Appendix 11 Surface Water Drainage Technical Note
Replacement to Appendix L2 of the ES (March 2021)

Berkeley St James Group Limited

MILTON KEYNES EAST

Drainage Technical Note

MKE-WSP-XX-XX-C-RP-0001
MARCH 2021

PUBLIC

Berkeley St James Group **Limited**

MILTON KEYNES EAST

Surface Water Drainage Technical Note

REPORT (RV1) PUBLIC

PROJECT NO. 70057521

OUR REF. NO. MKE-WSP-XX-XX-C-RP-0001

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CONTENTS

TABLES

FIGURES

APPENDICES

APPENDIX E

EXISTING AND PROPOSED OVERLAND FLOW ROUTES

APPENDIX F

SUPPORTING CALCULATIONS

APPENDIX G

PARCEL PRO-FORMA

EXECUTIVE SUMMARY

This surface water drainage strategy has been produced to provide further information and context to the integration of the highway, residential and commercial drainage to provide an integrated drainage strategy for the site. This strategy is prepared to accompany the hybrid planning application for the proposed strategic development of Milton Keynes East.

Item	Overview
Site Location	The site is located between the M1 which largely forms the southern boundary of the site and the A422 which forms the northern boundary. The grid reference for the site is 488630, 241770, with a nearest postcode of MK15 9LZ. The site is allocated for strategic development under the local plan.
Development Proposals	The masterplan for the development is still being refined, however under the local plan allocation, at least 4,000 new homes are to be delivered within the plan period, with 105 hectares of land allocated for mixed employment uses. Associated infrastructure including primary and secondary education, community facilities, health, retail, local services and a hotel will be incorporated into the development. The development will also include the creation of a linear park along f the River Ouzel, along with a new highway link across the floodplain with a 30m bridge opening centred on the River Ouzel.
Environment Agency Flood Zone(s)	The majority of the site is located in Flood Zone 1 based on the Environment Agency's Flood Map for Planning. The land adjacent to the River Ouzel is located in Flood Zone 3. There is also a small area in the south of the site within Flood Zone 3, located next to Broughton Brook.

1. INTRODUCTION

1.1. BACKGROUND

1.1.1. WSP UK Ltd (WSP) has been appointed by Berkeley St James Group Ltd (St James) to prepare a Drainage Strategy to support the planning application for a large mixed use development located on the land to the east of the M1 Motorway at Milton Keynes, (Approximate Post Code: MK15 9LZ).

1.1.2. The proposed development, referred to as Milton Keynes East (MKE) will consist of at least 4,000 homes, with approximately 85 hectares of land for a mix of employment uses, along with associated community facilities and infrastructure.

1.1.3. The objective of the study is to demonstrate that the site can be drained appropriately with sustainability in mind.

1.2. LIMITATIONS

1.2.1. WSP has prepared this report in accordance with the instructions of their client for their sole and specific use relating solely to the above site. Any person who uses any information contained herein does so at their own risk and shall hold WSP harmless in any event.

1.2.2. Whilst this report was prepared using the reasonable skill, care and diligence ordinarily exercised by engineers practicing under similar circumstances and reasonable checks have been made on data sources and the accuracy of the data, WSP accepts no liability in relation to the report should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP. In any event, WSP shall not be liable for any loss or damages arising under or in connection to the use of this report

2. SITE SETTING

2.1. LOCATION

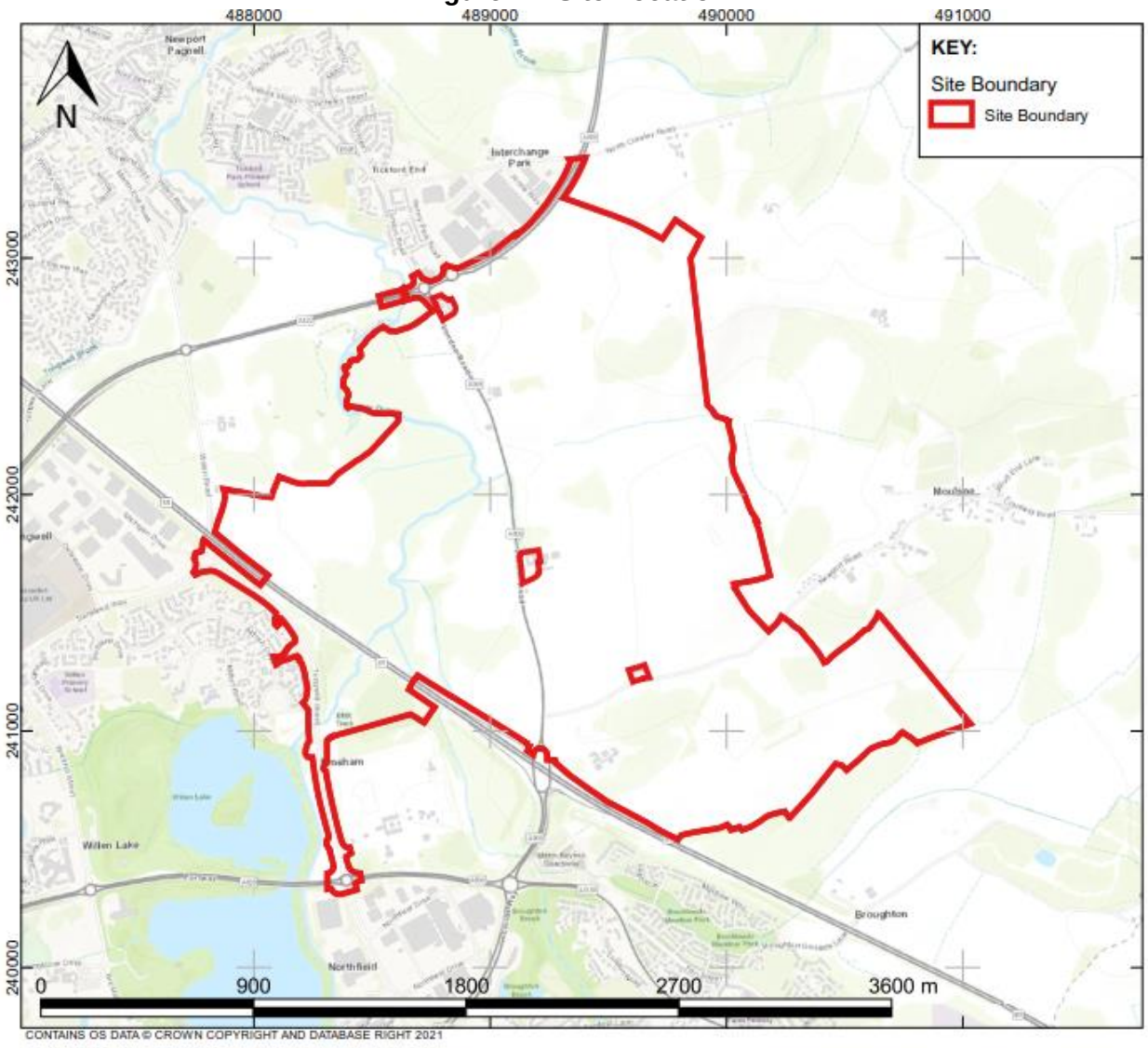
2.1.1. The site is located between the M1 which largely forms the southern boundary of the site and the A422 which forms the northern boundary. The grid reference for the site is 488630, 241770, with a nearest postcode of MK15 9LZ. The Site has an area of 436 hectares.

2.1.2. The Site largely consists of undeveloped land predominantly in agricultural use and is bordered by:

- The A422 to the north;
- Agricultural land to the east;
- The M1 Motorway to the south; and
- Willen Road to the west.

2.1.3. The site location plan is shown in Figure 1**.**

Figure 1 – Site Location



2.2. DEVELOPMENT PROPOSALS

2.2.1. ‘Milton Keynes East’ (MKE) has been identified as an allocation for a strategic urban extension within Plan:MK and Milton Keynes Council’s (MKC) aspirations for the allocation is set out within Policy SD12 of Plan:MK.

2.2.2. The masterplan for the Scheme is shown in Figure 2 and shows the large-scale mixed-use urban extension (creating a new community) including:

- Approximately 4,000 up to a maximum of 4,600 homes;
- Up to 403,650sq.m of employment floorspace;
- A community hub containing a range of commercial and community uses;
- Associated services, amenities and open space; and
- New road and redway extensions, including a new bridge over the M1 motorway and works to the Tongwell Street corridor.

2.2.3. A hybrid planning application for the site will be submitted in April 2021. This will consist of an outline application for the main part of the development as described above and a detailed application for the main highway infrastructure.

Figure 2 – Masterplan

Source: JTP

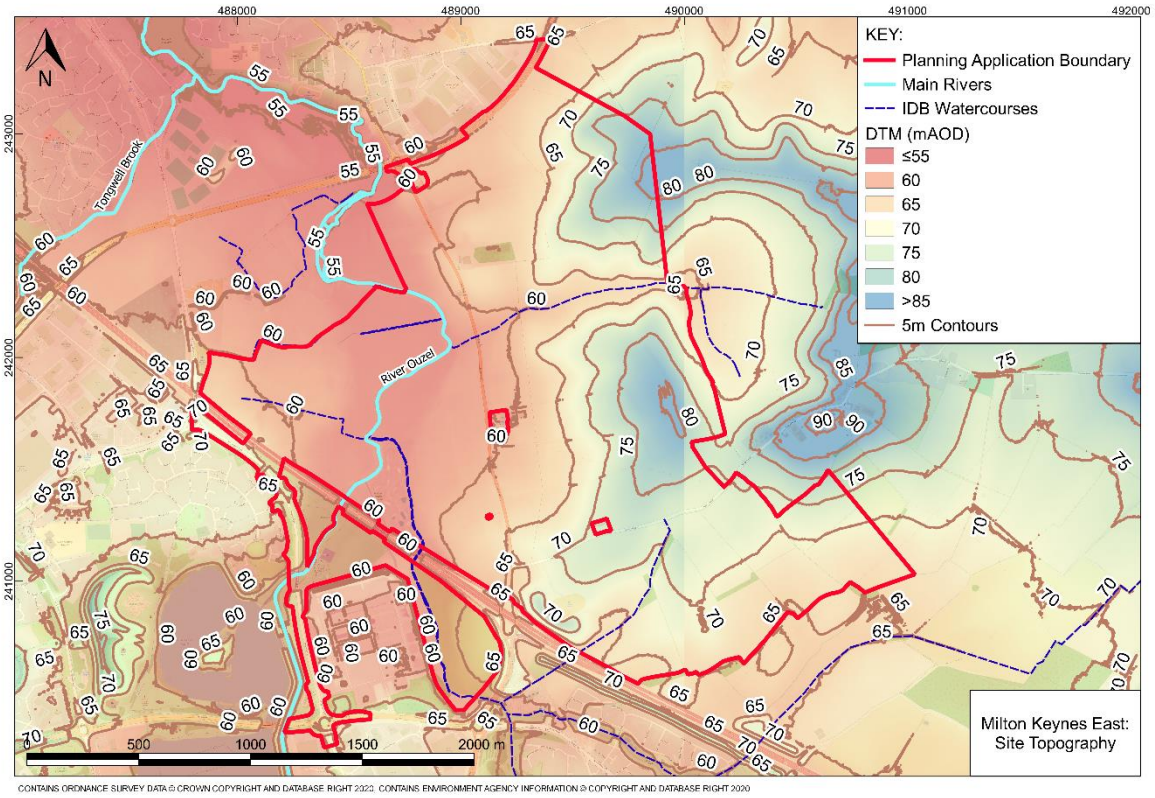
2.3. TOPOGRAPHY

2.3.1. Environment Agency 1m DTM LiDAR has been used to assess the topography at the site, as shown in Figure 3. Detailed topographical survey is available along the route of the main road infrastructure.

2.3.2. There is a gentle slope from south to north through the site, along the channel route of the River Ouzel, from approximately 60mAOD in the south of the site down to approximately 55mAOD in the north of the site.

2.3.3. The land either side of the River Ouzel significantly elevated above the floodplain, rising to a high point of approximately 80mAOD to the east of the site, with a high point in the land to the west of the Ouzel of approximately 70mAOD.

Figure 3 - Site Topography



2.4. GEOLOGICAL AND HYDROGEOLOGICAL CONTEXT

Geology

2.4.1. The British Geological Survey (BGS) GeoIndex indicates that the majority of the site is underlain by Mudstone bedrock from the Peterborough Member.

2.4.2. In the northwest of the site the bedrock comprises of Sandstone, Siltstone and Mudstone from the Kellaways Formation. To the east of the site, towards Moulsoe, the site is underlain by bedrock from the Stewartby Member Mudstone.

2.4.3. Superficial Head and Alluvium deposits are present across the floodplain of the River Ouzel and the Broughton Brook. There is also an area of superficial sand and gravel deposits to the west of the site, with superficial Diamicton deposits from the Oadby member present in the east of the site towards Moulsoe.

2.4.4. A Site Investigation has been undertaken to support the design of the strategic highway infrastructure and provide information on soakage rates across the main development.

Hydrogeology

2.4.5. According to the Source Protection Zone map provided by the Environment Agency, the site does not lie within any Source Protection Zones.

2.4.6. According to the Environment Agency's aquifer designation map, the bedrock to the west of the site is classified as a Secondary A Aquifer, whilst the bedrock to the east of the site is classified as

Unproductive Strata. The superficial alluvium and head deposits associated with the floodplain of the River Ouzel and its tributaries are categorised as Secondary A aquifers.

2.4.7. Secondary A aquifers are defined as permeable layers capable of supporting water supplies at a local rather than strategic scale, in some cases forming an important source of base flow to rivers.

3. PLANNING POLICY CONTEXT

3.1. NATIONAL PLANNING POLICY FRAMEWORK 2019

3.1.1. The National Planning Policy Framework (NPPF) as updated in February 2019, sets out the Government's national policies for flood risk management in a land use planning context within England.

3.1.2. Paragraph 155 of the NPPF states "*Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere."*

3.1.3. The guidance further states that local planning authorities should "*ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment."*

3.1.4. Allocation and planning of development must therefore be considered against a risk-based search sequence as provided by the guidance.

3.1.5. A sequential risk-based approach to determining the suitability of land for development in flood risk areas is central to the policy statement and should take into account the current and future impacts of climate change (Para. 157). This includes the intent to steer the most vulnerable parts of the development to the areas that experience the least, or an acceptable, degree of flood risk.

3.2. LOCAL PLANNING POLICY

Local Plan

3.2.1. Policy FR1 of Milton Keynes Council's local plan (Plan:MK 2016-2031[1]) sets out the council's current approach to flood risk management. Policy FR1 states that:

3.2.2. *"All new development must incorporate a surface water drainage system with acceptable flood control and demonstrate that water supply, foul sewerage and sewage treatment capacity is available or can be made available in time to serve the development. Suitable access is safeguarded for the maintenance of water supply and drainage infrastructure.*

Plan:MK will seek to steer all new development towards areas with the lowest probability of flooding. The sequential approach to development, as set out in national guidance, will therefore be applied across the Borough, taking into account all sources of flooding as contained within the Council's Strategic Flood Risk Assessment (SFRA).

Development within areas of flood risk from any source of flooding, will only be acceptable if it is clearly demonstrated that it is appropriate at that location, and that there are no suitable available alternative sites at a lower flood risk."

[1] Milton Keynes Council (2019) Plan:MK Adopted Version. Available online: https://www.milton-keynes.gov.uk/assets/attach/59718/PlanMK-Adoption-Version-March-2019-.pdf

3.2.3. Policy FR2 of the local plan sets out the requirement for new developments to incorporate Sustainable Drainage Systems (SuDS) and to take an integrated approach to flood risk management.

3.2.4. Policy FR3 (Protecting and Enhancing Watercourses) states that "*all new development must be set back at a distance of at least 8 metres from any main rivers, at least 9 metres from all other ordinary watercourses, or at an appropriate width as agreed by the Environment Agency, Lead Local Flood Authority or Internal Drainage Board".*

3.2.5. Surface Water Drainage Guidance for Developers (January 2020) sets out the Lead Local Flood Authorities (LLFA) role as a statutory consultee in regard to planning. This document sets out the level of information the LLFA expects to be submitted as part of a planning application

4. DRAINAGE STRATEGY

4.1. EXISTING DRAINAGE REGIME

4.1.1. The site currently drains via a series of ordinary watercourses and field ditches to the Buckikngham and River Ouzel Internal Drainage Board (IDB) maintained watercourses referenced as the Caldecote Stream, the Moulsoe stream, the Hermitage Stream and the Brooklands stream as shown on Figure 3. These watercourses discharge to the River ouzel. The ouzel is classified as a main river on the EA main River Mapping

4.1.2. From site visits it has been shown that the ordinary watercourses and Moulsoe Stream, field drain 1 and field drain 2 are dry apart from storm events.

4.1.3. Figure 5 shows the surface water flood map. This map demonstrates that the overland flow routes are concentrated around the IDB watercourses and the River Ouzel.

Figure 4 – Watercourse Features

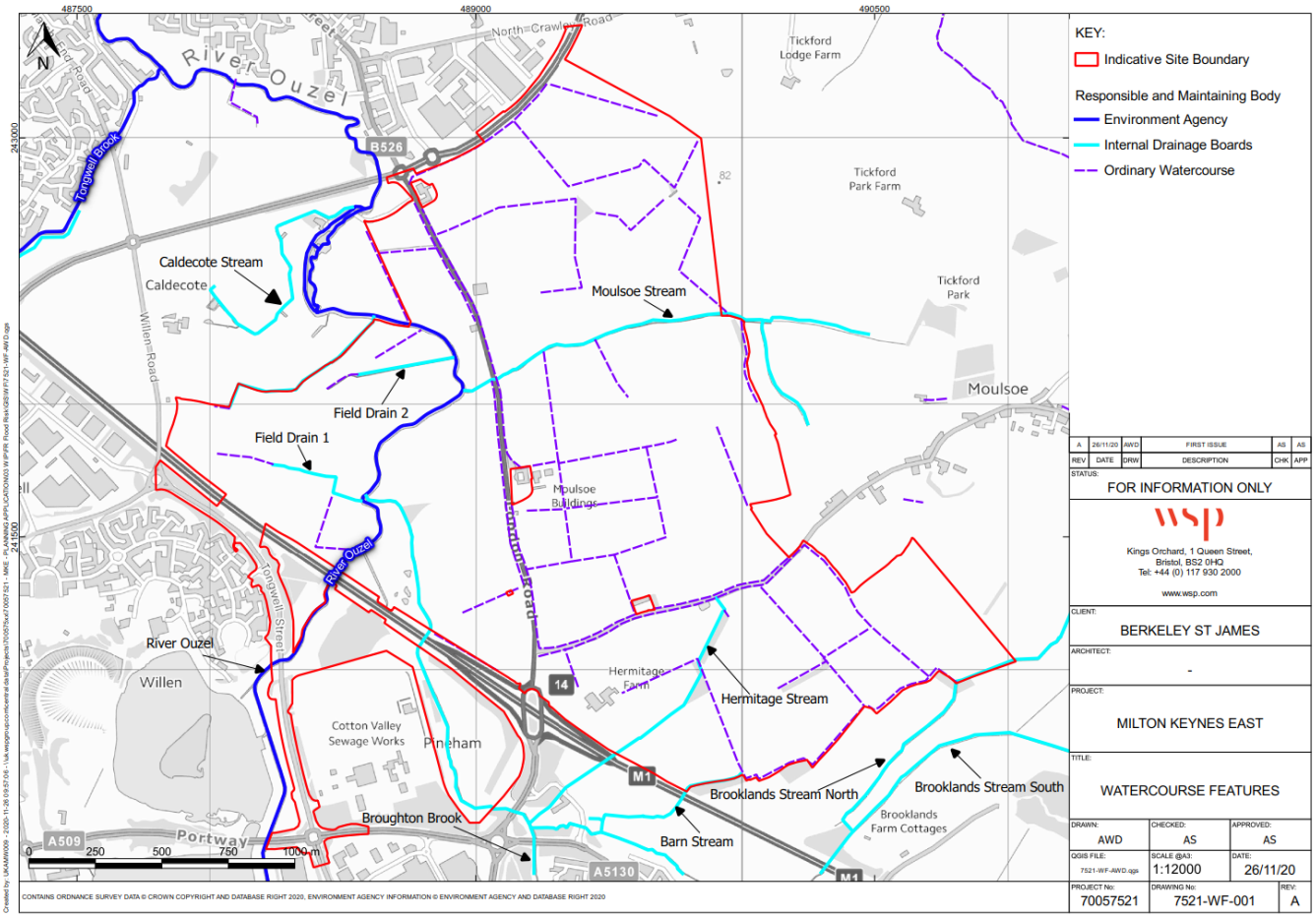
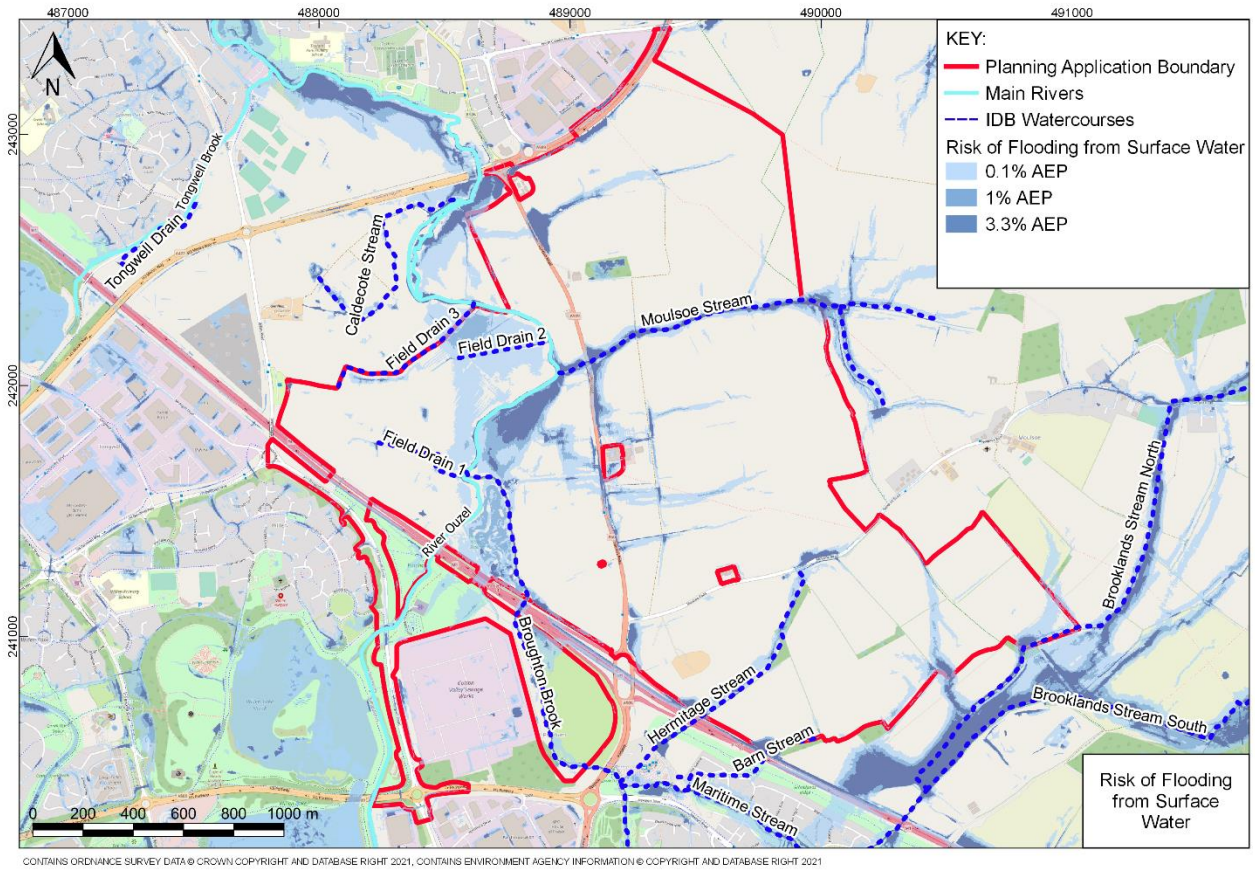


Figure 5 – Surface Water Flood Map



POST-DEVELOPMENT WATERCOURSE STRATEGY

4.1.4. To mitigate the risk of surface water flooding to the development a comprehensive drainage / SuDS strategy had been developed. This strategy involves attenuating the surface water runoff at source, attenuating in ponds and swales, prior to discharge to the River Ouzel or the Broughton Brook.

4.1.5. The SuDS Strategy has been developed in accordance with the policies set out within Plan MK, this requires the Scheme to continue the exemplar sustainable drainage model of Milton Keynes, with drainage infrastructure to be provided as strategically as possible and as part of a maintained, multi-functional blue-green infrastructure. The drainage strategy is being developed under these principles.

4.1.6. The development is following a holistic flood and water management approach that is designed to reduce flood risk, provide resilience and enhance bio-diversity.

4.1.7. Watercourses will be maintained and enhanced within the development wherever possible. The future maintenance regime associated with these watercourses is currently under review with the relevant stakeholders to ensure that drainage, flood risk, bio-diversity and amenity requirements are aligned.

4.1.8. There may be a range of small field drains / ordinary watercourses which are removed / realigned to become part of the SuDS strategy as a result of the Scheme, however, this will be determined during the detailed design phase and permission will be sought as part of the reserved matters applications.

4.2. SURFACE WATER DRAINAGE DISCHARGE OPTIONS

4.2.1. The Building Regulations Approved Document H and the Surface Water Drainage Guidance for Developers (January 2020) stipulates that rainwater from roofs and paved areas should discharge to one of the following, listed in order of priority:

1) an adequate soakaway or some other adequate infiltration system,

2) a watercourse or, where that is not practicable,

3) a sewer.

4.2.2. Option 1 – Infiltrate to Groundwater

Based on the geotechnical information obtained from BGS OpenGeoscience which classifies the underlying rock to be mudstone for the majority of the site and as such infiltration is not likely to be feasible. Soakage tests in accordance with BRE Digest 365 will be undertaken to confirm this.

4.2.3. Option 2 – Discharge into the Existing Watercourses/Ditches

In order to replicate the existing drainage regime, the development site would need to discharge into the existing IDB water courses and the River Ouzel.

4.2.4. Option 3 – Discharge into Public/Private Sewer(s)

There are no public surface water sewers within the site boundary. As there is opportunity to discharge into water courses this option has been discounted. It should be noted that under the Flood and Water Management Act 2010, there is no longer an automatic right of connection to the existing surface water sewer network.

4.2.5. Option 2 is the preferred method of surface water runoff discharge from the site. The drainage strategy will involve discharging to existing IDB and EA watercourses.

4.3. DRAINAGE DESIGN PARAMETERS

The proposed surface water drainage strategy has been designed in accordance with the following guidance:

- Design and Construction Guidance for foul and surface water sewers March 2020 that superseded Sewers for Adoption 7th Edition
- Milton Keynes Surface Water Drainage Guidance for Developers January 2020
- Non-statutory technical standards for sustainable drainage systems March 2015
- CIRIA SuDS Manual C753
- Building Regulation Approved Document H

4.3.1. The drainage system will be designed such that there will be no surcharging of pipes for a 1 in 2 year event, no flooding of the sewer system for 1 in 30 year event and all water will be contained on site for the 1 in 100 year plus 40% climate change event.

4.3.2. In line with best practice FEH rainfall data has been used to assess the site.

4.3.3. The proposed drainage strategy has been designed to manage as much water as possible at source on residential parcels whilst providing multiple benefits such as water quality management, amenity and biodiversity.

4.3.4. To manage water on site a discharge rate of 4 l/s/impermeable ha will be used. This has been agreed in principle with the IDB and is a betterment over the greenfield QBAR which would be 4 l/s/developable ha. Calculations for the greenfield QBAR are in Appendix A.

4.3.5. The objectives of this drainage strategy are to outline the approach for sustainable system that will:

- Prevent water from entering the system through the use of appropriate on plot design and measures that will hold water at source such as rainwater harvesting.
- Control the water at source through measures such as rain gardens to improve water quality and reduce hydraulic peaks.
- Treat the water prior to discharge into a water course via three treatment trains wherever possible.
- Incorporate the drainage into the wider site so that the attenuation basins and other methods fit in with the surrounding site

4.3.6. For the drainage strategy design it has been assumed that all highways will be 100% impermeable, the residential plots will be 60% impermeable with a 10% allowance for development creep for a total of 66% and the commercial plots will be 90% impermeable. The detailed catchment plan can be seen in Appendix B.

4.3.7. A different approach is required for each land use type.

4.3.8. Highway corridors will require surface water runoff to shed as quickly as possible to ensure the safety of all users. Any roadside SuDS will need to have a maximum depth of 150mm to ensure the safety of all users is not compromised in the case of any errant vehicles. This leads to sustainable storage options being limited' hence 100% of the runoff volume attenuation will be provided in a pond. Following consultation with MK Highways department, Mk have advised that all highway drainage should be provided by traditional measures ie pipe and gully networks. MK have advised they consider the use of highways SuDS features to be an unsustainable maintenance cost

4.3.9. The drainage of residential development plots will include source control features along with ponds storing runoff up to a depth of 2m in accordance the MK design guidance. This allows greater opportunity to integrate SuDS into the landscape a provide a holistic solution. It will be the intention to use as much of the SuDS toolkit as practicable. It is anticipated that a large proportion of attenuation storage can be addressed by use of source control techniques such as swales, filter drains, filter strips, porous/permeable surfaces, water butts and rain gardens with the remainder of runoff being collected and conveyed to regional treatment and storage ponds.

4.3.10. Surface water runoff from the commercial development plots will be drained via a variety of techniques including piped systems and conveyance channels. Discharge of surface water to

receiving watercourses will be managed by a mixture of above and below ground attenuation facilities. Commercial development will utilise urban channels, permeable paving and below ground attenuation upstream of attenuation ponds to ensure water quality standards are met.

4.4. DRAINAGE STRATEGY OPTIONS

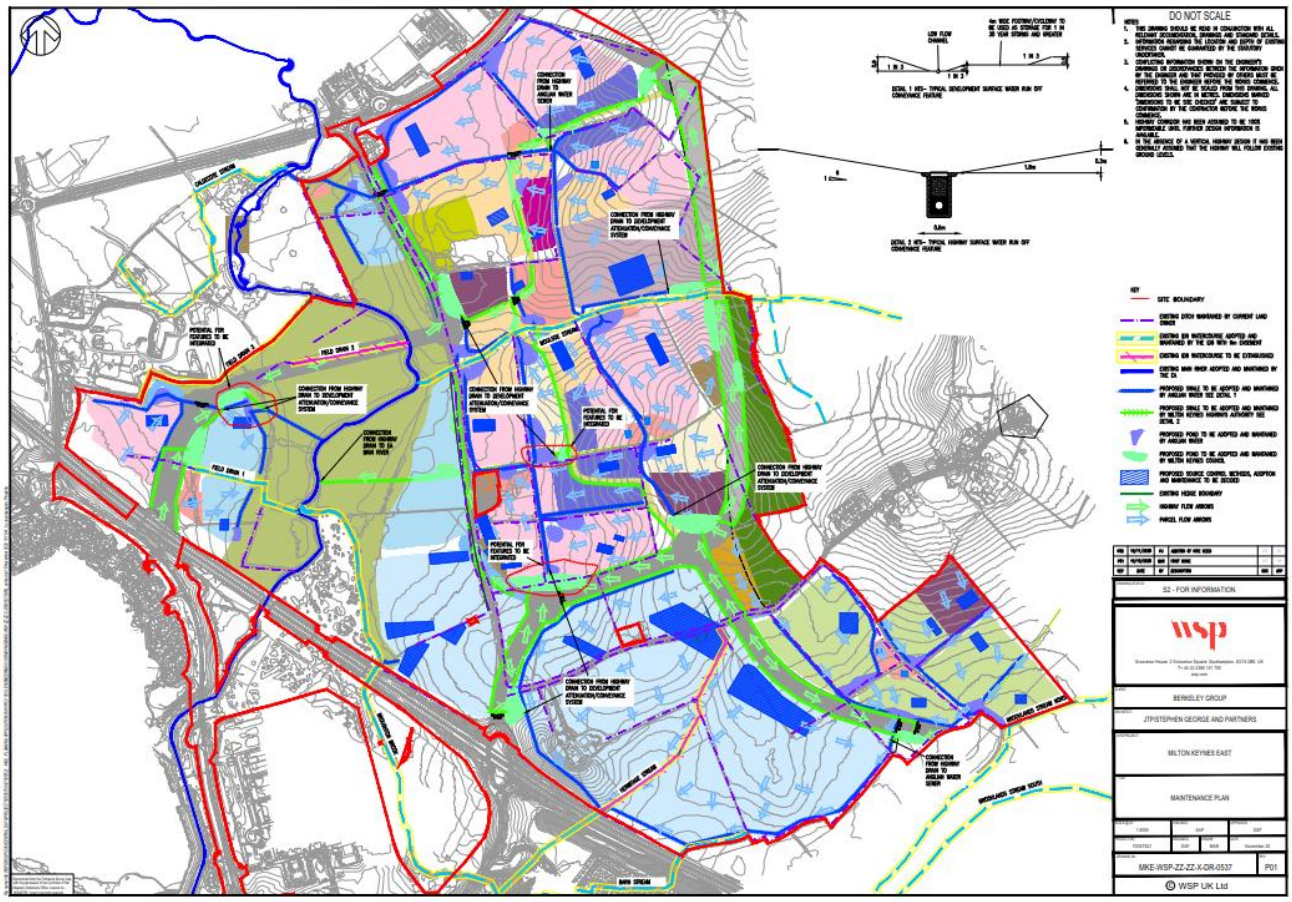
4.4.1. The drainage strategy has evolved throughout the design process, with the approach to be adopted to be confirmed at the relevant detailed design phase. At present there are two main options under consideration (segregated and integrated), these are presented below with the preference being the more holistic integrated drainage strategy.

4.4.2. The objectives of this drainage strategy are to outline the approach for sustainable system that will:

- Prevent water from entering the system through the use of good site design and measures that will hold water at source such as rainwater harvesting.
- Control the water at source through measures such as rain gardens to improve water quality and reduce hydraulic peaks.
- Treat the water prior to discharge into a water course via three treatment trains wherever possible.
- Incorporate the drainage into the wider site so that the attenuation basins and other methods fit in with the surrounding site

OPTION 1 SEGREGATED DRAINAGE STRATEGY

Figure 6– Segregated Drainage Strategy – Full size in Appendix C



4.4.3. In accordance with the above objectives a segregated drainage strategy has been considered.ie the highway drainage is completely segregated from the development parcel runoff This follows more traditional design methods to enable adoption of the highways and residential networks by separate authorities.

4.4.4. This design methodology allows the highways adoption authority to be responsible for the highways run off by managing the capture, flow and storage of highways runoff before discharging it to the wider strategic network.

4.4.5. Within this strategy each development parcel is also segregated with each development parcel becoming responsible for managing surface water runoff.

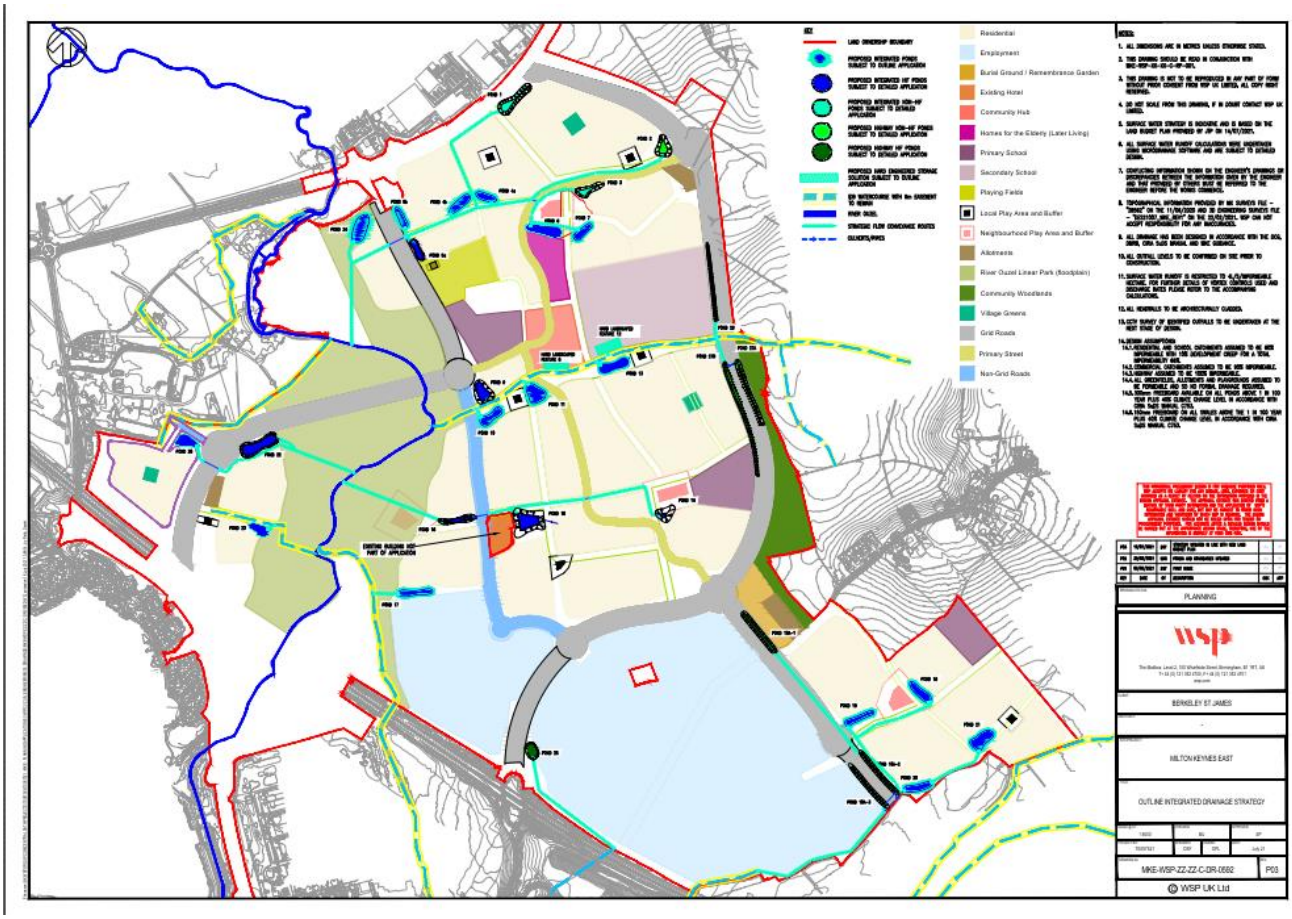
4.4.6. Following on from consultation with MK highways under this segregated strategy highway drainage would be drained by a traditional piped system out falling to attenuation ponds located within the designated transport corridor. This is then discharged to a strategic network at 4l/s/Impermeable HA.

4.4.7. The treatment train would be achieved via trapped gulley's, catchpits and forebays within the pond. The final outfall for each section would be a swale to add some additional polishing of the water. Should assessments show that this isn't sufficient then hard measures such as bypass interceptors and downstream defenders will be included

4.4.8. The challenge with this strategy is creating a holistic design that makes the attenuation features work within the development from a landscaping perspective. Extensive and divided maintenance responsibilities will create a long-term challenge.

INTEGRATED DRAINAGE STRATEGY

Figure 7– Integrated Drainage Strategy – Full size in Appendix D



4.4.9. Building on the segregated drainage strategy, a rationalisation of the attenuation design was undertaken leading to highway and residential runoff being managed within combined attenuation facilities ie an integrated approach. This is in accordance with the Surface Water Drainage Guidance for Developers (January 2020).

4.4.10. This integrated approach allows the incorporation of the drainage attenuation facilities within a landscape corridor thereby increasing the potential for biodiversity whilst including the attenuation facilities within a wider amenity corridor. It also means the overall number of drainage attenuation facilities can be reduced thereby decreasing maintenance requirements whilst maximising wider environmental benefits

4.4.11. The design methodology is very similar to the segregated strategy in using ponds and conveyance channels to store and treat the runoff. However, it has a greater focus on dealing with water at source and combining storage features where possible.

4.4.12. Within the integrated drainage strategy, it has been assumed that 40% of water falling on the residential parcels will be dealt with at source or on plot. Potential methods for this are discussed in

detail in paragraph 4.6.3 this approach follows best practice design and avoids a pipe to pond design.

Table 1 – Catchment Table

Catchment Reference (refer to Appendix B)	Total Area (ha)	Total Impermeable Area (ha)	Allowable Discharge Rate (l/s)	Attenuation Storage Required (m^3)
1	11.48	8.6	34.4	7,700
2	2.5	2.5	10	2,300
3	4.38	3.08	12.3	2,800
4	9.39	6.2	24.8	5,500
5	7.82	6.16	24.6	5,500
6	2.7	1.8	7.2	1,600
7	4.7	3.1	12.4	2,800
8	3.4	2.24	9.0	2,000
9	6.54	5.05	20.2	4,500
10	4.78	3.15	12.6	2,800
11	9.72	6.4	26.7	5,700
12	11.72	7.74	30.9	6,900
13	11.68	7.7	30.8	6,900
14	9.6	6.8	27.2	6,100
15	20.4	15.44	61.8	13,900
16	7.2	6.1	24.4	5,500
17	4.3	2.8	11.2	2,500
18	6.44	4.25	12.8	3,900
18A	5.95	5.95	23.8	5,300
19	5.2	3.4	13.6	3,100
20	4.9	3.2	12.8	2,900
21	6.85	4.52	18.1	4,000
22	11.2	9.9	39.6	8,900

23	1.63	1.08	4.3	1,000
24	3.18	2.1	8.4	1,900
25	1.32	1.32	5.3	1,200
26	2.2	2.2	8.8	2,000
27	4.3	4.3	17.2	3,900
28	5.38	3.69	14.8	3,300
Commercial 1	61.8	55.62	222.5	50,400
Commercial 2	17.1	15.6	62.4	14,000

4.5. OVERLAND FLOW ROUTES

4.5.1. Any rainfall event with intensity in excess of that of the design capacity of the development surface water drainage network may result in temporary above ground flooding, potentially giving rise to overland flows.

4.5.2. Overland flows in excess of the capacity of the positive drainage system will be routed away from buildings towards the less vulnerable highways, open space and surface water attenuation provision.

4.5.3. Existing and proposed overland flow routes can be seen in Appendix E.

4.6. SUDS TOOLKIT

4.6.1. Milton Keynes Council Surface Water Drainage Guidance for Developers requires that all new developments implement Sustainable Drainage Systems (SuDS) as the primary means of controlling surface water run-off in order to maintain flow rates and volumes discharged to the identified receptor post development.

4.6.2. In addition to the water control benefits, the SuDS Manual (CIRIA C753) states that “SuDS can treat and clean surface water runoff from urban areas so that the receiving environment is protected, while at the same time conveying, storing and infiltrating surface water to protect flood risk, river morphology and water resources, and delivering amenity and biodiversity value for the development.”

4.6.3. At the proposed site, a drainage strategy has been prepared in conjunction with the masterplan development thus making space for multi-function SuDS within the site boundary. Table 2 below provides a summary of the SuDS selection process and measures that will be introduced into the development

Table 2 - Summary of SuDS Selection

Feature	Description	Selection
Green Roofs	Green roofs are systems which cover a building's roof with vegetation. They are laid over a drainage layer, with other layers providing protection, waterproofing and insulation.	✓ Green roofs have the potential to be used within the commercial land and for any school or community type development areas.
Filter Strips	These are wide, gently sloping areas of grass or other dense vegetation that treat runoff from adjacent impermeable areas.	✓ Filter strips have the potential to be used within all settings
Pervious Surfaces	Pervious surfaces allow rainwater to infiltrate through the surface into an underlying storage layer, where water is stored before infiltration to the ground, reuse, or release to surface water.	✓ Pervious surfaces have the potential to be used within communal parking areas across all types of development
Bio-retention / raingardens	Bioretention systems are areas of vegetation into which rainwater and runoff can be directed. These are particularly affected at providing water quality improvements.	✓ These have potential to be used within the residential setting.
Swales	Swales are broad, shallow channels covered by grass or other suitable vegetation. They are designed to convey and/or store runoff and can infiltrate the water into the ground (if ground conditions allow).	✓ Swales have potential to be used adjacent to highways and within the residential development. MK highways have however stated they will not accept swales as a methodology for draining adoptable highways
Infiltration Basins	Infiltration basins are depressions in the surface that are designed to store runoff and infiltrate the water to the ground. They may also be landscaped to provide aesthetic and amenity value.	× Infiltration is not deemed to be a likely option on this site.
Wet Ponds	Wet ponds are basins that have a permanent pool of water for water quality treatment. They provide temporary storage for additional storm runoff above the permanent water level. Wet ponds may provide amenity and wildlife benefits.	✓ It is the intention to have some of the ponds on site within the residential green corridors as wet ponds.
Detention Basins	Detention basins are normally dry, though they may have small permanent pools at the inlet and outlet. They are designed to detain a certain volume of runoff as well as providing water quality treatment.	✓ Detention pond will be used where wet ponds aren't viable for the strategic network and also have the potential to be used within residential developments

		as smaller basins in communal areas.
Geocellular Storage	Geocellular storage structures are below-ground attenuation features. These are typically formed using crates which provide a high void space for attenuation and water quantity control.	✓ Geocellular storage has the potential to be used where space is constrained such as within the commercial areas.

4.6.4. The SuDS Manual (CIRIA C753) states the SuDS Management Train is a central design concept for SuDS. SuDS should not be thought of as an individual component, but as an interconnected system designed to manage, treat and make best use of surface water, from where it falls as rain to the point at which it is discharged into the receiving environment beyond the boundaries of the site.

4.6.5. There are six specific functions provided by SuDS components (rainwater harvesting, pervious surface systems, infiltration systems, conveyance systems, storage systems and treatment systems), which are not independent with one component being able to provide two or more functions.

4.6.6. There are many types of SuDS components which means that SuDS can be delivered anywhere, tailored to individual local contexts. Wherever possible, runoff should be managed at source with residual flows then conveyed downstream to further storage or treatment components.

4.6.7. Treatment design should implement SuDS components that use a range of treatment processes to reduce contaminant level in runoff to acceptable levels. This can be facilitated by the SuDS management train of a number of components in series that provide a range of treatment processes, delivering gradual improvement in water quality and providing an environmental buffer for accidental spills or unexpected high pollutant loadings from the site

4.6.8. The above has been considered in applying SuDS into the proposed development to help provide; prevention in terms of pollution, source control and site controls.

4.6.9. The toolkit of SuDS provided above is intended to allow a range of options to be selected that works for each site with a preference towards open vegetated solutions due the opportunity to generate additional benefits beyond water control.

4.6.10. In order to ensure that each parcel conforms with the above a proforma has been created and can be seen in Appendix G

4.7. MAINTENANCE AND MANAGEMENT

4.7.1. The proposed on-site surface water drainage network will be designed to the current version of the Design and Construction Guidance, Surface Water Drainage Guidance for Developers and CIRIA SuDS Manual C753 and will be offered for adoption by Anglian Water

4.7.2. The proposed on-site foul drainage network will be designed to the current version of Design and Construction Guidance and will be offered for adoption by Anglian Water.

4.7.3. With regards to SuDS, in view of the central government decision not to create SAB's, some uncertainty remains regarding by whom and how these features will be adopted and maintained. With the above in mind, it is likely that, should the SuDS be offered to the council (Parks Trust) for adoption and maintenance, commuted sums will be required for all adoptable SuDS processes.

4.7.4. As an alternative, it is becoming increasingly common for SuDS features to be operated and maintained by a third-party private maintenance company. Should this be necessary, a third-party management company would be established to maintain the features in perpetuity. An adoption agreement between the final site developer and Maintenance Company would be based upon the CIRIA ICoP MA2 SuDS Maintenance Framework Agreement.

4.7.5. In addition, Sewerage Sector Guidance has come into force during 2020. This gives the ability for sewerage undertakers to adopt SuDS features under certain conditions such as conveying flows. There may therefore be the potential for SuDS features to be adopted by Anglian Water.

4.7.6. It is currently proposed that i) Piped drainage systems within the highway and draining the highway only will be offered to the highway authority for adoption II) attenuation facilities that drain the highway only will be offered to the highway authority iii) Piped networks within adopted highway or public open space will be offered to the sewerage undertaker for adoption iv) the attenuation facilities will be offered to the Parks trust v) the maintenance of the watercourses within the site boundary is currently the subject of discussions between MKC/ the Parks Trust and the IDB. Ideally the maintenance of these watercourses should be under one body to ensure they are maintained appropriately for their setting. Final maintenance responsibility will be determined during the planning determination period.

4.7.7. A typical maintenance schedule of the attenuation and flow control devices proposed on site are shown in tables below.

Permeable Paving Indicative Maintenance Schedule

Frequency	Action
Monthly	▪ Refer to manufacturer specifications ▪ For sealed systems, inspections of outfalls should be undertaken
Six Monthly	▪ Brushing and vacuuming to manufacturer requirements. Re-grit where necessary
Annually	▪ N/A
As Required	▪ Inspect/check all inlets, outlets, inspection chambers, surface and overflows (where required) to ensure that they are in good condition, free from blockages and operating as designed. Take action where required (for 3 months following installation)
Following all significant storm events	▪ Inspect and carry out essential recovery works to return feature to full working order.

Attenuation Tank Indicative Maintenance Schedule

Frequency	Action
Monthly	▪ Inspect and identify any areas that are not operating correctly. If required, take remedial action (for three months following installation).
Six Monthly	▪ Inspect and identify any areas that are not operating correctly. If required, take remedial action (following initial 3 month period)
Annually	▪ Remove sediment from pre-treatment structures
As Required	▪ De-silt as required
Following all significant storm events	▪ Inspect and carry out essential recovery works to return feature to full working order.

Flow Control (e.g Hydrobrake) Indicative Maintenance Schedule

Frequency	Action
Monthly	▪ Inspect and identify any areas that are not operating correctly. If required, take remedial action (for three months following installation)
Six Monthly	▪ Inspect and identify any areas that are not operating correctly. If required, take remedial action. ▪ Remove sediment from pre-treatment structures
Annually	▪ N/A
Following all significant storm events	▪ Inspect and carry out essential recovery works to return the feature to full working order.

Green Roof Indicative Maintenance Schedule

Frequency	Action
Monthly	▪ Mow grasses (where required) and remove resultant clippings (during ▪ growing season only). ▪ I During establishment, replace dead plants as required (for 12 months following installation)
Six Monthly	▪ Remove fallen leaves and debris from deciduous plant foliage. ▪ Remove nuisance and invasive vegetation, including weeds. ▪ Remove debris & litter to prevent clogging of inlet drains and interference with plant growth. ▪ Noxious weed treatment (3 times a year).
Annually	▪ Replace dead plants as required (typically in the Autumn). ▪ Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes, and roof structure for proper operation, integrity of waterproofing and structural stability, take action where required. ▪ Inspect soil substrate for evidence of erosion channels and identify any sediment sources, take action where required. ▪ Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system, take action where required. ▪ Inspect underside of roof for evidence of leakage, take action where required. ▪ Inspect and document the presence of wildlife.
Following all significant storm events	▪ Inspect and carry out essential recovery works to return the feature to full working order.

Filter Drain Indicative Maintenance Schedule

Frequency	Action
Monthly	▪ Litter and debris removal. ▪ Mow grasses (where required to promote lateral runoff inflow) and remove resultant clippings (during growing season only). ▪ Remove nuisance and invasive vegetation (for 12 months following installation). ▪ Inspect/check all inlets, outlets, surface and overflows (where required) to ensure that they are in good condition, free from blockages and operating as designed. Take action where required.
Six Monthly	▪ N/A
Annually	▪ Remove nuisance and invasive vegetation ▪ Inspect and document the presence of wildlife

As-Required	▪ Repair erosion or other damage by re-turfing, reseeding or replacing filter material ▪ Re-level uneven surfaces and reinstate design levels (typically every 60 month period) ▪ Remove and replace top 300 – 500mm of gravel, clean and replace where required (typically every 60 month period) ▪ Remove and dispose of oils or petrol residues using safe standard practices
Following all significant storm events	▪ Inspect and carry out essential recovery works to return the feature to full working order.

Swale Indicative Maintenance Schedule

Frequency	Action
Monthly	▪ Litter and debris removal. ▪ Mow grasses (where required to promote lateral runoff inflow) and remove resultant clippings (during growing season only). ▪ Remove nuisance and invasive vegetation (for 12 months following installation). ▪ Inspect/check all inlets, outlets, surface and overflows (where required) to ensure that they are in good condition, free from blockages and operating as designed. Take action where required.
Six Monthly	▪ Remove nuisance and invasive vegetation.
Annually	▪ Check for poor vegetation growth due to lack of sunlight or dropping of leaf litter and cut back adjacent vegetation where required. ▪ Re-seed areas of poor vegetation growth. Alter plant types to better suit conditions, where required. ▪ Inspect and document the presence of wildlife.
As-Required	▪ Repair erosion or other damage by re-turfing, reseeding or replacing filter material. ▪ Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface where required. ▪ (typically every 60 month period). ▪ Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip, where required. ▪ Remove and dispose of oils or petrol residues using safe standard practices.

Following all significant storm events	▪ Inspect and carry out essential recovery works to return the feature to full working order.

Detention Basin Indicative Maintenance Schedule

Frequency	Action
Monthly	▪ Litter and debris removal. ▪ Mow grasses (where required to promote lateral runoff inflow) and remove resultant clippings (during growing season only). ▪ Remove nuisance and invasive vegetation (for 12 months following installation). ▪ Inspect/check all inlets, outlets, surface and overflows (where required) to ensure that they are in good condition, free from blockages and operating as designed. Take action where required.
Six Monthly	▪ Remove nuisance and invasive vegetation.
Annually	▪ Remove all dead growth prior to the start of growing season. ▪ Re-seed areas of poor vegetation growth. Alter plant types to better suit conditions, where required. ▪ Inspect and document the presence of wildlife. ▪ Remove sediment from inlets, outlet and forebay ▪ Manage wetland plants, where required
As-Required	▪ Prune and trim trees and remove cuttings. ▪ Remove sediment from forebay, when 50% full and from micropools if volume reduced by more than 25% ▪ Repair erosion or other damage by re-turfing or reseeding ▪ Re-level uneven surfaces and reinstate design levels (typically once every 60 month period) ▪ Remove and dispose of oils or petrol residues using safe standard practices
Following all significant storm events	▪ Inspect and carry out essential recovery works to return the feature to full working order.

Rain Garden Indicative Maintenance Schedule

Frequency	Action
Monthly	▪ Litter and debris removal. ▪ Mulching (where required) ▪ Inspect/check all inlets, outlets, surface and overflows (where required) to ensure that they are in good condition, free from blockages and operating as designed. Take action where required

Six Monthly	▪ Remove nuisance and invasive vegetation.
Annually	▪ Pruning and trimming of trees. ▪ Inspect and document the presence of wildlife. ▪ Check for poor vegetation growth due to lack of sunlight or dropping of leaf litter, and cut back adjacent vegetation where required.
As-Required	▪ Repair erosion or other damage by re-mulching or re-seeding. ▪ Re-seed areas of poor vegetation growth. Alter plant types to better suit conditions, if required. ▪ Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface (typically every 60 month period). ▪ Remove build-up of sediment, reinstate design levels (typically every 60 month period). ▪ Remove and dispose of oils or petrol residues using safe standard practices.
Following all significant storm events	▪ Inspect and carry out essential recovery works to return the feature to full working order.

4.7.8. The proposed maintenance regimes for the devices should be in accordance with The SuDS Manual (CIRIA C753) and other best practice guidelines and in accordance with manufacturer's recommendations. This will ensure the design performance, structural integrity and where applicable-appearance of each feature is maintained throughout its lifetime.

4.7.9. The details of the party responsible for maintenance of each feature will be confirmed prior to occupation of the proposed development. Until such times as this may be determined.

5. CONCLUSIONS

5.1.1. Based on the above the following is concluded

- It is proposed to drain the site by using an integrated drainage system to serve both the highways and the individual development parcels
- Rainfall will be managed at source and will utilise the SuDs train in accordance with best practise
- Priority will be given to above ground green storage systems where possible
- The discharge rate for all events up to and including the 1 in 100 year +40% climate change event will be 4l/s/impermeable hectare
- The drainage system will have no flooding above ground for the 1 in 30 year event and no uncontrolled flooding off site for the 1 in 100 year plus 40% climate change event with an allowance for 10% development creep in residential areas
- Residential run off will be dealt with using the toolkit above where possible to avoid a pipe to pond solution and retain water as close to the source as practicable
- It is proposed that Milton Keynes Council will adopt and maintain drains and ponds serving highway only drainage and that the Parks Trust will maintain all other ponds that serve both highways and residential drainage with Anglian Water responsible for any sewers. IDB will maintain jurisdiction over watercourses but the maintenance will be undertaken by the Parks Trust
- During exceedance events surface water will be directed along highways and towards open attenuation facilities

Appendix A

GREENFIELD CALCULATIONS

IH 124 Mean Annual Flood

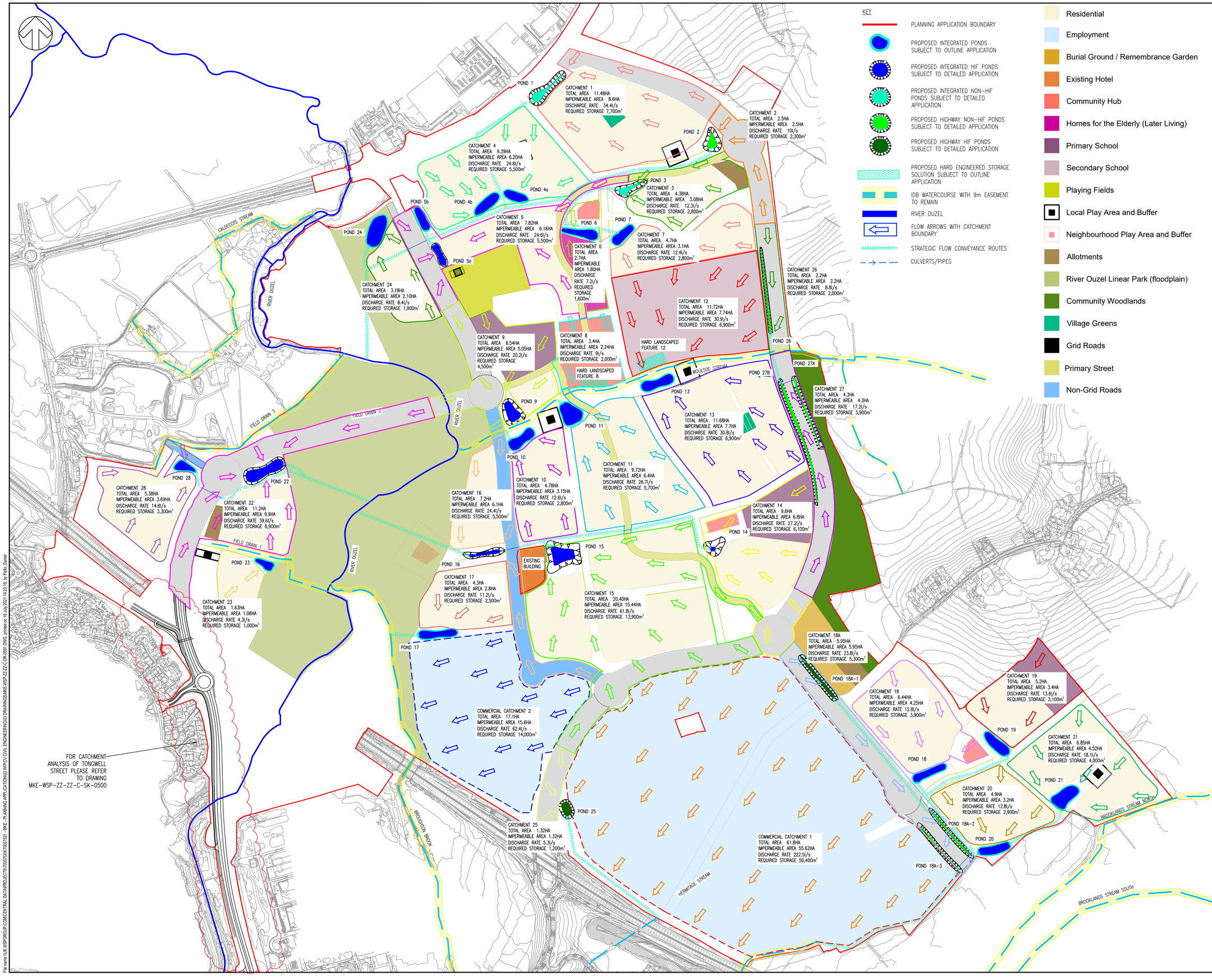
Input

Return Period (years)	1	Soil	0.450
Area (ha)	50.000	Urban	0.000
SAAR (mm)	650	Region Number	Region 5

Results	**l/s**
QBAR Rural	201.4
QBAR Urban	201.4
Q1 year	175.2
Q1 year	175.2
Q2 years	180.0
Q5 years	259.8
Q10 years	333.3
Q20 years	421.1
Q25 years	455.6
Q30 years	483.9
Q50 years	572.4
Q100 years	717.0
Q200 years	843.9
Q250 years	884.2
Q1000 years	1160.1

Appendix B

CATCHMENT PLAN



KEY

- PLANNING APPLICATION BOUNDARY
- PROPOSED INTEGRATED PONDS SUBJECT TO OUTLINE APPLICATION
- PROPOSED INTEGRATED HIF PONDS SUBJECT TO DETAILED APPLICATION
- PROPOSED INTEGRATED NON-HIF PONDS SUBJECT TO DETAILED APPLICATION
- PROPOSED HIGHWAY NON-HIF PONDS SUBJECT TO DETAILED APPLICATION
- PROPOSED HIGHWAY HIF PONDS SUBJECT TO DETAILED APPLICATION
- PROPOSED HARD ENGINEERED STORAGE SOLUTION SUBJECT TO OUTLINE APPLICATION
- IDB WATERCOURSE WITH 9m EASEMENT TO REMAIN
- RIVER OUZEL
- FLOW ARROWS WITH CATCHMENT BOUNDARY
- STRATEGIC FLOW CONVEYANCE ROUTES
- CULVERTS/PIPES

- Residential
- Employment
- Burial Ground / Remembrance Garden
- Existing Hotel
- Community Hub
- Homes for the Elderly (Later Living)
- Primary School
- Secondary School
- Playing Fields
- Local Play Area and Buffer
- Neighbourhood Play Area and Buffer
- Allotments
- River Ouzel Linear Park (floodplain)
- Community Woodlands
- Village Greens
- Grid Roads
- Primary Street
- Non-Grid Roads

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12. ALL HEADWALLS TO BE ARCHITECTURALLY CLADDED.
13. CCTV SURVEY OF IDENTIFIED OUTFALLS TO BE UNDERTAKEN AT THE NEXT STAGE OF DESIGN.
14. DESIGN ASSUMPTIONS:
    - 14.1. RESIDENTIAL AND SCHOOL CATCHMENTS ASSUMED TO BE 60% IMPERMEABLE WITH 10% DEVELOPMENT CREEP FOR A TOTAL IMPERMEABILITY 66%.
    - 14.2. COMMERCIAL CATCHMENTS ASSUMED TO BE 90% IMPERMEABLE.
    - 14.3. HIGHWAY ASSUMED TO BE 100% IMPERMEABLE.
    - 14.4. ALL GREENFIELDS, ALLOTMENTS AND PLAYGROUNDS ASSUMED TO BE PERMEABLE AND SO NO FORMAL DRAINAGE REQUIRED.
    - 14.5. 300mm FREEBOARD AVAILABLE ON ALL PONDS ABOVE 1 IN 100 YEAR PLUS 40% CLIMATE CHANGE LEVEL IN ACCORDANCE WITH CIRIA SuDS MANUAL C753.
    - 14.6. 150mm FREEBOARD ON ALL SWALES ABOVE THE 1 IN 100 YEAR PLUS 40% CLIMATE CHANGE LEVEL IN ACCORDANCE WITH CIRIA SuDS MANUAL C753.

REV	DATE	BY	DESCRIPTION	CHK	APP
P03	12/07/2021	DSF	CATCHMENTS UPDATED FOR REVISED LAND BUDGET PLAN	[illegible]	[illegible]
P02	29/03/2021	MAR	CATCHMENT INFORMATION UPDATED	[illegible]	[illegible]
P01	05/03/2021	DSF	FIRST ISSUE	[illegible]	[illegible]

DRAWING STATUS: PLANNING

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ARCHITECT: -

SITE/PROJECT: MILTON KEYNES EAST

TITLE: PROPOSED CATCHMENT PLAN

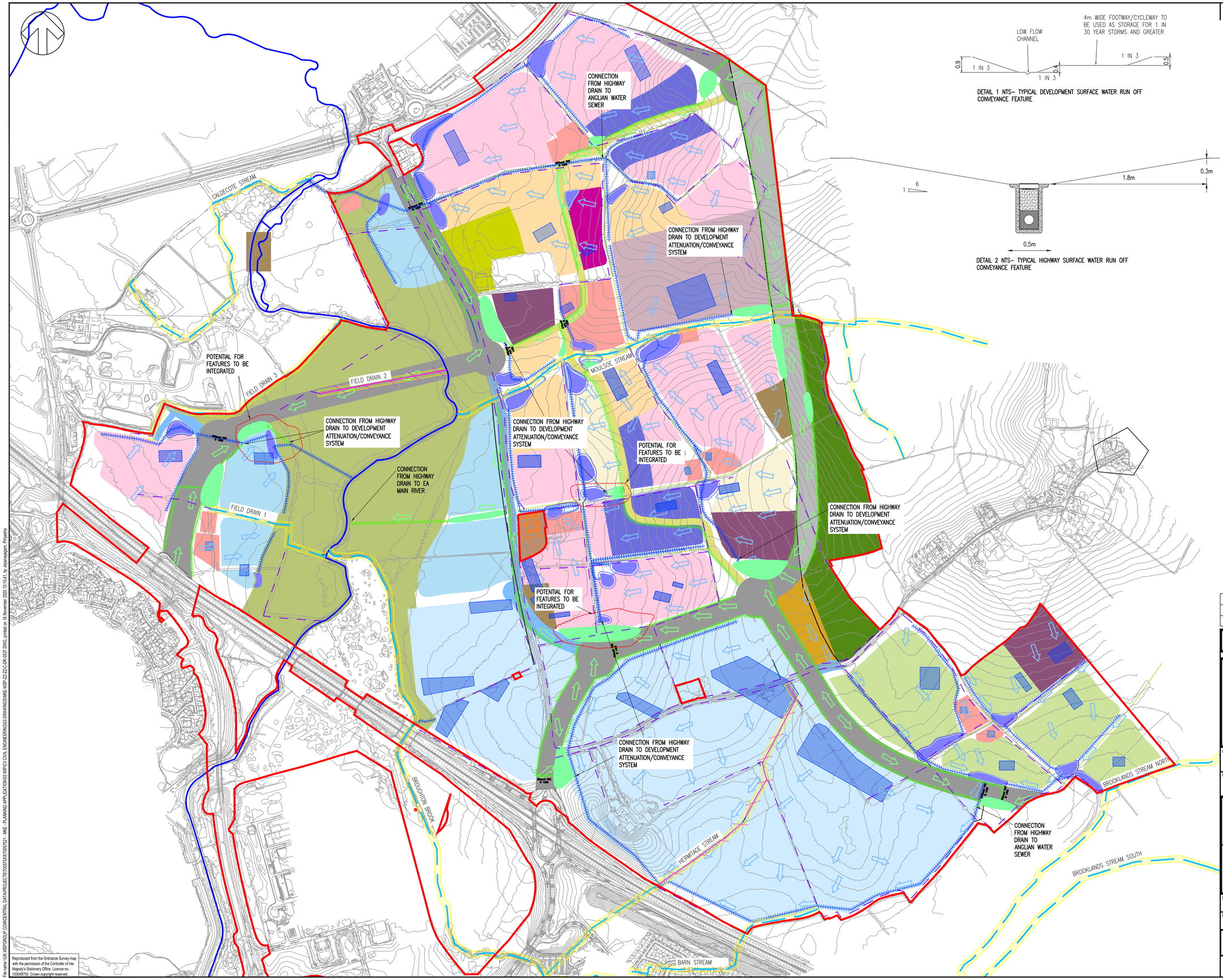
SCALE @ A1:	CHECKED:		APPROVED:
1:5000	BU		SP
PROJECT NO:	DESIGNED:	DRAWN:	DATE:
70057521	DSF	OPL	July 21

DRAWING No: MKE-WSP-ZZ-ZZ-C-DR-0591 REV: P03

File name I:\UK.WSPGROUP.COM\CENTRAL DATA\PROJECTS\70057500\70057521 - MKE - PLANNING APPLICATION\03 WIP\CV CIVIL ENGINEERING\03.DRAWING\[S3]MKE-WSP-ZZ-ZZ-C-DR-0591.DWG, printed on 16 July 2021 14:23:10, by Fiello, Daniel

Appendix C

SEGREGATED DRAINAGE STRATEGY



DETAIL 1 NTS– TYPICAL DEVELOPMENT SURFACE WATER RUN OFF CONVEYANCE FEATURE

DETAIL 2 NTS– TYPICAL HIGHWAY SURFACE WATER RUN OFF CONVEYANCE FEATURE

DO NOT SCALE

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5. HIGHWAY CORRIDOR HAS BEEN ASSUMED TO BE 100% IMPERMEABLE UNTIL FURTHER DESIGN INFORMATION IS AVAILABLE.
6. IN THE ABSENCE OF A VERTICAL HIGHWAY DESIGN IT HAS BEEN GENERALLY ASSUMED THAT THE HIGHWAY WILL FOLLOW EXISTING GROUND LEVELS.

KEY

- SITE BOUNDARY
- EXISTING DITCH MAINTAINED BY CURRENT LAND OWNER
- EXISTING IDB WATERCOURSE ADOPTED AND MAINTAINED BY THE IDB WITH 9m EASEMENT
- EXISTING IDB WATERCOURSE TO BE EXTINGUISHED
- EXISTING MAIN RIVER ADOPTED AND MAINTAINED BY THE EA
- PROPOSED SWALE TO BE ADOPTED AND MAINTAINED BY ANGLIAN WATER SEE DETAIL 1
- PROPOSED SWALE TO BE ADOPTED AND MAINTAINED BY MILTON KEYNES HIGHWAYS AUTHORITY SEE DETAIL 2
- PROPOSED POND TO BE ADOPTED AND MAINTAINED BY ANGLIAN WATER
- PROPOSED POND TO BE ADOPTED AND MAINTAINED BY MILTON KEYNES COUNCIL
- PROPOSED SOURCE CONTROL METHODS, ADOPTION AND MAINTENANCE TO BE DECIDED
- EXISTING HEDGE BOUNDARY
- HIGHWAY FLOW ARROWS
- PARCEL FLOW ARROWS

REV	DATE	BY	DESCRIPTION	CHK	APP
P02	18/11/2020	PJ	ADDITION OF PIPE SIZES	DSF	PJ
P01	16/10/2020	MAR	FIRST ISSUE	DSF	SAP

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ARCHITECT: JTP/STEPHEN GEORGE AND PARTNERS

SITE/PROJECT: MILTON KEYNES EAST

TITLE: SEGREGATED DRAINAGE STRATEGY

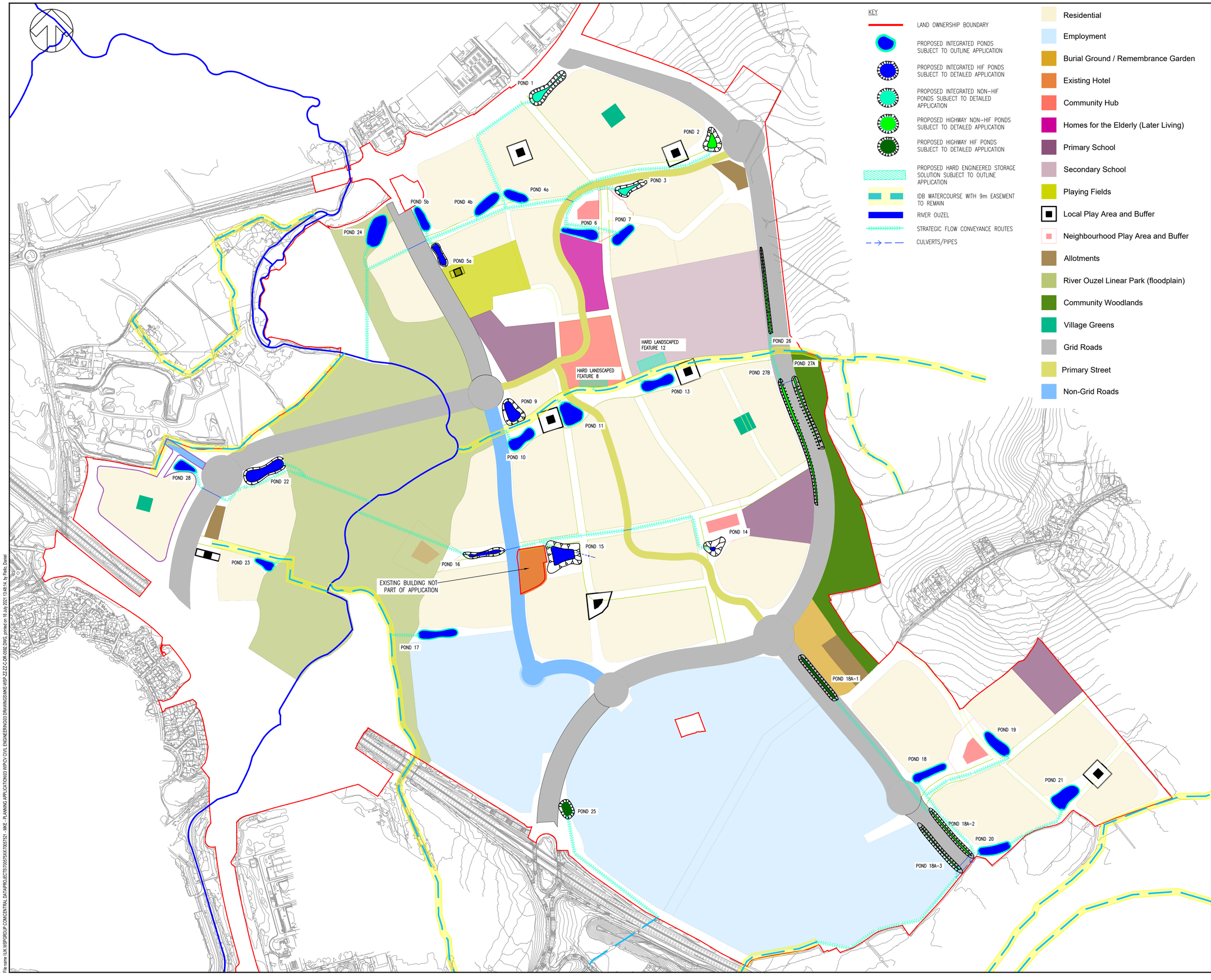
SCALE @ A1:	CHECKED:		APPROVED:
1:5000	SAP		DSF
PROJECT NO:	DESIGNED:	DRAWN:	DATE:
70057521	DSF	MAR	November 20

DRAWING No: MKE-WSP-ZZ-ZZ-X-DR-0537 REV: P01

File name: \\UK.WSPGROUP.COM\CENTRAL DATA\PROJECTS\70057521\00\70057521 - MKE - PLANNING APPLICATION\03 WIP\C\CIVIL ENGINEERING\03 DRAWINGS\MKE-WSP-ZZ-ZZ-DR-0537.DWG, printed on 18 November 2020 10:15:41, by Jeevanagan, Priyatha

Appendix D

INTEGRATED DRAINAGE STRATEGY



KEY

- LAND OWNERSHIP BOUNDARY
- PROPOSED INTEGRATED PONDS SUBJECT TO OUTLINE APPLICATION
- PROPOSED INTEGRATED HIF PONDS SUBJECT TO DETAILED APPLICATION
- PROPOSED INTEGRATED NON-HIF PONDS SUBJECT TO DETAILED APPLICATION
- PROPOSED HIGHWAY NON-HIF PONDS SUBJECT TO DETAILED APPLICATION
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REV	DATE	BY	DESCRIPTION	CHK	APP
P03	13/07/2021	DSF	STRATEGY UPDATED IN LINE WITH NEW LAND BUDGET PLAN	[illegible]	SP
P02	29/03/2021	MAR	PONDS AND BOUNDARIES UPDATED	[illegible]	SP
P01	05/03/2021	DSF	FIRST ISSUE	[illegible]	SP

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CLIENT: BERKELEY ST JAMES

ARCHITECT: -

SITE/PROJECT: MILTON KEYNES EAST

TITLE: OUTLINE INTEGRATED DRAINAGE STRATEGY

SCALE @ A1:	CHECKED:		APPROVED:
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PROJECT NO:	DESIGNED:	DRAWN:	DATE:
70057521	DSF	OPL	July 21

DRAWING No: MKE-WSP-ZZ-ZZ-C-DR-0592 REV: P03

Appendix E

EXISTING AND PROPOSED OVERLAND FLOW ROUTES

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2. INFORMATION REGARDING THE LOCATION AND DEPTH OF EXISTING SERVICES CANNOT BE GUARANTEED BY THE STATUTORY UNDERTAKER.
3. CONFLICTING INFORMATION SHOWN ON THE ENGINEER'S DRAWINGS OR DISCREPANCIES BETWEEN THE INFORMATION GIVEN BY THE ENGINEER AND THAT PROVIDED BY OTHERS MUST BE REFERRED TO THE ENGINEER BEFORE THE WORKS COMMENCE.
4. DIMENSIONS SHALL NOT BE SCALED FROM THIS DRAWING. ALL DIMENSIONS SHOWN ARE IN METRES. DIMENSIONS MARKED 'DIMENSIONS TO BE SITE CHECKED' ARE SUBJECT TO CONFIRMATION BY THE CONTRACTOR BEFORE THE WORKS COMMENCE.
5. HIGHWAY CORRIDOR HAS BEEN ASSUMED TO BE 100% IMPERMEABLE UNTIL FURTHER DESIGN INFORMATION IS AVAILABLE.
6. IN THE ABSENCE OF A VERTICAL HIGHWAY DESIGN IT HAS BEEN GENERALLY ASSUMED THAT THE HIGHWAY WILL FOLLOW EXISTING GROUND LEVELS.

60
65
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67.000

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	XX/XX/2021	MAR	FIRST ISSUE	DSF	SAP

DRAWING STATUS: S2 - FOR INFORMATION

wsp
Grosvenor House, 2 Grosvenor Square, Southampton, SO15 2BE, UK
T+ 44 (0) 2380 101 700
wsp.com

CLIENT: BERKELEY GROUP

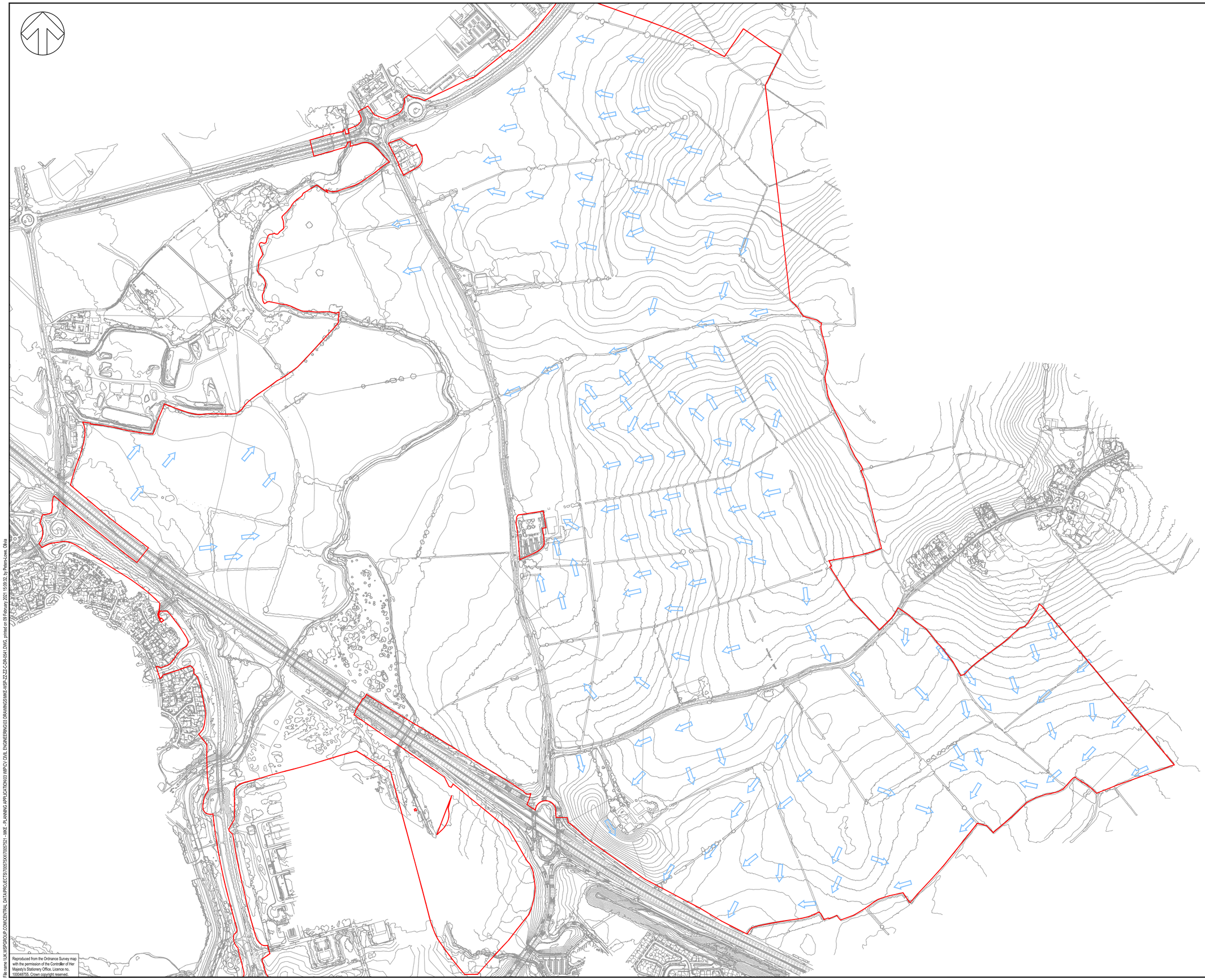
ARCHITECT: JTP/STEPHEN GEORGE AND PARTNERS

SITE/PROJECT: MILTON KEYNES EAST

TITLE: PROPOSED EXCEEDANCE FLOW ROUTE PLAN

SCALE @ A1:	CHECKED:		APPROVED:
1:5000	SAP		DSF
PROJECT NO: 70057521	DESIGNED: DSF	DRAWN: MAR	DATE: February 21
DRAWING No: MKE-WSP-ZZ-ZZ-X-DR-0542			REV: P01

File name: I:\UK-VS\SP\GROUP COM\CENTRAL DATA\PROJECTS\70057500\70057521 - MKE - PLANNING APPLICATION\03 WIP\CV CIVIL ENGINEERING\03 DRAWINGS\MKE-WSP-ZZ-ZZ-C-DR-0542.DWG, printed on 08 February 2021 16:47:58, by Richards, Manpal



DO NOT SCALE

NOTES

1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL RELEVANT DOCUMENTATION, DRAWINGS AND STANDARD DETAILS.
2. INFORMATION REGARDING THE LOCATION AND DEPTH OF EXISTING SERVICES CANNOT BE GUARANTEED BY THE STATUTORY UNDERTAKER.
3. CONFLICTING INFORMATION SHOWN ON THE ENGINEER'S DRAWINGS OR DISCREPANCIES BETWEEN THE INFORMATION GIVEN BY THE ENGINEER AND THAT PROVIDED BY OTHERS MUST BE REFERRED TO THE ENGINEER BEFORE THE WORKS COMMENCE.
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5. HIGHWAY CORRIDOR HAS BEEN ASSUMED TO BE 100% IMPERMEABLE UNTIL FURTHER DESIGN INFORMATION IS AVAILABLE.
6. IN THE ABSENCE OF A VERTICAL HIGHWAY DESIGN IT HAS BEEN GENERALLY ASSUMED THAT THE HIGHWAY WILL FOLLOW EXISTING GROUND LEVELS.

KEY

SITE BOUNDARY

DIRECTION OF FLOW

REV	DATE	BY	DESCRIPTION	CHK	APP
P01	XX/XX/2021	MAR	FIRST ISSUE	DSF	SAP

DRAWING STATUS: S2 - FOR INFORMATION

wsp

Grosvenor House, 2 Grosvenor Square, Southampton, SO15 2BE, UK
T+ 44 (0) 2380 101 700
wsp.com

CLIENT: BERKELEY GROUP

ARCHITECT: JTP/STEPHEN GEORGE AND PARTNERS

SITE/PROJECT: MILTON KEYNES EAST

TITLE: EXISTING EXCEEDANCE FLOW ROUTE PLAN

SCALE @ A1:	CHECKED:		APPROVED:
1:5000	SAP		DSF
PROJECT NO:	DESIGNED:	DRAWN:	DATE:
70057521	DSF	MAR	February 21

DRAWING No: MKE-WSP-ZZ-ZZ-X-DR-0541 REV: P01

Appendix F

SUPPORTING CALCULATIONS

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.304	0.304	33.9	2429.3	O K
30 min Summer	0.390	0.390	34.3	3120.5	O K
60 min Summer	0.473	0.473	34.3	3787.3	O K
120 min Summer	0.576	0.576	34.3	4607.4	O K
180 min Summer	0.635	0.635	34.3	5080.7	O K
240 min Summer	0.673	0.673	34.3	5383.4	O K
360 min Summer	0.715	0.715	34.3	5716.6	O K
480 min Summer	0.733	0.733	34.3	5862.4	O K
600 min Summer	0.739	0.739	34.3	5915.5	O K
720 min Summer	0.739	0.739	34.3	5914.9	O K
960 min Summer	0.727	0.727	34.3	5817.6	O K
1440 min Summer	0.685	0.685	34.3	5483.6	O K
2160 min Summer	0.636	0.636	34.3	5085.9	O K
2880 min Summer	0.597	0.597	34.3	4779.6	O K
4320 min Summer	0.540	0.540	34.3	4321.7	O K
5760 min Summer	0.495	0.495	34.3	3963.8	O K
7200 min Summer	0.460	0.460	34.3	3679.3	O K
8640 min Summer	0.432	0.432	34.3	3452.2	O K
10080 min Summer	0.409	0.409	34.3	3273.3	O K
15 min Winter	0.385	0.385	34.3	3080.9	O K
30 min Winter	0.495	0.495	34.3	3961.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	1693.5	23
30 min Summer	98.091	0.0	2212.2	38
60 min Summer	59.966	0.0	3340.9	68
120 min Summer	36.932	0.0	4109.5	126
180 min Summer	27.466	0.0	4542.8	186
240 min Summer	22.073	0.0	4811.8	246
360 min Summer	15.975	0.0	5092.3	366
480 min Summer	12.562	0.0	5200.8	484
600 min Summer	10.371	0.0	5226.6	604
720 min Summer	8.843	0.0	5205.7	724
960 min Summer	6.842	0.0	5090.1	962
1440 min Summer	4.743	0.0	4787.3	1284
2160 min Summer	3.288	0.0	7167.6	1600
2880 min Summer	2.547	0.0	7345.0	1968
4320 min Summer	1.811	0.0	7612.1	2768
5760 min Summer	1.443	0.0	8749.3	3576
7200 min Summer	1.224	0.0	9252.7	4328
8640 min Summer	1.080	0.0	9749.8	5104
10080 min Summer	0.980	0.0	10215.8	5856
15 min Winter	152.119	0.0	2178.1	23
30 min Winter	98.091	0.0	2695.9	37

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.602	0.602	34.3	4814.7	O K
120 min Winter	0.734	0.734	34.3	5872.4	O K
180 min Winter	0.811	0.811	34.3	6491.7	O K
240 min Winter	0.861	0.861	34.3	6890.0	O K
360 min Winter	0.917	0.917	34.3	7337.9	O K
480 min Winter	0.943	0.943	34.3	7546.7	O K
600 min Winter	0.955	0.955	34.3	7639.5	O K
720 min Winter	0.958	0.958	34.3	7666.6	O K
960 min Winter	0.951	0.951	34.3	7608.3	O K
1440 min Winter	0.915	0.915	34.3	7322.2	O K
2160 min Winter	0.848	0.848	34.3	6786.6	O K
2880 min Winter	0.794	0.794	34.3	6354.2	O K
4320 min Winter	0.703	0.703	34.3	5624.9	O K
5760 min Winter	0.627	0.627	34.3	5012.4	O K
7200 min Winter	0.563	0.563	34.3	4506.0	O K
8640 min Winter	0.511	0.511	34.3	4087.8	O K
10080 min Winter	0.469	0.469	34.3	3748.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	4229.5	66
120 min Winter	36.932	0.0	5064.2	126
180 min Winter	27.466	0.0	5402.6	184
240 min Winter	22.073	0.0	5502.4	242
360 min Winter	15.975	0.0	5447.7	360
480 min Winter	12.562	0.0	5371.2	478
600 min Winter	10.371	0.0	5296.0	594
720 min Winter	8.843	0.0	5221.6	710
960 min Winter	6.842	0.0	5073.3	938
1440 min Winter	4.743	0.0	4777.9	1386
2160 min Winter	3.288	0.0	8926.6	1988
2880 min Winter	2.547	0.0	9040.7	2248
4320 min Winter	1.811	0.0	8965.1	3116
5760 min Winter	1.443	0.0	11102.6	3976
7200 min Winter	1.224	0.0	11749.7	4760
8640 min Winter	1.080	0.0	12398.9	5616
10080 min Winter	0.980	0.0	13017.7	6352

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 8.600

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	4.300	4	8	4.300

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	8000.0	0.700	8000.0	1.000	8000.0	1.300	8000.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0251-3440-1000-3440
Design Head (m)	1.000
Design Flow (l/s)	34.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	251
Invert Level (m)	0.000
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)	1.000	34.4	Kick-Flo®	0.757	30.1
Flush-Flo™	0.397	34.3	Mean Flow over Head Range	-	28.2

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	8.1	1.200	37.5	3.000	58.3	7.000	88.1
0.200	25.7	1.400	40.4	3.500	62.9	7.500	91.1
0.300	33.8	1.600	43.1	4.000	67.1	8.000	94.0
0.400	34.3	1.800	45.6	4.500	71.0	8.500	96.8
0.500	34.0	2.000	48.0	5.000	74.8	9.000	99.6
0.600	33.2	2.200	50.2	5.500	78.3	9.500	102.2
0.800	30.9	2.400	52.4	6.000	81.7		
1.000	34.4	2.600	54.4	6.500	85.0		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.282	0.282	9.9	705.2	O K
30 min Summer	0.362	0.362	9.9	906.0	O K
60 min Summer	0.440	0.440	9.9	1099.2	O K
120 min Summer	0.534	0.534	9.9	1336.0	O K
180 min Summer	0.589	0.589	9.9	1472.1	O K
240 min Summer	0.624	0.624	9.9	1558.9	O K
360 min Summer	0.661	0.661	9.9	1653.6	O K
480 min Summer	0.678	0.678	9.9	1693.9	O K
600 min Summer	0.683	0.683	9.9	1707.2	O K
720 min Summer	0.682	0.682	9.9	1704.8	O K
960 min Summer	0.669	0.669	9.9	1671.6	O K
1440 min Summer	0.624	0.624	9.9	1559.4	O K
2160 min Summer	0.569	0.569	9.9	1422.7	O K
2880 min Summer	0.528	0.528	9.9	1319.2	O K
4320 min Summer	0.467	0.467	9.9	1166.9	O K
5760 min Summer	0.420	0.420	9.9	1051.0	O K
7200 min Summer	0.384	0.384	9.9	960.3	O K
8640 min Summer	0.355	0.355	9.9	888.6	O K
10080 min Summer	0.333	0.333	9.9	832.5	O K
15 min Winter	0.358	0.358	9.9	894.9	O K
30 min Winter	0.460	0.460	9.9	1150.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	571.3	23
30 min Summer	98.091	0.0	721.1	38
60 min Summer	59.966	0.0	1037.8	68
120 min Summer	36.932	0.0	1269.0	126
180 min Summer	27.466	0.0	1398.1	186
240 min Summer	22.073	0.0	1475.1	246
360 min Summer	15.975	0.0	1542.9	366
480 min Summer	12.562	0.0	1551.6	484
600 min Summer	10.371	0.0	1536.5	604
720 min Summer	8.843	0.0	1516.3	724
960 min Summer	6.842	0.0	1478.6	962
1440 min Summer	4.743	0.0	1408.4	1318
2160 min Summer	3.288	0.0	2147.6	1604
2880 min Summer	2.547	0.0	2207.8	1988
4320 min Summer	1.811	0.0	2309.1	2772
5760 min Summer	1.443	0.0	2572.3	3576
7200 min Summer	1.224	0.0	2723.8	4328
8640 min Summer	1.080	0.0	2876.3	5104
10080 min Summer	0.980	0.0	3025.0	5856
15 min Winter	152.119	0.0	711.8	23
30 min Winter	98.091	0.0	829.4	37

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.559	0.559	9.9	1398.0	O K
120 min Winter	0.682	0.682	9.9	1704.8	O K
180 min Winter	0.753	0.753	9.9	1883.3	O K
240 min Winter	0.799	0.799	9.9	1997.7	O K
360 min Winter	0.850	0.850	9.9	2125.5	O K
480 min Winter	0.874	0.874	9.9	2183.9	O K
600 min Winter	0.883	0.883	9.9	2208.7	O K
720 min Winter	0.886	0.886	9.9	2214.4	O K
960 min Winter	0.877	0.877	9.9	2193.2	O K
1440 min Winter	0.841	0.841	9.9	2102.2	O K
2160 min Winter	0.774	0.774	9.9	1935.1	O K
2880 min Winter	0.716	0.716	9.9	1791.2	O K
4320 min Winter	0.621	0.621	9.9	1552.2	O K
5760 min Winter	0.543	0.543	9.9	1357.3	O K
7200 min Winter	0.480	0.480	9.9	1199.7	O K
8640 min Winter	0.428	0.428	9.9	1071.2	O K
10080 min Winter	0.387	0.387	9.9	967.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	1304.1	66
120 min Winter	36.932	0.0	1539.2	126
180 min Winter	27.466	0.0	1590.7	184
240 min Winter	22.073	0.0	1576.2	242
360 min Winter	15.975	0.0	1547.9	360
480 min Winter	12.562	0.0	1525.4	478
600 min Winter	10.371	0.0	1505.7	594
720 min Winter	8.843	0.0	1487.1	710
960 min Winter	6.842	0.0	1451.2	940
1440 min Winter	4.743	0.0	1380.6	1386
2160 min Winter	3.288	0.0	2673.7	2012
2880 min Winter	2.547	0.0	2712.2	2272
4320 min Winter	1.811	0.0	2677.3	3152
5760 min Winter	1.443	0.0	3260.6	3976
7200 min Winter	1.224	0.0	3453.9	4824
8640 min Winter	1.080	0.0	3651.1	5616
10080 min Winter	0.980	0.0	3846.1	6352

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.500

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.250	4	8	1.250

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2500.0	1.000	2500.0	1.300	2500.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0146-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	146
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	10.0	Kick-Flo®	0.673	8.3
Flush-Flo™	0.306	9.9	Mean Flow over Head Range	-	8.6

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	5.2	1.200	10.9	3.000	16.8	7.000	25.2
0.200	9.6	1.400	11.7	3.500	18.1	7.500	26.1
0.300	9.9	1.600	12.5	4.000	19.3	8.000	26.9
0.400	9.8	1.800	13.2	4.500	20.4	8.500	27.7
0.500	9.6	2.000	13.9	5.000	21.5	9.000	28.5
0.600	9.1	2.200	14.5	5.500	22.5	9.500	29.2
0.800	9.0	2.400	15.1	6.000	23.4		
1.000	10.0	2.600	15.7	6.500	24.4		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.290	0.290	12.3	869.0	O K
30 min Summer	0.372	0.372	12.3	1116.4	O K
60 min Summer	0.452	0.452	12.3	1354.5	O K
120 min Summer	0.549	0.549	12.3	1646.5	O K
180 min Summer	0.605	0.605	12.3	1814.5	O K
240 min Summer	0.641	0.641	12.3	1921.6	O K
360 min Summer	0.680	0.680	12.3	2038.9	O K
480 min Summer	0.696	0.696	12.3	2089.0	O K
600 min Summer	0.702	0.702	12.3	2105.7	O K
720 min Summer	0.701	0.701	12.3	2103.2	O K
960 min Summer	0.688	0.688	12.3	2063.8	O K
1440 min Summer	0.642	0.642	12.3	1927.3	O K
2160 min Summer	0.587	0.587	12.3	1760.8	O K
2880 min Summer	0.545	0.545	12.3	1634.8	O K
4320 min Summer	0.483	0.483	12.3	1448.8	O K
5760 min Summer	0.436	0.436	12.3	1306.5	O K
7200 min Summer	0.398	0.398	12.3	1194.9	O K
8640 min Summer	0.369	0.369	12.3	1106.5	O K
10080 min Summer	0.346	0.346	12.3	1037.1	O K
15 min Winter	0.368	0.368	12.3	1102.6	O K
30 min Winter	0.473	0.473	12.3	1417.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	694.0	23
30 min Summer	98.091	0.0	879.6	38
60 min Summer	59.966	0.0	1270.4	68
120 min Summer	36.932	0.0	1554.2	126
180 min Summer	27.466	0.0	1712.9	186
240 min Summer	22.073	0.0	1808.2	246
360 min Summer	15.975	0.0	1894.5	366
480 min Summer	12.562	0.0	1909.6	484
600 min Summer	10.371	0.0	1894.5	604
720 min Summer	8.843	0.0	1868.9	724
960 min Summer	6.842	0.0	1819.7	962
1440 min Summer	4.743	0.0	1730.6	1318
2160 min Summer	3.288	0.0	2638.0	1604
2880 min Summer	2.547	0.0	2711.2	1988
4320 min Summer	1.811	0.0	2833.3	2772
5760 min Summer	1.443	0.0	3165.9	3576
7200 min Summer	1.224	0.0	3351.8	4328
8640 min Summer	1.080	0.0	3538.7	5104
10080 min Summer	0.980	0.0	3720.1	5856
15 min Winter	152.119	0.0	867.9	23
30 min Winter	98.091	0.0	1020.7	37

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.574	0.574	12.3	1722.6	O K
120 min Winter	0.700	0.700	12.3	2100.8	O K
180 min Winter	0.774	0.774	12.3	2320.6	O K
240 min Winter	0.821	0.821	12.3	2461.6	O K
360 min Winter	0.873	0.873	12.3	2619.1	O K
480 min Winter	0.897	0.897	12.3	2691.1	O K
600 min Winter	0.907	0.907	12.3	2721.7	O K
720 min Winter	0.910	0.910	12.3	2728.8	O K
960 min Winter	0.901	0.901	12.3	2702.9	O K
1440 min Winter	0.864	0.864	12.3	2591.2	O K
2160 min Winter	0.795	0.795	12.3	2386.2	O K
2880 min Winter	0.738	0.738	12.3	2212.9	O K
4320 min Winter	0.641	0.641	12.3	1923.2	O K
5760 min Winter	0.561	0.561	12.3	1683.2	O K
7200 min Winter	0.496	0.496	12.3	1489.1	O K
8640 min Winter	0.443	0.443	12.3	1330.2	O K
10080 min Winter	0.400	0.400	12.3	1201.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	1597.4	66
120 min Winter	36.932	0.0	1888.8	126
180 min Winter	27.466	0.0	1963.6	184
240 min Winter	22.073	0.0	1949.8	242
360 min Winter	15.975	0.0	1915.9	360
480 min Winter	12.562	0.0	1888.5	478
600 min Winter	10.371	0.0	1864.1	594
720 min Winter	8.843	0.0	1841.0	710
960 min Winter	6.842	0.0	1795.9	940
1440 min Winter	4.743	0.0	1706.9	1386
2160 min Winter	3.288	0.0	3285.1	2008
2880 min Winter	2.547	0.0	3332.7	2252
4320 min Winter	1.811	0.0	3290.2	3152
5760 min Winter	1.443	0.0	4013.3	3976
7200 min Winter	1.224	0.0	4250.9	4824
8640 min Winter	1.080	0.0	4492.9	5616
10080 min Winter	0.980	0.0	4731.2	6352

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 3.080

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.500	4	8	1.580

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	3000.0	1.000	3000.0	1.300	3000.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0160-1230-1000-1230
Design Head (m)	1.000
Design Flow (l/s)	12.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	160
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	12.3	Kick-Flo®	0.687	10.3
Flush-Flo™	0.310	12.3	Mean Flow over Head Range	-	10.5

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	5.7	1.200	13.4	3.000	20.7	7.000	31.2
0.200	11.9	1.400	14.4	3.500	22.3	7.500	32.2
0.300	12.3	1.600	15.4	4.000	23.8	8.000	33.2
0.400	12.2	1.800	16.2	4.500	25.2	8.500	34.2
0.500	11.9	2.000	17.1	5.000	26.5	9.000	35.2
0.600	11.4	2.200	17.9	5.500	27.7	9.500	36.1
0.800	11.1	2.400	18.6	6.000	28.9		
1.000	12.3	2.600	19.4	6.500	30.1		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.318	0.318	24.6	1750.1	O K
30 min Summer	0.409	0.409	24.7	2248.3	O K
60 min Summer	0.496	0.496	24.7	2728.5	O K
120 min Summer	0.603	0.603	24.7	3318.5	O K
180 min Summer	0.665	0.665	24.7	3658.9	O K
240 min Summer	0.705	0.705	24.7	3876.9	O K
360 min Summer	0.749	0.749	24.7	4117.1	O K
480 min Summer	0.767	0.767	24.7	4220.0	O K
600 min Summer	0.774	0.774	24.7	4255.7	O K
720 min Summer	0.773	0.773	24.7	4253.5	O K
960 min Summer	0.761	0.761	24.7	4183.3	O K
1440 min Summer	0.715	0.715	24.7	3931.7	O K
2160 min Summer	0.657	0.657	24.7	3610.9	O K
2880 min Summer	0.613	0.613	24.7	3370.0	O K
4320 min Summer	0.548	0.548	24.7	3013.1	O K
5760 min Summer	0.498	0.498	24.7	2737.4	O K
7200 min Summer	0.458	0.458	24.7	2519.3	O K
8640 min Summer	0.427	0.427	24.7	2346.1	O K
10080 min Summer	0.402	0.402	24.7	2209.5	O K
15 min Winter	0.404	0.404	24.7	2220.2	O K
30 min Winter	0.519	0.519	24.7	2855.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	1318.3	23
30 min Summer	98.091	0.0	1692.9	38
60 min Summer	59.966	0.0	2491.4	68
120 min Summer	36.932	0.0	3053.7	126
180 min Summer	27.466	0.0	3368.5	186
240 min Summer	22.073	0.0	3559.3	246
360 min Summer	15.975	0.0	3742.7	366
480 min Summer	12.562	0.0	3796.7	484
600 min Summer	10.371	0.0	3788.7	604
720 min Summer	8.843	0.0	3747.6	724
960 min Summer	6.842	0.0	3636.3	962
1440 min Summer	4.743	0.0	3428.2	1342
2160 min Summer	3.288	0.0	5246.0	1608
2880 min Summer	2.547	0.0	5384.5	1988
4320 min Summer	1.811	0.0	5605.1	2772
5760 min Summer	1.443	0.0	6345.4	3576
7200 min Summer	1.224	0.0	6714.9	4328
8640 min Summer	1.080	0.0	7083.1	5104
10080 min Summer	0.980	0.0	7434.9	5856
15 min Winter	152.119	0.0	1668.7	23
30 min Winter	98.091	0.0	2013.1	37

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.631	0.631	24.7	3469.5	O K
120 min Winter	0.769	0.769	24.7	4231.9	O K
180 min Winter	0.850	0.850	24.7	4674.2	O K
240 min Winter	0.901	0.901	24.7	4958.2	O K
360 min Winter	0.959	0.959	24.7	5275.7	O K
480 min Winter	0.986	0.986	24.7	5421.0	O K
600 min Winter	0.997	0.997	24.8	5483.1	O K
720 min Winter	1.000	1.000	24.8	5497.8	O K
960 min Winter	0.990	0.990	24.7	5447.0	O K
1440 min Winter	0.950	0.950	24.7	5225.2	O K
2160 min Winter	0.877	0.877	24.7	4822.0	O K
2880 min Winter	0.819	0.819	24.7	4506.0	O K
4320 min Winter	0.724	0.724	24.7	3979.7	O K
5760 min Winter	0.637	0.637	24.7	3502.6	O K
7200 min Winter	0.567	0.567	24.7	3117.6	O K
8640 min Winter	0.510	0.510	24.7	2802.5	O K
10080 min Winter	0.463	0.463	24.7	2546.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	3140.2	66
120 min Winter	36.932	0.0	3729.9	126
180 min Winter	27.466	0.0	3940.6	184
240 min Winter	22.073	0.0	3964.2	242
360 min Winter	15.975	0.0	3915.0	360
480 min Winter	12.562	0.0	3866.7	478
600 min Winter	10.371	0.0	3819.5	594
720 min Winter	8.843	0.0	3772.5	710
960 min Winter	6.842	0.0	3676.9	938
1440 min Winter	4.743	0.0	3482.8	1384
2160 min Winter	3.288	0.0	6540.0	1972
2880 min Winter	2.547	0.0	6630.6	2224
4320 min Winter	1.811	0.0	6491.7	3156
5760 min Winter	1.443	0.0	8046.9	3984
7200 min Winter	1.224	0.0	8520.4	4824
8640 min Winter	1.080	0.0	8999.4	5616
10080 min Winter	0.980	0.0	9464.3	6352

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 6.200

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	3.100	4	8	3.100

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	5500.0	1.000	5500.0	1.300	5500.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0218-2480-1000-2480
Design Head (m)	1.000
Design Flow (l/s)	24.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	218
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	24.8	Kick-Flo®	0.733	21.4
Flush-Flo™	0.360	24.7	Mean Flow over Head Range	-	20.6

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	7.4	1.200	27.0	3.000	42.0	7.000	63.3
0.200	21.4	1.400	29.1	3.500	45.3	7.500	65.5
0.300	24.6	1.600	31.0	4.000	48.3	8.000	67.6
0.400	24.7	1.800	32.8	4.500	51.1	8.500	69.6
0.500	24.3	2.000	34.6	5.000	53.8	9.000	71.6
0.600	23.6	2.200	36.2	5.500	56.3	9.500	73.5
0.800	22.3	2.400	37.7	6.000	58.8		
1.000	24.8	2.600	39.2	6.500	61.1		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.401	0.401	24.6	2206.0	O K
30 min Summer	0.516	0.516	24.6	2836.7	O K
60 min Summer	0.627	0.627	24.6	3448.0	O K
120 min Summer	0.765	0.765	24.6	4206.1	O K
180 min Summer	0.845	0.845	24.6	4646.2	O K
240 min Summer	0.896	0.896	24.6	4928.8	O K
360 min Summer	0.953	0.953	24.6	5244.0	O K
480 min Summer	0.980	0.980	24.6	5387.9	O K
600 min Summer	0.991	0.991	24.6	5449.1	O K
720 min Summer	0.993	0.993	24.6	5463.2	O K
960 min Summer	0.984	0.984	24.6	5410.1	O K
1440 min Summer	0.942	0.942	24.6	5180.4	O K
2160 min Summer	0.878	0.878	24.6	4826.7	O K
2880 min Summer	0.829	0.829	24.6	4561.6	O K
4320 min Summer	0.761	0.761	24.6	4184.8	O K
5760 min Summer	0.704	0.704	24.6	3870.9	O K
7200 min Summer	0.659	0.659	24.6	3624.3	O K
8640 min Summer	0.624	0.624	24.6	3432.2	O K
10080 min Summer	0.597	0.597	24.6	3285.9	O K
15 min Winter	0.401	0.401	24.6	2205.9	O K
30 min Winter	0.516	0.516	24.6	2836.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	1656.0	23
30 min Summer	98.091	0.0	1999.0	38
60 min Summer	59.966	0.0	3117.9	68
120 min Summer	36.932	0.0	3703.1	128
180 min Summer	27.466	0.0	3909.8	186
240 min Summer	22.073	0.0	3930.8	246
360 min Summer	15.975	0.0	3878.1	366
480 min Summer	12.562	0.0	3827.5	486
600 min Summer	10.371	0.0	3778.4	604
720 min Summer	8.843	0.0	3729.4	724
960 min Summer	6.842	0.0	3630.3	962
1440 min Summer	4.743	0.0	3427.8	1440
2160 min Summer	3.288	0.0	6485.3	1776
2880 min Summer	2.547	0.0	6558.7	2140
4320 min Summer	1.811	0.0	6257.9	2944
5760 min Summer	1.443	0.0	7989.9	3752
7200 min Summer	1.224	0.0	8457.9	4544
8640 min Summer	1.080	0.0	8930.2	5360
10080 min Summer	0.980	0.0	9383.4	6152
15 min Winter	152.119	0.0	1656.1	23
30 min Winter	98.091	0.0	1999.3	37

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.627	0.627	24.6	3447.2	O K
120 min Winter	0.765	0.765	24.6	4204.8	O K
180 min Winter	0.844	0.844	24.6	4644.5	O K
240 min Winter	0.896	0.896	24.6	4926.8	O K
360 min Winter	0.953	0.953	24.6	5242.6	O K
480 min Winter	0.980	0.980	24.6	5387.4	O K
600 min Winter	0.991	0.991	24.6	5449.4	O K
720 min Winter	0.994	0.994	24.6	5464.5	O K
960 min Winter	0.984	0.984	24.6	5414.5	O K
1440 min Winter	0.945	0.945	24.6	5195.3	O K
2160 min Winter	0.872	0.872	24.6	4795.4	O K
2880 min Winter	0.815	0.815	24.6	4480.1	O K
4320 min Winter	0.719	0.719	24.6	3953.9	O K
5760 min Winter	0.633	0.633	24.6	3481.4	O K
7200 min Winter	0.563	0.563	24.6	3099.2	O K
8640 min Winter	0.507	0.507	24.6	2786.1	O K
10080 min Winter	0.460	0.460	24.6	2531.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	3118.1	66
120 min Winter	36.932	0.0	3704.4	126
180 min Winter	27.466	0.0	3913.3	184
240 min Winter	22.073	0.0	3936.6	242
360 min Winter	15.975	0.0	3885.4	360
480 min Winter	12.562	0.0	3836.2	478
600 min Winter	10.371	0.0	3788.5	594
720 min Winter	8.843	0.0	3741.3	710
960 min Winter	6.842	0.0	3645.8	938
1440 min Winter	4.743	0.0	3452.6	1384
2160 min Winter	3.288	0.0	6494.6	1972
2880 min Winter	2.547	0.0	6583.9	2228
4320 min Winter	1.811	0.0	6454.5	3156
5760 min Winter	1.443	0.0	7994.2	3976
7200 min Winter	1.224	0.0	8464.5	4824
8640 min Winter	1.080	0.0	8940.2	5616
10080 min Winter	0.980	0.0	9401.7	6352

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 6.160

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	3.000	4	8	3.160

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	5500.0	1.000	5500.0	1.300	5500.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0217-2460-1000-2460
Design Head (m)	1.000
Design Flow (l/s)	24.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	217
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	24.6	Kick-Flo®	0.732	21.2
Flush-Flo™	0.358	24.6	Mean Flow over Head Range	-	20.5

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	7.3	1.200	26.8	3.000	41.7	7.000	62.8
0.200	21.3	1.400	28.9	3.500	44.9	7.500	65.0
0.300	24.4	1.600	30.8	4.000	47.9	8.000	67.1
0.400	24.5	1.800	32.6	4.500	50.7	8.500	69.1
0.500	24.1	2.000	34.3	5.000	53.4	9.000	71.0
0.600	23.4	2.200	35.9	5.500	55.9	9.500	72.9
0.800	22.1	2.400	37.4	6.000	58.3		
1.000	24.6	2.600	38.9	6.500	60.6		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.282	0.282	7.2	507.6	O K
30 min Summer	0.362	0.362	7.2	652.1	O K
60 min Summer	0.439	0.439	7.2	790.9	O K
120 min Summer	0.534	0.534	7.2	961.0	O K
180 min Summer	0.588	0.588	7.2	1058.7	O K
240 min Summer	0.623	0.623	7.2	1121.0	O K
360 min Summer	0.661	0.661	7.2	1189.0	O K
480 min Summer	0.676	0.676	7.2	1217.4	O K
600 min Summer	0.681	0.681	7.2	1226.2	O K
720 min Summer	0.680	0.680	7.2	1224.0	O K
960 min Summer	0.667	0.667	7.2	1199.9	O K
1440 min Summer	0.620	0.620	7.2	1115.9	O K
2160 min Summer	0.562	0.562	7.2	1011.8	O K
2880 min Summer	0.519	0.519	7.2	934.2	O K
4320 min Summer	0.456	0.456	7.2	821.1	O K
5760 min Summer	0.409	0.409	7.2	735.9	O K
7200 min Summer	0.372	0.372	7.2	669.7	O K
8640 min Summer	0.343	0.343	7.2	617.6	O K
10080 min Summer	0.320	0.320	7.2	576.7	O K
15 min Winter	0.358	0.358	7.2	644.1	O K
30 min Winter	0.460	0.460	7.2	828.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	424.7	23
30 min Summer	98.091	0.0	532.5	38
60 min Summer	59.966	0.0	757.8	68
120 min Summer	36.932	0.0	926.3	126
180 min Summer	27.466	0.0	1020.3	186
240 min Summer	22.073	0.0	1075.5	246
360 min Summer	15.975	0.0	1119.7	366
480 min Summer	12.562	0.0	1120.5	484
600 min Summer	10.371	0.0	1107.2	604
720 min Summer	8.843	0.0	1092.8	724
960 min Summer	6.842	0.0	1065.4	962
1440 min Summer	4.743	0.0	1019.6	1344
2160 min Summer	3.288	0.0	1556.1	1608
2880 min Summer	2.547	0.0	1601.2	1988
4320 min Summer	1.811	0.0	1679.5	2768
5760 min Summer	1.443	0.0	1856.0	3576
7200 min Summer	1.224	0.0	1965.7	4328
8640 min Summer	1.080	0.0	2076.7	5104
10080 min Summer	0.980	0.0	2186.1	5856
15 min Winter	152.119	0.0	525.9	23
30 min Winter	98.091	0.0	602.9	37

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.559	0.559	7.2	1006.2	O K
120 min Winter	0.682	0.682	7.2	1226.9	O K
180 min Winter	0.753	0.753	7.2	1354.9	O K
240 min Winter	0.798	0.798	7.2	1436.8	O K
360 min Winter	0.849	0.849	7.2	1528.1	O K
480 min Winter	0.872	0.872	7.2	1569.4	O K
600 min Winter	0.881	0.881	7.2	1586.6	O K
720 min Winter	0.883	0.883	7.2	1590.0	O K
960 min Winter	0.874	0.874	7.2	1573.5	O K
1440 min Winter	0.837	0.837	7.2	1505.7	O K
2160 min Winter	0.768	0.768	7.2	1382.6	O K
2880 min Winter	0.709	0.709	7.2	1276.7	O K
4320 min Winter	0.611	0.611	7.2	1100.5	O K
5760 min Winter	0.531	0.531	7.2	955.7	O K
7200 min Winter	0.467	0.467	7.2	840.1	O K
8640 min Winter	0.415	0.415	7.2	746.5	O K
10080 min Winter	0.373	0.373	7.2	671.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	951.7	66
120 min Winter	36.932	0.0	1118.9	126
180 min Winter	27.466	0.0	1145.4	184
240 min Winter	22.073	0.0	1133.8	242
360 min Winter	15.975	0.0	1113.2	360
480 min Winter	12.562	0.0	1097.3	478
600 min Winter	10.371	0.0	1083.6	594
720 min Winter	8.843	0.0	1070.8	710
960 min Winter	6.842	0.0	1046.0	940
1440 min Winter	4.743	0.0	997.7	1386
2160 min Winter	3.288	0.0	1939.7	2012
2880 min Winter	2.547	0.0	1969.6	2276
4320 min Winter	1.811	0.0	1944.2	3156
5760 min Winter	1.443	0.0	2352.2	3976
7200 min Winter	1.224	0.0	2492.1	4824
8640 min Winter	1.080	0.0	2635.3	5616
10080 min Winter	0.980	0.0	2778.1	6352

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.800

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.900	4	8	0.900

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1800.0	1.000	1800.0	1.300	1800.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0125-7200-1000-7200
Design Head (m)	1.000
Design Flow (l/s)	7.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	125
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	7.2	Kick-Flo®	0.656	5.9
Flush-Flo™	0.298	7.2	Mean Flow over Head Range	-	6.2

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	4.5	1.200	7.8	3.000	12.1	7.000	18.1
0.200	7.0	1.400	8.4	3.500	13.0	7.500	18.7
0.300	7.2	1.600	9.0	4.000	13.9	8.000	19.3
0.400	7.1	1.800	9.5	4.500	14.7	8.500	19.9
0.500	6.9	2.000	10.0	5.000	15.4	9.000	20.4
0.600	6.4	2.200	10.4	5.500	16.1	9.500	21.0
0.800	6.5	2.400	10.9	6.000	16.8		
1.000	7.2	2.600	11.3	6.500	17.5		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.312	0.312	12.4	874.3	O K
30 min Summer	0.401	0.401	12.4	1123.3	O K
60 min Summer	0.487	0.487	12.4	1362.9	O K
120 min Summer	0.592	0.592	12.4	1656.6	O K
180 min Summer	0.652	0.652	12.4	1825.8	O K
240 min Summer	0.691	0.691	12.4	1934.2	O K
360 min Summer	0.733	0.733	12.4	2051.8	O K
480 min Summer	0.750	0.750	12.4	2100.3	O K
600 min Summer	0.756	0.756	12.4	2115.6	O K
720 min Summer	0.754	0.754	12.4	2112.2	O K
960 min Summer	0.740	0.740	12.4	2073.1	O K
1440 min Summer	0.694	0.694	12.4	1944.3	O K
2160 min Summer	0.629	0.629	12.4	1762.4	O K
2880 min Summer	0.582	0.582	12.4	1630.0	O K
4320 min Summer	0.513	0.513	12.4	1437.3	O K
5760 min Summer	0.461	0.461	12.4	1291.3	O K
7200 min Summer	0.420	0.420	12.4	1176.9	O K
8640 min Summer	0.388	0.388	12.4	1086.3	O K
10080 min Summer	0.363	0.363	12.4	1015.2	O K
15 min Winter	0.396	0.396	12.4	1109.5	O K
30 min Winter	0.510	0.510	12.4	1426.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	714.4	23
30 min Summer	98.091	0.0	901.7	38
60 min Summer	59.966	0.0	1290.9	68
120 min Summer	36.932	0.0	1578.5	126
180 min Summer	27.466	0.0	1738.4	186
240 min Summer	22.073	0.0	1832.0	246
360 min Summer	15.975	0.0	1911.9	366
480 min Summer	12.562	0.0	1920.8	484
600 min Summer	10.371	0.0	1900.3	604
720 min Summer	8.843	0.0	1874.1	724
960 min Summer	6.842	0.0	1821.0	962
1440 min Summer	4.743	0.0	1718.7	1376
2160 min Summer	3.288	0.0	2665.9	1624
2880 min Summer	2.547	0.0	2741.6	1988
4320 min Summer	1.811	0.0	2870.7	2772
5760 min Summer	1.443	0.0	3191.0	3576
7200 min Summer	1.224	0.0	3379.0	4328
8640 min Summer	1.080	0.0	3568.4	5104
10080 min Summer	0.980	0.0	3753.6	5856
15 min Winter	152.119	0.0	890.0	23
30 min Winter	98.091	0.0	1035.2	37

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.619	0.619	12.4	1733.5	O K
120 min Winter	0.755	0.755	12.4	2113.8	O K
180 min Winter	0.833	0.833	12.4	2333.5	O K
240 min Winter	0.884	0.884	12.4	2474.3	O K
360 min Winter	0.940	0.940	12.4	2630.7	O K
480 min Winter	0.965	0.965	12.4	2701.2	O K
600 min Winter	0.975	0.975	12.4	2730.1	O K
720 min Winter	0.977	0.977	12.4	2735.4	O K
960 min Winter	0.966	0.966	12.4	2706.0	O K
1440 min Winter	0.924	0.924	12.4	2587.9	O K
2160 min Winter	0.849	0.849	12.4	2376.5	O K
2880 min Winter	0.788	0.788	12.4	2206.9	O K
4320 min Winter	0.689	0.689	12.4	1929.0	O K
5760 min Winter	0.598	0.598	12.4	1673.6	O K
7200 min Winter	0.526	0.526	12.4	1473.0	O K
8640 min Winter	0.468	0.468	12.4	1310.1	O K
10080 min Winter	0.421	0.421	12.4	1178.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	1621.8	66
120 min Winter	36.932	0.0	1911.2	126
180 min Winter	27.466	0.0	1980.2	184
240 min Winter	22.073	0.0	1967.6	242
360 min Winter	15.975	0.0	1940.3	360
480 min Winter	12.562	0.0	1917.4	478
600 min Winter	10.371	0.0	1896.1	594
720 min Winter	8.843	0.0	1875.1	710
960 min Winter	6.842	0.0	1832.7	938
1440 min Winter	4.743	0.0	1746.5	1384
2160 min Winter	3.288	0.0	3326.9	1988
2880 min Winter	2.547	0.0	3378.5	2248
4320 min Winter	1.811	0.0	3288.7	3160
5760 min Winter	1.443	0.0	4044.7	3984
7200 min Winter	1.224	0.0	4284.7	4824
8640 min Winter	1.080	0.0	4529.7	5616
10080 min Winter	0.980	0.0	4772.3	6352

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 3.100

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	1.550	4	8	1.550

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2800.0	1.000	2800.0	1.300	2800.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0161-1240-1000-1240
Design Head (m)	1.000
Design Flow (l/s)	12.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	161
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	12.4	Kick-Flo®	0.691	10.4
Flush-Flo™	0.314	12.4	Mean Flow over Head Range	-	10.6

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	13.5	3.000	20.9	7.000	31.4
0.200	12.0	1.400	14.5	3.500	22.5	7.500	32.5
0.300	12.4	1.600	15.5	4.000	24.0	8.000	33.5
0.400	12.3	1.800	16.4	4.500	25.4	8.500	34.5
0.500	12.0	2.000	17.2	5.000	26.7	9.000	35.5
0.600	11.5	2.200	18.0	5.500	27.9	9.500	36.4
0.800	11.2	2.400	18.8	6.000	29.1		
1.000	12.4	2.600	19.5	6.500	30.3		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.316	0.316	9.0	631.3	O K
30 min Summer	0.406	0.406	9.0	811.6	O K
60 min Summer	0.492	0.492	9.0	984.8	O K
120 min Summer	0.599	0.599	9.0	1197.4	O K
180 min Summer	0.660	0.660	9.0	1320.0	O K
240 min Summer	0.699	0.699	9.0	1398.2	O K
360 min Summer	0.741	0.741	9.0	1481.6	O K
480 min Summer	0.758	0.758	9.0	1515.4	O K
600 min Summer	0.763	0.763	9.0	1525.3	O K
720 min Summer	0.761	0.761	9.0	1521.8	O K
960 min Summer	0.746	0.746	9.0	1491.8	O K
1440 min Summer	0.699	0.699	9.0	1398.2	O K
2160 min Summer	0.631	0.631	9.0	1262.7	O K
2880 min Summer	0.580	0.580	9.0	1160.8	O K
4320 min Summer	0.508	0.508	9.0	1015.8	O K
5760 min Summer	0.454	0.454	9.0	907.6	O K
7200 min Summer	0.412	0.412	9.0	823.2	O K
8640 min Summer	0.378	0.378	9.0	756.7	O K
10080 min Summer	0.352	0.352	9.0	704.4	O K
15 min Winter	0.401	0.401	9.0	801.5	O K
30 min Winter	0.516	0.516	9.0	1031.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	534.9	27
30 min Summer	98.091	0.0	670.3	41
60 min Summer	59.966	0.0	948.3	70
120 min Summer	36.932	0.0	1158.7	130
180 min Summer	27.466	0.0	1274.6	190
240 min Summer	22.073	0.0	1340.6	250
360 min Summer	15.975	0.0	1392.0	368
480 min Summer	12.562	0.0	1390.2	486
600 min Summer	10.371	0.0	1372.8	606
720 min Summer	8.843	0.0	1354.3	724
960 min Summer	6.842	0.0	1316.9	962
1440 min Summer	4.743	0.0	1242.5	1376
2160 min Summer	3.288	0.0	1942.1	1648
2880 min Summer	2.547	0.0	1999.2	1996
4320 min Summer	1.811	0.0	2099.3	2772
5760 min Summer	1.443	0.0	2314.9	3576
7200 min Summer	1.224	0.0	2451.9	4336
8640 min Summer	1.080	0.0	2590.6	5104
10080 min Summer	0.980	0.0	2727.7	5856
15 min Winter	152.119	0.0	662.1	27
30 min Winter	98.091	0.0	754.1	41

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.627	0.627	9.0	1253.6	O K
120 min Winter	0.764	0.764	9.0	1528.4	O K
180 min Winter	0.843	0.843	9.0	1686.6	O K
240 min Winter	0.894	0.894	9.0	1788.1	O K
360 min Winter	0.950	0.950	9.0	1900.3	O K
480 min Winter	0.975	0.975	9.0	1950.3	O K
600 min Winter	0.985	0.985	9.0	1970.2	O K
720 min Winter	0.987	0.987	9.0	1973.0	O K
960 min Winter	0.975	0.975	9.0	1949.8	O K
1440 min Winter	0.930	0.930	9.0	1860.8	O K
2160 min Winter	0.852	0.852	9.0	1703.8	O K
2880 min Winter	0.789	0.789	9.0	1579.0	O K
4320 min Winter	0.689	0.689	9.0	1378.8	O K
5760 min Winter	0.594	0.594	9.0	1187.2	O K
7200 min Winter	0.519	0.519	9.0	1037.3	O K
8640 min Winter	0.459	0.459	9.0	917.2	O K
10080 min Winter	0.410	0.410	9.0	820.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	1190.0	70
120 min Winter	36.932	0.0	1395.6	128
180 min Winter	27.466	0.0	1429.6	186
240 min Winter	22.073	0.0	1419.5	246
360 min Winter	15.975	0.0	1401.1	362
480 min Winter	12.562	0.0	1386.0	480
600 min Winter	10.371	0.0	1372.0	596
720 min Winter	8.843	0.0	1358.0	712
960 min Winter	6.842	0.0	1329.7	940
1440 min Winter	4.743	0.0	1271.9	1386
2160 min Winter	3.288	0.0	2427.2	1984
2880 min Winter	2.547	0.0	2467.3	2244
4320 min Winter	1.811	0.0	2379.5	3164
5760 min Winter	1.443	0.0	2933.6	3992
7200 min Winter	1.224	0.0	3108.4	4824
8640 min Winter	1.080	0.0	3287.3	5616
10080 min Winter	0.980	0.0	3466.0	6360

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.244

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.748	4	8	0.748	8	12	0.748

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2000.0	1.000	2000.0	1.300	2000.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0139-9000-1000-9000
Design Head (m)	1.000
Design Flow (l/s)	9.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	139
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	9.0	Kick-Flo®	0.668	7.5
Flush-Flo™	0.301	9.0	Mean Flow over Head Range	-	7.7

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	5.0	1.200	9.8	3.000	15.1	7.000	22.7
0.200	8.7	1.400	10.5	3.500	16.3	7.500	23.5
0.300	9.0	1.600	11.2	4.000	17.4	8.000	24.2
0.400	8.9	1.800	11.9	4.500	18.4	8.500	24.9
0.500	8.6	2.000	12.5	5.000	19.3	9.000	25.6
0.600	8.2	2.200	13.1	5.500	20.2	9.500	26.3
0.800	8.1	2.400	13.6	6.000	21.1		
1.000	9.0	2.600	14.1	6.500	21.9		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.316	0.316	20.1	1422.5	O K
30 min Summer	0.406	0.406	20.1	1828.5	O K
60 min Summer	0.493	0.493	20.1	2219.6	O K
120 min Summer	0.600	0.600	20.1	2700.3	O K
180 min Summer	0.662	0.662	20.1	2977.2	O K
240 min Summer	0.701	0.701	20.1	3154.7	O K
360 min Summer	0.744	0.744	20.1	3349.9	O K
480 min Summer	0.763	0.763	20.1	3432.4	O K
600 min Summer	0.769	0.769	20.1	3460.5	O K
720 min Summer	0.768	0.768	20.1	3457.8	O K
960 min Summer	0.755	0.755	20.1	3399.4	O K
1440 min Summer	0.710	0.710	20.1	3194.9	O K
2160 min Summer	0.649	0.649	20.1	2922.3	O K
2880 min Summer	0.604	0.604	20.1	2719.8	O K
4320 min Summer	0.538	0.538	20.1	2421.4	O K
5760 min Summer	0.487	0.487	20.1	2192.2	O K
7200 min Summer	0.447	0.447	20.1	2011.1	O K
8640 min Summer	0.415	0.415	20.1	1867.6	O K
10080 min Summer	0.390	0.390	20.1	1754.6	O K
15 min Winter	0.401	0.401	20.1	1805.3	O K
30 min Winter	0.516	0.516	20.1	2322.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	1103.1	27
30 min Summer	98.091	0.0	1407.8	41
60 min Summer	59.966	0.0	2053.9	70
120 min Summer	36.932	0.0	2514.6	130
180 min Summer	27.466	0.0	2771.5	190
240 min Summer	22.073	0.0	2925.4	250
360 min Summer	15.975	0.0	3067.7	368
480 min Summer	12.562	0.0	3101.9	486
600 min Summer	10.371	0.0	3085.2	606
720 min Summer	8.843	0.0	3044.3	724
960 min Summer	6.842	0.0	2953.9	962
1440 min Summer	4.743	0.0	2783.4	1368
2160 min Summer	3.288	0.0	4296.4	1624
2880 min Summer	2.547	0.0	4412.5	1992
4320 min Summer	1.811	0.0	4600.7	2772
5760 min Summer	1.443	0.0	5179.5	3576
7200 min Summer	1.224	0.0	5482.3	4336
8640 min Summer	1.080	0.0	5785.2	5104
10080 min Summer	0.980	0.0	6076.6	5856
15 min Winter	152.119	0.0	1388.4	27
30 min Winter	98.091	0.0	1655.0	41

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.628	0.628	20.1	2823.8	O K
120 min Winter	0.766	0.766	20.1	3444.8	O K
180 min Winter	0.845	0.845	20.1	3804.2	O K
240 min Winter	0.897	0.897	20.1	4035.4	O K
360 min Winter	0.954	0.954	20.1	4293.3	O K
480 min Winter	0.980	0.980	20.1	4411.0	O K
600 min Winter	0.991	0.991	20.1	4460.7	O K
720 min Winter	0.994	0.994	20.1	4471.9	O K
960 min Winter	0.984	0.984	20.1	4428.6	O K
1440 min Winter	0.943	0.943	20.1	4244.7	O K
2160 min Winter	0.869	0.869	20.1	3911.6	O K
2880 min Winter	0.811	0.811	20.1	3649.0	O K
4320 min Winter	0.715	0.715	20.1	3215.9	O K
5760 min Winter	0.626	0.626	20.1	2817.8	O K
7200 min Winter	0.555	0.555	20.1	2499.7	O K
8640 min Winter	0.498	0.498	20.1	2239.9	O K
10080 min Winter	0.451	0.451	20.1	2028.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	2585.0	70
120 min Winter	36.932	0.0	3060.9	128
180 min Winter	27.466	0.0	3213.8	186
240 min Winter	22.073	0.0	3214.6	246
360 min Winter	15.975	0.0	3173.1	362
480 min Winter	12.562	0.0	3134.8	480
600 min Winter	10.371	0.0	3097.8	596
720 min Winter	8.843	0.0	3061.3	712
960 min Winter	6.842	0.0	2986.8	940
1440 min Winter	4.743	0.0	2835.0	1386
2160 min Winter	3.288	0.0	5356.6	1976
2880 min Winter	2.547	0.0	5431.9	2228
4320 min Winter	1.811	0.0	5292.3	3160
5760 min Winter	1.443	0.0	6567.1	3984
7200 min Winter	1.224	0.0	6954.6	4824
8640 min Winter	1.080	0.0	7348.0	5616
10080 min Winter	0.980	0.0	7732.1	6360

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 5.051

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.683	4	8	1.683	8	12	1.684

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	4500.0	1.000	4500.0	1.300	4500.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0199-2020-1000-2020
Design Head (m)	1.000
Design Flow (l/s)	20.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	199
Invert Level (m)	0.000
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)	1.000	20.2	Kick-Flo®	0.718	17.3
Flush-Flo™	0.341	20.1	Mean Flow over Head Range	-	16.9

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	6.9	1.200	22.0	3.000	34.2	7.000	51.5
0.200	18.8	1.400	23.7	3.500	36.8	7.500	53.2
0.300	20.0	1.600	25.3	4.000	39.3	8.000	54.9
0.400	20.0	1.800	26.7	4.500	41.6	8.500	56.6
0.500	19.7	2.000	28.1	5.000	43.7	9.000	58.2
0.600	19.1	2.200	29.4	5.500	45.8	9.500	59.7
0.800	18.2	2.400	30.7	6.000	47.8		
1.000	20.2	2.600	31.9	6.500	49.7		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.296	0.296	12.6	888.6	O K
30 min Summer	0.381	0.381	12.6	1141.6	O K
60 min Summer	0.462	0.462	12.6	1385.1	O K
120 min Summer	0.561	0.561	12.6	1683.7	O K
180 min Summer	0.618	0.618	12.6	1855.5	O K
240 min Summer	0.655	0.655	12.6	1965.1	O K
360 min Summer	0.695	0.695	12.6	2085.3	O K
480 min Summer	0.712	0.712	12.6	2136.2	O K
600 min Summer	0.718	0.718	12.6	2152.9	O K
720 min Summer	0.717	0.717	12.6	2150.2	O K
960 min Summer	0.704	0.704	12.6	2110.7	O K
1440 min Summer	0.657	0.657	12.6	1970.8	O K
2160 min Summer	0.599	0.599	12.6	1797.7	O K
2880 min Summer	0.556	0.556	12.6	1667.7	O K
4320 min Summer	0.492	0.492	12.6	1476.2	O K
5760 min Summer	0.443	0.443	12.6	1329.9	O K
7200 min Summer	0.405	0.405	12.6	1215.1	O K
8640 min Summer	0.375	0.375	12.6	1124.2	O K
10080 min Summer	0.351	0.351	12.6	1053.0	O K
15 min Winter	0.376	0.376	12.6	1127.5	O K
30 min Winter	0.483	0.483	12.6	1450.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	713.3	23
30 min Summer	98.091	0.0	903.5	38
60 min Summer	59.966	0.0	1302.0	68
120 min Summer	36.932	0.0	1592.8	126
180 min Summer	27.466	0.0	1755.5	186
240 min Summer	22.073	0.0	1852.8	246
360 min Summer	15.975	0.0	1939.8	366
480 min Summer	12.562	0.0	1954.5	484
600 min Summer	10.371	0.0	1938.1	604
720 min Summer	8.843	0.0	1911.6	724
960 min Summer	6.842	0.0	1859.3	962
1440 min Summer	4.743	0.0	1768.8	1342
2160 min Summer	3.288	0.0	2700.5	1608
2880 min Summer	2.547	0.0	2775.8	1988
4320 min Summer	1.811	0.0	2902.5	2772
5760 min Summer	1.443	0.0	3238.8	3576
7200 min Summer	1.224	0.0	3429.1	4328
8640 min Summer	1.080	0.0	3620.5	5104
10080 min Summer	0.980	0.0	3806.6	5856
15 min Winter	152.119	0.0	891.5	23
30 min Winter	98.091	0.0	1047.1	37

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.587	0.587	12.6	1761.6	O K
120 min Winter	0.716	0.716	12.6	2148.3	O K
180 min Winter	0.791	0.791	12.6	2372.7	O K
240 min Winter	0.839	0.839	12.6	2516.5	O K
360 min Winter	0.892	0.892	12.6	2677.0	O K
480 min Winter	0.917	0.917	12.6	2750.0	O K
600 min Winter	0.927	0.927	12.6	2780.7	O K
720 min Winter	0.929	0.929	12.6	2787.4	O K
960 min Winter	0.920	0.920	12.6	2759.9	O K
1440 min Winter	0.881	0.881	12.6	2643.9	O K
2160 min Winter	0.811	0.811	12.6	2432.7	O K
2880 min Winter	0.752	0.752	12.6	2257.3	O K
4320 min Winter	0.654	0.654	12.6	1963.2	O K
5760 min Winter	0.572	0.572	12.6	1714.6	O K
7200 min Winter	0.505	0.505	12.6	1514.8	O K
8640 min Winter	0.451	0.451	12.6	1351.5	O K
10080 min Winter	0.406	0.406	12.6	1219.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	1637.0	66
120 min Winter	36.932	0.0	1934.8	126
180 min Winter	27.466	0.0	2012.2	184
240 min Winter	22.073	0.0	1999.2	242
360 min Winter	15.975	0.0	1966.7	360
480 min Winter	12.562	0.0	1939.9	478
600 min Winter	10.371	0.0	1915.8	594
720 min Winter	8.843	0.0	1892.7	710
960 min Winter	6.842	0.0	1847.2	938
1440 min Winter	4.743	0.0	1756.5	1386
2160 min Winter	3.288	0.0	3365.4	1992
2880 min Winter	2.547	0.0	3415.7	2252
4320 min Winter	1.811	0.0	3367.2	3156
5760 min Winter	1.443	0.0	4105.7	3976
7200 min Winter	1.224	0.0	4348.9	4824
8640 min Winter	1.080	0.0	4596.7	5616
10080 min Winter	0.980	0.0	4841.0	6352

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 3.150

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.575	4	8	1.575

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	3000.0	1.000	3000.0	1.300	3000.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0162-1260-1000-1260
Design Head (m)	1.000
Design Flow (l/s)	12.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	162
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	12.6	Kick-Flo®	0.690	10.6
Flush-Flo™	0.313	12.6	Mean Flow over Head Range	-	10.8

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	13.7	3.000	21.2	7.000	31.9
0.200	12.2	1.400	14.8	3.500	22.9	7.500	33.0
0.300	12.6	1.600	15.7	4.000	24.4	8.000	34.1
0.400	12.5	1.800	16.6	4.500	25.8	8.500	35.1
0.500	12.2	2.000	17.5	5.000	27.1	9.000	36.1
0.600	11.7	2.200	18.3	5.500	28.4	9.500	37.0
0.800	11.3	2.400	19.1	6.000	29.6		
1.000	12.6	2.600	19.8	6.500	30.8		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.401	0.401	26.6	2287.4	O K
30 min Summer	0.516	0.516	26.6	2942.3	O K
60 min Summer	0.627	0.627	26.6	3576.3	O K
120 min Summer	0.765	0.765	26.6	4363.0	O K
180 min Summer	0.845	0.845	26.6	4818.2	O K
240 min Summer	0.896	0.896	26.6	5109.3	O K
360 min Summer	0.953	0.953	26.6	5432.2	O K
480 min Summer	0.978	0.978	26.6	5577.3	O K
600 min Summer	0.989	0.989	26.6	5636.2	O K
720 min Summer	0.991	0.991	26.6	5646.3	O K
960 min Summer	0.979	0.979	26.6	5582.6	O K
1440 min Summer	0.935	0.935	26.6	5327.5	O K
2160 min Summer	0.870	0.870	26.6	4958.6	O K
2880 min Summer	0.821	0.821	26.6	4678.9	O K
4320 min Summer	0.749	0.749	26.6	4270.0	O K
5760 min Summer	0.689	0.689	26.6	3925.1	O K
7200 min Summer	0.642	0.642	26.6	3661.5	O K
8640 min Summer	0.606	0.606	26.6	3455.8	O K
10080 min Summer	0.578	0.578	26.6	3296.0	O K
15 min Winter	0.401	0.401	26.6	2287.5	O K
30 min Winter	0.516	0.516	26.6	2942.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	1733.4	27
30 min Summer	98.091	0.0	2122.5	41
60 min Summer	59.966	0.0	3254.2	72
120 min Summer	36.932	0.0	3898.2	130
180 min Summer	27.466	0.0	4171.3	190
240 min Summer	22.073	0.0	4255.2	250
360 min Summer	15.975	0.0	4219.9	368
480 min Summer	12.562	0.0	4166.0	488
600 min Summer	10.371	0.0	4111.5	606
720 min Summer	8.843	0.0	4056.5	726
960 min Summer	6.842	0.0	3944.4	964
1440 min Summer	4.743	0.0	3715.5	1434
2160 min Summer	3.288	0.0	6783.1	1748
2880 min Summer	2.547	0.0	6892.5	2112
4320 min Summer	1.811	0.0	6784.6	2940
5760 min Summer	1.443	0.0	8305.5	3704
7200 min Summer	1.224	0.0	8793.1	4536
8640 min Summer	1.080	0.0	9283.6	5280
10080 min Summer	0.980	0.0	9754.2	6056
15 min Winter	152.119	0.0	1733.4	26
30 min Winter	98.091	0.0	2122.7	41

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.627	0.627	26.6	3576.5	O K
120 min Winter	0.765	0.765	26.6	4361.8	O K
180 min Winter	0.845	0.845	26.6	4816.4	O K
240 min Winter	0.896	0.896	26.6	5107.7	O K
360 min Winter	0.953	0.953	26.6	5431.5	O K
480 min Winter	0.978	0.978	26.6	5577.4	O K
600 min Winter	0.989	0.989	26.6	5637.2	O K
720 min Winter	0.991	0.991	26.6	5648.3	O K
960 min Winter	0.980	0.980	26.6	5587.5	O K
1440 min Winter	0.937	0.937	26.6	5343.3	O K
2160 min Winter	0.862	0.862	26.6	4911.3	O K
2880 min Winter	0.804	0.804	26.6	4580.6	O K
4320 min Winter	0.701	0.701	26.6	3995.8	O K
5760 min Winter	0.613	0.613	26.6	3495.9	O K
7200 min Winter	0.542	0.542	26.6	3091.2	O K
8640 min Winter	0.484	0.484	26.6	2760.2	O K
10080 min Winter	0.437	0.437	26.6	2492.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	3254.4	70
120 min Winter	36.932	0.0	3899.4	128
180 min Winter	27.466	0.0	4174.4	186
240 min Winter	22.073	0.0	4260.7	246
360 min Winter	15.975	0.0	4228.2	362
480 min Winter	12.562	0.0	4176.0	478
600 min Winter	10.371	0.0	4123.3	596
720 min Winter	8.843	0.0	4070.2	710
960 min Winter	6.842	0.0	3962.6	940
1440 min Winter	4.743	0.0	3744.7	1380
2160 min Winter	3.288	0.0	6791.5	1804
2880 min Winter	2.547	0.0	6914.4	2220
4320 min Winter	1.811	0.0	6968.4	3116
5760 min Winter	1.443	0.0	8309.4	3928
7200 min Winter	1.224	0.0	8798.9	4760
8640 min Winter	1.080	0.0	9292.2	5536
10080 min Winter	0.980	0.0	9770.5	6264

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 6.401

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	2.133	4	8	2.133	8	12	2.134

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	5700.0	1.000	5700.0	1.300	5700.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0225-2670-1000-2670
Design Head (m)	1.000
Design Flow (l/s)	26.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	225
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	26.7	Kick-Flo®	0.740	23.1
Flush-Flo™	0.370	26.6	Mean Flow over Head Range	-	22.2

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	7.5	1.200	29.1	3.000	45.2	7.000	68.2
0.200	22.4	1.400	31.4	3.500	48.7	7.500	70.6
0.300	26.4	1.600	33.4	4.000	52.0	8.000	72.8
0.400	26.6	1.800	35.4	4.500	55.1	8.500	75.0
0.500	26.2	2.000	37.2	5.000	57.9	9.000	77.1
0.600	25.6	2.200	39.0	5.500	60.7	9.500	79.2
0.800	24.0	2.400	40.6	6.000	63.3		
1.000	26.7	2.600	42.2	6.500	65.8		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.395	0.395	30.8	2768.0	O K
30 min Summer	0.509	0.509	30.8	3560.6	O K
60 min Summer	0.618	0.618	30.8	4329.2	O K
120 min Summer	0.755	0.755	30.8	5283.9	O K
180 min Summer	0.834	0.834	30.8	5839.9	O K
240 min Summer	0.885	0.885	30.8	6197.2	O K
360 min Summer	0.943	0.943	30.8	6597.6	O K
480 min Summer	0.969	0.969	30.8	6782.9	O K
600 min Summer	0.980	0.980	30.8	6863.5	O K
720 min Summer	0.984	0.984	30.8	6885.1	O K
960 min Summer	0.975	0.975	30.8	6825.7	O K
1440 min Summer	0.936	0.936	30.8	6549.9	O K
2160 min Summer	0.874	0.874	30.8	6117.9	O K
2880 min Summer	0.828	0.828	30.8	5794.9	O K
4320 min Summer	0.762	0.762	30.8	5333.3	O K
5760 min Summer	0.707	0.707	30.8	4947.2	O K
7200 min Summer	0.664	0.664	30.8	4649.2	O K
8640 min Summer	0.631	0.631	30.8	4415.3	O K
10080 min Summer	0.605	0.605	30.8	4236.5	O K
15 min Winter	0.395	0.395	30.8	2768.0	O K
30 min Winter	0.509	0.509	30.8	3561.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	2009.4	27
30 min Summer	98.091	0.0	2459.5	41
60 min Summer	59.966	0.0	3851.9	72
120 min Summer	36.932	0.0	4592.0	130
180 min Summer	27.466	0.0	4874.8	190
240 min Summer	22.073	0.0	4935.6	250
360 min Summer	15.975	0.0	4873.9	368
480 min Summer	12.562	0.0	4807.3	488
600 min Summer	10.371	0.0	4741.6	606
720 min Summer	8.843	0.0	4676.1	726
960 min Summer	6.842	0.0	4543.8	964
1440 min Summer	4.743	0.0	4275.3	1440
2160 min Summer	3.288	0.0	8071.4	1784
2880 min Summer	2.547	0.0	8154.2	2144
4320 min Summer	1.811	0.0	7812.6	2948
5760 min Summer	1.443	0.0	10008.9	3752
7200 min Summer	1.224	0.0	10591.5	4544
8640 min Summer	1.080	0.0	11176.5	5360
10080 min Summer	0.980	0.0	11731.4	6152
15 min Winter	152.119	0.0	2009.4	27
30 min Winter	98.091	0.0	2459.7	41

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.618	0.618	30.8	4329.4	O K
120 min Winter	0.755	0.755	30.8	5282.4	O K
180 min Winter	0.834	0.834	30.8	5837.3	O K
240 min Winter	0.885	0.885	30.8	6194.6	O K
360 min Winter	0.942	0.942	30.8	6595.5	O K
480 min Winter	0.969	0.969	30.8	6781.3	O K
600 min Winter	0.980	0.980	30.8	6862.7	O K
720 min Winter	0.984	0.984	30.8	6884.8	O K
960 min Winter	0.975	0.975	30.8	6828.1	O K
1440 min Winter	0.938	0.938	30.8	6563.1	O K
2160 min Winter	0.868	0.868	30.8	6073.3	O K
2880 min Winter	0.812	0.812	30.8	5685.5	O K
4320 min Winter	0.719	0.719	30.8	5032.5	O K
5760 min Winter	0.638	0.638	30.8	4464.0	O K
7200 min Winter	0.571	0.571	30.8	3998.1	O K
8640 min Winter	0.516	0.516	30.8	3615.0	O K
10080 min Winter	0.472	0.472	30.8	3303.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	3852.2	70
120 min Winter	36.932	0.0	4593.6	128
180 min Winter	27.466	0.0	4879.1	186
240 min Winter	22.073	0.0	4943.1	246
360 min Winter	15.975	0.0	4884.6	362
480 min Winter	12.562	0.0	4820.3	480
600 min Winter	10.371	0.0	4757.1	596
720 min Winter	8.843	0.0	4694.1	712
960 min Winter	6.842	0.0	4567.2	940
1440 min Winter	4.743	0.0	4311.9	1386
2160 min Winter	3.288	0.0	8085.0	1980
2880 min Winter	2.547	0.0	8188.7	2232
4320 min Winter	1.811	0.0	8063.5	3152
5760 min Winter	1.443	0.0	10014.8	3984
7200 min Winter	1.224	0.0	10600.8	4824
8640 min Winter	1.080	0.0	11191.0	5616
10080 min Winter	0.980	0.0	11757.5	6360

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 7.740

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	2.580	4	8	2.580	8	12	2.580

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	7000.0	1.000	7000.0	1.300	7000.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0240-3090-1000-3090
Design Head (m)	1.000
Design Flow (l/s)	30.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	240
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	30.9	Kick-Flo®	0.748	26.9
Flush-Flo™	0.386	30.8	Mean Flow over Head Range	-	25.5

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	33.7	3.000	52.4	7.000	79.1
0.200	24.3	1.400	36.3	3.500	56.5	7.500	81.8
0.300	30.4	1.600	38.7	4.000	60.3	8.000	84.4
0.400	30.8	1.800	41.0	4.500	63.8	8.500	86.9
0.500	30.4	2.000	43.1	5.000	67.1	9.000	89.4
0.600	29.7	2.200	45.1	5.500	70.3	9.500	91.8
0.800	27.8	2.400	47.1	6.000	73.4		
1.000	30.9	2.600	48.9	6.500	76.3		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.315	0.315	30.5	2174.2	O K
30 min Summer	0.405	0.405	30.7	2793.1	O K
60 min Summer	0.491	0.491	30.7	3389.8	O K
120 min Summer	0.598	0.598	30.7	4123.4	O K
180 min Summer	0.659	0.659	30.7	4546.8	O K
240 min Summer	0.698	0.698	30.7	4817.7	O K
360 min Summer	0.742	0.742	30.7	5116.6	O K
480 min Summer	0.760	0.760	30.7	5247.4	O K
600 min Summer	0.767	0.767	30.7	5294.4	O K
720 min Summer	0.767	0.767	30.7	5293.6	O K
960 min Summer	0.755	0.755	30.7	5208.0	O K
1440 min Summer	0.710	0.710	30.7	4897.6	O K
2160 min Summer	0.655	0.655	30.7	4521.6	O K
2880 min Summer	0.614	0.614	30.7	4234.8	O K
4320 min Summer	0.552	0.552	30.7	3808.4	O K
5760 min Summer	0.504	0.504	30.7	3476.6	O K
7200 min Summer	0.466	0.466	30.7	3213.3	O K
8640 min Summer	0.435	0.435	30.7	3003.7	O K
10080 min Summer	0.411	0.411	30.7	2838.7	O K
15 min Winter	0.400	0.400	30.7	2757.9	O K
30 min Winter	0.514	0.514	30.7	3546.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	1575.1	23
30 min Summer	98.091	0.0	2040.4	38
60 min Summer	59.966	0.0	3041.9	68
120 min Summer	36.932	0.0	3734.9	126
180 min Summer	27.466	0.0	4124.3	186
240 min Summer	22.073	0.0	4363.6	246
360 min Summer	15.975	0.0	4604.6	366
480 min Summer	12.562	0.0	4686.6	484
600 min Summer	10.371	0.0	4693.8	604
720 min Summer	8.843	0.0	4659.1	724
960 min Summer	6.842	0.0	4532.1	962
1440 min Summer	4.743	0.0	4273.0	1312
2160 min Summer	3.288	0.0	6465.5	1604
2880 min Summer	2.547	0.0	6630.8	1968
4320 min Summer	1.811	0.0	6887.1	2768
5760 min Summer	1.443	0.0	7857.2	3576
7200 min Summer	1.224	0.0	8312.0	4328
8640 min Summer	1.080	0.0	8763.0	5104
10080 min Summer	0.980	0.0	9189.8	5856
15 min Winter	152.119	0.0	2010.1	23
30 min Winter	98.091	0.0	2459.3	37

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.625	0.625	30.7	4310.0	O K
120 min Winter	0.762	0.762	30.7	5257.3	O K
180 min Winter	0.842	0.842	30.7	5808.8	O K
240 min Winter	0.893	0.893	30.7	6163.1	O K
360 min Winter	0.951	0.951	30.7	6560.4	O K
480 min Winter	0.977	0.977	30.7	6743.7	O K
600 min Winter	0.989	0.989	30.7	6823.4	O K
720 min Winter	0.992	0.992	30.7	6844.4	O K
960 min Winter	0.983	0.983	30.7	6786.1	O K
1440 min Winter	0.945	0.945	30.7	6519.4	O K
2160 min Winter	0.874	0.874	30.7	6029.0	O K
2880 min Winter	0.818	0.818	30.7	5643.1	O K
4320 min Winter	0.723	0.723	30.7	4992.0	O K
5760 min Winter	0.641	0.641	30.7	4421.3	O K
7200 min Winter	0.573	0.573	30.7	3954.1	O K
8640 min Winter	0.517	0.517	30.7	3570.7	O K
10080 min Winter	0.472	0.472	30.7	3258.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	3842.3	66
120 min Winter	36.932	0.0	4582.2	126
180 min Winter	27.466	0.0	4869.3	184
240 min Winter	22.073	0.0	4934.9	242
360 min Winter	15.975	0.0	4877.9	360
480 min Winter	12.562	0.0	4814.5	478
600 min Winter	10.371	0.0	4751.9	594
720 min Winter	8.843	0.0	4689.6	710
960 min Winter	6.842	0.0	4563.7	938
1440 min Winter	4.743	0.0	4309.9	1384
2160 min Winter	3.288	0.0	8057.7	1972
2880 min Winter	2.547	0.0	8165.0	2224
4320 min Winter	1.811	0.0	8047.6	3152
5760 min Winter	1.443	0.0	9967.3	3976
7200 min Winter	1.224	0.0	10551.1	4824
8640 min Winter	1.080	0.0	11139.1	5616
10080 min Winter	0.980	0.0	11704.5	6352

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 7.700

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	3.850	4	8	3.850

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	6900.0	1.000	6900.0	1.300	6900.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0239-3080-1000-3080
Design Head (m)	1.000
Design Flow (l/s)	30.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	239
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	30.8	Kick-Flo®	0.749	26.8
Flush-Flo™	0.384	30.7	Mean Flow over Head Range	-	25.4

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	33.6	3.000	52.2	7.000	78.8
0.200	24.3	1.400	36.2	3.500	56.3	7.500	81.5
0.300	30.4	1.600	38.5	4.000	60.0	8.000	84.1
0.400	30.7	1.800	40.8	4.500	63.5	8.500	86.6
0.500	30.4	2.000	42.9	5.000	66.9	9.000	89.0
0.600	29.6	2.200	44.9	5.500	70.1	9.500	91.4
0.800	27.7	2.400	46.9	6.000	73.1		
1.000	30.8	2.600	48.7	6.500	76.0		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.310	0.310	27.0	1919.9	O K
30 min Summer	0.398	0.398	27.2	2466.3	O K
60 min Summer	0.483	0.483	27.2	2993.1	O K
120 min Summer	0.587	0.587	27.2	3640.5	O K
180 min Summer	0.647	0.647	27.2	4014.0	O K
240 min Summer	0.686	0.686	27.2	4252.8	O K
360 min Summer	0.728	0.728	27.2	4515.8	O K
480 min Summer	0.747	0.747	27.2	4630.6	O K
600 min Summer	0.753	0.753	27.2	4671.5	O K
720 min Summer	0.753	0.753	27.2	4670.2	O K
960 min Summer	0.741	0.741	27.2	4592.1	O K
1440 min Summer	0.696	0.696	27.2	4314.3	O K
2160 min Summer	0.642	0.642	27.2	3978.7	O K
2880 min Summer	0.600	0.600	27.2	3722.5	O K
4320 min Summer	0.539	0.539	27.2	3340.9	O K
5760 min Summer	0.491	0.491	27.2	3044.4	O K
7200 min Summer	0.453	0.453	27.2	2809.5	O K
8640 min Summer	0.423	0.423	27.2	2622.7	O K
10080 min Summer	0.399	0.399	27.2	2475.6	O K
15 min Winter	0.393	0.393	27.2	2435.3	O K
30 min Winter	0.505	0.505	27.2	3131.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	1409.5	23
30 min Summer	98.091	0.0	1820.9	38
60 min Summer	59.966	0.0	2702.3	68
120 min Summer	36.932	0.0	3316.3	126
180 min Summer	27.466	0.0	3661.4	186
240 min Summer	22.073	0.0	3873.3	246
360 min Summer	15.975	0.0	4085.7	366
480 min Summer	12.562	0.0	4155.9	484
600 min Summer	10.371	0.0	4159.1	604
720 min Summer	8.843	0.0	4125.7	724
960 min Summer	6.842	0.0	4013.3	962
1440 min Summer	4.743	0.0	3787.2	1312
2160 min Summer	3.288	0.0	5725.8	1604
2880 min Summer	2.547	0.0	5873.9	1968
4320 min Summer	1.811	0.0	6106.5	2768
5760 min Summer	1.443	0.0	6946.1	3576
7200 min Summer	1.224	0.0	7348.9	4328
8640 min Summer	1.080	0.0	7749.2	5104
10080 min Summer	0.980	0.0	8129.0	5856
15 min Winter	152.119	0.0	1794.2	23
30 min Winter	98.091	0.0	2186.7	37

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.614	0.614	27.2	3805.8	O K
120 min Winter	0.749	0.749	27.2	4642.1	O K
180 min Winter	0.827	0.827	27.2	5129.0	O K
240 min Winter	0.878	0.878	27.2	5441.8	O K
360 min Winter	0.934	0.934	27.2	5792.4	O K
480 min Winter	0.960	0.960	27.2	5954.1	O K
600 min Winter	0.972	0.972	27.2	6024.3	O K
720 min Winter	0.975	0.975	27.2	6042.6	O K
960 min Winter	0.966	0.966	27.2	5990.6	O K
1440 min Winter	0.928	0.928	27.2	5753.9	O K
2160 min Winter	0.858	0.858	27.2	5318.1	O K
2880 min Winter	0.802	0.802	27.2	4970.5	O K
4320 min Winter	0.707	0.707	27.2	4382.9	O K
5760 min Winter	0.625	0.625	27.2	3875.6	O K
7200 min Winter	0.558	0.558	27.2	3460.4	O K
8640 min Winter	0.503	0.503	27.2	3119.5	O K
10080 min Winter	0.458	0.458	27.2	2842.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	3411.3	66
120 min Winter	36.932	0.0	4065.6	126
180 min Winter	27.466	0.0	4312.1	184
240 min Winter	22.073	0.0	4359.0	242
360 min Winter	15.975	0.0	4301.6	360
480 min Winter	12.562	0.0	4243.5	478
600 min Winter	10.371	0.0	4187.6	594
720 min Winter	8.843	0.0	4132.4	710
960 min Winter	6.842	0.0	4022.0	938
1440 min Winter	4.743	0.0	3800.7	1384
2160 min Winter	3.288	0.0	7134.4	1988
2880 min Winter	2.547	0.0	7231.4	2244
4320 min Winter	1.811	0.0	7141.6	3152
5760 min Winter	1.443	0.0	8810.6	3976
7200 min Winter	1.224	0.0	9327.5	4760
8640 min Winter	1.080	0.0	9848.9	5616
10080 min Winter	0.980	0.0	10351.8	6352

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 6.800

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	3.400	4	8	3.400

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	6200.0	1.000	6200.0	1.300	6200.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0227-2720-1000-2720
Design Head (m)	1.000
Design Flow (l/s)	27.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	227
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	27.2	Kick-Flo®	0.740	23.6
Flush-Flo™	0.368	27.2	Mean Flow over Head Range	-	22.6

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	7.6	1.200	29.7	3.000	46.1	7.000	69.6
0.200	22.6	1.400	32.0	3.500	49.7	7.500	71.9
0.300	27.0	1.600	34.1	4.000	53.0	8.000	74.2
0.400	27.2	1.800	36.1	4.500	56.1	8.500	76.5
0.500	26.8	2.000	37.9	5.000	59.1	9.000	78.6
0.600	26.0	2.200	39.7	5.500	61.9	9.500	80.7
0.800	24.5	2.400	41.4	6.000	64.5		
1.000	27.2	2.600	43.0	6.500	67.1		

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.312	0.312	59.5	4366.2	O K
30 min Summer	0.401	0.401	61.3	5607.2	O K
60 min Summer	0.486	0.486	61.8	6805.8	O K
120 min Summer	0.592	0.592	61.8	8281.9	O K
180 min Summer	0.653	0.653	61.8	9135.8	O K
240 min Summer	0.692	0.692	61.8	9683.0	O K
360 min Summer	0.735	0.735	61.8	10287.9	O K
480 min Summer	0.754	0.754	61.8	10556.1	O K
600 min Summer	0.761	0.761	61.8	10657.8	O K
720 min Summer	0.762	0.762	61.8	10663.5	O K
960 min Summer	0.750	0.750	61.8	10504.2	O K
1440 min Summer	0.711	0.711	61.8	9953.9	O K
2160 min Summer	0.665	0.665	61.8	9311.1	O K
2880 min Summer	0.630	0.630	61.8	8816.6	O K
4320 min Summer	0.577	0.577	61.8	8080.3	O K
5760 min Summer	0.536	0.536	61.8	7501.8	O K
7200 min Summer	0.503	0.503	61.8	7039.8	O K
8640 min Summer	0.476	0.476	61.8	6668.8	O K
10080 min Summer	0.455	0.455	61.7	6376.2	O K
15 min Winter	0.395	0.395	61.3	5534.7	O K
30 min Winter	0.508	0.508	61.8	7116.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	2703.0	23
30 min Summer	98.091	0.0	3629.3	38
60 min Summer	59.966	0.0	5696.5	68
120 min Summer	36.932	0.0	7051.6	126
180 min Summer	27.466	0.0	7820.2	186
240 min Summer	22.073	0.0	8304.1	246
360 min Summer	15.975	0.0	8831.0	366
480 min Summer	12.562	0.0	9065.3	484
600 min Summer	10.371	0.0	9158.9	604
720 min Summer	8.843	0.0	9172.0	722
960 min Summer	6.842	0.0	9055.6	962
1440 min Summer	4.743	0.0	8538.9	1256
2160 min Summer	3.288	0.0	12572.1	1584
2880 min Summer	2.547	0.0	12856.3	1964
4320 min Summer	1.811	0.0	13249.9	2768
5760 min Summer	1.443	0.0	15554.3	3568
7200 min Summer	1.224	0.0	16432.5	4328
8640 min Summer	1.080	0.0	17288.1	5104
10080 min Summer	0.980	0.0	18070.0	5856
15 min Winter	152.119	0.0	3567.5	23
30 min Winter	98.091	0.0	4554.3	37

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.618	0.618	61.8	8649.7	O K
120 min Winter	0.754	0.754	61.8	10551.2	O K
180 min Winter	0.833	0.833	61.8	11667.3	O K
240 min Winter	0.885	0.885	61.8	12387.8	O K
360 min Winter	0.943	0.943	61.8	13201.2	O K
480 min Winter	0.970	0.970	61.8	13584.6	O K
600 min Winter	0.983	0.983	61.8	13759.6	O K
720 min Winter	0.987	0.987	61.8	13816.3	O K
960 min Winter	0.981	0.981	61.8	13727.4	O K
1440 min Winter	0.946	0.946	61.8	13243.5	O K
2160 min Winter	0.880	0.880	61.8	12325.2	O K
2880 min Winter	0.829	0.829	61.8	11609.9	O K
4320 min Winter	0.743	0.743	61.8	10400.8	O K
5760 min Winter	0.670	0.670	61.8	9382.5	O K
7200 min Winter	0.610	0.610	61.8	8534.7	O K
8640 min Winter	0.559	0.559	61.8	7832.5	O K
10080 min Winter	0.519	0.519	61.8	7262.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	7266.9	66
120 min Winter	36.932	0.0	8774.8	126
180 min Winter	27.466	0.0	9465.3	184
240 min Winter	22.073	0.0	9773.3	242
360 min Winter	15.975	0.0	9862.1	360
480 min Winter	12.562	0.0	9738.6	478
600 min Winter	10.371	0.0	9603.3	594
720 min Winter	8.843	0.0	9463.5	710
960 min Winter	6.842	0.0	9176.1	938
1440 min Winter	4.743	0.0	8593.5	1384
2160 min Winter	3.288	0.0	15682.4	1972
2880 min Winter	2.547	0.0	15865.9	2224
4320 min Winter	1.811	0.0	15766.9	3116
5760 min Winter	1.443	0.0	19760.2	3976
7200 min Winter	1.224	0.0	20895.1	4760
8640 min Winter	1.080	0.0	22018.0	5544
10080 min Winter	0.980	0.0	23062.1	6352

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 15.440

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	7.720	4	8	7.720

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	14000.0	1.000	14000.0	1.300	14000.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0322-6180-1000-6180
Design Head (m)	1.000
Design Flow (l/s)	61.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	322
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	2100

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	61.7	Kick-Flo®	0.802	55.5
Flush-Flo™	0.475	61.8	Mean Flow over Head Range	-	48.9

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	9.6	1.200	67.4	3.000	105.2	7.000	159.1
0.200	32.9	1.400	72.6	3.500	113.4	7.500	164.6
0.300	58.0	1.600	77.5	4.000	121.0	8.000	169.8
0.400	61.3	1.800	82.0	4.500	128.2	8.500	175.0
0.500	61.7	2.000	86.3	5.000	134.9	9.000	179.9
0.600	60.9	2.200	90.4	5.500	141.4	9.500	184.8
0.800	55.6	2.400	94.3	6.000	147.5		
1.000	61.7	2.600	98.1	6.500	153.4		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.313	0.313	24.2	1721.9	O K
30 min Summer	0.402	0.402	24.3	2212.1	O K
60 min Summer	0.488	0.488	24.3	2684.6	O K
120 min Summer	0.594	0.594	24.3	3265.0	O K
180 min Summer	0.655	0.655	24.3	3599.8	O K
240 min Summer	0.693	0.693	24.3	3813.9	O K
360 min Summer	0.736	0.736	24.3	4049.9	O K
480 min Summer	0.755	0.755	24.3	4151.8	O K
600 min Summer	0.761	0.761	24.3	4187.4	O K
720 min Summer	0.761	0.761	24.3	4185.5	O K
960 min Summer	0.748	0.748	24.3	4116.0	O K
1440 min Summer	0.703	0.703	24.3	3864.2	O K
2160 min Summer	0.646	0.646	24.3	3553.7	O K
2880 min Summer	0.603	0.603	24.3	3318.5	O K
4320 min Summer	0.540	0.540	24.3	2969.3	O K
5760 min Summer	0.491	0.491	24.3	2699.2	O K
7200 min Summer	0.452	0.452	24.3	2485.4	O K
8640 min Summer	0.421	0.421	24.3	2315.6	O K
10080 min Summer	0.397	0.397	24.3	2181.7	O K
15 min Winter	0.397	0.397	24.3	2184.4	O K
30 min Winter	0.511	0.511	24.3	2809.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	1291.8	23
30 min Summer	98.091	0.0	1660.4	38
60 min Summer	59.966	0.0	2447.0	68
120 min Summer	36.932	0.0	3000.0	126
180 min Summer	27.466	0.0	3310.0	186
240 min Summer	22.073	0.0	3498.7	246
360 min Summer	15.975	0.0	3682.3	366
480 min Summer	12.562	0.0	3737.3	484
600 min Summer	10.371	0.0	3731.4	604
720 min Summer	8.843	0.0	3693.2	724
960 min Summer	6.842	0.0	3585.9	962
1440 min Summer	4.743	0.0	3387.1	1318
2160 min Summer	3.288	0.0	5157.9	1604
2880 min Summer	2.547	0.0	5293.6	1988
4320 min Summer	1.811	0.0	5509.3	2768
5760 min Summer	1.443	0.0	6241.3	3576
7200 min Summer	1.224	0.0	6604.4	4328
8640 min Summer	1.080	0.0	6966.3	5104
10080 min Summer	0.980	0.0	7311.6	5856
15 min Winter	152.119	0.0	1636.6	23
30 min Winter	98.091	0.0	1977.7	37

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.621	0.621	24.3	3413.5	O K
120 min Winter	0.757	0.757	24.3	4163.7	O K
180 min Winter	0.836	0.836	24.3	4599.4	O K
240 min Winter	0.887	0.887	24.3	4879.3	O K
360 min Winter	0.944	0.944	24.3	5192.4	O K
480 min Winter	0.970	0.970	24.3	5336.1	O K
600 min Winter	0.981	0.981	24.3	5397.8	O K
720 min Winter	0.984	0.984	24.3	5413.0	O K
960 min Winter	0.975	0.975	24.3	5364.0	O K
1440 min Winter	0.936	0.936	24.3	5147.9	O K
2160 min Winter	0.864	0.864	24.3	4752.5	O K
2880 min Winter	0.807	0.807	24.3	4438.9	O K
4320 min Winter	0.711	0.711	24.3	3912.3	O K
5760 min Winter	0.627	0.627	24.3	3448.7	O K
7200 min Winter	0.559	0.559	24.3	3072.0	O K
8640 min Winter	0.502	0.502	24.3	2763.6	O K
10080 min Winter	0.457	0.457	24.3	2512.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	3085.2	66
120 min Winter	36.932	0.0	3667.6	126
180 min Winter	27.466	0.0	3876.2	184
240 min Winter	22.073	0.0	3900.9	242
360 min Winter	15.975	0.0	3849.7	360
480 min Winter	12.562	0.0	3800.1	478
600 min Winter	10.371	0.0	3752.3	594
720 min Winter	8.843	0.0	3705.1	710
960 min Winter	6.842	0.0	3609.8	938
1440 min Winter	4.743	0.0	3417.1	1384
2160 min Winter	3.288	0.0	6428.1	1976
2880 min Winter	2.547	0.0	6516.6	2228
4320 min Winter	1.811	0.0	6407.3	3156
5760 min Winter	1.443	0.0	7915.2	3976
7200 min Winter	1.224	0.0	8380.6	4824
8640 min Winter	1.080	0.0	8851.3	5616
10080 min Winter	0.980	0.0	9307.7	6352

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 6.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	3.050	4	8	3.050

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	5500.0	1.000	5500.0	1.300	5500.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0216-2440-1000-2440
Design Head (m)	1.000
Design Flow (l/s)	24.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	216
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	24.4	Kick-Flo®	0.733	21.0
Flush-Flo™	0.359	24.3	Mean Flow over Head Range	-	20.3

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	7.3	1.200	26.6	3.000	41.3	7.000	62.3
0.200	21.2	1.400	28.6	3.500	44.5	7.500	64.4
0.300	24.2	1.600	30.5	4.000	47.5	8.000	66.5
0.400	24.3	1.800	32.3	4.500	50.3	8.500	68.5
0.500	23.9	2.000	34.0	5.000	52.9	9.000	70.4
0.600	23.2	2.200	35.6	5.500	55.4	9.500	72.3
0.800	21.9	2.400	37.1	6.000	57.8		
1.000	24.4	2.600	38.6	6.500	60.1		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.304	0.304	11.2	789.7	O K
30 min Summer	0.390	0.390	11.2	1014.6	O K
60 min Summer	0.473	0.473	11.2	1230.9	O K
120 min Summer	0.575	0.575	11.2	1496.1	O K
180 min Summer	0.634	0.634	11.2	1648.8	O K
240 min Summer	0.672	0.672	11.2	1746.4	O K
360 min Summer	0.713	0.713	11.2	1852.9	O K
480 min Summer	0.730	0.730	11.2	1897.1	O K
600 min Summer	0.735	0.735	11.2	1911.1	O K
720 min Summer	0.734	0.734	11.2	1908.1	O K
960 min Summer	0.720	0.720	11.2	1872.8	O K
1440 min Summer	0.674	0.674	11.2	1751.9	O K
2160 min Summer	0.611	0.611	11.2	1589.4	O K
2880 min Summer	0.565	0.565	11.2	1470.2	O K
4320 min Summer	0.499	0.499	11.2	1296.3	O K
5760 min Summer	0.448	0.448	11.2	1164.4	O K
7200 min Summer	0.408	0.408	11.2	1061.1	O K
8640 min Summer	0.377	0.377	11.2	979.6	O K
10080 min Summer	0.352	0.352	11.2	915.5	O K
15 min Winter	0.385	0.385	11.2	1002.1	O K
30 min Winter	0.496	0.496	11.2	1288.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	646.8	23
30 min Summer	98.091	0.0	815.7	38
60 min Summer	59.966	0.0	1167.3	68
120 min Summer	36.932	0.0	1427.3	126
180 min Summer	27.466	0.0	1572.1	186
240 min Summer	22.073	0.0	1657.1	246
360 min Summer	15.975	0.0	1728.6	366
480 min Summer	12.562	0.0	1735.6	484
600 min Summer	10.371	0.0	1716.5	604
720 min Summer	8.843	0.0	1692.9	724
960 min Summer	6.842	0.0	1645.6	962
1440 min Summer	4.743	0.0	1560.6	1372
2160 min Summer	3.288	0.0	2409.4	1624
2880 min Summer	2.547	0.0	2478.0	1988
4320 min Summer	1.811	0.0	2594.9	2772
5760 min Summer	1.443	0.0	2882.8	3576
7200 min Summer	1.224	0.0	3052.7	4328
8640 min Summer	1.080	0.0	3223.9	5104
10080 min Summer	0.980	0.0	3391.5	5856
15 min Winter	152.119	0.0	805.2	23
30 min Winter	98.091	0.0	935.1	37

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.602	0.602	11.2	1565.7	O K
120 min Winter	0.734	0.734	11.2	1909.2	O K
180 min Winter	0.811	0.811	11.2	2107.9	O K
240 min Winter	0.860	0.860	11.2	2235.2	O K
360 min Winter	0.914	0.914	11.2	2376.8	O K
480 min Winter	0.939	0.939	11.2	2440.8	O K
600 min Winter	0.949	0.949	11.2	2467.2	O K
720 min Winter	0.951	0.951	11.2	2472.3	O K
960 min Winter	0.941	0.941	11.2	2446.3	O K
1440 min Winter	0.900	0.900	11.2	2340.4	O K
2160 min Winter	0.827	0.827	11.2	2149.9	O K
2880 min Winter	0.767	0.767	11.2	1994.3	O K
4320 min Winter	0.668	0.668	11.2	1737.0	O K
5760 min Winter	0.580	0.580	11.2	1508.8	O K
7200 min Winter	0.511	0.511	11.2	1328.3	O K
8640 min Winter	0.455	0.455	11.2	1181.7	O K
10080 min Winter	0.409	0.409	11.2	1062.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	1466.6	66
120 min Winter	36.932	0.0	1727.7	126
180 min Winter	27.466	0.0	1786.3	184
240 min Winter	22.073	0.0	1773.0	242
360 min Winter	15.975	0.0	1746.4	360
480 min Winter	12.562	0.0	1724.5	478
600 min Winter	10.371	0.0	1704.6	594
720 min Winter	8.843	0.0	1685.3	710
960 min Winter	6.842	0.0	1646.8	938
1440 min Winter	4.743	0.0	1569.1	1386
2160 min Winter	3.288	0.0	3005.2	1992
2880 min Winter	2.547	0.0	3051.3	2248
4320 min Winter	1.811	0.0	2983.8	3160
5760 min Winter	1.443	0.0	3653.9	3984
7200 min Winter	1.224	0.0	3870.8	4824
8640 min Winter	1.080	0.0	4092.2	5616
10080 min Winter	0.980	0.0	4311.7	6352

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.800

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.400	4	8	1.400

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2600.0	1.000	2600.0	1.300	2600.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0154-1120-1000-1120
Design Head (m)	1.000
Design Flow (l/s)	11.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	154
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	11.2	Kick-Flo®	0.683	9.4
Flush-Flo™	0.308	11.2	Mean Flow over Head Range	-	9.6

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	5.5	1.200	12.2	3.000	18.9	7.000	28.3
0.200	10.8	1.400	13.1	3.500	20.3	7.500	29.3
0.300	11.2	1.600	14.0	4.000	21.6	8.000	30.2
0.400	11.1	1.800	14.8	4.500	22.9	8.500	31.1
0.500	10.8	2.000	15.5	5.000	24.1	9.000	32.0
0.600	10.3	2.200	16.3	5.500	25.2	9.500	32.8
0.800	10.1	2.400	17.0	6.000	26.3		
1.000	11.2	2.600	17.6	6.500	27.3		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.301	0.301	12.8	1202.2	O K
30 min Summer	0.386	0.386	12.8	1546.0	O K
60 min Summer	0.470	0.470	12.8	1879.3	O K
120 min Summer	0.573	0.573	12.8	2291.8	O K
180 min Summer	0.633	0.633	12.8	2533.7	O K
240 min Summer	0.673	0.673	12.8	2691.9	O K
360 min Summer	0.718	0.718	12.8	2873.7	O K
480 min Summer	0.740	0.740	12.8	2961.1	O K
600 min Summer	0.751	0.751	12.8	3002.4	O K
720 min Summer	0.754	0.754	12.8	3017.9	O K
960 min Summer	0.751	0.751	12.8	3003.2	O K
1440 min Summer	0.726	0.726	12.8	2902.6	O K
2160 min Summer	0.673	0.673	12.8	2691.9	O K
2880 min Summer	0.632	0.632	12.8	2528.6	O K
4320 min Summer	0.579	0.579	12.8	2317.8	O K
5760 min Summer	0.541	0.541	12.8	2163.8	O K
7200 min Summer	0.511	0.511	12.8	2045.1	O K
8640 min Summer	0.488	0.488	12.8	1952.0	O K
10080 min Summer	0.470	0.470	12.8	1881.1	O K
15 min Winter	0.381	0.381	12.8	1524.8	O K
30 min Winter	0.491	0.491	12.8	1962.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	868.8	23
30 min Summer	98.091	0.0	1042.6	38
60 min Summer	59.966	0.0	1668.8	68
120 min Summer	36.932	0.0	1977.6	128
180 min Summer	27.466	0.0	2078.8	186
240 min Summer	22.073	0.0	2074.2	246
360 min Summer	15.975	0.0	2016.2	366
480 min Summer	12.562	0.0	1971.5	486
600 min Summer	10.371	0.0	1934.7	604
720 min Summer	8.843	0.0	1902.0	724
960 min Summer	6.842	0.0	1843.2	964
1440 min Summer	4.743	0.0	1735.5	1442
2160 min Summer	3.288	0.0	3473.0	1888
2880 min Summer	2.547	0.0	3506.8	2192
4320 min Summer	1.811	0.0	3350.0	2940
5760 min Summer	1.443	0.0	4342.2	3744
7200 min Summer	1.224	0.0	4594.1	4544
8640 min Summer	1.080	0.0	4847.5	5360
10080 min Summer	0.980	0.0	5089.0	6152
15 min Winter	152.119	0.0	1036.5	23
30 min Winter	98.091	0.0	1084.3	37

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.597	0.597	12.8	2387.4	O K
120 min Winter	0.730	0.730	12.8	2919.2	O K
180 min Winter	0.808	0.808	12.8	3231.6	O K
240 min Winter	0.859	0.859	12.8	3436.2	O K
360 min Winter	0.918	0.918	12.8	3673.6	O K
480 min Winter	0.948	0.948	12.8	3793.0	O K
600 min Winter	0.964	0.964	12.8	3855.1	O K
720 min Winter	0.971	0.971	12.8	3884.2	O K
960 min Winter	0.971	0.971	12.8	3885.9	O K
1440 min Winter	0.950	0.950	12.8	3801.0	O K
2160 min Winter	0.902	0.902	12.8	3608.3	O K
2880 min Winter	0.852	0.852	12.8	3409.2	O K
4320 min Winter	0.784	0.784	12.8	3137.3	O K
5760 min Winter	0.731	0.731	12.8	2923.6	O K
7200 min Winter	0.682	0.682	12.8	2726.3	O K
8640 min Winter	0.637	0.637	12.8	2549.3	O K
10080 min Winter	0.603	0.603	12.8	2410.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	2020.1	66
120 min Winter	36.932	0.0	2073.3	126
180 min Winter	27.466	0.0	2020.8	184
240 min Winter	22.073	0.0	1991.4	244
360 min Winter	15.975	0.0	1960.5	362
480 min Winter	12.562	0.0	1940.9	478
600 min Winter	10.371	0.0	1923.8	596
720 min Winter	8.843	0.0	1907.6	714
960 min Winter	6.842	0.0	1875.2	946
1440 min Winter	4.743	0.0	1813.3	1402
2160 min Winter	3.288	0.0	3794.6	2060
2880 min Winter	2.547	0.0	3640.7	2660
4320 min Winter	1.811	0.0	3331.3	3328
5760 min Winter	1.443	0.0	5487.0	4264
7200 min Winter	1.224	0.0	5795.2	5184
8640 min Winter	1.080	0.0	6095.5	6048
10080 min Winter	0.980	0.0	6347.7	6856

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 4.250

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	2.125	4	8	2.125

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	4000.0	1.000	4000.0	1.300	4000.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0163-1280-1000-1280
Design Head (m)	1.000
Design Flow (l/s)	12.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	163
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	12.8	Kick-Flo®	0.691	10.8
Flush-Flo™	0.312	12.8	Mean Flow over Head Range	-	10.9

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	14.0	3.000	21.6	7.000	32.4
0.200	12.4	1.400	15.0	3.500	23.2	7.500	33.5
0.300	12.8	1.600	16.0	4.000	24.8	8.000	34.6
0.400	12.7	1.800	16.9	4.500	26.2	8.500	35.6
0.500	12.4	2.000	17.8	5.000	27.6	9.000	36.6
0.600	11.9	2.200	18.6	5.500	28.9	9.500	37.6
0.800	11.5	2.400	19.4	6.000	30.1		
1.000	12.8	2.600	20.2	6.500	31.3		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.305	0.305	23.7	1679.6	O K
30 min Summer	0.392	0.392	23.8	2157.8	O K
60 min Summer	0.476	0.476	23.8	2618.6	O K
120 min Summer	0.579	0.579	23.8	3184.7	O K
180 min Summer	0.638	0.638	23.8	3510.9	O K
240 min Summer	0.676	0.676	23.8	3719.4	O K
360 min Summer	0.718	0.718	23.8	3948.6	O K
480 min Summer	0.736	0.736	23.8	4048.2	O K
600 min Summer	0.742	0.742	23.8	4083.4	O K
720 min Summer	0.742	0.742	23.8	4081.4	O K
960 min Summer	0.729	0.729	23.8	4010.8	O K
1440 min Summer	0.684	0.684	23.8	3764.3	O K
2160 min Summer	0.630	0.630	23.8	3466.9	O K
2880 min Summer	0.589	0.589	23.8	3239.6	O K
4320 min Summer	0.527	0.527	23.8	2901.2	O K
5760 min Summer	0.480	0.480	23.8	2638.9	O K
7200 min Summer	0.442	0.442	23.8	2431.1	O K
8640 min Summer	0.412	0.412	23.8	2266.0	O K
10080 min Summer	0.388	0.388	23.8	2136.0	O K
15 min Winter	0.387	0.387	23.8	2130.7	O K
30 min Winter	0.498	0.498	23.8	2740.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	1252.6	23
30 min Summer	98.091	0.0	1612.7	38
60 min Summer	59.966	0.0	2380.9	68
120 min Summer	36.932	0.0	2920.1	126
180 min Summer	27.466	0.0	3223.1	186
240 min Summer	22.073	0.0	3408.7	246
360 min Summer	15.975	0.0	3593.3	366
480 min Summer	12.562	0.0	3651.6	484
600 min Summer	10.371	0.0	3650.3	604
720 min Summer	8.843	0.0	3617.6	724
960 min Summer	6.842	0.0	3519.0	962
1440 min Summer	4.743	0.0	3324.2	1312
2160 min Summer	3.288	0.0	5026.2	1604
2880 min Summer	2.547	0.0	5157.9	1968
4320 min Summer	1.811	0.0	5367.1	2768
5760 min Summer	1.443	0.0	6085.1	3576
7200 min Summer	1.224	0.0	6438.8	4328
8640 min Summer	1.080	0.0	6791.0	5104
10080 min Summer	0.980	0.0	7126.6	5856
15 min Winter	152.119	0.0	1589.3	23
30 min Winter	98.091	0.0	1926.7	37

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.605	0.605	23.8	3329.6	O K
120 min Winter	0.738	0.738	23.8	4061.0	O K
180 min Winter	0.816	0.816	23.8	4487.0	O K
240 min Winter	0.866	0.866	23.8	4760.5	O K
360 min Winter	0.921	0.921	23.8	5066.9	O K
480 min Winter	0.947	0.947	23.8	5208.0	O K
600 min Winter	0.958	0.958	23.8	5269.1	O K
720 min Winter	0.961	0.961	23.8	5284.7	O K
960 min Winter	0.952	0.952	23.8	5238.5	O K
1440 min Winter	0.915	0.915	23.8	5029.9	O K
2160 min Winter	0.845	0.845	23.8	4645.9	O K
2880 min Winter	0.788	0.788	23.8	4335.7	O K
4320 min Winter	0.693	0.693	23.8	3810.8	O K
5760 min Winter	0.612	0.612	23.8	3364.3	O K
7200 min Winter	0.545	0.545	23.8	2999.1	O K
8640 min Winter	0.491	0.491	23.8	2699.1	O K
10080 min Winter	0.446	0.446	23.8	2455.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	3003.3	66
120 min Winter	36.932	0.0	3576.0	126
180 min Winter	27.466	0.0	3783.2	184
240 min Winter	22.073	0.0	3811.4	242
360 min Winter	15.975	0.0	3756.4	360
480 min Winter	12.562	0.0	3704.8	478
600 min Winter	10.371	0.0	3655.9	594
720 min Winter	8.843	0.0	3608.0	710
960 min Winter	6.842	0.0	3512.8	938
1440 min Winter	4.743	0.0	3322.6	1384
2160 min Winter	3.288	0.0	6261.9	1988
2880 min Winter	2.547	0.0	6348.7	2248
4320 min Winter	1.811	0.0	6278.0	3120
5760 min Winter	1.443	0.0	7717.7	3976
7200 min Winter	1.224	0.0	8171.3	4760
8640 min Winter	1.080	0.0	8629.5	5616
10080 min Winter	0.980	0.0	9073.2	6352

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 5.950

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	2.975	4	8	2.975

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	5500.0	1.000	5500.0	1.300	5500.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0214-2380-1000-2380
Design Head (m)	1.000
Design Flow (l/s)	23.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	214
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	23.8	Kick-Flo®	0.732	20.5
Flush-Flo™	0.356	23.8	Mean Flow over Head Range	-	19.9

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	7.3	1.200	26.0	3.000	40.3	7.000	60.8
0.200	20.9	1.400	28.0	3.500	43.4	7.500	62.8
0.300	23.7	1.600	29.8	4.000	46.3	8.000	64.9
0.400	23.7	1.800	31.5	4.500	49.0	8.500	66.8
0.500	23.4	2.000	33.2	5.000	51.6	9.000	68.7
0.600	22.7	2.200	34.7	5.500	54.1	9.500	70.5
0.800	21.4	2.400	36.2	6.000	56.4		
1.000	23.8	2.600	37.6	6.500	58.6		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.300	0.300	13.6	959.2	O K
30 min Summer	0.385	0.385	13.6	1232.3	O K
60 min Summer	0.467	0.467	13.6	1495.2	O K
120 min Summer	0.568	0.568	13.6	1817.6	O K
180 min Summer	0.626	0.626	13.6	2003.2	O K
240 min Summer	0.663	0.663	13.6	2121.7	O K
360 min Summer	0.704	0.704	13.6	2251.8	O K
480 min Summer	0.721	0.721	13.6	2306.8	O K
600 min Summer	0.727	0.727	13.6	2324.9	O K
720 min Summer	0.726	0.726	13.6	2322.2	O K
960 min Summer	0.713	0.713	13.6	2280.3	O K
1440 min Summer	0.666	0.666	13.6	2131.1	O K
2160 min Summer	0.608	0.608	13.6	1944.6	O K
2880 min Summer	0.564	0.564	13.6	1804.8	O K
4320 min Summer	0.500	0.500	13.6	1598.8	O K
5760 min Summer	0.450	0.450	13.6	1441.4	O K
7200 min Summer	0.412	0.412	13.6	1317.6	O K
8640 min Summer	0.381	0.381	13.6	1219.7	O K
10080 min Summer	0.357	0.357	13.6	1142.8	O K
15 min Winter	0.380	0.380	13.6	1217.1	O K
30 min Winter	0.489	0.489	13.6	1565.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	766.1	23
30 min Summer	98.091	0.0	971.4	38
60 min Summer	59.966	0.0	1402.1	68
120 min Summer	36.932	0.0	1715.5	126
180 min Summer	27.466	0.0	1890.5	186
240 min Summer	22.073	0.0	1995.3	246
360 min Summer	15.975	0.0	2089.2	366
480 min Summer	12.562	0.0	2105.9	484
600 min Summer	10.371	0.0	2089.0	604
720 min Summer	8.843	0.0	2060.1	724
960 min Summer	6.842	0.0	2002.5	962
1440 min Summer	4.743	0.0	1902.7	1342
2160 min Summer	3.288	0.0	2911.6	1608
2880 min Summer	2.547	0.0	2992.5	1988
4320 min Summer	1.811	0.0	3127.7	2772
5760 min Summer	1.443	0.0	3494.6	3576
7200 min Summer	1.224	0.0	3699.8	4328
8640 min Summer	1.080	0.0	3906.0	5104
10080 min Summer	0.980	0.0	4106.2	5856
15 min Winter	152.119	0.0	958.4	23
30 min Winter	98.091	0.0	1128.2	37

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.594	0.594	13.6	1901.6	O K
120 min Winter	0.725	0.725	13.6	2319.1	O K
180 min Winter	0.800	0.800	13.6	2561.2	O K
240 min Winter	0.849	0.849	13.6	2716.4	O K
360 min Winter	0.903	0.903	13.6	2889.6	O K
480 min Winter	0.928	0.928	13.6	2968.4	O K
600 min Winter	0.938	0.938	13.6	3001.6	O K
720 min Winter	0.940	0.940	13.6	3008.8	O K
960 min Winter	0.931	0.931	13.6	2979.2	O K
1440 min Winter	0.892	0.892	13.6	2854.1	O K
2160 min Winter	0.821	0.821	13.6	2626.7	O K
2880 min Winter	0.762	0.762	13.6	2439.5	O K
4320 min Winter	0.664	0.664	13.6	2126.3	O K
5760 min Winter	0.581	0.581	13.6	1857.7	O K
7200 min Winter	0.513	0.513	13.6	1642.1	O K
8640 min Winter	0.458	0.458	13.6	1466.0	O K
10080 min Winter	0.413	0.413	13.6	1322.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	1763.1	66
120 min Winter	36.932	0.0	2084.1	126
180 min Winter	27.466	0.0	2170.5	184
240 min Winter	22.073	0.0	2158.4	242
360 min Winter	15.975	0.0	2124.5	360
480 min Winter	12.562	0.0	2096.2	478
600 min Winter	10.371	0.0	2070.4	594
720 min Winter	8.843	0.0	2045.6	710
960 min Winter	6.842	0.0	1996.4	938
1440 min Winter	4.743	0.0	1898.0	1386
2160 min Winter	3.288	0.0	3628.7	1992
2880 min Winter	2.547	0.0	3682.3	2252
4320 min Winter	1.811	0.0	3622.5	3156
5760 min Winter	1.443	0.0	4430.1	3976
7200 min Winter	1.224	0.0	4692.4	4824
8640 min Winter	1.080	0.0	4959.4	5616
10080 min Winter	0.980	0.0	5222.4	6352

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 3.400

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.700	4	8	1.700

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	3200.0	1.000	3200.0	1.300	3200.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0167-1360-1000-1360
Design Head (m)	1.000
Design Flow (l/s)	13.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	167
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	13.6	Kick-Flo®	0.694	11.5
Flush-Flo™	0.316	13.6	Mean Flow over Head Range	-	11.6

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	6.0	1.200	14.8	3.000	22.9	7.000	34.5
0.200	13.1	1.400	15.9	3.500	24.7	7.500	35.7
0.300	13.6	1.600	17.0	4.000	26.3	8.000	36.8
0.400	13.5	1.800	18.0	4.500	27.9	8.500	37.9
0.500	13.2	2.000	18.9	5.000	29.3	9.000	39.0
0.600	12.7	2.200	19.8	5.500	30.7	9.500	40.0
0.800	12.2	2.400	20.6	6.000	32.0		
1.000	13.6	2.600	21.4	6.500	33.3		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.301	0.301	12.8	902.7	O K
30 min Summer	0.387	0.387	12.8	1159.7	O K
60 min Summer	0.469	0.469	12.8	1407.1	O K
120 min Summer	0.570	0.570	12.8	1710.4	O K
180 min Summer	0.628	0.628	12.8	1885.0	O K
240 min Summer	0.666	0.666	12.8	1996.6	O K
360 min Summer	0.706	0.706	12.8	2118.9	O K
480 min Summer	0.723	0.723	12.8	2170.2	O K
600 min Summer	0.729	0.729	12.8	2187.0	O K
720 min Summer	0.728	0.728	12.8	2184.1	O K
960 min Summer	0.715	0.715	12.8	2144.5	O K
1440 min Summer	0.668	0.668	12.8	2004.3	O K
2160 min Summer	0.609	0.609	12.8	1825.7	O K
2880 min Summer	0.564	0.564	12.8	1692.6	O K
4320 min Summer	0.499	0.499	12.8	1497.1	O K
5760 min Summer	0.449	0.449	12.8	1348.0	O K
7200 min Summer	0.410	0.410	12.8	1230.9	O K
8640 min Summer	0.379	0.379	12.8	1138.5	O K
10080 min Summer	0.355	0.355	12.8	1065.7	O K
15 min Winter	0.382	0.382	12.8	1145.4	O K
30 min Winter	0.491	0.491	12.8	1473.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	726.9	23
30 min Summer	98.091	0.0	920.1	38
60 min Summer	59.966	0.0	1324.3	68
120 min Summer	36.932	0.0	1620.0	126
180 min Summer	27.466	0.0	1785.0	186
240 min Summer	22.073	0.0	1883.3	246
360 min Summer	15.975	0.0	1969.7	366
480 min Summer	12.562	0.0	1983.2	484
600 min Summer	10.371	0.0	1965.3	604
720 min Summer	8.843	0.0	1938.0	724
960 min Summer	6.842	0.0	1883.6	962
1440 min Summer	4.743	0.0	1789.3	1346
2160 min Summer	3.288	0.0	2744.7	1620
2880 min Summer	2.547	0.0	2821.5	1988
4320 min Summer	1.811	0.0	2950.9	2772
5760 min Summer	1.443	0.0	3290.8	3576
7200 min Summer	1.224	0.0	3484.3	4328
8640 min Summer	1.080	0.0	3678.9	5104
10080 min Summer	0.980	0.0	3868.3	5856
15 min Winter	152.119	0.0	908.0	23
30 min Winter	98.091	0.0	1064.7	37

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.597	0.597	12.8	1789.6	O K
120 min Winter	0.727	0.727	12.8	2182.4	O K
180 min Winter	0.803	0.803	12.8	2410.1	O K
240 min Winter	0.852	0.852	12.8	2556.0	O K
360 min Winter	0.906	0.906	12.8	2718.6	O K
480 min Winter	0.931	0.931	12.8	2792.5	O K
600 min Winter	0.941	0.941	12.8	2823.3	O K
720 min Winter	0.943	0.943	12.8	2829.8	O K
960 min Winter	0.934	0.934	12.8	2801.3	O K
1440 min Winter	0.894	0.894	12.8	2682.6	O K
2160 min Winter	0.822	0.822	12.8	2467.4	O K
2880 min Winter	0.764	0.764	12.8	2290.5	O K
4320 min Winter	0.665	0.665	12.8	1995.5	O K
5760 min Winter	0.580	0.580	12.8	1740.1	O K
7200 min Winter	0.512	0.512	12.8	1535.9	O K
8640 min Winter	0.457	0.457	12.8	1369.5	O K
10080 min Winter	0.411	0.411	12.8	1234.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	1664.8	66
120 min Winter	36.932	0.0	1966.0	126
180 min Winter	27.466	0.0	2043.2	184
240 min Winter	22.073	0.0	2030.2	242
360 min Winter	15.975	0.0	1998.5	360
480 min Winter	12.562	0.0	1972.3	478
600 min Winter	10.371	0.0	1948.5	594
720 min Winter	8.843	0.0	1925.5	710
960 min Winter	6.842	0.0	1879.9	938
1440 min Winter	4.743	0.0	1788.4	1386
2160 min Winter	3.288	0.0	3421.5	1992
2880 min Winter	2.547	0.0	3472.8	2248
4320 min Winter	1.811	0.0	3411.4	3156
5760 min Winter	1.443	0.0	4171.6	3976
7200 min Winter	1.224	0.0	4418.8	4824
8640 min Winter	1.080	0.0	4670.7	5616
10080 min Winter	0.980	0.0	4919.3	6352

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 3.200

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.600	4	8	1.600

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	3000.0	1.000	3000.0	1.300	3000.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0163-1280-1000-1280
Design Head (m)	1.000
Design Flow (l/s)	12.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	163
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	12.8	Kick-Flo®	0.691	10.8
Flush-Flo™	0.312	12.8	Mean Flow over Head Range	-	10.9

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	14.0	3.000	21.6	7.000	32.4
0.200	12.4	1.400	15.0	3.500	23.2	7.500	33.5
0.300	12.8	1.600	16.0	4.000	24.8	8.000	34.6
0.400	12.7	1.800	16.9	4.500	26.2	8.500	35.6
0.500	12.4	2.000	17.8	5.000	27.6	9.000	36.6
0.600	11.9	2.200	18.6	5.500	28.9	9.500	37.6
0.800	11.5	2.400	19.4	6.000	30.1		
1.000	12.8	2.600	20.2	6.500	31.3		

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 4.520

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	2.260	4	8	2.260

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	4000.0	1.000	4000.0	1.300	4000.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0190-1810-1000-1810
Design Head (m)	1.000
Design Flow (l/s)	18.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	190
Invert Level (m)	0.000
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)	1.000	18.1	Kick-Flo®	0.713	15.4
Flush-Flo™	0.332	18.1	Mean Flow over Head Range	-	15.3

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	6.6	1.200	19.7	3.000	30.6	7.000	46.1
0.200	17.3	1.400	21.2	3.500	33.0	7.500	47.6
0.300	18.0	1.600	22.6	4.000	35.1	8.000	49.2
0.400	18.0	1.800	23.9	4.500	37.2	8.500	50.6
0.500	17.6	2.000	25.2	5.000	39.1	9.000	52.0
0.600	17.1	2.200	26.4	5.500	41.0	9.500	53.4
0.800	16.3	2.400	27.5	6.000	42.8		
1.000	18.1	2.600	28.6	6.500	44.4		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.314	0.314	39.0	2792.0	O K
30 min Summer	0.403	0.403	39.6	3587.7	O K
60 min Summer	0.489	0.489	39.6	4355.3	O K
120 min Summer	0.596	0.596	39.6	5300.5	O K
180 min Summer	0.657	0.657	39.6	5845.9	O K
240 min Summer	0.696	0.696	39.6	6195.1	O K
360 min Summer	0.739	0.739	39.6	6581.5	O K
480 min Summer	0.759	0.759	39.6	6751.3	O K
600 min Summer	0.766	0.766	39.6	6814.7	O K
720 min Summer	0.766	0.766	39.6	6816.0	O K
960 min Summer	0.754	0.754	39.6	6707.4	O K
1440 min Summer	0.711	0.711	39.6	6325.1	O K
2160 min Summer	0.659	0.659	39.6	5867.6	O K
2880 min Summer	0.620	0.620	39.6	5516.4	O K
4320 min Summer	0.561	0.561	39.6	4992.5	O K
5760 min Summer	0.515	0.515	39.6	4583.1	O K
7200 min Summer	0.478	0.478	39.6	4257.1	O K
8640 min Summer	0.449	0.449	39.6	3997.1	O K
10080 min Summer	0.426	0.426	39.6	3792.3	O K
15 min Winter	0.398	0.398	39.6	3541.3	O K
30 min Winter	0.512	0.512	39.6	4555.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	1929.4	27
30 min Summer	98.091	0.0	2526.7	41
60 min Summer	59.966	0.0	3828.8	70
120 min Summer	36.932	0.0	4712.1	130
180 min Summer	27.466	0.0	5210.0	190
240 min Summer	22.073	0.0	5518.9	248
360 min Summer	15.975	0.0	5841.1	368
480 min Summer	12.562	0.0	5965.6	486
600 min Summer	10.371	0.0	5995.5	606
720 min Summer	8.843	0.0	5972.2	724
960 min Summer	6.842	0.0	5840.9	962
1440 min Summer	4.743	0.0	5491.9	1288
2160 min Summer	3.288	0.0	8233.6	1600
2880 min Summer	2.547	0.0	8436.1	1968
4320 min Summer	1.811	0.0	8739.5	2772
5760 min Summer	1.443	0.0	10063.5	3576
7200 min Summer	1.224	0.0	10641.5	4328
8640 min Summer	1.080	0.0	11211.6	5104
10080 min Summer	0.980	0.0	11744.6	5856
15 min Winter	152.119	0.0	2487.5	26
30 min Winter	98.091	0.0	3088.6	41

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.622	0.622	39.6	5538.7	O K
120 min Winter	0.759	0.759	39.6	6757.9	O K
180 min Winter	0.839	0.839	39.6	7469.4	O K
240 min Winter	0.891	0.891	39.6	7927.8	O K
360 min Winter	0.949	0.949	39.6	8442.9	O K
480 min Winter	0.976	0.976	39.6	8682.7	O K
600 min Winter	0.988	0.988	39.6	8789.0	O K
720 min Winter	0.991	0.991	39.6	8819.4	O K
960 min Winter	0.983	0.983	39.6	8750.7	O K
1440 min Winter	0.946	0.946	39.6	8419.0	O K
2160 min Winter	0.877	0.877	39.6	7802.4	O K
2880 min Winter	0.822	0.822	39.6	7319.8	O K
4320 min Winter	0.730	0.730	39.6	6500.5	O K
5760 min Winter	0.651	0.651	39.6	5792.8	O K
7200 min Winter	0.585	0.585	39.6	5209.2	O K
8640 min Winter	0.531	0.531	39.6	4728.0	O K
10080 min Winter	0.487	0.487	39.6	4337.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	4850.1	70
120 min Winter	36.932	0.0	5808.5	128
180 min Winter	27.466	0.0	6207.0	186
240 min Winter	22.073	0.0	6338.0	246
360 min Winter	15.975	0.0	6293.6	362
480 min Winter	12.562	0.0	6210.6	480
600 min Winter	10.371	0.0	6126.6	596
720 min Winter	8.843	0.0	6042.1	712
960 min Winter	6.842	0.0	5871.3	940
1440 min Winter	4.743	0.0	5527.5	1386
2160 min Winter	3.288	0.0	10261.9	1972
2880 min Winter	2.547	0.0	10392.7	2228
4320 min Winter	1.811	0.0	10280.8	3120
5760 min Winter	1.443	0.0	12771.4	3976
7200 min Winter	1.224	0.0	13515.0	4768
8640 min Winter	1.080	0.0	14260.0	5616
10080 min Winter	0.980	0.0	14968.5	6352

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 9.900

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	3.300	4	8	3.300	8	12	3.300

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	8900.0	1.000	8900.0	1.300	8900.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0267-3960-1000-3960
Design Head (m)	1.000
Design Flow (l/s)	39.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	267
Invert Level (m)	0.000
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)	1.000	39.6	Kick-Flo®	0.766	34.8
Flush-Flo™	0.413	39.6	Mean Flow over Head Range	-	32.2

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	8.5	1.200	43.2	3.000	67.3	7.000	101.6
0.200	27.4	1.400	46.5	3.500	72.5	7.500	105.1
0.300	38.8	1.600	49.6	4.000	77.4	8.000	108.5
0.400	39.6	1.800	52.5	4.500	81.9	8.500	111.7
0.500	39.3	2.000	55.3	5.000	86.2	9.000	114.9
0.600	38.4	2.200	57.9	5.500	90.3	9.500	118.0
0.800	35.6	2.400	60.4	6.000	94.3		
1.000	39.6	2.600	62.8	6.500	98.0		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.253	0.253	4.3	303.9	O K
30 min Summer	0.326	0.326	4.3	390.6	O K
60 min Summer	0.395	0.395	4.3	473.9	O K
120 min Summer	0.480	0.480	4.3	575.9	O K
180 min Summer	0.528	0.528	4.3	634.2	O K
240 min Summer	0.559	0.559	4.3	671.1	O K
360 min Summer	0.593	0.593	4.3	711.1	O K
480 min Summer	0.606	0.606	4.3	727.5	O K
600 min Summer	0.610	0.610	4.3	732.2	O K
720 min Summer	0.609	0.609	4.3	730.2	O K
960 min Summer	0.595	0.595	4.3	714.0	O K
1440 min Summer	0.553	0.553	4.3	663.5	O K
2160 min Summer	0.502	0.502	4.3	602.7	O K
2880 min Summer	0.464	0.464	4.3	556.4	O K
4320 min Summer	0.407	0.407	4.3	489.0	O K
5760 min Summer	0.365	0.365	4.3	438.6	O K
7200 min Summer	0.333	0.333	4.3	399.7	O K
8640 min Summer	0.308	0.308	4.3	369.2	O K
10080 min Summer	0.288	0.288	4.3	345.5	O K
15 min Winter	0.321	0.321	4.3	385.8	O K
30 min Winter	0.414	0.414	4.3	496.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	258.2	27
30 min Summer	98.091	0.0	321.3	41
60 min Summer	59.966	0.0	457.9	70
120 min Summer	36.932	0.0	559.5	130
180 min Summer	27.466	0.0	616.1	190
240 min Summer	22.073	0.0	649.3	250
360 min Summer	15.975	0.0	676.1	368
480 min Summer	12.562	0.0	677.6	488
600 min Summer	10.371	0.0	671.3	606
720 min Summer	8.843	0.0	664.4	726
960 min Summer	6.842	0.0	650.5	962
1440 min Summer	4.743	0.0	622.3	1312
2160 min Summer	3.288	0.0	936.9	1604
2880 min Summer	2.547	0.0	964.2	1972
4320 min Summer	1.811	0.0	1011.9	2772
5760 min Summer	1.443	0.0	1114.8	3576
7200 min Summer	1.224	0.0	1180.9	4328
8640 min Summer	1.080	0.0	1248.0	5104
10080 min Summer	0.980	0.0	1314.4	5856
15 min Winter	152.119	0.0	317.6	27
30 min Winter	98.091	0.0	359.0	41

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.503	0.503	4.3	603.1	O K
120 min Winter	0.613	0.613	4.3	735.2	O K
180 min Winter	0.677	0.677	4.3	812.5	O K
240 min Winter	0.718	0.718	4.3	862.0	O K
360 min Winter	0.764	0.764	4.3	917.3	O K
480 min Winter	0.785	0.785	4.3	942.6	O K
600 min Winter	0.794	0.794	4.3	953.2	O K
720 min Winter	0.796	0.796	4.3	955.7	O K
960 min Winter	0.789	0.789	4.3	946.4	O K
1440 min Winter	0.755	0.755	4.3	906.5	O K
2160 min Winter	0.694	0.694	4.3	832.6	O K
2880 min Winter	0.636	0.636	4.3	762.6	O K
4320 min Winter	0.545	0.545	4.3	653.7	O K
5760 min Winter	0.475	0.475	4.3	569.7	O K
7200 min Winter	0.418	0.418	4.3	502.2	O K
8640 min Winter	0.373	0.373	4.3	447.6	O K
10080 min Winter	0.337	0.337	4.3	404.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	574.7	70
120 min Winter	36.932	0.0	675.8	128
180 min Winter	27.466	0.0	687.0	188
240 min Winter	22.073	0.0	678.5	246
360 min Winter	15.975	0.0	663.5	362
480 min Winter	12.562	0.0	652.4	480
600 min Winter	10.371	0.0	643.1	596
720 min Winter	8.843	0.0	634.8	714
960 min Winter	6.842	0.0	619.7	942
1440 min Winter	4.743	0.0	591.3	1392
2160 min Winter	3.288	0.0	1166.7	2032
2880 min Winter	2.547	0.0	1185.9	2308
4320 min Winter	1.811	0.0	1177.7	3120
5760 min Winter	1.443	0.0	1412.8	3976
7200 min Winter	1.224	0.0	1496.9	4768
8640 min Winter	1.080	0.0	1583.2	5616
10080 min Winter	0.980	0.0	1669.7	6360

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.080

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.360	4	8	0.360	8	12	0.360

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1200.0	1.000	1200.0	1.300	1200.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0098-4300-1000-4300
Design Head (m)	1.000
Design Flow (l/s)	4.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	98
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	4.3	Kick-Flo®	0.636	3.5
Flush-Flo™	0.298	4.3	Mean Flow over Head Range	-	3.7

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	3.2	1.200	4.7	3.000	7.2	7.000	10.7
0.200	4.2	1.400	5.0	3.500	7.7	7.500	11.1
0.300	4.3	1.600	5.3	4.000	8.2	8.000	11.4
0.400	4.2	1.800	5.6	4.500	8.7	8.500	11.8
0.500	4.1	2.000	5.9	5.000	9.1	9.000	12.1
0.600	3.7	2.200	6.2	5.500	9.6	9.500	12.4
0.800	3.9	2.400	6.5	6.000	10.0		
1.000	4.3	2.600	6.7	6.500	10.4		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.396	0.396	8.3	751.6	O K
30 min Summer	0.509	0.509	8.3	966.4	O K
60 min Summer	0.618	0.618	8.3	1174.4	O K
120 min Summer	0.753	0.753	8.3	1431.4	O K
180 min Summer	0.831	0.831	8.3	1579.4	O K
240 min Summer	0.881	0.881	8.3	1674.1	O K
360 min Summer	0.936	0.936	8.3	1778.5	O K
480 min Summer	0.960	0.960	8.3	1824.7	O K
600 min Summer	0.970	0.970	8.3	1842.8	O K
720 min Summer	0.971	0.971	8.3	1845.0	O K
960 min Summer	0.959	0.959	8.3	1821.9	O K
1440 min Summer	0.913	0.913	8.3	1735.1	O K
2160 min Summer	0.843	0.843	8.3	1602.1	O K
2880 min Summer	0.791	0.791	8.3	1502.5	O K
4320 min Summer	0.718	0.718	8.3	1363.5	O K
5760 min Summer	0.660	0.660	8.3	1254.5	O K
7200 min Summer	0.611	0.611	8.3	1161.2	O K
8640 min Summer	0.575	0.575	8.3	1091.7	O K
10080 min Summer	0.547	0.547	8.3	1039.1	O K
15 min Winter	0.396	0.396	8.3	751.5	O K
30 min Winter	0.509	0.509	8.3	966.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	619.0	23
30 min Summer	98.091	0.0	701.0	38
60 min Summer	59.966	0.0	1113.6	68
120 min Summer	36.932	0.0	1302.0	128
180 min Summer	27.466	0.0	1327.5	186
240 min Summer	22.073	0.0	1317.8	246
360 min Summer	15.975	0.0	1300.5	366
480 min Summer	12.562	0.0	1286.5	486
600 min Summer	10.371	0.0	1273.4	604
720 min Summer	8.843	0.0	1260.4	724
960 min Summer	6.842	0.0	1233.7	962
1440 min Summer	4.743	0.0	1178.5	1440
2160 min Summer	3.288	0.0	2268.1	1796
2880 min Summer	2.547	0.0	2298.0	2164
4320 min Summer	1.811	0.0	2159.4	2980
5760 min Summer	1.443	0.0	2744.6	3808
7200 min Summer	1.224	0.0	2907.8	4608
8640 min Summer	1.080	0.0	3074.7	5360
10080 min Summer	0.980	0.0	3240.6	6152
15 min Winter	152.119	0.0	619.0	23
30 min Winter	98.091	0.0	701.2	37

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.618	0.618	8.3	1174.1	O K
120 min Winter	0.753	0.753	8.3	1431.3	O K
180 min Winter	0.831	0.831	8.3	1579.6	O K
240 min Winter	0.881	0.881	8.3	1674.5	O K
360 min Winter	0.937	0.937	8.3	1779.6	O K
480 min Winter	0.961	0.961	8.3	1826.6	O K
600 min Winter	0.971	0.971	8.3	1845.5	O K
720 min Winter	0.973	0.973	8.3	1848.4	O K
960 min Winter	0.962	0.962	8.3	1827.1	O K
1440 min Winter	0.918	0.918	8.3	1744.8	O K
2160 min Winter	0.842	0.842	8.3	1598.9	O K
2880 min Winter	0.780	0.780	8.3	1481.7	O K
4320 min Winter	0.682	0.682	8.3	1295.1	O K
5760 min Winter	0.588	0.588	8.3	1117.0	O K
7200 min Winter	0.515	0.515	8.3	978.1	O K
8640 min Winter	0.456	0.456	8.3	866.5	O K
10080 min Winter	0.409	0.409	8.3	776.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	1113.7	66
120 min Winter	36.932	0.0	1302.5	126
180 min Winter	27.466	0.0	1328.4	184
240 min Winter	22.073	0.0	1318.7	242
360 min Winter	15.975	0.0	1301.3	360
480 min Winter	12.562	0.0	1287.3	478
600 min Winter	10.371	0.0	1274.3	594
720 min Winter	8.843	0.0	1261.5	710
960 min Winter	6.842	0.0	1235.2	938
1440 min Winter	4.743	0.0	1182.0	1386
2160 min Winter	3.288	0.0	2269.8	1988
2880 min Winter	2.547	0.0	2304.8	2248
4320 min Winter	1.811	0.0	2213.3	3164
5760 min Winter	1.443	0.0	2745.6	3984
7200 min Winter	1.224	0.0	2909.1	4824
8640 min Winter	1.080	0.0	3076.6	5616
10080 min Winter	0.980	0.0	3244.2	6360

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.000	4	8	1.100

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1900.0	1.000	1900.0	1.300	1900.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0134-8400-1000-8400
Design Head (m)	1.000
Design Flow (l/s)	8.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	134
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	8.4	Kick-Flo®	0.662	6.9
Flush-Flo™	0.301	8.3	Mean Flow over Head Range	-	7.2

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	4.8	1.200	9.1	3.000	14.1	7.000	21.2
0.200	8.1	1.400	9.8	3.500	15.2	7.500	21.9
0.300	8.3	1.600	10.5	4.000	16.2	8.000	22.6
0.400	8.2	1.800	11.1	4.500	17.1	8.500	23.2
0.500	8.0	2.000	11.6	5.000	18.0	9.000	23.9
0.600	7.5	2.200	12.2	5.500	18.8	9.500	24.5
0.800	7.6	2.400	12.7	6.000	19.6		
1.000	8.4	2.600	13.2	6.500	20.4		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.310	0.310	5.3	372.0	O K
30 min Summer	0.398	0.398	5.3	477.9	O K
60 min Summer	0.483	0.483	5.3	579.5	O K
120 min Summer	0.587	0.587	5.3	704.1	O K
180 min Summer	0.647	0.647	5.3	776.1	O K
240 min Summer	0.685	0.685	5.3	821.6	O K
360 min Summer	0.725	0.725	5.3	869.8	O K
480 min Summer	0.741	0.741	5.3	888.9	O K
600 min Summer	0.745	0.745	5.3	894.1	O K
720 min Summer	0.743	0.743	5.3	891.4	O K
960 min Summer	0.727	0.727	5.3	872.6	O K
1440 min Summer	0.680	0.680	5.3	815.5	O K
2160 min Summer	0.610	0.610	5.3	732.5	O K
2880 min Summer	0.558	0.558	5.3	669.5	O K
4320 min Summer	0.485	0.485	5.3	581.7	O K
5760 min Summer	0.431	0.431	5.3	517.3	O K
7200 min Summer	0.390	0.390	5.3	467.4	O K
8640 min Summer	0.357	0.357	5.3	428.3	O K
10080 min Summer	0.331	0.331	5.3	397.6	O K
15 min Winter	0.394	0.394	5.3	472.2	O K
30 min Winter	0.506	0.506	5.3	607.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	325.9	23
30 min Summer	98.091	0.0	404.9	38
60 min Summer	59.966	0.0	566.4	68
120 min Summer	36.932	0.0	691.9	126
180 min Summer	27.466	0.0	760.6	186
240 min Summer	22.073	0.0	798.6	246
360 min Summer	15.975	0.0	822.6	366
480 min Summer	12.562	0.0	816.9	484
600 min Summer	10.371	0.0	807.2	604
720 min Summer	8.843	0.0	797.0	724
960 min Summer	6.842	0.0	776.4	962
1440 min Summer	4.743	0.0	735.1	1396
2160 min Summer	3.288	0.0	1150.1	1664
2880 min Summer	2.547	0.0	1185.0	1992
4320 min Summer	1.811	0.0	1248.2	2772
5760 min Summer	1.443	0.0	1364.6	3576
7200 min Summer	1.224	0.0	1445.7	4328
8640 min Summer	1.080	0.0	1528.4	5104
10080 min Summer	0.980	0.0	1611.0	5848
15 min Winter	152.119	0.0	400.3	23
30 min Winter	98.091	0.0	444.5	37

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.615	0.615	5.3	737.7	O K
120 min Winter	0.749	0.749	5.3	898.9	O K
180 min Winter	0.826	0.826	5.3	991.7	O K
240 min Winter	0.876	0.876	5.3	1051.0	O K
360 min Winter	0.930	0.930	5.3	1116.3	O K
480 min Winter	0.954	0.954	5.3	1145.1	O K
600 min Winter	0.964	0.964	5.3	1156.3	O K
720 min Winter	0.965	0.965	5.3	1157.5	O K
960 min Winter	0.952	0.952	5.3	1142.9	O K
1440 min Winter	0.907	0.907	5.3	1088.9	O K
2160 min Winter	0.829	0.829	5.3	994.5	O K
2880 min Winter	0.765	0.765	5.3	918.5	O K
4320 min Winter	0.665	0.665	5.3	798.2	O K
5760 min Winter	0.569	0.569	5.3	682.6	O K
7200 min Winter	0.494	0.494	5.3	593.1	O K
8640 min Winter	0.435	0.435	5.3	522.1	O K
10080 min Winter	0.388	0.388	5.3	465.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	710.4	66
120 min Winter	36.932	0.0	827.6	126
180 min Winter	27.466	0.0	837.2	184
240 min Winter	22.073	0.0	830.8	242
360 min Winter	15.975	0.0	819.8	360
480 min Winter	12.562	0.0	811.1	478
600 min Winter	10.371	0.0	803.2	594
720 min Winter	8.843	0.0	795.5	710
960 min Winter	6.842	0.0	780.0	938
1440 min Winter	4.743	0.0	748.8	1384
2160 min Winter	3.288	0.0	1439.1	1988
2880 min Winter	2.547	0.0	1464.0	2248
4320 min Winter	1.811	0.0	1407.6	3196
5760 min Winter	1.443	0.0	1729.0	3984
7200 min Winter	1.224	0.0	1832.4	4824
8640 min Winter	1.080	0.0	1938.5	5616
10080 min Winter	0.980	0.0	2045.7	6352

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.320

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.660	4	8	0.660

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1200.0	1.000	1200.0	1.300	1200.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0108-5300-1000-5300
Design Head (m)	1.000
Design Flow (l/s)	5.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	108
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	5.3	Kick-Flo®	0.641	4.3
Flush-Flo™	0.295	5.3	Mean Flow over Head Range	-	4.6

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	3.7	1.200	5.8	3.000	8.9	7.000	13.3
0.200	5.2	1.400	6.2	3.500	9.5	7.500	13.7
0.300	5.3	1.600	6.6	4.000	10.2	8.000	14.1
0.400	5.2	1.800	7.0	4.500	10.7	8.500	14.6
0.500	5.0	2.000	7.3	5.000	11.3	9.000	15.0
0.600	4.6	2.200	7.7	5.500	11.8	9.500	15.4
0.800	4.8	2.400	8.0	6.000	12.3		
1.000	5.3	2.600	8.3	6.500	12.8		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.282	0.282	8.8	620.5	O K
30 min Summer	0.362	0.362	8.8	797.2	O K
60 min Summer	0.440	0.440	8.8	967.1	O K
120 min Summer	0.534	0.534	8.8	1175.2	O K
180 min Summer	0.589	0.589	8.8	1294.9	O K
240 min Summer	0.623	0.623	8.8	1371.1	O K
360 min Summer	0.661	0.661	8.8	1454.5	O K
480 min Summer	0.677	0.677	8.8	1489.7	O K
600 min Summer	0.682	0.682	8.8	1501.1	O K
720 min Summer	0.681	0.681	8.8	1498.8	O K
960 min Summer	0.668	0.668	8.8	1469.8	O K
1440 min Summer	0.622	0.622	8.8	1369.1	O K
2160 min Summer	0.566	0.566	8.8	1245.5	O K
2880 min Summer	0.524	0.524	8.8	1152.7	O K
4320 min Summer	0.462	0.462	8.8	1016.6	O K
5760 min Summer	0.415	0.415	8.8	913.4	O K
7200 min Summer	0.379	0.379	8.8	832.9	O K
8640 min Summer	0.350	0.350	8.8	769.3	O K
10080 min Summer	0.327	0.327	8.8	719.5	O K
15 min Winter	0.358	0.358	8.8	787.4	O K
30 min Winter	0.460	0.460	8.8	1012.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	509.6	23
30 min Summer	98.091	0.0	641.7	38
60 min Summer	59.966	0.0	918.7	68
120 min Summer	36.932	0.0	1123.3	126
180 min Summer	27.466	0.0	1237.4	186
240 min Summer	22.073	0.0	1305.2	246
360 min Summer	15.975	0.0	1362.9	366
480 min Summer	12.562	0.0	1367.9	484
600 min Summer	10.371	0.0	1353.0	604
720 min Summer	8.843	0.0	1335.1	724
960 min Summer	6.842	0.0	1301.1	962
1440 min Summer	4.743	0.0	1242.0	1342
2160 min Summer	3.288	0.0	1894.9	1608
2880 min Summer	2.547	0.0	1948.9	1988
4320 min Summer	1.811	0.0	2041.0	2768
5760 min Summer	1.443	0.0	2265.7	3576
7200 min Summer	1.224	0.0	2399.3	4328
8640 min Summer	1.080	0.0	2534.1	5104
10080 min Summer	0.980	0.0	2666.1	5856
15 min Winter	152.119	0.0	633.5	23
30 min Winter	98.091	0.0	734.2	37

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.559	0.559	8.8	1230.1	O K
120 min Winter	0.682	0.682	8.8	1500.0	O K
180 min Winter	0.753	0.753	8.8	1656.7	O K
240 min Winter	0.799	0.799	8.8	1757.2	O K
360 min Winter	0.850	0.850	8.8	1869.2	O K
480 min Winter	0.873	0.873	8.8	1920.2	O K
600 min Winter	0.883	0.883	8.8	1941.7	O K
720 min Winter	0.885	0.885	8.8	1946.3	O K
960 min Winter	0.876	0.876	8.8	1927.1	O K
1440 min Winter	0.839	0.839	8.8	1845.8	O K
2160 min Winter	0.771	0.771	8.8	1697.2	O K
2880 min Winter	0.713	0.713	8.8	1569.5	O K
4320 min Winter	0.617	0.617	8.8	1356.9	O K
5760 min Winter	0.537	0.537	8.8	1182.4	O K
7200 min Winter	0.474	0.474	8.8	1042.1	O K
8640 min Winter	0.422	0.422	8.8	928.0	O K
10080 min Winter	0.380	0.380	8.8	835.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	1154.2	66
120 min Winter	36.932	0.0	1360.3	126
180 min Winter	27.466	0.0	1401.0	184
240 min Winter	22.073	0.0	1387.1	242
360 min Winter	15.975	0.0	1361.6	360
480 min Winter	12.562	0.0	1341.9	478
600 min Winter	10.371	0.0	1324.6	594
720 min Winter	8.843	0.0	1308.6	710
960 min Winter	6.842	0.0	1277.5	940
1440 min Winter	4.743	0.0	1216.6	1386
2160 min Winter	3.288	0.0	2360.4	2012
2880 min Winter	2.547	0.0	2395.6	2276
4320 min Winter	1.811	0.0	2365.5	3156
5760 min Winter	1.443	0.0	2871.7	3976
7200 min Winter	1.224	0.0	3042.2	4824
8640 min Winter	1.080	0.0	3216.4	5616
10080 min Winter	0.980	0.0	3389.2	6352

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.200

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.100	4	8	1.100

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2200.0	1.000	2200.0	1.300	2200.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0137-8800-1000-8800
Design Head (m)	1.000
Design Flow (l/s)	8.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	137
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	8.8	Kick-Flo®	0.664	7.3
Flush-Flo™	0.299	8.8	Mean Flow over Head Range	-	7.6

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	5.0	1.200	9.6	3.000	14.8	7.000	22.2
0.200	8.5	1.400	10.3	3.500	15.9	7.500	22.9
0.300	8.8	1.600	11.0	4.000	17.0	8.000	23.7
0.400	8.7	1.800	11.6	4.500	18.0	8.500	24.4
0.500	8.4	2.000	12.2	5.000	18.9	9.000	25.0
0.600	7.9	2.200	12.8	5.500	19.8	9.500	25.7
0.800	7.9	2.400	13.3	6.000	20.6		
1.000	8.8	2.600	13.8	6.500	21.4		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.302	0.302	17.2	1208.6	O K
30 min Summer	0.389	0.389	17.2	1554.1	O K
60 min Summer	0.472	0.472	17.2	1887.3	O K
120 min Summer	0.574	0.574	17.2	2296.2	O K
180 min Summer	0.633	0.633	17.2	2531.6	O K
240 min Summer	0.671	0.671	17.2	2682.2	O K
360 min Summer	0.712	0.712	17.2	2847.9	O K
480 min Summer	0.730	0.730	17.2	2918.9	O K
600 min Summer	0.736	0.736	17.2	2943.2	O K
720 min Summer	0.735	0.735	17.2	2940.9	O K
960 min Summer	0.722	0.722	17.2	2889.9	O K
1440 min Summer	0.676	0.676	17.2	2705.8	O K
2160 min Summer	0.619	0.619	17.2	2477.8	O K
2880 min Summer	0.576	0.576	17.2	2305.7	O K
4320 min Summer	0.513	0.513	17.2	2050.9	O K
5760 min Summer	0.464	0.464	17.2	1855.1	O K
7200 min Summer	0.425	0.425	17.2	1700.5	O K
8640 min Summer	0.395	0.395	17.2	1578.0	O K
10080 min Summer	0.370	0.370	17.2	1481.8	O K
15 min Winter	0.384	0.384	17.2	1534.3	O K
30 min Winter	0.494	0.494	17.2	1974.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	944.7	30
30 min Summer	98.091	0.0	1204.4	45
60 min Summer	59.966	0.0	1753.7	74
120 min Summer	36.932	0.0	2147.1	134
180 min Summer	27.466	0.0	2367.2	192
240 min Summer	22.073	0.0	2500.0	252
360 min Summer	15.975	0.0	2623.8	370
480 min Summer	12.562	0.0	2652.7	490
600 min Summer	10.371	0.0	2638.4	608
720 min Summer	8.843	0.0	2603.9	726
960 min Summer	6.842	0.0	2529.8	964
1440 min Summer	4.743	0.0	2398.1	1340
2160 min Summer	3.288	0.0	3663.8	1612
2880 min Summer	2.547	0.0	3763.3	1988
4320 min Summer	1.811	0.0	3926.2	2776
5760 min Summer	1.443	0.0	4411.8	3576
7200 min Summer	1.224	0.0	4670.0	4336
8640 min Summer	1.080	0.0	4928.4	5104
10080 min Summer	0.980	0.0	5177.5	5856
15 min Winter	152.119	0.0	1187.9	30
30 min Winter	98.091	0.0	1413.8	45

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.600	0.600	17.2	2401.4	O K
120 min Winter	0.733	0.733	17.2	2930.6	O K
180 min Winter	0.809	0.809	17.2	3237.6	O K
240 min Winter	0.859	0.859	17.2	3434.8	O K
360 min Winter	0.914	0.914	17.2	3655.3	O K
480 min Winter	0.939	0.939	17.2	3756.4	O K
600 min Winter	0.950	0.950	17.2	3799.4	O K
720 min Winter	0.952	0.952	17.2	3809.7	O K
960 min Winter	0.943	0.943	17.2	3773.9	O K
1440 min Winter	0.905	0.905	17.2	3618.5	O K
2160 min Winter	0.834	0.834	17.2	3334.8	O K
2880 min Winter	0.776	0.776	17.2	3103.5	O K
4320 min Winter	0.679	0.679	17.2	2715.1	O K
5760 min Winter	0.595	0.595	17.2	2381.3	O K
7200 min Winter	0.528	0.528	17.2	2111.5	O K
8640 min Winter	0.473	0.473	17.2	1890.5	O K
10080 min Winter	0.428	0.428	17.2	1710.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	2207.3	74
120 min Winter	36.932	0.0	2615.4	132
180 min Winter	27.466	0.0	2740.9	190
240 min Winter	22.073	0.0	2735.7	248
360 min Winter	15.975	0.0	2693.9	364
480 min Winter	12.562	0.0	2657.8	482
600 min Winter	10.371	0.0	2624.5	598
720 min Winter	8.843	0.0	2592.1	714
960 min Winter	6.842	0.0	2527.6	942
1440 min Winter	4.743	0.0	2398.4	1388
2160 min Winter	3.288	0.0	4565.0	1992
2880 min Winter	2.547	0.0	4630.3	2252
4320 min Winter	1.811	0.0	4558.0	3156
5760 min Winter	1.443	0.0	5593.7	3984
7200 min Winter	1.224	0.0	5924.0	4824
8640 min Winter	1.080	0.0	6259.4	5616
10080 min Winter	0.980	0.0	6587.5	6360

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 4.300

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	1.100	4	8	1.100	8	12	1.100	12	16	1.000

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	4000.0	1.000	4000.0	1.300	4000.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0186-1720-1000-1720
Design Head (m)	1.000
Design Flow (l/s)	17.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	186
Invert Level (m)	0.000
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)	1.000	17.2	Kick-Flo®	0.709	14.6
Flush-Flo™	0.328	17.2	Mean Flow over Head Range	-	14.5

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	6.5	1.200	18.8	3.000	29.1	7.000	43.8
0.200	16.5	1.400	20.2	3.500	31.3	7.500	45.2
0.300	17.2	1.600	21.5	4.000	33.4	8.000	46.7
0.400	17.1	1.800	22.8	4.500	35.3	8.500	48.1
0.500	16.7	2.000	23.9	5.000	37.2	9.000	49.4
0.600	16.2	2.200	25.0	5.500	38.9	9.500	50.7
0.800	15.5	2.400	26.1	6.000	40.6		
1.000	17.2	2.600	27.1	6.500	42.2		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.297	0.297	14.8	1039.0	O K
30 min Summer	0.382	0.382	14.8	1335.6	O K
60 min Summer	0.463	0.463	14.8	1621.0	O K
120 min Summer	0.563	0.563	14.8	1971.5	O K
180 min Summer	0.621	0.621	14.8	2172.9	O K
240 min Summer	0.658	0.658	14.8	2301.5	O K
360 min Summer	0.698	0.698	14.8	2442.9	O K
480 min Summer	0.715	0.715	14.8	2503.2	O K
600 min Summer	0.721	0.721	14.8	2523.4	O K
720 min Summer	0.720	0.720	14.8	2520.8	O K
960 min Summer	0.707	0.707	14.8	2475.2	O K
1440 min Summer	0.661	0.661	14.8	2313.6	O K
2160 min Summer	0.605	0.605	14.8	2115.8	O K
2880 min Summer	0.562	0.562	14.8	1966.2	O K
4320 min Summer	0.499	0.499	14.8	1744.8	O K
5760 min Summer	0.450	0.450	14.8	1574.9	O K
7200 min Summer	0.412	0.412	14.8	1441.3	O K
8640 min Summer	0.382	0.382	14.8	1335.4	O K
10080 min Summer	0.358	0.358	14.8	1252.2	O K
15 min Winter	0.377	0.377	14.8	1318.7	O K
30 min Winter	0.485	0.485	14.8	1696.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	821.6	27
30 min Summer	98.091	0.0	1044.9	41
60 min Summer	59.966	0.0	1513.8	70
120 min Summer	36.932	0.0	1853.1	130
180 min Summer	27.466	0.0	2043.1	190
240 min Summer	22.073	0.0	2157.9	250
360 min Summer	15.975	0.0	2264.4	368
480 min Summer	12.562	0.0	2287.7	488
600 min Summer	10.371	0.0	2274.0	606
720 min Summer	8.843	0.0	2244.0	726
960 min Summer	6.842	0.0	2181.9	964
1440 min Summer	4.743	0.0	2072.1	1322
2160 min Summer	3.288	0.0	3152.8	1608
2880 min Summer	2.547	0.0	3239.6	1988
4320 min Summer	1.811	0.0	3383.9	2772
5760 min Summer	1.443	0.0	3789.5	3576
7200 min Summer	1.224	0.0	4011.6	4328
8640 min Summer	1.080	0.0	4234.4	5104
10080 min Summer	0.980	0.0	4449.9	5856
15 min Winter	152.119	0.0	1030.7	26
30 min Winter	98.091	0.0	1221.7	41

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.589	0.589	14.8	2062.3	O K
120 min Winter	0.719	0.719	14.8	2515.7	O K
180 min Winter	0.794	0.794	14.8	2778.8	O K
240 min Winter	0.842	0.842	14.8	2947.9	O K
360 min Winter	0.896	0.896	14.8	3136.6	O K
480 min Winter	0.921	0.921	14.8	3222.8	O K
600 min Winter	0.931	0.931	14.8	3259.4	O K
720 min Winter	0.934	0.934	14.8	3267.7	O K
960 min Winter	0.925	0.925	14.8	3236.4	O K
1440 min Winter	0.886	0.886	14.8	3101.9	O K
2160 min Winter	0.816	0.816	14.8	2856.4	O K
2880 min Winter	0.758	0.758	14.8	2653.6	O K
4320 min Winter	0.661	0.661	14.8	2312.0	O K
5760 min Winter	0.578	0.578	14.8	2023.9	O K
7200 min Winter	0.512	0.512	14.8	1790.9	O K
8640 min Winter	0.457	0.457	14.8	1600.2	O K
10080 min Winter	0.413	0.413	14.8	1445.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	1904.8	70
120 min Winter	36.932	0.0	2256.5	128
180 min Winter	27.466	0.0	2359.4	188
240 min Winter	22.073	0.0	2350.3	246
360 min Winter	15.975	0.0	2312.2	362
480 min Winter	12.562	0.0	2280.2	480
600 min Winter	10.371	0.0	2251.1	596
720 min Winter	8.843	0.0	2223.2	712
960 min Winter	6.842	0.0	2168.3	942
1440 min Winter	4.743	0.0	2058.8	1388
2160 min Winter	3.288	0.0	3929.0	1996
2880 min Winter	2.547	0.0	3987.5	2252
4320 min Winter	1.811	0.0	3940.0	3156
5760 min Winter	1.443	0.0	4804.4	3984
7200 min Winter	1.224	0.0	5088.5	4824
8640 min Winter	1.080	0.0	5377.3	5616
10080 min Winter	0.980	0.0	5660.8	6360

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 3.690

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.230	4	8	1.230	8	12	1.230

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	3500.0	1.000	3500.0	1.300	3500.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0174-1480-1000-1480
Design Head (m)	1.000
Design Flow (l/s)	14.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	174
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	14.8	Kick-Flo®	0.699	12.5
Flush-Flo™	0.319	14.8	Mean Flow over Head Range	-	12.6

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	6.2	1.200	16.1	3.000	25.0	7.000	37.6
0.200	14.3	1.400	17.3	3.500	26.9	7.500	38.8
0.300	14.8	1.600	18.5	4.000	28.7	8.000	40.1
0.400	14.7	1.800	19.6	4.500	30.3	8.500	41.3
0.500	14.4	2.000	20.6	5.000	31.9	9.000	42.4
0.600	13.8	2.200	21.5	5.500	33.4	9.500	43.5
0.800	13.3	2.400	22.4	6.000	34.9		
1.000	14.8	2.600	23.3	6.500	36.2		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.310	0.310	108.0	15788.3	O K
30 min Summer	0.398	0.398	161.2	20281.4	O K
60 min Summer	0.483	0.483	209.9	24612.3	O K
120 min Summer	0.587	0.587	220.0	29949.9	O K
180 min Summer	0.648	0.648	221.9	33056.0	O K
240 min Summer	0.688	0.688	222.4	35062.9	O K
360 min Summer	0.732	0.732	222.5	37307.3	O K
480 min Summer	0.752	0.752	222.5	38338.1	O K
600 min Summer	0.760	0.760	222.5	38769.6	O K
720 min Summer	0.762	0.762	222.5	38860.4	O K
960 min Summer	0.754	0.754	222.5	38438.0	O K
1440 min Summer	0.724	0.724	222.5	36926.0	O K
2160 min Summer	0.692	0.692	222.4	35288.8	O K
2880 min Summer	0.668	0.668	222.2	34082.5	O K
4320 min Summer	0.635	0.635	221.6	32409.6	O K
5760 min Summer	0.610	0.610	220.9	31129.5	O K
7200 min Summer	0.591	0.591	220.2	30120.0	O K
8640 min Summer	0.575	0.575	219.5	29318.5	O K
10080 min Summer	0.563	0.563	218.9	28701.4	O K
15 min Winter	0.392	0.392	157.5	19982.1	O K
30 min Winter	0.503	0.503	215.0	25672.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.119	0.0	6097.9	27
30 min Summer	98.091	0.0	8820.4	41
60 min Summer	59.966	0.0	16336.5	70
120 min Summer	36.932	0.0	20968.3	130
180 min Summer	27.466	0.0	23640.3	188
240 min Summer	22.073	0.0	25369.3	248
360 min Summer	15.975	0.0	27367.0	366
480 min Summer	12.562	0.0	28388.8	486
600 min Summer	10.371	0.0	28938.8	604
720 min Summer	8.843	0.0	29218.6	724
960 min Summer	6.842	0.0	29290.2	962
1440 min Summer	4.743	0.0	28458.9	1230
2160 min Summer	3.288	0.0	41019.0	1564
2880 min Summer	2.547	0.0	41662.2	1964
4320 min Summer	1.811	0.0	42189.9	2768
5760 min Summer	1.443	0.0	53361.8	3576
7200 min Summer	1.224	0.0	56124.7	4328
8640 min Summer	1.080	0.0	58682.7	5104
10080 min Summer	0.980	0.0	60810.2	5856
15 min Winter	152.119	0.0	8628.0	27
30 min Winter	98.091	0.0	12203.2	41

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.612	0.612	221.0	31215.3	O K
120 min Winter	0.747	0.747	222.5	38095.6	O K
180 min Winter	0.826	0.826	222.5	42135.3	O K
240 min Winter	0.878	0.878	222.5	44775.9	O K
360 min Winter	0.938	0.938	222.5	47827.9	O K
480 min Winter	0.967	0.967	222.5	49325.3	O K
600 min Winter	0.982	0.982	222.5	50063.3	O K
720 min Winter	0.988	0.988	222.5	50369.4	O K
960 min Winter	0.985	0.985	222.5	50239.8	O K
1440 min Winter	0.958	0.958	222.5	48838.3	O K
2160 min Winter	0.900	0.900	222.5	45890.0	O K
2880 min Winter	0.860	0.860	222.5	43842.3	O K
4320 min Winter	0.798	0.798	222.5	40675.0	O K
5760 min Winter	0.746	0.746	222.5	38058.0	O K
7200 min Winter	0.703	0.703	222.5	35877.3	O K
8640 min Winter	0.668	0.668	222.2	34060.9	O K
10080 min Winter	0.639	0.639	221.7	32577.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.966	0.0	21741.4	70
120 min Winter	36.932	0.0	27162.3	128
180 min Winter	27.466	0.0	30076.6	186
240 min Winter	22.073	0.0	31799.2	244
360 min Winter	15.975	0.0	33464.5	362
480 min Winter	12.562	0.0	34031.2	478
600 min Winter	10.371	0.0	34101.6	596
720 min Winter	8.843	0.0	33891.8	710
960 min Winter	6.842	0.0	32995.8	940
1440 min Winter	4.743	0.0	30646.8	1384
2160 min Winter	3.288	0.0	51855.0	1800
2880 min Winter	2.547	0.0	52387.7	2196
4320 min Winter	1.811	0.0	52008.7	3076
5760 min Winter	1.443	0.0	68261.3	3928
7200 min Winter	1.224	0.0	71900.8	4760
8640 min Winter	1.080	0.0	75304.3	5544
10080 min Winter	0.980	0.0	78186.1	6352

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 489026 242081 SP 89026 42081
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 55.620

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	20.000	4	8	20.000	8	12	15.620

Model Details

Storage is Online Cover Level (m) 1.300

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	51000.0	1.000	51000.0	1.300	51000.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0553-2225-1000-2225
Design Head (m)	1.000
Design Flow (l/s)	222.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	553
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	Site Specific Design (Contact Hydro International)
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	222.4	Kick-Flo®	0.933	214.9
Flush-Flo™	0.707	222.5	Mean Flow over Head Range	-	153.4

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	13.3	1.200	243.1	3.000	381.0	7.000	578.2
0.200	49.6	1.400	262.2	3.500	411.0	7.500	598.2
0.300	102.3	1.600	279.9	4.000	438.9	8.000	617.6
0.400	162.5	1.800	296.5	4.500	465.1	8.500	636.3
0.500	214.8	2.000	312.2	5.000	489.8	9.000	654.5
0.600	220.5	2.200	327.2	5.500	513.4	9.500	672.3
0.800	221.2	2.400	341.4	6.000	535.9		
1.000	222.4	2.600	355.1	6.500	557.5		

Appendix G

PARCEL PRO-FORMA

St James

MILTON KEYNES EAST DEVELOPMENT

[Plot Ref.] Drainage and Flood Risk Statement

[OUR REF.]
JUNE 2021

CONFIDENTIAL

St James

MILTON KEYNES EAST DEVELOPMENT

[Plot Ref.] Drainage and Flood Risk Statement

TYPE OF DOCUMENT (VERSION) CONFIDENTIAL

PROJECT NO. [PROJECT NUMBER]

OUR REF. NO. [OUR REF.]

DATE: JUNE 2021

WSP

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QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	Table text	Table text	Table text	Table text
Date	Table text	Table text	Table text	
Prepared by	Table text	Table text	Table text	
Signature				
Checked by	Table text	Table text	Table text	Table text
Signature				
Authorised by	Table text	Table text	Table text	Table text
Signature				
Project number	Table text	Table text	Table text	Table text
Report number	Table text			
File reference	Table text	Table text	Table text	Table text

CONTENTS

TABLES

FIGURES

No table of figures entries found.

APPENDICES

No table of contents entries found.

1 INTRODUCTION

[Consultant Name] have been appointed by [Client Name] to undertake the drainage design to accompany the reserved matters application for the construction of [insert detailed description of development proposals] within Plot [##] of the wider Milton Keynes East (MKE) development masterplan.

As part of the outline planning application (ref: [insert ref]) for the site, the foul and surface water drainage strategies were agreed. This statement has been prepared in accordance with the requirements of outline conditions [list all drainage and flood risk relevant conditions] to demonstrate that the design indicated on drawing [insert drawing references] complies with the requirements of the approved documents.

1.1 BACKGROUND INFORMATION

The development parcel is located [full description of location of site within wider masterplan and drainage catchments] of the MKE masterplan. The plot comprises an area of approximately [###]ha (National Grid Reference (NGR): [insert grid ref]).

The site boundaries are formed [insert full description of site boundary for the RMA development].

The site typically falls in a [insert north/south/east/west] direction at levels of between ###.##m and ###.##mAOD.

2 FLOOD RISK ASSESSMENT

A Flood Risk Assessment (FRA) was carried out by WSP for the overall site (ref: ###### Revision ##, dated ######) and approved as part of the outline planning application for the site.

The nearest source of fluvial flooding is identified as [insert source name], which is located approximately ##km to the [insert north/south/east/west] of the development parcel. The peak flood level advised by the Environment Agency for storms up to the 1 in 1000 year, plus allowance for climate change is ###mAOD. This is significantly [higher/lower] than the site levels and therefore [does/does not] pose a risk to the development parcel.

There were no other sources of flooding from groundwater or artificial sources identified in the previous FRAs for the development site.

A drainage strategy for the surface water was developed to accompany the FRA based on modelling of the drainage networks across the entire development. The construction of the drainage in accordance with this strategy will minimise the risks associated with this potential mechanism of flooding.

3 PROPOSED SURFACE WATER DRAINAGE STRATEGY

The overall strategy agreed for the site drainage is based on providing a piped drainage network within the site to accommodate run-off, with above ground storage provided in large attenuation features at the end of the network prior to an outfall with a hydraulic control limiting the discharge rates to greenfield run-off rates.

The Drainage Strategy prepared as part of the FRA determined maximum permitted impermeable areas and associated flow rates during the 1 in 2 year return period from each of the development parcels within the masterplan. This approach would ensure that the drainage system would not be surcharged during this storm event.

The strategy identifies [insert number of outfalls] surface water outfalls from this part of Parcel [insert parcel refence] to the sewer system within the plot boundary. These are summarised in Table 1 below.

Table 1. Permitted Surface Water Drainage Outfalls

Manhole Reference	Cover Level (m)	Invert Level (m)	Permitted Impermeable Area (m2)	Permitted Discharge Rate, 1:2 yr (l/s)

An assessment of the development proposals for Parcel [insert parcel refence] has been undertaken to prepare an indicative drainage layout for the building to comply with the design parameters defined above.

[Describe proposed surface water drainage system in a short paragraph]

The proposed impermeable areas and anticipated flow rates are indicated in Table 2.

Table 2. Proposed Drainage Connection

Manhole Reference	Impermeable Area (m2)	Discharge Rate, 1:2 yr (l/s)

The anticipated flow rates during the 1 in 2 year return period storm event are [equal/lower] than the permitted maximum rates, therefore the development drainage is deemed to be acceptable as part of the wider scheme.

4 PROPOSED FOUL WATER DRAINAGE STRATEGY

As part of condition [insert condition ref.] associated with the Outline Planning Approval, the foul drainage should be developed in accordance with the phasing plan for the foul water infrastructure.

The drainage in the vicinity of the development parcel has been constructed, with the provision of [insert number] drainage spurs and manholes to service the site. The details of these manholes are identified in Table 3 below.

Table 3. Existing Foul Water Outfall

Manhole Reference	Cover Level (m)	Invert Level (m)

[Insert description of foul water connection, e.g., *The drainage proposals for the site indicate connection to potentially only one of these existing manholes (F44) for disposal of foul water. This is due to the updated masterplan design meaning the remaining manholes are in unfavourable locations and thus may need to be abandoned. This would mean the gym, food store and all 10 retail units discharge into manhole F44, a breakdown of which is provided in Table 4*].

Table 4. Foul Water Discharge Rate Estimate

Land Use	Occupancy Rates	Development Quantum (m2)	Discharge rate (l/person/day), DWF	Hours of operation	Discharge (l/day), DWF*	Peak Discharge Rate (l/s)**
Gym	65m2/staff	604	50	15	1,500	0.085
	900 users/day	60[4]	50	15	45,000	2.500
Food store	17.5m2/staff	418	50	15	3,600	0.208
Retail Units	17.5[m]2/staff	693	50	10	4,000	0.222
Total					54,100	[3].015

*Assumes staff work 5 hour shifts; **3 x DWF for employment

Based on the above criteria the total proposed dry weather flow (DWF) has been calculated as being #### l/day (###m3/day).

To estimate dry weather peak flow which takes into account diurnal peaks and seasonal fluctuations in water consumption a multiple is applied to the DWF. This has been allowed at a factor of 3 for non-residential occupancy. The proposed peak flow is therefore estimated as being #### l/s.

5 CONCLUSIONS

The following conclusions can be drawn from this Statement:

- The development site is at a low risk of flooding from tidal or fluvial sources;
- The surface water drainage proposals for the scheme are based on and in compliance with the approved FRA and drainage strategy, with discharge rates lower than the maximum permitted discharge rates;
- Foul water drainage from the proposed development will discharge to the existing drainage network.

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