5	0.104167	18.28	25.97	31.34	36.77	40	44.23	47.73	50.32	54.17	57.04	67.17
2.75	0.114583	19.01	26.81	32.24	37.74	41.03	45.31	48.88	51.53	55.46	58.4	68.79
3	0.125	19.68	27.58	33.08	38.65	41.98	46.32	49.95	52.65	56.67	59.67	70.3
3.25	0.135417	20.31	28.3	33.86	39.49	42.87	47.27	50.95	53.69	57.79	60.86	71.73
3.5	0.145833	20.9	28.98	34.6	40.28	43.69	48.15	51.88	54.67	58.85	61.97	73.07
3.75	0.15625	21.46	29.61	35.28	41.02	44.47	48.98	52.77	55.6	59.85	63.03	74.33
4	0.166667	21.98	30.2	35.93	41.72	45.2	49.77	53.6	56.48	60.79	64.03	75.53
4.25	0.177083	22.47	30.76	36.54	42.38	45.89	50.51	54.4	57.31	61.68	64.97	76.67
4.5	0.1875	22.93	31.29	37.11	43	46.55	51.22	55.16	58.11	62.53	65.87	77.75
4.75	0.197917	23.37	31.79	37.66	43.59	47.17	51.89	55.88	58.86	63.34	66.72	78.78
5	0.208333	23.79	32.27	38.18	44.15	47.76	52.54	56.57	59.58	64.11	67.54	79.76
5.25	0.21875	24.19	32.72	38.68	44.69	48.33	53.15	57.22	60.27	64.85	68.32	80.7
5.5	0.229167	24.57	33.16	39.15	45.2	48.87	53.74	57.85	60.93	65.56	69.07	81.61
5.75	0.239583	24.94	33.58	39.61	45.7	49.39	54.3	58.46	61.57	66.24	69.79	82.47
6	0.25	25.29	33.98	40.04	46.17	49.88	54.84	59.04	62.18	66.9	70.48	83.31
6.25	0.260417	25.63	34.36	40.46	46.62	50.36	55.36	59.59	62.76	67.53	71.15	84.11
6.5	0.270833	25.95	34.73	40.86	47.06	50.83	55.86	60.12	63.32	68.13	71.8	84.88
6.75	0.28125	26.27	35.09	41.24	47.48	51.27	56.33	60.63	63.86	68.72	72.42	85.63
7	0.291667	26.57	35.43	41.61	47.88	51.7	56.8	61.12	64.38	69.29	73.03	86.35
7.25	0.302083	26.86	35.76	41.97	48.28	52.11	57.24	61.6	64.88	69.84	73.61	87.04
7.5	0.3125	27.14	36.08	42.32	48.66	52.52	57.67	62.06	65.37	70.37	74.17	87.71
7.75	0.322917	27.42	36.39	42.66	49.02	52.91	58.09	62.51	65.84	70.88	74.72	88.36
8	0.333333	27.68	36.69	42.98	49.38	53.28	58.5	62.94	66.3	71.38	75.25	88.99
8.25	0.34375	27.94	36.99	43.3	49.72	53.65	58.89	63.36	66.74	71.86	75.76	89.6
8.5	0.354167	28.19	37.27	43.61	50.06	54	59.27	63.77	67.17	72.33	76.26	90.2
8.75	0.364583	28.44	37.55	43.9	50.38	54.35	59.64	64.17	67.59	72.79	76.75	90.77
9	0.375	28.67	37.82	44.19	50.7	54.69	60	64.55	68	73.24	77.22	91.33
9.25	0.385417	28.9	38.08	44.48	51.01	55.01	60.35	64.93	68.4	73.67	77.68	91.88
9.5	0.395833	29.13	38.33	44.75	51.31	55.33	60.7	65.29	68.78	74.09	78.13	92.41
9.75	0.40625	29.35	38.58	45.02	51.6	55.64	61.03	65.65	69.16	74.5	78.57	92.92
10	0.416667	29.56	38.83	45.28	51.89	55.95	61.36	66	69.53	74.9	78.99	93.42
10.25	0.427083	29.77	39.06	45.54	52.17	56.24	61.67	66.34	69.89	75.3	79.41	93.91
10.5	0.4375	29.98	39.3	45.79	52.44	56.53	61.98	66.67	70.24	75.68	79.81	94.39
10.75	0.447917	30.18	39.52	46.04	52.71	56.81	62.29	67	70.59	76.05	80.21	94.86
11	0.458333	30.38	39.75	46.28	52.97	57.09	62.59	67.32	70.92	76.42	80.6	95.31
11.25	0.46875	30.57	39.96	46.51	53.22	57.36	62.88	67.63	71.25	76.78	80.98	95.76
11.5	0.479167	30.76	40.18	46.74	53.47	57.63	63.16	67.93	71.57	77.13	81.35	96.19
11.75	0.489583	30.94	40.38	46.96	53.72	57.88	63.44	68.23	71.89	77.47	81.71	96.61
12	0.5	31.12	40.59	47.18	53.96	58.14	63.71	68.53	72.2	77.8	82.06	97.03
12.25	0.510417	31.29	40.79	47.4	54.19	58.38	63.98	68.81	72.5	78.13	82.4	97.43
12.5	0.520833	31.47	40.98	47.61	54.41	58.62	64.24	69.09	72.8	78.45	82.74	97.82
12.75	0.53125	31.63	41.18	47.82	54.64	58.86	64.49	69.37	73.09	78.76	83.07	98.2
13	0.541667	31.8	41.36	48.02	54.86	59.09	64.74	69.64	73.38	79.06	83.39	98.58
13.25	0.552083	31.96	41.55	48.22	55.07	59.31	64.99	69.9	73.66	79.36	83.7	98.94
13.5	0.5625	32.12	41.73	48.42	55.28	59.54	65.23	70.16	73.93	79.66	84.01	99.3
13.75	0.572917	32.28	41.91	48.61	55.49	59.76	65.47	70.42	74.2	79.95	84.32	99.66
14	0.583333	32.44	42.09	48.8	55.7	59.97	65.7	70.67	74.47	80.23	84.61	100
14.25	0.59375	32.59	42.26	48.99	55.9	60.18	65.93	70.92	74.73	80.51	84.91	100.35
14.5	0.604167	32.74	42.43	49.17	56.1	60.39	66.15	71.16	74.99	80.79	85.2	100.68
14.75	0.614583	32.89	42.6	49.35	56.29	60.6	66.38	71.4	75.24	81.06	85.48	101.01
15	0.625	33.03	42.76	49.53	56.48	60.8	66.6	71.64	75.49	81.32	85.76	101.33
15.25	0.635417	33.18	42.93	49.71	56.67	61	66.81	71.87	75.74	81.58	86.03	101.65

15.5	0.645833	33.32	43.09	49.88	56.86	61.19	67.02	72.1	75.98	81.84	86.3	101.96
15.75	0.65625	33.46	43.25	50.05	57.04	61.39	67.23	72.33	76.22	82.1	86.57	102.27
16	0.666667	33.6	43.41	50.22	57.22	61.58	67.44	72.55	76.45	82.35	86.83	102.57
16.25	0.677083	33.73	43.56	50.39	57.4	61.76	67.64	72.77	76.68	82.59	87.09	102.87
16.5	0.6875	33.87	43.71	50.55	57.58	61.95	67.85	72.98	76.91	82.83	87.34	103.16
16.75	0.697917	34	43.86	50.71	57.75	62.13	68.04	73.2	77.13	83.07	87.59	103.45
17	0.708333	34.14	44.01	50.87	57.92	62.31	68.24	73.41	77.35	83.31	87.84	103.74
17.25	0.71875	34.27	44.16	51.03	58.09	62.49	68.43	73.61	77.57	83.54	88.08	104.02
17.5	0.729167	34.39	44.3	51.19	58.26	62.67	68.62	73.82	77.79	83.77	88.32	104.29
17.75	0.739583	34.52	44.45	51.34	58.43	62.84	68.81	74.02	78	84	88.56	104.56
18	0.75	34.65	44.59	51.49	58.59	63.01	69	74.22	78.21	84.22	88.79	104.83
18.25	0.760417	34.77	44.73	51.64	58.75	63.18	69.18	74.42	78.41	84.44	89.02	105.09
18.5	0.770833	34.9	44.87	51.79	58.91	63.35	69.37	74.61	78.61	84.66	89.25	105.35
18.75	0.78125	35.02	45.01	51.94	59.07	63.51	69.55	74.8	78.81	84.87	89.48	105.61
19	0.791667	35.15	45.14	52.08	59.22	63.68	69.72	74.99	79.01	85.08	89.7	105.86
19.25	0.802083	35.27	45.28	52.23	59.38	63.84	69.9	75.18	79.2	85.29	89.92	106.11
19.5	0.8125	35.39	45.41	52.37	59.53	64	70.07	75.36	79.4	85.5	90.14	106.36
19.75	0.822917	35.51	45.54	52.51	59.68	64.16	70.25	75.55	79.59	85.7	90.35	106.6
20	0.833333	35.63	45.67	52.65	59.83	64.31	70.42	75.73	79.77	85.9	90.56	106.84
20.25	0.84375	35.74	45.8	52.79	59.98	64.47	70.59	75.91	79.96	86.1	90.77	107.08
20.5	0.854167	35.86	45.93	52.93	60.13	64.62	70.76	76.08	80.15	86.3	90.98	107.32
20.75	0.864583	35.97	46.06	53.07	60.28	64.78	70.92	76.26	80.33	86.49	91.19	107.55
21	0.875	36.09	46.18	53.2	60.42	64.93	71.09	76.43	80.51	86.69	91.39	107.78
21.25	0.885417	36.2	46.31	53.34	60.56	65.08	71.25	76.61	80.69	86.88	91.59	108.01
21.5	0.895833	36.32	46.43	53.47	60.71	65.23	71.41	76.78	80.86	87.07	91.79	108.24
21.75	0.90625	36.43	46.56	53.6	60.85	65.38	71.57	76.95	81.04	87.26	91.99	108.46
22	0.916667	36.54	46.68	53.73	60.99	65.52	71.73	77.11	81.21	87.44	92.19	108.68
22.25	0.927083	36.65	46.8	53.86	61.13	65.67	71.89	77.28	81.39	87.63	92.38	108.9
22.5	0.9375	36.76	46.92	53.99	61.26	65.81	72.04	77.45	81.56	87.81	92.57	109.12
22.75	0.947917	36.87	47.04	54.12	61.4	65.95	72.2	77.61	81.73	87.99	92.76	109.34
23	0.958333	36.98	47.16	54.25	61.54	66.1	72.35	77.77	81.89	88.17	92.95	109.55
23.25	0.96875	37.08	47.28	54.37	61.67	66.24	72.5	77.93	82.06	88.35	93.14	109.76
23.5	0.979167	37.19	47.4	54.5	61.8	66.38	72.65	78.09	82.22	88.53	93.33	109.97
23.75	0.989583	37.29	47.51	54.62	61.94	66.51	72.8	78.25	82.39	88.7	93.51	110.18
24	1	37.4	47.63	54.74	62.07	66.65	72.95	78.4	82.55	88.87	93.69	110.38
24.25	1.010417	37.5	47.74	54.86	62.2	66.79	73.1	78.55	82.71	89.04	93.87	110.58
24.5	1.020833	37.61	47.86	54.99	62.32	66.92	73.24	78.7	82.86	89.21	94.04	110.78
24.75	1.03125	37.71	47.97	55.1	62.45	67.05	73.38	78.85	83.02	89.37	94.22	110.98
25	1.041667	37.81	48.08	55.22	62.58	67.18	73.52	79	83.17	89.54	94.39	111.17
25.25	1.052083	37.91	48.19	55.34	62.7	67.31	73.66	79.15	83.32	89.7	94.56	111.37
25.5	1.0625	38.01	48.3	55.46	62.83	67.44	73.8	79.29	83.48	89.86	94.73	111.56
25.75	1.072917	38.11	48.41	55.58	62.95	67.57	73.93	79.44	83.63	90.02	94.89	111.75
26	1.083333	38.21	48.52	55.69	63.08	67.7	74.07	79.58	83.78	90.18	95.06	111.94
26.25	1.09375	38.31	48.63	55.81	63.2	67.83	74.21	79.73	83.92	90.34	95.23	112.13
26.5	1.104167	38.4	48.74	55.92	63.32	67.96	74.34	79.87	84.07	90.5	95.39	112.31
26.75	1.114583	38.5	48.85	56.04	63.44	68.08	74.48	80.01	84.22	90.65	95.56	112.5
27	1.125	38.6	48.95	56.15	63.56	68.21	74.61	80.15	84.36	90.81	95.72	112.68
27.25	1.135417	38.69	49.06	56.26	63.68	68.33	74.74	80.29	84.51	90.96	95.88	112.86
27.5	1.145833	38.79	49.17	56.38	63.8	68.46	74.87	80.43	84.65	91.12	96.04	113.05
27.75	1.15625	38.89	49.27	56.49	63.92	68.58	75	80.56	84.8	91.27	96.2	113.23
28	1.166667	38.98	49.38	56.6	64.04	68.7	75.13	80.7	84.94	91.42	96.36	113.41
28.25	1.177083	39.08	49.48	56.71	64.16	68.83	75.26	80.84	85.08	91.57	96.51	113.58
28.5	1.1875	39.17	49.58	56.82	64.27	68.95	75.39	80.97	85.22	91.72	96.67	113.76
28.75	1.197917	39.26	49.69	56.93	64.39	69.07	75.52	81.1	85.36	91.87	96.82	113.94
29	1.208333	39.36	49.79	57.04	64.51	69.19	75.64	81.24	85.5	92.02	96.98	114.11
29.25	1.21875	39.45	49.89	57.15	64.62	69.31	75.77	81.37	85.64	92.16	97.13	114.29
29.5	1.229167	39.54	49.99	57.26	64.74	69.43	75.9	81.5	85.77	92.31	97.28	114.46
29.75	1.239583	39.63	50.1	57.36	64.85	69.55	76.02	81.63	85.91	92.46	97.44	114.63
30	1.25	39.72	50.2	57.47	64.96	69.66	76.15	81.76	86.05	92.6	97.59	114.81
30.25	1.260417	39.82	50.3	57.58	65.08	69.78	76.27	81.89	86.18	92.74	97.74	114.98
30.5	1.270833	39.91	50.4	57.68	65.19	69.9	76.39	82.02	86.31	92.89	97.89	115.15
30.75	1.28125	40	50.5	57.79	65.3	70.01	76.51	82.15	86.45	93.03	98.04	115.31
31	1.291667	40.09	50.6	57.9	65.41	70.13	76.64	82.28	86.58	93.17	98.18	115.48
31.25	1.302083	40.18	50.7	58	65.52	70.24	76.76	82.41	86.71	93.31	98.33	115.65
31.5	1.3125	40.27	50.8	58.1	65.63	70.36	76.88	82.53	86.85	93.45	98.48	115.82
31.75	1.322917	40.35	50.89	58.21	65.74	70.47	77	82.66	86.98	93.59	98.62	115.98
32	1.333333	40.44	50.99	58.31	65.85	70.59	77.12	82.79	87.11	93.73	98.77	116.15
32.25	1.34375	40.53	51.09	58.42	65.96	70.7	77.24	82.91	87.24	93.87	98.91	116.31
32.5	1.354167	40.62	51.19	58.52	66.07	70.81	77.35	83.03	87.37	94	99.05	116.47
32.75	1.364583	40.71	51.28	58.62	66.18	70.92	77.47	83.16	87.5	94.14	99.2	116.63

33	1.375	40.79	51.38	58.72	66.29	71.04	77.59	83.28	87.62	94.28	99.34	116.8
33.25	1.385417	40.88	51.47	58.82	66.39	71.15	77.71	83.4	87.75	94.41	99.48	116.96
33.5	1.395833	40.97	51.57	58.92	66.5	71.26	77.82	83.53	87.88	94.55	99.62	117.12
33.75	1.40625	41.05	51.67	59.03	66.61	71.37	77.94	83.65	88	94.68	99.76	117.28
34	1.416667	41.14	51.76	59.13	66.71	71.48	78.05	83.77	88.13	94.82	99.9	117.44
34.25	1.427083	41.23	51.86	59.23	66.82	71.59	78.17	83.89	88.25	94.95	100.04	117.59
34.5	1.4375	41.31	51.95	59.33	66.92	71.7	78.28	84.01	88.38	95.08	100.18	117.75
34.75	1.447917	41.4	52.04	59.42	67.03	71.81	78.4	84.13	88.5	95.21	100.31	117.91
35	1.458333	41.48	52.14	59.52	67.13	71.91	78.51	84.25	88.63	95.34	100.45	118.06
35.25	1.46875	41.57	52.23	59.62	67.24	72.02	78.62	84.37	88.75	95.48	100.59	118.22
35.5	1.479167	41.65	52.32	59.72	67.34	72.13	78.74	84.48	88.87	95.61	100.72	118.37
35.75	1.489583	41.73	52.42	59.82	67.44	72.24	78.85	84.6	89	95.74	100.86	118.53
36	1.5	41.82	52.51	59.92	67.55	72.34	78.96	84.72	89.12	95.87	100.99	118.68
36.25	1.510417	41.9	52.6	60.01	67.65	72.45	79.07	84.83	89.24	95.99	101.13	118.83
36.5	1.520833	41.98	52.69	60.11	67.75	72.55	79.18	84.95	89.36	96.12	101.26	118.99
36.75	1.53125	42.07	52.78	60.21	67.85	72.66	79.29	85.07	89.48	96.25	101.39	119.14
37	1.541667	42.15	52.88	60.3	67.96	72.77	79.4	85.18	89.6	96.38	101.53	119.29
37.25	1.552083	42.23	52.97	60.4	68.06	72.87	79.51	85.3	89.72	96.5	101.66	119.44
37.5	1.5625	42.31	53.06	60.5	68.16	72.97	79.62	85.41	89.84	96.63	101.79	119.59
37.75	1.572917	42.4	53.15	60.59	68.26	73.08	79.73	85.52	89.96	96.76	101.92	119.74
38	1.583333	42.48	53.24	60.69	68.36	73.18	79.84	85.64	90.08	96.88	102.05	119.89
38.25	1.59375	42.56	53.33	60.78	68.46	73.29	79.95	85.75	90.19	97.01	102.18	120.04
38.5	1.604167	42.64	53.42	60.88	68.56	73.39	80.05	85.86	90.31	97.13	102.31	120.19
38.75	1.614583	42.72	53.51	60.97	68.66	73.49	80.16	85.98	90.43	97.25	102.44	120.33
39	1.625	42.8	53.6	61.06	68.76	73.59	80.27	86.09	90.54	97.38	102.57	120.48
39.25	1.635417	42.88	53.68	61.16	68.86	73.7	80.37	86.2	90.66	97.5	102.7	120.63
39.5	1.645833	42.96	53.77	61.25	68.96	73.8	80.48	86.31	90.78	97.62	102.83	120.77
39.75	1.65625	43.04	53.86	61.34	69.05	73.9	80.59	86.42	90.89	97.75	102.95	120.92
40	1.666667	43.12	53.95	61.44	69.15	74	80.69	86.53	91.01	97.87	103.08	121.06
40.25	1.677083	43.2	54.04	61.53	69.25	74.1	80.8	86.64	91.12	97.99	103.21	121.21
40.5	1.6875	43.28	54.13	61.62	69.35	74.2	80.9	86.75	91.23	98.11	103.33	121.35
40.75	1.697917	43.36	54.21	61.71	69.44	74.3	81.01	86.86	91.35	98.23	103.46	121.5
41	1.708333	43.44	54.3	61.81	69.54	74.4	81.11	86.97	91.46	98.35	103.59	121.64
41.25	1.71875	43.52	54.39	61.9	69.64	74.5	81.22	87.08	91.58	98.47	103.71	121.78
41.5	1.729167	43.6	54.47	61.99	69.73	74.6	81.32	87.19	91.69	98.59	103.84	121.92
41.75	1.739583	43.68	54.56	62.08	69.83	74.7	81.42	87.3	91.8	98.71	103.96	122.07
42	1.75	43.76	54.65	62.17	69.93	74.8	81.53	87.41	91.91	98.83	104.08	122.21
42.25	1.760417	43.83	54.73	62.26	70.02	74.9	81.63	87.51	92.02	98.95	104.21	122.35
42.5	1.770833	43.91	54.82	62.35	70.12	75	81.73	87.62	92.14	99.07	104.33	122.49
42.75	1.78125	43.99	54.9	62.44	70.21	75.1	81.83	87.73	92.25	99.18	104.45	122.63
43	1.791667	44.07	54.99	62.53	70.31	75.19	81.93	87.83	92.36	99.3	104.57	122.77
43.25	1.802083	44.14	55.08	62.62	70.4	75.29	82.04	87.94	92.47	99.42	104.7	122.91
43.5	1.8125	44.22	55.16	62.71	70.49	75.39	82.14	88.05	92.58	99.54	104.82	123.05
43.75	1.822917	44.3	55.25	62.8	70.59	75.49	82.24	88.15	92.69	99.65	104.94	123.19
44	1.833333	44.38	55.33	62.89	70.68	75.58	82.34	88.26	92.8	99.77	105.06	123.32
44.25	1.84375	44.45	55.41	62.98	70.78	75.68	82.44	88.36	92.91	99.88	105.18	123.46
44.5	1.854167	44.53	55.5	63.07	70.87	75.78	82.54	88.47	93.02	100	105.3	123.6
44.75	1.864583	44.61	55.58	63.16	70.96	75.87	82.64	88.57	93.13	100.11	105.42	123.74
45	1.875	44.68	55.67	63.25	71.06	75.97	82.74	88.68	93.23	100.23	105.54	123.87
45.25	1.885417	44.76	55.75	63.33	71.15	76.07	82.84	88.78	93.34	100.34	105.66	124.01
45.5	1.895833	44.83	55.83	63.42	71.24	76.16	82.94	88.88	93.45	100.46	105.78	124.15
45.75	1.90625	44.91	55.92	63.51	71.33	76.26	83.04	88.99	93.56	100.57	105.9	124.28
46	1.916667	44.99	56	63.6	71.43	76.35	83.14	89.09	93.66	100.68	106.02	124.42
46.25	1.927083	45.06	56.08	63.68	71.52	76.45	83.24	89.19	93.77	100.8	106.13	124.55
46.5	1.9375	45.14	56.17	63.77	71.61	76.54	83.33	89.3	93.88	100.91	106.25	124.69
46.75	1.947917	45.21	56.25	63.86	71.7	76.64	83.43	89.4	93.98	101.02	106.37	124.82
47	1.958333	45.29	56.33	63.95	71.79	76.73	83.53	89.5	94.09	101.14	106.49	124.96
47.25	1.96875	45.36	56.42	64.03	71.88	76.82	83.63	89.6	94.2	101.25	106.6	125.09
47.5	1.979167	45.44	56.5	64.12	71.97	76.92	83.72	89.7	94.3	101.36	106.72	125.22
47.75	1.989583	45.51	56.58	64.21	72.06	77.01	83.82	89.81	94.41	101.47	106.84	125.36
48	2	45.58	56.66	64.29	72.16	77.1	83.92	89.91	94.51	101.58	106.95	125.49
48.25	2.010417	45.66	56.75	64.38	72.25	77.2	84.02	90.01	94.62	101.7	107.07	125.63
48.5	2.020833	45.74	56.83	64.47	72.34	77.3	84.12	90.11	94.73	101.81	107.19	125.76
48.75	2.03125	45.81	56.91	64.56	72.43	77.39	84.22	90.22	94.83	101.92	107.31	125.9
49	2.041667	45.89	57	64.64	72.53	77.49	84.32	90.32	94.94	102.04	107.42	126.03
49.25	2.052083	45.97	57.08	64.73	72.62	77.58	84.41	90.42	95.05	102.15	107.54	126.17
49.5	2.0625	46.04	57.16	64.82	72.71	77.68	84.51	90.53	95.15	102.26	107.66	126.3
49.75	2.072917	46.12	57.25	64.91	72.8	77.77	84.61	90.63	95.26	102.37	107.77	126.44
50	2.083333	46.19	57.33	64.99	72.89	77.86	84.71	90.73	95.36	102.48	107.89	126.57
50.25	2.09375	46.27	57.41	65.08	72.98	77.96	84.81	90.83	95.47	102.59	108.01	126.71

50.5	2.104167	46.34	57.49	65.17	73.07	78.05	84.9	90.93	95.58	102.71	108.12	126.84
50.75	2.114583	46.42	57.58	65.25	73.17	78.15	85	91.04	95.68	102.82	108.24	126.97
51	2.125	46.49	57.66	65.34	73.26	78.24	85.1	91.14	95.79	102.93	108.36	127.11
51.25	2.135417	46.57	57.74	65.43	73.35	78.33	85.2	91.24	95.89	103.04	108.47	127.24
51.5	2.145833	46.64	57.82	65.51	73.44	78.43	85.29	91.34	96	103.15	108.59	127.37
51.75	2.15625	46.72	57.9	65.6	73.53	78.52	85.39	91.44	96.1	103.26	108.7	127.51
52	2.166667	46.79	57.99	65.69	73.62	78.61	85.49	91.54	96.2	103.37	108.82	127.64
52.25	2.177083	46.87	58.07	65.77	73.71	78.71	85.58	91.64	96.31	103.48	108.93	127.77
52.5	2.1875	46.94	58.15	65.86	73.8	78.8	85.68	91.74	96.41	103.59	109.05	127.9
52.75	2.197917	47.02	58.23	65.94	73.89	78.89	85.78	91.84	96.51	103.7	109.16	128.03
53	2.208333	47.09	58.31	66.03	73.98	78.98	85.87	91.94	96.62	103.81	109.27	128.17
53.25	2.21875	47.16	58.39	66.11	74.07	79.08	85.97	92.04	96.72	103.92	109.39	128.3
53.5	2.229167	47.24	58.47	66.2	74.16	79.17	86.06	92.14	96.82	104.03	109.5	128.43
53.75	2.239583	47.31	58.56	66.28	74.25	79.26	86.16	92.24	96.93	104.13	109.62	128.56
54	2.25	47.39	58.64	66.37	74.34	79.35	86.26	92.34	97.03	104.24	109.73	128.69
54.25	2.260417	47.46	58.72	66.45	74.42	79.44	86.35	92.44	97.13	104.35	109.84	128.82
54.5	2.270833	47.53	58.8	66.54	74.51	79.54	86.45	92.54	97.24	104.46	109.96	128.95
54.75	2.28125	47.61	58.88	66.62	74.6	79.63	86.54	92.64	97.34	104.57	110.07	129.08
55	2.291667	47.68	58.96	66.71	74.69	79.72	86.64	92.74	97.44	104.67	110.18	129.21
55.25	2.302083	47.75	59.04	66.79	74.78	79.81	86.73	92.83	97.54	104.78	110.29	129.34
55.5	2.3125	47.83	59.12	66.88	74.87	79.9	86.83	92.93	97.64	104.89	110.41	129.47
55.75	2.322917	47.9	59.2	66.96	74.96	79.99	86.92	93.03	97.74	105	110.52	129.6
56	2.333333	47.97	59.28	67.04	75.04	80.08	87.01	93.13	97.85	105.1	110.63	129.73
56.25	2.34375	48.04	59.36	67.13	75.13	80.17	87.11	93.23	97.95	105.21	110.74	129.86
56.5	2.354167	48.12	59.44	67.21	75.22	80.26	87.2	93.32	98.05	105.32	110.85	129.99
56.75	2.364583	48.19	59.52	67.29	75.31	80.35	87.3	93.42	98.15	105.42	110.96	130.12
57	2.375	48.26	59.6	67.38	75.39	80.44	87.39	93.52	98.25	105.53	111.08	130.24
57.25	2.385417	48.33	59.68	67.46	75.48	80.53	87.48	93.62	98.35	105.64	111.19	130.37
57.5	2.395833	48.41	59.75	67.54	75.57	80.62	87.58	93.71	98.45	105.74	111.3	130.5
57.75	2.40625	48.48	59.83	67.63	75.66	80.71	87.67	93.81	98.55	105.85	111.41	130.63
58	2.416667	48.55	59.91	67.71	75.74	80.8	87.76	93.91	98.65	105.95	111.52	130.76
58.25	2.427083	48.62	59.99	67.79	75.83	80.89	87.86	94	98.75	106.06	111.63	130.88
58.5	2.4375	48.7	60.07	67.88	75.92	80.98	87.95	94.1	98.85	106.17	111.74	131.01
58.75	2.447917	48.77	60.15	67.96	76	81.07	88.04	94.2	98.95	106.27	111.85	131.14
59	2.458333	48.84	60.23	68.04	76.09	81.16	88.13	94.29	99.05	106.38	111.96	131.27
59.25	2.46875	48.91	60.31	68.12	76.18	81.25	88.23	94.39	99.15	106.48	112.07	131.39
59.5	2.479167	48.98	60.38	68.21	76.26	81.34	88.32	94.49	99.25	106.59	112.18	131.52
59.75	2.489583	49.05	60.46	68.29	76.35	81.43	88.41	94.58	99.35	106.69	112.29	131.65
60	2.5	49.12	60.54	68.37	76.43	81.51	88.5	94.68	99.45	106.8	112.4	131.77
60.25	2.510417	49.2	60.62	68.45	76.52	81.6	88.6	94.77	99.55	106.9	112.51	131.9
60.5	2.520833	49.27	60.7	68.53	76.61	81.69	88.69	94.87	99.65	107	112.61	132.02
60.75	2.53125	49.34	60.77	68.62	76.69	81.78	88.78	94.96	99.74	107.11	112.72	132.15
61	2.541667	49.41	60.85	68.7	76.78	81.87	88.87	95.06	99.84	107.21	112.83	132.28
61.25	2.552083	49.48	60.93	68.78	76.86	81.96	88.96	95.15	99.94	107.32	112.94	132.4
61.5	2.5625	49.55	61.01	68.86	76.95	82.04	89.05	95.25	100.04	107.42	113.05	132.53
61.75	2.572917	49.62	61.08	68.94	77.03	82.13	89.14	95.34	100.14	107.52	113.16	132.65
62	2.583333	49.69	61.16	69.02	77.12	82.22	89.24	95.44	100.23	107.63	113.27	132.78
62.25	2.59375	49.76	61.24	69.1	77.2	82.31	89.33	95.53	100.33	107.73	113.37	132.9
62.5	2.604167	49.83	61.32	69.18	77.29	82.39	89.42	95.63	100.43	107.83	113.48	133.03
62.75	2.614583	49.9	61.39	69.27	77.37	82.48	89.51	95.72	100.53	107.94	113.59	133.15
63	2.625	49.98	61.47	69.35	77.46	82.57	89.6	95.82	100.63	108.04	113.7	133.28
63.25	2.635417	50.05	61.55	69.43	77.54	82.66	89.69	95.91	100.72	108.14	113.8	133.4
63.5	2.645833	50.12	61.62	69.51	77.63	82.74	89.78	96	100.82	108.24	113.91	133.53
63.75	2.65625	50.19	61.7	69.59	77.71	82.83	89.87	96.1	100.92	108.35	114.02	133.65
64	2.666667	50.26	61.78	69.67	77.8	82.92	89.96	96.19	101.01	108.45	114.13	133.77
64.25	2.677083	50.33	61.85	69.75	77.88	83	90.05	96.29	101.11	108.55	114.23	133.9
64.5	2.6875	50.4	61.93	69.83	77.96	83.09	90.14	96.38	101.21	108.65	114.34	134.02
64.75	2.697917	50.47	62.01	69.91	78.05	83.18	90.23	96.47	101.3	108.76	114.45	134.14
65	2.708333	50.54	62.08	69.99	78.13	83.26	90.32	96.57	101.4	108.86	114.55	134.27
65.25	2.71875	50.61	62.16	70.07	78.21	83.35	90.41	96.66	101.5	108.96	114.66	134.39
65.5	2.729167	50.68	62.23	70.15	78.3	83.44	90.5	96.75	101.59	109.06	114.77	134.51
65.75	2.739583	50.74	62.31	70.23	78.38	83.52	90.59	96.84	101.69	109.16	114.87	134.64
66	2.75	50.81	62.39	70.31	78.47	83.61	90.68	96.94	101.79	109.26	114.98	134.76
66.25	2.760417	50.88	62.46	70.39	78.55	83.69	90.77	97.03	101.88	109.37	115.08	134.88
66.5	2.770833	50.95	62.54	70.47	78.63	83.78	90.86	97.12	101.98	109.47	115.19	135.01
66.75	2.78125	51.02	62.61	70.55	78.72	83.86	90.94	97.22	102.07	109.57	115.3	135.13
67	2.791667	51.09	62.69	70.63	78.8	83.95	91.03	97.31	102.17	109.67	115.4	135.25
67.25	2.802083	51.16	62.77	70.71	78.88	84.04	91.12	97.4	102.26	109.77	115.51	135.37
67.5	2.8125	51.23	62.84	70.79	78.96	84.12	91.21	97.49	102.36	109.87	115.61	135.49
67.75	2.822917	51.3	62.92	70.86	79.05	84.21	91.3	97.58	102.45	109.97	115.72	135.62

68	2.833333	51.37	62.99	70.94	79.13	84.29	91.39	97.68	102.55	110.07	115.82	135.74
68.25	2.84375	51.44	63.07	71.02	79.21	84.38	91.48	97.77	102.64	110.17	115.93	135.86
68.5	2.854167	51.51	63.14	71.1	79.3	84.46	91.56	97.86	102.74	110.27	116.03	135.98
68.75	2.864583	51.57	63.22	71.18	79.38	84.55	91.65	97.95	102.83	110.37	116.14	136.1
69	2.875	51.64	63.29	71.26	79.46	84.63	91.74	98.04	102.93	110.47	116.24	136.22
69.25	2.885417	51.71	63.37	71.34	79.54	84.72	91.83	98.14	103.02	110.57	116.35	136.35
69.5	2.895833	51.78	63.44	71.42	79.63	84.8	91.92	98.23	103.12	110.67	116.45	136.47
69.75	2.90625	51.85	63.52	71.49	79.71	84.89	92.01	98.32	103.21	110.77	116.55	136.59
70	2.916667	51.92	63.59	71.57	79.79	84.97	92.09	98.41	103.31	110.87	116.66	136.71
70.25	2.927083	51.99	63.67	71.65	79.87	85.05	92.18	98.5	103.4	110.97	116.76	136.83
70.5	2.9375	52.05	63.74	71.73	79.95	85.14	92.27	98.59	103.5	111.07	116.87	136.95
70.75	2.947917	52.12	63.81	71.81	80.03	85.22	92.36	98.68	103.59	111.17	116.97	137.07
71	2.958333	52.19	63.89	71.89	80.12	85.31	92.44	98.77	103.68	111.27	117.08	137.19
71.25	2.96875	52.26	63.96	71.96	80.2	85.39	92.53	98.86	103.78	111.37	117.18	137.31
71.5	2.979167	52.33	64.04	72.04	80.28	85.48	92.62	98.95	103.87	111.47	117.28	137.43
71.75	2.989583	52.39	64.11	72.12	80.36	85.56	92.7	99.05	103.97	111.57	117.39	137.55
72	3	52.46	64.19	72.2	80.44	85.64	92.79	99.14	104.06	111.67	117.49	137.67
72.25	3.010417	52.53	64.26	72.27	80.52	85.73	92.88	99.23	104.15	111.76	117.59	137.79
72.5	3.020833	52.6	64.33	72.35	80.61	85.81	92.97	99.32	104.25	111.86	117.7	137.91
72.75	3.03125	52.67	64.41	72.43	80.69	85.89	93.05	99.41	104.34	111.96	117.8	138.03
73	3.041667	52.73	64.48	72.51	80.77	85.98	93.14	99.5	104.43	112.06	117.9	138.15
73.25	3.052083	52.8	64.56	72.58	80.85	86.06	93.23	99.59	104.53	112.16	118.01	138.27
73.5	3.0625	52.87	64.63	72.66	80.93	86.14	93.31	99.68	104.62	112.26	118.11	138.39
73.75	3.072917	52.94	64.7	72.74	81.01	86.23	93.4	99.77	104.71	112.36	118.21	138.51
74	3.083333	53	64.78	72.82	81.09	86.31	93.49	99.86	104.81	112.45	118.31	138.63
74.25	3.09375	53.07	64.85	72.89	81.17	86.39	93.57	99.95	104.9	112.55	118.42	138.75
74.5	3.104167	53.14	64.92	72.97	81.25	86.48	93.66	100.04	104.99	112.65	118.52	138.87
74.75	3.114583	53.21	65	73.05	81.33	86.56	93.74	100.13	105.08	112.75	118.62	138.99
75	3.125	53.27	65.07	73.12	81.41	86.64	93.83	100.22	105.18	112.85	118.72	139.11
75.25	3.135417	53.34	65.14	73.2	81.49	86.73	93.92	100.31	105.27	112.94	118.83	139.23
75.5	3.145833	53.41	65.22	73.28	81.57	86.81	94	100.39	105.36	113.04	118.93	139.34
75.75	3.15625	53.47	65.29	73.35	81.65	86.89	94.09	100.48	105.45	113.14	119.03	139.46
76	3.166667	53.54	65.36	73.43	81.73	86.97	94.17	100.57	105.55	113.24	119.13	139.58
76.25	3.177083	53.61	65.44	73.51	81.82	87.06	94.26	100.66	105.64	113.33	119.24	139.7
76.5	3.1875	53.68	65.51	73.58	81.9	87.14	94.35	100.75	105.73	113.43	119.34	139.82
76.75	3.197917	53.74	65.58	73.66	81.98	87.22	94.43	100.84	105.82	113.53	119.44	139.94
77	3.208333	53.81	65.65	73.74	82.06	87.3	94.52	100.93	105.91	113.63	119.54	140.05
77.25	3.21875	53.88	65.73	73.81	82.14	87.39	94.6	101.02	106.01	113.72	119.64	140.17
77.5	3.229167	53.94	65.8	73.89	82.21	87.47	94.69	101.11	106.1	113.82	119.74	140.29
77.75	3.239583	54.01	65.87	73.97	82.29	87.55	94.77	101.2	106.19	113.92	119.85	140.41
78	3.25	54.08	65.94	74.04	82.37	87.63	94.86	101.28	106.28	114.01	119.95	140.53
78.25	3.260417	54.14	66.02	74.12	82.45	87.71	94.94	101.37	106.37	114.11	120.05	140.64
78.5	3.270833	54.21	66.09	74.19	82.53	87.8	95.03	101.46	106.46	114.21	120.15	140.76
78.75	3.28125	54.28	66.16	74.27	82.61	87.88	95.11	101.55	106.56	114.3	120.25	140.88
79	3.291667	54.34	66.23	74.35	82.69	87.96	95.2	101.64	106.65	114.4	120.35	141
79.25	3.302083	54.41	66.31	74.42	82.77	88.04	95.28	101.73	106.74	114.5	120.45	141.11
79.5	3.3125	54.48	66.38	74.5	82.85	88.12	95.37	101.81	106.83	114.59	120.55	141.23
79.75	3.322917	54.54	66.45	74.57	82.93	88.2	95.45	101.9	106.92	114.69	120.66	141.35
80	3.333333	54.61	66.52	74.65	83.01	88.28	95.54	101.99	107.01	114.79	120.76	141.47
80.25	3.34375	54.67	66.6	74.72	83.09	88.37	95.62	102.08	107.1	114.88	120.86	141.58
80.5	3.354167	54.74	66.67	74.8	83.17	88.45	95.71	102.17	107.19	114.98	120.96	141.7
80.75	3.364583	54.81	66.74	74.88	83.25	88.53	95.79	102.25	107.29	115.07	121.06	141.82
81	3.375	54.87	66.81	74.95	83.33	88.61	95.87	102.34	107.38	115.17	121.16	141.93
81.25	3.385417	54.94	66.88	75.03	83.4	88.69	95.96	102.43	107.47	115.27	121.26	142.05
81.5	3.395833	55	66.95	75.1	83.48	88.77	96.04	102.52	107.56	115.36	121.36	142.17
81.75	3.40625	55.07	67.03	75.18	83.56	88.85	96.13	102.61	107.65	115.46	121.46	142.29
82	3.416667	55.14	67.1	75.25	83.64	88.93	96.21	102.69	107.74	115.55	121.56	142.4
82.25	3.427083	55.2	67.17	75.33	83.72	89.02	96.3	102.78	107.83	115.65	121.66	142.52
82.5	3.4375	55.27	67.24	75.4	83.8	89.1	96.38	102.87	107.92	115.75	121.76	142.64
82.75	3.447917	55.33	67.31	75.48	83.88	89.18	96.46	102.96	108.01	115.84	121.86	142.75
83	3.458333	55.4	67.38	75.55	83.95	89.26	96.55	103.04	108.1	115.94	121.96	142.87
83.25	3.46875	55.46	67.46	75.63	84.03	89.34	96.63	103.13	108.19	116.03	122.06	142.98
83.5	3.479167	55.53	67.53	75.7	84.11	89.42	96.72	103.22	108.28	116.13	122.16	143.1
83.75	3.489583	55.6	67.6	75.78	84.19	89.5	96.8	103.3	108.37	116.22	122.26	143.22
84	3.5	55.66	67.67	75.85	84.27	89.58	96.88	103.39	108.46	116.32	122.36	143.33
84.25	3.510417	55.73	67.74	75.93	84.35	89.66	96.97	103.48	108.55	116.41	122.46	143.45
84.5	3.520833	55.79	67.81	76	84.42	89.74	97.05	103.57	108.64	116.51	122.56	143.56
84.75	3.53125	55.86	67.88	76.07	84.5	89.82	97.13	103.65	108.73	116.6	122.66	143.68
85	3.541667	55.92	67.95	76.15	84.58	89.9	97.22	103.74	108.82	116.7	122.76	143.8
85.25	3.552083	55.99	68.03	76.22	84.66	89.98	97.3	103.83	108.91	116.79	122.86	143.91

85.5	3.5625	56.05	68.1	76.3	84.74	90.06	97.38	103.91	109	116.89	122.96	144.03
85.75	3.572917	56.12	68.17	76.37	84.81	90.14	97.47	104	109.09	116.98	123.06	144.14
86	3.583333	56.18	68.24	76.45	84.89	90.22	97.55	104.09	109.18	117.08	123.16	144.26
86.25	3.59375	56.25	68.31	76.52	84.97	90.3	97.63	104.17	109.27	117.17	123.26	144.37
86.5	3.604167	56.31	68.38	76.6	85.05	90.38	97.72	104.26	109.36	117.27	123.35	144.49
86.75	3.614583	56.38	68.45	76.67	85.12	90.46	97.8	104.35	109.45	117.36	123.45	144.61
87	3.625	56.44	68.52	76.74	85.2	90.54	97.88	104.43	109.54	117.46	123.55	144.72
87.25	3.635417	56.51	68.59	76.82	85.28	90.62	97.97	104.52	109.63	117.55	123.65	144.84
87.5	3.645833	56.57	68.66	76.89	85.36	90.7	98.05	104.6	109.72	117.65	123.75	144.95
87.75	3.65625	56.64	68.73	76.97	85.43	90.78	98.13	104.69	109.81	117.74	123.85	145.07
88	3.666667	56.7	68.8	77.04	85.51	90.86	98.21	104.78	109.9	117.84	123.95	145.18
88.25	3.677083	56.77	68.87	77.11	85.59	90.94	98.3	104.86	109.98	117.93	124.05	145.3
88.5	3.6875	56.83	68.94	77.19	85.67	91.02	98.38	104.95	110.07	118.02	124.15	145.41
88.75	3.697917	56.9	69.02	77.26	85.74	91.1	98.46	105.03	110.16	118.12	124.25	145.53
89	3.708333	56.96	69.09	77.33	85.82	91.18	98.54	105.12	110.25	118.21	124.34	145.64
89.25	3.71875	57.03	69.16	77.41	85.9	91.26	98.63	105.21	110.34	118.31	124.44	145.76
89.5	3.729167	57.09	69.23	77.48	85.97	91.34	98.71	105.29	110.43	118.4	124.54	145.87
89.75	3.739583	57.16	69.3	77.56	86.05	91.42	98.79	105.38	110.52	118.49	124.64	145.99
90	3.75	57.22	69.37	77.63	86.13	91.5	98.87	105.46	110.61	118.59	124.74	146.1
90.25	3.760417	57.29	69.44	77.7	86.21	91.57	98.96	105.55	110.7	118.68	124.84	146.22
90.5	3.770833	57.35	69.51	77.78	86.28	91.65	99.04	105.64	110.78	118.78	124.94	146.33
90.75	3.78125	57.42	69.58	77.85	86.36	91.73	99.12	105.72	110.87	118.87	125.03	146.45
91	3.791667	57.48	69.65	77.92	86.44	91.81	99.2	105.81	110.96	118.96	125.13	146.56
91.25	3.802083	57.54	69.72	78	86.51	91.89	99.29	105.89	111.05	119.06	125.23	146.67
91.5	3.8125	57.61	69.79	78.07	86.59	91.97	99.37	105.98	111.14	119.15	125.33	146.79
91.75	3.822917	57.67	69.86	78.14	86.67	92.05	99.45	106.06	111.23	119.24	125.43	146.9
92	3.833333	57.74	69.93	78.22	86.74	92.13	99.53	106.15	111.32	119.34	125.52	147.02
92.25	3.84375	57.8	70	78.29	86.82	92.21	99.61	106.23	111.4	119.43	125.62	147.13
92.5	3.854167	57.87	70.07	78.36	86.9	92.28	99.7	106.32	111.49	119.53	125.72	147.25
92.75	3.864583	57.93	70.14	78.44	86.97	92.36	99.78	106.4	111.58	119.62	125.82	147.36
93	3.875	57.99	70.21	78.51	87.05	92.44	99.86	106.49	111.67	119.71	125.92	147.47
93.25	3.885417	58.06	70.28	78.58	87.12	92.52	99.94	106.58	111.76	119.81	126.01	147.59
93.5	3.895833	58.12	70.34	78.65	87.2	92.6	100.02	106.66	111.85	119.9	126.11	147.7
93.75	3.90625	58.19	70.41	78.73	87.28	92.68	100.1	106.75	111.93	119.99	126.21	147.82
94	3.916667	58.25	70.48	78.8	87.35	92.76	100.19	106.83	112.02	120.09	126.31	147.93
94.25	3.927083	58.31	70.55	78.87	87.43	92.83	100.27	106.92	112.11	120.18	126.41	148.04
94.5	3.9375	58.38	70.62	78.95	87.51	92.91	100.35	107	112.2	120.27	126.5	148.16
94.75	3.947917	58.44	70.69	79.02	87.58	92.99	100.43	107.09	112.29	120.37	126.6	148.27
95	3.958333	58.51	70.76	79.09	87.66	93.07	100.51	107.17	112.37	120.46	126.7	148.39
95.25	3.96875	58.57	70.83	79.16	87.73	93.15	100.59	107.26	112.46	120.55	126.8	148.5
95.5	3.979167	58.63	70.9	79.24	87.81	93.23	100.68	107.34	112.55	120.64	126.89	148.61
95.75	3.989583	58.7	70.97	79.31	87.89	93.3	100.76	107.43	112.64	120.74	126.99	148.73
96	4	58.76	71.04	79.38	87.96	93.38	100.84	107.51	112.73	120.83	127.09	148.84

1000 year r	10000 year
34.74	50.24
47.13	69.5
54.9	81.62
60.66	90.43
64.37	95.61
67.28	99.54
69.74	102.78
71.9	105.57
74.06	108.39
76.04	110.96
77.88	113.33
79.59	115.51
81.2	117.55
82.72	119.45
84.14	121.24
85.5	122.92
86.78	124.5
88	125.99
89.16	127.4
90.26	128.75
91.32	130.03
92.33	131.25
93.3	132.42
94.23	133.53
95.12	134.6
95.98	135.63
96.8	136.61
97.6	137.56
98.36	138.48
99.1	139.36
99.82	140.21
100.51	141.03
101.18	141.83
101.83	142.6
102.46	143.35
103.08	144.08
103.67	144.78
104.25	145.47
104.81	146.14
105.36	146.79
105.9	147.42
106.42	148.04
106.92	148.64
107.42	149.22
107.9	149.8
108.37	150.36
108.84	150.9
109.29	151.44
109.72	151.95
110.14	152.45
110.56	152.95
110.96	153.43
111.36	153.91
111.75	154.37
112.13	154.83
112.51	155.28
112.88	155.72
113.24	156.15
113.59	156.57
113.94	156.99
114.29	157.4

114.63	157.8
114.96	158.2
115.29	158.59
115.61	158.98
115.93	159.36
116.24	159.73
116.55	160.1
116.85	160.46
117.15	160.82
117.44	161.18
117.74	161.52
118.02	161.87
118.3	162.21
118.58	162.54
118.86	162.87
119.13	163.2
119.4	163.53
119.67	163.85
119.93	164.16
120.19	164.48
120.45	164.79
120.71	165.09
120.96	165.4
121.21	165.7
121.46	166
121.7	166.29
121.95	166.59
122.19	166.88
122.42	167.16
122.66	167.45
122.89	167.73
123.12	168.01
123.35	168.29
123.58	168.56
123.81	168.84
124.02	169.1
124.24	169.36
124.45	169.62
124.66	169.88
124.87	170.14
125.08	170.39
125.29	170.65
125.5	170.9
125.7	171.15
125.9	171.4
126.1	171.64
126.3	171.89
126.5	172.13
126.7	172.37
126.9	172.61
127.09	172.85
127.28	173.09
127.48	173.33
127.67	173.56
127.86	173.8
128.05	174.03
128.24	174.26
128.42	174.49
128.61	174.72
128.79	174.95
128.98	175.17
129.16	175.4
129.34	175.62
129.53	175.85
129.71	176.07
129.89	176.29
130.06	176.51
130.24	176.73
130.42	176.95
130.59	177.16

130.77	177.38
130.94	177.6
131.12	177.81
131.29	178.02
131.46	178.24
131.63	178.45
131.8	178.66
131.97	178.87
132.14	179.08
132.31	179.29
132.48	179.5
132.65	179.7
132.81	179.91
132.98	180.12
133.15	180.32
133.31	180.52
133.47	180.73
133.64	180.93
133.8	181.13
133.96	181.33
134.12	181.53
134.28	181.73
134.45	181.93
134.61	182.13
134.76	182.33
134.92	182.53
135.08	182.72
135.24	182.92
135.4	183.12
135.55	183.31
135.71	183.51
135.87	183.7
136.02	183.89
136.18	184.09
136.33	184.28
136.48	184.47
136.64	184.66
136.79	184.85
136.94	185.04
137.1	185.23
137.25	185.42
137.4	185.61
137.55	185.8
137.7	185.98
137.85	186.17
138	186.36
138.15	186.54
138.3	186.73
138.45	186.92
138.59	187.1
138.74	187.28
138.89	187.47
139.04	187.65
139.18	187.84
139.33	188.02
139.48	188.2
139.62	188.38
139.77	188.56
139.91	188.75
140.06	188.93
140.2	189.11
140.35	189.29
140.5	189.48
140.64	189.66
140.79	189.85
140.94	190.03
141.09	190.22
141.23	190.4
141.38	190.58
141.53	190.77

141.67	190.95
141.82	191.13
141.97	191.31
142.11	191.5
142.26	191.68
142.4	191.86
142.55	192.04
142.69	192.22
142.83	192.4
142.98	192.58
143.12	192.76
143.27	192.94
143.41	193.12
143.55	193.3
143.7	193.48
143.84	193.66
143.98	193.84
144.12	194.02
144.27	194.19
144.41	194.37
144.55	194.55
144.69	194.73
144.83	194.9
144.97	195.08
145.11	195.26
145.25	195.43
145.39	195.61
145.53	195.78
145.67	195.96
145.81	196.14
145.95	196.31
146.09	196.49
146.23	196.66
146.37	196.84
146.51	197.01
146.65	197.18
146.79	197.36
146.93	197.53
147.07	197.71
147.2	197.88
147.34	198.05
147.48	198.23
147.62	198.4
147.75	198.57
147.89	198.74
148.03	198.92
148.17	199.09
148.3	199.26
148.44	199.43
148.57	199.6
148.71	199.77
148.85	199.94
148.98	200.12
149.12	200.29
149.25	200.46
149.39	200.63
149.53	200.8
149.66	200.97
149.8	201.14
149.93	201.31
150.07	201.48
150.2	201.65
150.34	201.82
150.47	201.99
150.6	202.15
150.74	202.32
150.87	202.49
151.01	202.66
151.14	202.83
151.27	203

151.41	203.17
151.54	203.33
151.67	203.5
151.81	203.67
151.94	203.84
152.07	204
152.21	204.17
152.34	204.34
152.47	204.51
152.6	204.67
152.74	204.84
152.87	205.01
153	205.17
153.13	205.34
153.26	205.5
153.4	205.67
153.53	205.84
153.66	206
153.79	206.17
153.92	206.33
154.05	206.5
154.18	206.66
154.31	206.83
154.45	206.99
154.58	207.16
154.71	207.32
154.84	207.49
154.97	207.65
155.1	207.82
155.23	207.98
155.36	208.15
155.49	208.31
155.62	208.48
155.75	208.64
155.88	208.8
156.01	208.97
156.14	209.13
156.27	209.3
156.4	209.46
156.53	209.62
156.66	209.79
156.78	209.95
156.91	210.11
157.04	210.27
157.17	210.44
157.3	210.6
157.43	210.76
157.56	210.93
157.69	211.09
157.82	211.25
157.94	211.41
158.07	211.58
158.2	211.74
158.33	211.9
158.46	212.06
158.58	212.22
158.71	212.39
158.84	212.55
158.97	212.71
159.1	212.87
159.22	213.03
159.35	213.19
159.48	213.36
159.61	213.52
159.73	213.68
159.86	213.84
159.99	214
160.12	214.16
160.24	214.32
160.37	214.48

160.5	214.64
160.62	214.8
160.75	214.97
160.88	215.13
161	215.29
161.13	215.45
161.26	215.61
161.38	215.77
161.51	215.93
161.64	216.09
161.76	216.25
161.89	216.41
162.02	216.57
162.14	216.73
162.27	216.89
162.4	217.05
162.52	217.21
162.65	217.37
162.77	217.53
162.9	217.69
163.03	217.85
163.15	218.01
163.28	218.16
163.4	218.32
163.53	218.48
163.65	218.64
163.78	218.8
163.9	218.96
164.03	219.12
164.16	219.28
164.28	219.44
164.41	219.6
164.53	219.76
164.66	219.92
164.78	220.07
164.91	220.23
165.03	220.39
165.16	220.55
165.28	220.71
165.41	220.87
165.53	221.03
165.66	221.18
165.78	221.34

Summary of Results for 2 year Return Period (+35%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	6.968	0.068	2.9	260.3	O K
30 min Summer	6.987	0.087	4.6	336.1	O K
60 min Summer	7.008	0.108	6.5	416.2	O K
120 min Summer	7.042	0.142	9.6	547.3	O K
180 min Summer	7.061	0.161	11.0	622.1	O K
240 min Summer	7.073	0.173	11.8	670.4	O K
360 min Summer	7.087	0.187	12.3	725.2	O K
480 min Summer	7.094	0.194	12.4	753.7	O K
600 min Summer	7.099	0.199	12.4	773.4	O K
720 min Summer	7.102	0.202	12.5	786.8	O K
960 min Summer	7.106	0.206	12.5	801.9	O K
1440 min Summer	7.108	0.208	12.6	810.7	O K
2160 min Summer	7.106	0.206	12.5	802.4	O K
2880 min Summer	7.102	0.202	12.5	785.6	O K
4320 min Summer	7.093	0.193	12.3	749.8	O K
5760 min Summer	7.084	0.184	12.2	716.2	O K
15 min Winter	6.968	0.068	2.9	260.4	O K
30 min Winter	6.987	0.087	4.6	336.2	O K
60 min Winter	7.008	0.108	6.6	416.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	45.666	0.0	133.5	31
30 min Summer	29.686	0.0	192.9	45
60 min Summer	18.640	0.0	329.8	74
120 min Summer	12.640	0.0	472.1	130
180 min Summer	9.865	0.0	564.7	188
240 min Summer	8.204	0.0	633.5	246
360 min Summer	6.244	0.0	731.7	362
480 min Summer	5.103	0.0	801.0	430
600 min Summer	4.348	0.0	854.6	492
720 min Summer	3.806	0.0	897.5	556
960 min Summer	3.072	0.0	962.7	686
1440 min Summer	2.269	0.0	1050.3	960
2160 min Summer	1.683	0.0	1308.8	1368
2880 min Summer	1.372	0.0	1417.2	1768
4320 min Summer	1.047	0.0	1594.7	2552
5760 min Summer	0.877	0.0	1887.5	3288
15 min Winter	45.666	0.0	133.5	30
30 min Winter	29.686	0.0	192.9	44
60 min Winter	18.640	0.0	329.8	72

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Summary of Results for 2 year Return Period (+35%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
120 min Winter	7.042	0.142	9.6	548.8	O K
180 min Winter	7.061	0.161	11.0	624.6	O K
240 min Winter	7.074	0.174	11.9	673.8	O K
360 min Winter	7.088	0.188	12.3	730.4	O K
480 min Winter	7.095	0.195	12.4	758.7	O K
600 min Winter	7.099	0.199	12.4	772.8	O K
720 min Winter	7.102	0.202	12.5	784.1	O K
960 min Winter	7.104	0.204	12.5	792.9	O K
1440 min Winter	7.102	0.202	12.5	785.3	O K
2160 min Winter	7.094	0.194	12.4	753.3	O K
2880 min Winter	7.085	0.185	12.2	717.1	O K
4320 min Winter	7.070	0.170	11.6	659.6	O K
5760 min Winter	7.059	0.159	10.8	615.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
120 min Winter	12.640	0.0	472.1	128
180 min Winter	9.865	0.0	564.7	184
240 min Winter	8.204	0.0	633.5	240
360 min Winter	6.244	0.0	731.7	352
480 min Winter	5.103	0.0	801.0	458
600 min Winter	4.348	0.0	854.7	510
720 min Winter	3.806	0.0	897.7	572
960 min Winter	3.072	0.0	963.1	726
1440 min Winter	2.269	0.0	1051.2	1028
2160 min Winter	1.683	0.0	1309.1	1456
2880 min Winter	1.372	0.0	1417.7	1860
4320 min Winter	1.047	0.0	1595.5	2640
5760 min Winter	0.877	0.0	1887.7	3408

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 343678 430016 SD 43678 30016
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	5760
Climate Change %	+35

Time Area Diagram

Total Area (ha) 2.300

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.575	4	8	0.575	8	12	0.575	12	16	0.575

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Model Details

Storage is Online Cover Level (m) 8.400

Tank or Pond Structure

Invert Level (m) 6.900

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	3815.0	1.500	5008.0	1.600	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0162-1360-1400-1360
Design Head (m)	1.400
Design Flow (l/s)	13.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	162
Invert Level (m)	6.900
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.400	13.6	Kick-Flo®	0.900	11.0
Flush-Flo™	0.415	13.6	Mean Flow over Head Range	-	11.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.8	1.200	12.6	3.000	19.5	7.000	29.3
0.200	12.5	1.400	13.6	3.500	21.0	7.500	30.3
0.300	13.3	1.600	14.5	4.000	22.4	8.000	31.3
0.400	13.6	1.800	15.3	4.500	23.7	8.500	32.2
0.500	13.5	2.000	16.1	5.000	25.0	9.000	33.1
0.600	13.3	2.200	16.9	5.500	26.1	9.500	34.0
0.800	12.3	2.400	17.6	6.000	27.2		
1.000	11.6	2.600	18.2	6.500	28.3		

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Summary of Results for 30 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	7.042	0.142	9.6	548.5	O K
30 min Summer	7.085	0.185	12.2	718.6	O K
60 min Summer	7.130	0.230	12.8	897.3	O K
120 min Summer	7.173	0.273	13.2	1068.9	O K
180 min Summer	7.198	0.298	13.3	1169.6	O K
240 min Summer	7.214	0.314	13.4	1236.8	O K
360 min Summer	7.234	0.334	13.5	1317.9	O K
480 min Summer	7.245	0.345	13.5	1359.9	O K
600 min Summer	7.250	0.350	13.5	1379.6	O K
720 min Summer	7.251	0.351	13.5	1384.9	O K
960 min Summer	7.250	0.350	13.5	1383.0	O K
1440 min Summer	7.246	0.346	13.5	1365.5	O K
2160 min Summer	7.236	0.336	13.5	1324.9	O K
2880 min Summer	7.225	0.325	13.4	1279.2	O K
4320 min Summer	7.204	0.304	13.4	1193.1	O K
5760 min Summer	7.185	0.285	13.3	1115.7	O K
15 min Winter	7.042	0.142	9.6	548.6	O K
30 min Winter	7.085	0.185	12.2	719.1	O K
60 min Winter	7.130	0.230	12.8	897.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	96.720	0.0	368.4	30
30 min Summer	63.856	0.0	516.3	45
60 min Summer	40.300	0.0	799.9	74
120 min Summer	24.479	0.0	984.8	132
180 min Summer	18.191	0.0	1102.6	190
240 min Summer	14.690	0.0	1188.8	250
360 min Summer	10.807	0.0	1310.8	366
480 min Summer	8.658	0.0	1395.7	484
600 min Summer	7.274	0.0	1459.0	602
720 min Summer	6.299	0.0	1507.9	704
960 min Summer	5.003	0.0	1575.9	808
1440 min Summer	3.610	0.0	1641.9	1050
2160 min Summer	2.612	0.0	2057.5	1456
2880 min Summer	2.088	0.0	2183.1	1856
4320 min Summer	1.546	0.0	2382.6	2680
5760 min Summer	1.265	0.0	2740.9	3464
15 min Winter	96.720	0.0	368.4	30
30 min Winter	63.856	0.0	516.3	44
60 min Winter	40.300	0.0	799.9	72

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Summary of Results for 30 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
120 min Winter	7.173	0.273	13.2	1069.8	O K
180 min Winter	7.198	0.298	13.3	1170.6	O K
240 min Winter	7.215	0.315	13.4	1238.0	O K
360 min Winter	7.235	0.335	13.5	1319.0	O K
480 min Winter	7.245	0.345	13.5	1361.2	O K
600 min Winter	7.250	0.350	13.5	1381.6	O K
720 min Winter	7.252	0.352	13.5	1388.2	O K
960 min Winter	7.249	0.349	13.5	1376.1	O K
1440 min Winter	7.240	0.340	13.5	1342.0	O K
2160 min Winter	7.223	0.323	13.4	1271.4	O K
2880 min Winter	7.204	0.304	13.4	1194.6	O K
4320 min Winter	7.169	0.269	13.2	1054.5	O K
5760 min Winter	7.140	0.240	12.9	935.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
120 min Winter	24.479	0.0	984.8	130
180 min Winter	18.191	0.0	1102.7	186
240 min Winter	14.690	0.0	1189.0	244
360 min Winter	10.807	0.0	1311.2	358
480 min Winter	8.658	0.0	1396.4	472
600 min Winter	7.274	0.0	1460.1	584
720 min Winter	6.299	0.0	1509.4	692
960 min Winter	5.003	0.0	1578.5	890
1440 min Winter	3.610	0.0	1648.3	1102
2160 min Winter	2.612	0.0	2058.6	1556
2880 min Winter	2.088	0.0	2184.8	1992
4320 min Winter	1.546	0.0	2387.7	2816
5760 min Winter	1.265	0.0	2741.4	3584

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 343678 430016 SD 43678 30016
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	5760
Climate Change %	+30

Time Area Diagram

Total Area (ha) 2.300

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.575	4	8	0.575	8	12	0.575	12	16	0.575

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Model Details

Storage is Online Cover Level (m) 8.400

Tank or Pond Structure

Invert Level (m) 6.900

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	3815.0	1.500	5008.0	1.600	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0162-1360-1400-1360
Design Head (m)	1.400
Design Flow (l/s)	13.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	162
Invert Level (m)	6.900
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.400	13.6	Kick-Flo®	0.900	11.0
Flush-Flo™	0.415	13.6	Mean Flow over Head Range	-	11.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.8	1.200	12.6	3.000	19.5	7.000	29.3
0.200	12.5	1.400	13.6	3.500	21.0	7.500	30.3
0.300	13.3	1.600	14.5	4.000	22.4	8.000	31.3
0.400	13.6	1.800	15.3	4.500	23.7	8.500	32.2
0.500	13.5	2.000	16.1	5.000	25.0	9.000	33.1
0.600	13.3	2.200	16.9	5.500	26.1	9.500	34.0
0.800	12.3	2.400	17.6	6.000	27.2		
1.000	11.6	2.600	18.2	6.500	28.3		

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Summary of Results for 100 year Return Period (+35%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	7.085	0.185	12.2	720.0	O K
30 min Summer	7.145	0.245	13.0	955.8	O K
60 min Summer	7.207	0.307	13.4	1206.4	O K
120 min Summer	7.258	0.358	13.5	1414.7	O K
180 min Summer	7.289	0.389	13.6	1541.5	O K
240 min Summer	7.311	0.411	13.6	1629.5	O K
360 min Summer	7.338	0.438	13.6	1743.6	O K
480 min Summer	7.354	0.454	13.6	1807.9	O K
600 min Summer	7.362	0.462	13.6	1844.2	O K
720 min Summer	7.367	0.467	13.6	1862.8	O K
960 min Summer	7.368	0.468	13.6	1866.0	O K
1440 min Summer	7.360	0.460	13.6	1836.0	O K
2160 min Summer	7.347	0.447	13.6	1779.1	O K
2880 min Summer	7.332	0.432	13.6	1720.0	O K
4320 min Summer	7.306	0.406	13.6	1610.4	O K
5760 min Summer	7.282	0.382	13.6	1512.1	O K
15 min Winter	7.085	0.185	12.2	720.2	O K
30 min Winter	7.145	0.245	13.0	956.1	O K
60 min Winter	7.207	0.307	13.4	1206.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	127.062	0.0	514.2	30
30 min Summer	84.726	0.0	708.0	45
60 min Summer	53.906	0.0	1091.8	74
120 min Summer	32.123	0.0	1307.1	132
180 min Summer	23.693	0.0	1444.9	192
240 min Summer	19.062	0.0	1545.7	250
360 min Summer	13.991	0.0	1687.4	368
480 min Summer	11.188	0.0	1780.3	486
600 min Summer	9.387	0.0	1844.2	604
720 min Summer	8.123	0.0	1888.3	724
960 min Summer	6.450	0.0	1932.9	952
1440 min Summer	4.643	0.0	1902.0	1156
2160 min Summer	3.342	0.0	2635.4	1536
2880 min Summer	2.658	0.0	2776.1	1940
4320 min Summer	1.951	0.0	2976.4	2764
5760 min Summer	1.585	0.0	3445.1	3576
15 min Winter	127.062	0.0	514.2	30
30 min Winter	84.726	0.0	708.1	44
60 min Winter	53.906	0.0	1091.8	72

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Summary of Results for 100 year Return Period (+35%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
120 min Winter	7.258	0.358	13.5	1415.2	O K
180 min Winter	7.289	0.389	13.6	1541.9	O K
240 min Winter	7.311	0.411	13.6	1629.8	O K
360 min Winter	7.338	0.438	13.6	1743.7	O K
480 min Winter	7.354	0.454	13.6	1808.0	O K
600 min Winter	7.362	0.462	13.6	1844.4	O K
720 min Winter	7.367	0.467	13.6	1863.5	O K
960 min Winter	7.368	0.468	13.6	1868.9	O K
1440 min Winter	7.356	0.456	13.6	1817.2	O K
2160 min Winter	7.336	0.436	13.6	1735.7	O K
2880 min Winter	7.314	0.414	13.6	1643.8	O K
4320 min Winter	7.271	0.371	13.6	1467.8	O K
5760 min Winter	7.233	0.333	13.5	1311.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
120 min Winter	32.123	0.0	1307.2	130
180 min Winter	23.693	0.0	1445.1	188
240 min Winter	19.062	0.0	1546.1	246
360 min Winter	13.991	0.0	1688.3	362
480 min Winter	11.188	0.0	1781.9	476
600 min Winter	9.387	0.0	1846.6	590
720 min Winter	8.122	0.0	1891.8	704
960 min Winter	6.450	0.0	1939.7	924
1440 min Winter	4.643	0.0	1918.7	1186
2160 min Winter	3.342	0.0	2637.3	1624
2880 min Winter	2.658	0.0	2779.5	2076
4320 min Winter	1.951	0.0	2988.5	2944
5760 min Winter	1.585	0.0	3445.9	3752

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 343678 430016 SD 43678 30016
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	5760
Climate Change %	+35

Time Area Diagram

Total Area (ha) 2.300

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.575	4	8	0.575	8	12	0.575	12	16	0.575

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Model Details

Storage is Online Cover Level (m) 8.400

Tank or Pond Structure

Invert Level (m) 6.900

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	3815.0	1.500	5008.0	1.600	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0162-1360-1400-1360
Design Head (m)	1.400
Design Flow (l/s)	13.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	162
Invert Level (m)	6.900
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.400	13.6	Kick-Flo®	0.900	11.0
Flush-Flo™	0.415	13.6	Mean Flow over Head Range	-	11.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.8	1.200	12.6	3.000	19.5	7.000	29.3
0.200	12.5	1.400	13.6	3.500	21.0	7.500	30.3
0.300	13.3	1.600	14.5	4.000	22.4	8.000	31.3
0.400	13.6	1.800	15.3	4.500	23.7	8.500	32.2
0.500	13.5	2.000	16.1	5.000	25.0	9.000	33.1
0.600	13.3	2.200	16.9	5.500	26.1	9.500	34.0
0.800	12.3	2.400	17.6	6.000	27.2		
1.000	11.6	2.600	18.2	6.500	28.3		

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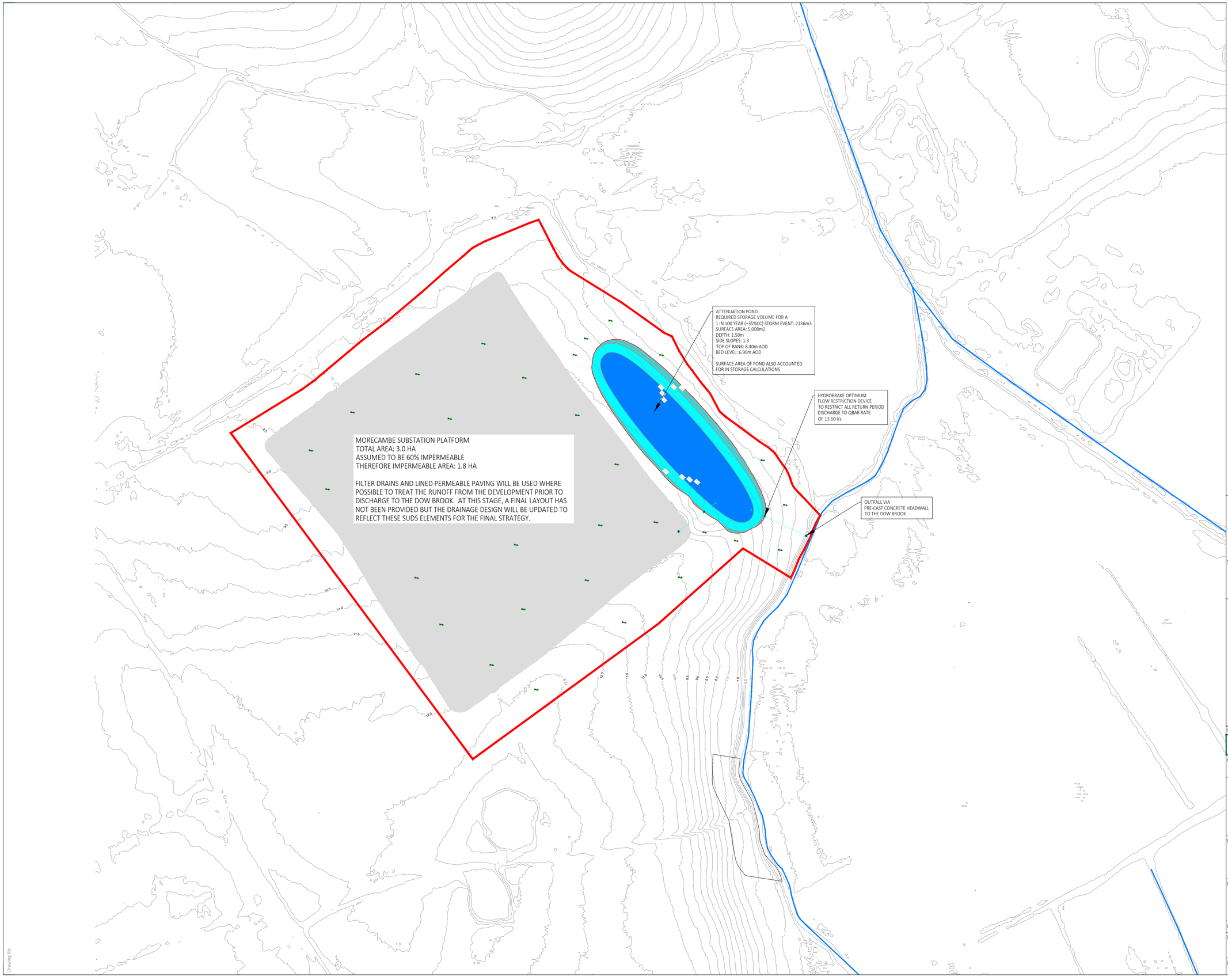

1. GENERAL
(i) WORK TO FIGURED DIMENSIONS ONLY.
(ii) THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTURAL DRAWINGS, DETAILED SPECIFICATIONS WHERE APPLICABLE AND ALL ASSOCIATED DRAWINGS IN THIS SERIES.
(iii) ANY DISCREPANCY ON THIS DRAWING IS TO BE REPORTED IMMEDIATELY TO THE COMPANY FOR CLARIFICATION.
(iv) THE CONTRACTOR IS RESPONSIBLE FOR ALL TEMPORARY WORKS AND FOR THE STABILITY OF THE WORKS IN PROGRESS.
2. DRAINAGE GENERAL
(i) ALL FOUL AND STORM WATER DRAINS WHICH ARE NOT TO BE ADOPTED AS PUBLIC SEWERS UNDER A SECTION 104 AGREEMENT MUST BE CONSTRUCTED IN ACCORDANCE WITH THE BUILDING REGULATIONS, BS EN 752 AND WHERE APPROPRIATE THE RELEVANT AGREEMENT CERTIFICATES.
(ii) MANHOLES, GULLIES, GULLY CONNECTIONS, SEWERS AND OTHER SEWERAGE STRUCTURES INTENDED TO CONVEY SURFACE WATER ARE TO BE CONSTRUCTED IN ACCORDANCE WITH THE WATER AUTHORITIES ASSOCIATION SPECIFICATION 'SEWERS FOR ADOPTION' 6TH EDITION AND RELEVANT COUNCIL DESIGN GUIDE.
(iii) ALL CONCRETE USED IN DRAINAGE WORKS TO COMPLY WITH BRE DIGEST 363 FOR CLASS 2 SULPHATE CONDITIONS.
3. MANHOLE COVERS AND FRAMES
(i) MANHOLE COVERS TO BE CLASS D400 IN HIGHWAYS, CLASS B125 IN FOOTWAYS AND VERGES, CLASS A15 IN NON-TRAFFICKED AREAS.
(ii) MANHOLE COVER AND FRAME TO BE BEDDED AND SURROUNDED IN 1:3 MORTAR.
4. MANHOLE RINGS, COVER SLABS & TAPERS
(i) PRECAST CONCRETE MANHOLE UNITS SHALL COMPLY WITH THE REQUIREMENTS OF BS 5911. THE RELEVANT ABSORPTION TESTS REQUIRED SHALL BE CARRIED OUT ON A SAMPLE OF THOSE RINGS AND SLABS USED UNLESS A CERTIFICATE OF TESTING IS SUPPLIED BY THE MANUFACTURER. COVER SLABS SITUATED UNDER CARRIAGEWAYS OR TRAFFICKED AREAS SHALL BE HEAVY DUTY AND THOSE ELSEWHERE SHALL BE LIGHT DUTY. MANHOLE UNITS SHALL BE COMPLETE WITH STEP IRONS IF REQUIRED.
5. PIPES
(i) PLASTIC PIPES SHALL BE OF UNPLASTICISED POLYVINYL CHLORIDE (UPVC) COMPLYING WITH THE REQUIREMENTS OF BS EN 1401.
(ii) CONCRETE PIPES SHALL BE SPUN BY A CENTRIFUGAL PROCESS OR BE VERTICALLY PRESSED. THEY SHALL POSSESS SELF INVERTING SOCKETS AND SHALL COMPLY WITH WITH THE REQUIREMENTS OF AND BE TESTED IN ACCORDANCE WITH BS 5911.
(iii) SOLID WALL CONCENTRIC EXTERNAL RIB-REINFORCED UNPLASTICISED PVC PIPE SHALL COMPLY WITH ASTM A978.
(iv) ALL VITRIFIED CLAY PIPES TO BE IN ACCORDFANCE WITH BS EN 295.
(v) ALL PIPE CONNECTIONS TO MHS AND CATCH PITS TO HAVE MIN 600MM ROCKER PIPE AS CLOSE AS PRACTICABLE TO CHAMBER WALL.
6. GULLY GRATES & FRAMES
(i) GULLY GRATES AND FRAMES FOR CARRIAGEWAY GULLIES SHALL COMPLY WITH BS EN 142. GULLIES SHALL BE PATTERN GB4-325 FOR ROADS BELOW 50 DV AND PATTERN GA2-450 FOR ROADS ABOVE 50 DV. GULLY GRATES AND FRAMES FOR KERB SIDE GULLIES SHALL BE PATTERN GK-115 FOR ROADS BELOW 50 DV AND GK-165 FOR ROADS ABOVE 50 DV. CURVED BAR GULLY GRATES SHALL BE USED IN ROADS WHERE THE GRADIENT EXCEEDS 4%.

WARNING!

WORKING ON LIVE DRAINAGE INFRASTRUCTURE AND IN CONFINED SPACES MUST BE UNDERTAKEN IN ACCORDANCE WITH AN APPROPRIATE RISK ASSESSMENT.

PRIOR TO OCCUPATION OF THE DEVELOPMENT A CCTV DRAINAGE SURVEY AND INSPECTION OF THE INSTALLED DRAINAGE ASSETS MUST BE UNDERTAKEN TO CONFIRM THAT THE SYSTEM HAS BEEN CONSTRUCTED PROPERLY. ANY DEFECTS IN THE SYSTEM SHALL BE REPAIRED PRIOR TO OCCUPATION OF THE DEVELOPMENT.

LEGEND

- PRIVATE SURFACE WATER DRAIN
- TYPE 2 MANHOLE
- PROPOSED IMPERMEABLE AREA
- OVERLAND FLOW

REV	DATE	BY	CKD	APPD	DESCRIPTION

PRELIMINARY DRAWING
FOR INFORMATION ONLY. NOT FOR CONSTRUCTION.

Client
BP/FLOTATION ENERGY

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Project
MORECAMBE SUBSTATION SITE

Drawing
OUTLINE SURFACE WATER DRAINAGE STRATEGY

Drawn by:
Date: 16/09/24

Drawing No.
PC1165- 3500

Revision
B

Drawing Scale: 1:2000

Drawing No.