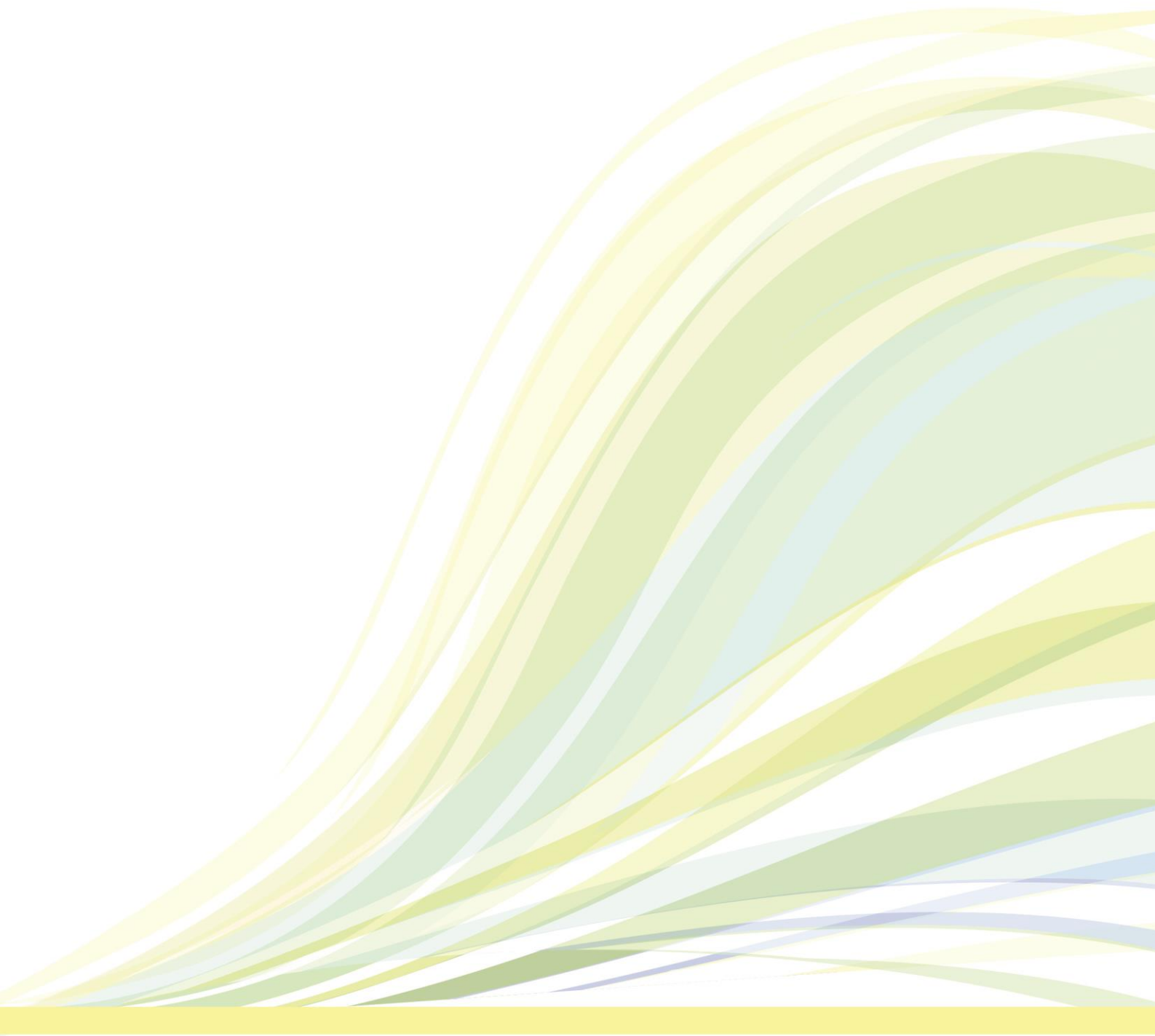




South West Milton Keynes

Updated Flood Risk Assessment - (ES Appendix 8.1)

Author: WSP

MAY 2020



South West Milton Keynes

FLOOD RISK ASSESSMENT AND SURFACE WATER DRAINAGE STRATEGY





South West Milton Keynes

FLOOD RISK ASSESSMENT AND SURFACE WATER DRAINAGE STRATEGY

REPORT (RV8):ISSUE

PROJECT NO. 70069442

OUR REF. NO. FRA 001

DATE: MAY 2020

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CONTENTS

EXECUTIVE SUMMARY	9
--------------------------	----------

1. INTRODUCTION	10
2. SITE SETTING	12
3. POLICY CONTEXT	16
4. ASSESSMENT OF FLOOD RISK	20
5. SURFACE WATER DRAINAGE	28
6. FOUL WATER DRAINAGE	38
7. OPERATION AND MAINTENANCE	39
8. CONCLUSIONS	42

TABLES

Table 1 – Summary of FRA	9
Table 2 – Stakeholder Consultation Summary	11
Table 3 - BGS Borehole Summary	14
Table 4 - Flood Risk Overview	20
Table 5 - SuDS Drainage Hierarchy	29
Table 6 - Summary of SuDS Selection	30
Table 7 - Greenfield Run-Off Rates	31
Table 8 - Site Run-Off Assessment	32
Table 9 - Site Attenuation Requirements	33
Table 10 - Development Creep Assessment	35
Table 11 - Flow Control (e.g Vortex Flow Control) Indicative Maintenance Schedule	39
Table 12 - Swale Indicative Maintenance Schedule	40
Table 13 - Attenuation Basin Indicative Maintenance Schedule	40

FIGURES

Figure 1 – Site Location	12
Figure 2 - Existing Drainage Features Plan Extract	13
Figure 3 – BGS Map Extract	14
Figure 4 - Environment Agency Flood Map for Planning	21
Figure 5 – Flood Risk from Surface Water Map	23
Figure 6 – Baseline Drainage Features	28
Figure 7 – Anglian Water Foul Water Connection Location	38

APPENDICES

APPENDIX A

APPENDIX B

APPENDIX B.1

APPENDIX B.2

APPENDIX B.3

APPENDIX B.4

APPENDIX C

EXECUTIVE SUMMARY

This Flood Risk Assessment (FRA) has been prepared to support the outline planning application for the proposed development at South West Milton Keynes, largely in accordance with the guidelines set out in the National Planning Policy Framework (NPPF) and other relevant local and national guidance.

Table 1 – Summary of FRA

Item	Overview
Site Location	The site is located south-west of Milton Keynes, bound by the A421 to the north and the discussed former Oxford to Bletchley railway line to the south. The site has an approximate postcode of MK17 0EG and site co-ordinates of 483547, 232482.
Development Proposals	It is proposed to develop the site as a mixed-use residential and commercial development over an approximate site area of 144.48ha.
Environment Agency Flood Zone(s)	The majority of the site lies within Flood Zone 1, with a small area (approximately 9,000m ²) of the north-east of the site located within Flood Zone 2 and 3 associated with an unnamed ordinary watercourse.
Vulnerability Classification(s)	Residential Development - 'More Vulnerable' Commercial Development - 'Less Vulnerable'
Fluvial Flood Risk	There is a localised area, to the north west of the proposed development site, which is identified to be located within Flood Zone 3 (i.e. the 1 in 100 year event) and Flood Zone 2 (i.e. and 1 in 1,000 year fluvial flood extent event), associated with the ordinary watercourse.
Tidal Flood Risk	Very Low Risk
Surface Water Flood Risk	Low Risk
Groundwater Flood Risk	Low Risk
Sewer Flood Risk	Low Risk
Artificial Flood Risk	Low Risk
Surface Water Drainage	Surface water will be managed through integration of sustainable drainage systems (SuDS) which will attenuate runoff and discharge to existing unnamed watercourses and drainage ditches within the site boundary at existing QBar greenfield discharge rates.

1. INTRODUCTION

1.1. BACKGROUND

- 1.1.1. WSP has been appointed by the South West Milton Keynes (SWMK) Consortium to prepare a Flood Risk Assessment (FRA) and Drainage Strategy (DS) to support an outline planning application at South West Milton Keynes, (an approximate Post Code: MK17 0EG).
- 1.1.2. The objective of the study is to demonstrate that the site may be developed safely, without exposing the development to an unacceptable degree of flood risk or increasing the flood risk to third parties. The objectives are to:
- Identify potential sources of flooding which may affect the site,
 - Undertake an appraisal of the flood risk posed to the site and potential impact of the development on flood risk elsewhere; and,
 - Provide an indicative surface water drainage strategy for the proposed development.
- 1.1.3. The proposed allocation of the site is referred to as 'NLV001' in the emerging Vale of Aylesbury Local Plan and is currently subject to a number of undetermined planning applications presently residing with Aylesbury Vale District Council (AVDC) and Milton Keynes Council (MKC) (Planning Reference No 15/00314/AO & 15/00619/OUT respectively. The AVDC application has a resolution to grant, awaiting agreement of the Section 106.

1.2. CONSTRUCTION (DESIGN AND MANAGEMENT) REGULATIONS 2015

- 1.2.1. The revised Construction (Design and Management) Regulations 2015 (CDM Regulations) came into force on April 2015 to update certain duties on all parties involved in a construction project, including those promoting the development. One of the designer's responsibilities under clause 9 (1) is to ensure that the client organisation, in this instance the SWMK Consortium, is made aware of their duties under the CDM Regulations.

1.3. SCOPE OF ASSESSMENT

- 1.3.1. The assessment has been undertaken largely in accordance with the overarching national requirements for FRAs for proposed developments including, but not limited to, the following:
- National Planning Policy Framework (NPPF)
 - Development and Flood Risk (CIRIA C624)
 - The SuDS Manual (CIRIA C753)
 - Flood Risk Assessments: Climate Change Allowances 2017
 - DEFRA R&D Technical Report W5-074/A/TR/1 Revision D
 - Rainfall Runoff Management for Developments Report – SC030219

1.4. CONSULTATION

1.4.1. Ahead of the production of this report, initial pre-application consultation requests were issued to relevant stakeholders with the following responses received.

Table 2 – Stakeholder Consultation Summary

Stakeholder	Comments
Milton Keynes Council	Initial contact has been made requesting written pre-application advice.
Aylesbury Vale District Council	Initial contact has been made regarding flood records and additional information
Buckinghamshire County Council (Lead Local Flood Authority)	Advice has been provided by the LLFA which includes: - Confirmation an FRA is required, 10% development creep should be applied to the surface water drainage calculations, - FEH rainfall data should be utilised, - Rainwater harvesting should be considered for the proposed development, - Indicative maintenance schedules should be provided, and Further information about surface water flood risk from ordinary watercourses within the development should be assessed.
Environment Agency	Confirmed Product 4 data was not available for this site and the Flood Zones associated with the Loughton Brook are based on a 1D model in this location.
Anglian Water	Anglian Water have stated that they have the available capacity in their network for both a clean water connection and foul water connection. Details of connection locations to the Anglian Water network were also provided.

1.5. PREVIOUS DOCUMENTATION

1.5.1. All of the relevant previous documentation relevant to the flood risk and drainage within SWMK can be seen listed chronologically below:

- 2015 Flood Risk Assessment (ref. R53295Y001D) by Pell Frischmann
- 2015 Environmental Statement Drainage Chapter (ref. Chapter 8 – ES – Drainage) by Pell Frischmann
- 2019 Environmental Statement Drainage Chapter (ref. Chapter 8 – ES – Drainage) by WSP
- 2020 Environmental Statement Drainage Chapter (ref. Chapter 08 – ES – Drainage) by WSP**

2. SITE SETTING

2.1. LOCATION

- 2.1.1. The site is located south-west of Milton Keynes and is bound to the north by the A421 (Standing Way) and to the south by the disused former Oxford to Bletchley railway line. The west of the site is bound by Whaddon Road, beyond which lies agricultural land, and to the east the site is bound by the urban edge of Milton Keynes at Far Bletchley.
- 2.1.2. The site location is shown in Figure 1 and is also included in Appendix A.

Figure 1 – Site Location



2.2. DEVELOPMENT PROPOSALS

- 2.2.1. The description of the development for the purpose of the planning applications is as follows:

“Outline planning application with all matters reserved except for access for a mixed-use sustainable urban extension on land to the south west of Milton Keynes to provide up to 1,855 mixed tenure dwellings, including 60 extra care units (C3); an employment area (B1) including provision for a 6GP surgery (D1); a neighbourhood centre including retail (A1/A2/A3/A4/A5), community (D1/D2) and residential (C3) uses; a primary school; a grid road reserve; multi-functional green space; a sustainable drainage system; and associated access, drainage and public transport infrastructure”.

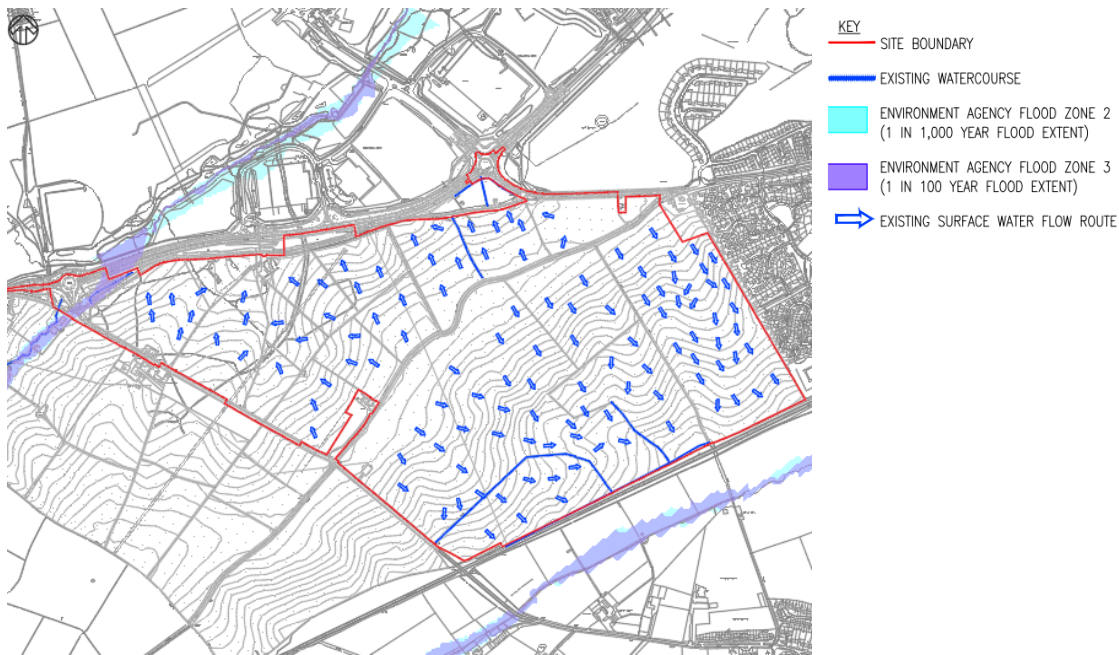
2.3. TOPOGRAPHY

- 2.3.1. There is a ridge which runs east-west through the centre of the proposed development site which has a maximum and uniform height of approximately 120mAOD. The southern area of the site falls towards the railway line which forms the southern boundary, reaching a low point of approximately 98mAOD. North of the ridgeline, the site falls towards the A421 and former Buckingham Road which forms the northern site boundary and has a low point of approximately 102mAOD.

2.4. EXISTING DRAINAGE NETWORK

- 2.4.1. The northern area of the site currently drains toward the A421, where there are a number of existing unnamed ordinary watercourses as identified in Figure 2.
- 2.4.2. The southern area of the site currently drains towards the railway line, forming the southern boundary of the site. There are a number of unnamed ordinary watercourses that run from the centre of the site towards the south, which drain into a ditch that runs adjacent to the disused railway line before entering a culvert underneath the railway embankment.

Figure 2 - Existing Drainage Features Plan Extract

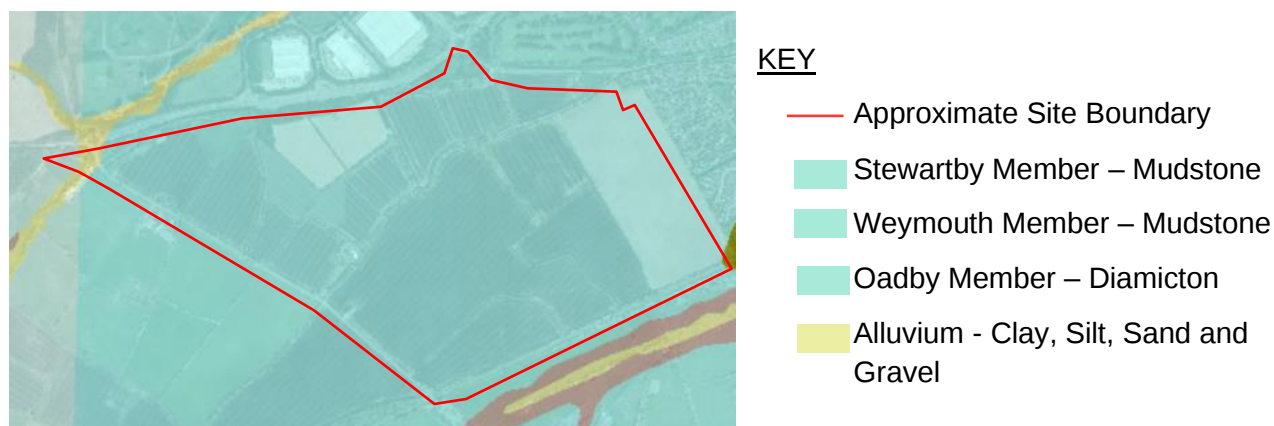


2.5. GEOLOGICAL AND HYDROGEOLOGICAL CONTEXT

Geology

- 2.5.1. Reference to the British Geological Survey (BGS) published mapping identifies the majority of the proposed development site to be underlain by bedrock of Stewartby Member – Mudstone, a small area of the south-western corner of the proposed development to be underlain by a bedrock of Weymouth Member – Mudstone. The majority of the proposed development site has overlying superficial deposits of Oadby Member – Diamicton, a small area of the north-west of the proposed development site has overlying superficial deposits of Alluvium - Clay, Silt, Sand and Gravel associated with the watercourse within this location. An extract of the BGS map is shown in Figure 3.

Figure 3 – BGS Map Extract



- 2.5.2. There is one publicly available borehole scan available within the site boundary of 3.7m in depth. The scan identifies the ground profile to be predominantly clay.

Table 3 - BGS Borehole Summary

Description	Approximate Depth [mBGL]
Topsoil	0 – 0.6m
Clay	0.6 – 1.4m
Sand	1.4 – 1.7m
Gravel	1.7m – 1.85m
Clay	1.85 – 3.7

- 2.5.3. In addition to this, a site investigation was undertaken by Geo Environmental Group GEG detailed within the Phase I Review & Strategic Phase II Geo-Environmental Assessment dated December 2017 which identified a silt / clay topsoil with Oadby Member Diamicton underlying this described as brown slightly gravelly clay.
- 2.5.4. With regards to infiltration potential, the report states *“It was not possible to calculate soil infiltration rates in the natural strata due to the absence of significant infiltration, which was consistent with the predominantly cohesive strata encountered.”*

Hydrogeology

- 2.5.5. According to the publicly available Source Protection Zone map, the site does not lie within any Source Protection Zone.
- 2.5.6. The online BGS Aquifer Map (Bedrock Designation) indicates that the site is not underlain by a bedrock aquifer and is therefore Unproductive Strata, that is *“geological strata with low permeability that have negligible significance for water supply or river base flow”*.
- 2.5.7. The online BGS Aquifer Map (Superficial Deposits Designation) indicates that the site is underlined by a ‘Secondary Undifferentiated’ aquifer. That is: *“has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in*



question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.”

3. POLICY CONTEXT

- 3.1.1. While the proposed development is subject to National Policy and Guidance, the proposed development lies across two Local Authority and Lead Local Flood Authority boundaries. The following section provides a summary of the relevant national and local policy.

3.2. ADOPTED AYLESBURY VALE DISTRICT LOCAL PLAN (2004)

- 3.2.1. The current Aylesbury Vale District Local Plan was adopted in 2004 and various policies within the adopted Local Plan were saved by ministerial direction in 2007.
- 3.2.2. The adopted Local Plan makes no reference to this proposed development within the 'Proposals Map'
- 3.2.3. Further, Policy GP67 "*Development and the risk of flooding*" was not saved and as such may be considered superseded by the NPPF, associated guidance and the emerging draft Vale of Aylesbury Local Plan.

3.3. PLAN:MK: 2016-2031

- 3.3.1. The new Local Plan for Milton Keynes, Plan:MK was adopted by Milton Keynes Council in March 2019. This document provides policy for 'Managing Flood Risk' (FR1), 'Sustainable Drainage Systems (SuDS)' and Integrated Flood Risk Management' (FR2) and 'Protecting and Enhancing Watercourses' (FR3).
- 3.3.2. Under Policy FR1 the "*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 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*".
- 3.3.3. Under Policy FR2 the "*Plan:MK advocates the continuation of a strategic, integrated approach to managing flood risk which seeks the management of surface water to be planned at the largest appropriate scale for the new development and incorporated into the site at the earliest opportunity in the design process. New development is required to incorporate SuDS; in line with national policy and guidance and, which meet the requirements set out in national standards and the Council's relevant local guidance*".
- 3.3.4. Under Policy FR3 "*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, in order to provide an adequate undeveloped buffer zone. The Council will resist proposals that would adversely affect the natural functioning of main rivers and ordinary watercourses, this includes through the culverting of open channels, unless for access purposes*".
- 3.3.5. This FRA identifies that this proposed development is compliant with these three policies.

3.4. DRAFT VALE OF AYLESBURY LOCAL PLAN (2013-2033)

- 3.4.1. The draft Vale of Aylesbury Local Plan (2013-2033) was approved by AVDC in October 2017 and underwent a six-week consultation period. This was submitted to the Planning Inspectorate in February 2018 and public examination hearings were held in July 2018.
- 3.4.2. A Main Modifications document was produced to summarise the proposed changes to plan in line with the Inspector's findings in order to make the plan sound. Public consultation on the proposed Main Modifications closed in December 2019 and the Main Modifications have been submitted to the Inspector for Consideration. It is hoped the Local Plan will be adopted during 2020.
- 3.4.3. Policy I14 (Flooding) states that development layout should be informed by SuDS, and all sites should manage surface water run-off using SuDS.
- 3.4.4. In addition to this a management plan should be provided to ensure the maintenance of SuDS on new development sites.
- 3.4.5. The site is also allocated (site reference NLV001) within the Local Plan, the following comment is made with relation to surface water drainage and the site:
"Multi-functional Green Infrastructure will be required to control surface water flows and flooding."
- 3.4.6. A surface water drainage strategy is available in Chapter 5 and SuDS operation and maintenance information in Chapter 5 of this FRA which complies with Local Plan policy.

3.5. NATIONAL PLANNING POLICY FRAMEWORK 2019

- 3.5.1. The updated National Planning Policy Framework (NPPF) was published in February 2019 and sets out the Government's national policies for flood risk management in a land use planning context within England.
- 3.5.2. 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."*
- 3.5.3. 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."*
- 3.5.4. Allocation and planning of development must therefore be considered against a risk-based search sequence as provided by the guidance, known as the sequential test.
- 3.5.5. Government guidance states that development proposals should be accompanied by a sequential test if both of the following apply:
 - The development is located in Flood Zone 2 or 3 as per the publicly available Flood Map for Planning
 - A sequential test hasn't already been undertaken for the development proposals.
- 3.5.6. In line with the NPPF, it is for the local planning authority to formally undertake the sequential test and the site has been assessed through the Aylesbury Vale Level 1 & 2 Strategic Flood Risk Assessments and the proposed site is allocated.

- 3.5.7. As such, the sequential test may be considered to have previously been undertaken and additional sequential testing may not be considered necessary. This is further discussed in Section 4.3.

3.6. AYLESBURY VALE LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT (AV1SFRA) (AUGUST 2017)

- 3.6.1. The AV1SFRA identifies flood risk is a key issue across the District and stresses the importance of surface water management for the area. It also identifies infiltration potential across the District, with the need for site-specific infiltration testing to be undertaken to confirm the viability of this as a method of surface water disposal.
- 3.6.2. Intrusive site investigations as detailed within paragraph 2.5.4 identify that infiltration is highly unlikely to be a viable means of surface water disposal on site and therefore, this FRA does not propose an infiltration led drainage strategy.

3.7. AYLESBURY VALE LEVEL 2 STRATEGIC FLOOD RISK ASSESSMENT (AV2SFRA) (AUGUST 2017)

- 3.7.1. The site is specifically referenced in the AV2SFRA as site 'NLV001.' This identifies that the site is 99% in Flood Zone 1 and there is no historic evidence of flooding at the site based on the Environment Agency Historic Flood Map.
- 3.7.2. It also identifies that the current Flood Zones within the site boundary are based on a JFLOW+ model. It is stated that;

“JFLOW+ shows the drain to the north of the site has a relatively confined floodplain, even at the 1 in 100 + 65% climate change, with relatively shallow floodplain depths (<0.1m)”

- 3.7.3. As such, the site is identified to be acceptable for the development proposed. Further assessment of flood risk is contained within this report.

3.8. MILTON KEYNES SURFACE WATER DRAINAGE; LOCAL GUIDANCE FOR PLANNING APPLICATIONS (DECEMBER 2014)

- 3.8.1. This guidance document provides advice for developers including that surface water should be controlled as near to source as possible, promotes the use of green open SUDS features, and that future maintenance of proposed features has been considered.
- 3.8.2. This FRA identifies attenuation and runoff requirements and provides an indicative surface water drainage strategy and the respective operation and maintenance information for the proposed development.

3.9. MILTON KEYNES LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT (MK1SFRA) (APRIL 2015)

- 3.9.1. The MK1SFRA identifies that areas of Milton Keynes flooded significantly during floods of 1947 and 1968 including areas surrounding Bletchley, however since the development of Milton Keynes New Town catchment characteristics have altered significantly.
- 3.9.2. Within Bletchley, flooding was also reported on Water Eaton Road in both 1998 and 2006, this is significantly downstream of the site.

- 3.9.3. It is also indicated that Tattenhoe Park (north of the proposed development site) is understood to have swales and ponds taking surface water from roads and surrounding residential developments and controls outflow rates to the Loughton Brook.
- 3.9.4. Surface water will be managed on site in a manner that does not exacerbate potential flood risk to properties downstream.

4. ASSESSMENT OF FLOOD RISK

4.1. OVERVIEW

4.1.1. The potential flooding mechanisms at the site have been identified and are summarised in Table 4.

Table 4 - Flood Risk Overview

Mechanism	Risk	Comment
Fluvial	Low	The majority of the site is identified to lie within Flood Zone 1, with a small, localised area to the north west of the within Flood Zone 2 and 3.
Tidal	Very Low	Due to its inland location, tidal flood risk may be considered to be very low.
Surface Water	Medium - Low	Surface water flow paths follow the route of unnamed ordinary watercourses within the site boundary. The potential risk from surface water flooding will be mitigated by ensuring surface water is sustainably managed on site and finished floor levels are appropriately set above surrounding ground levels.
Ground Water	Low	There are no Environment Agency historic records of flooding identified within the Milton Keynes Level 1 SFRA within the vicinity of the site.
Sewers	Low	There are currently no sewers identified within the site boundary.
Artificial Sources	Low	There are no canals or reservoirs within the vicinity of the proposed development site.

4.2. HISTORIC FLOODING

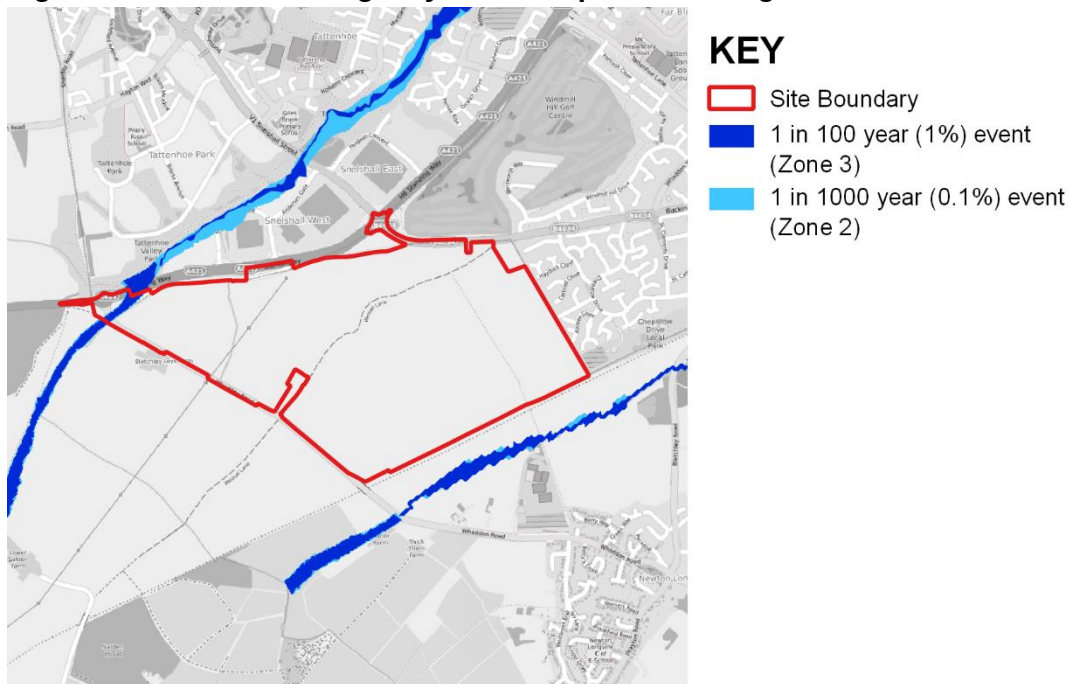
- 4.2.1. Contact has been made with Buckinghamshire County Council LLFA and Milton Keynes Council LLFA to enquire about historical flooding in proximity to the proposed development however no response has been received to date.
- 4.2.2. SFRAs undertaken for both Aylesbury Vale District Council and Milton Keynes Council have been examined for historic flood risk. These do not identify any historic flooding within the site boundary.

4.3. FLUVIAL FLOOD RISK

- 4.3.1. Reference to the publicly available Flood Map for Planning identifies that the majority of the proposed development site lies within Flood Zone 1, with a small, localised area (approximately 9,000m²) to the north-west of the site which lies within Flood Zone 2 and 3 associated with an unnamed ordinary watercourse.

4.3.2. The publicly available Flood Map for Planning is reprinted as Figure 4.

Figure 4 - Environment Agency Flood Map for Planning



Vulnerability Classification

4.3.3. The development is classified as both ‘More Vulnerable’ residential development and ‘Less Vulnerable’ commercial development under the NPPF which is defined as follows:

“More Vulnerable

- Hospitals
- Residential institutions such as residential care homes, children’s homes, social services homes, prisons and hostels.
- Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.
- Non-residential uses for health services, nurseries and educational establishments.
- Landfill* and sites used for waste management facilities for hazardous waste.
- Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.”

“Less Vulnerable

- Police, ambulance and fire stations which are not required to be operational during flooding
- Buildings used for shops, financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in “More Vulnerable”, and assemble and leisure
- Land and buildings used for agriculture and forestry
- Waste treatment (except landfill and hazardous waste facilities)
- Minerals working and processing (except for sand and gravel working)
- Water treatment works which do not need to remain operational during times of flood

- *Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place)."*

Sequential Test

- 4.3.4. The PPG and NPPF Guidance states that Planning Authorities should complete a risk based "Sequential Test" when developing Local Plans, to ascertain areas most suitable, from a flood risk perspective, for future development.
- 4.3.5. The essence of the "Sequential Test" is to "*steer new developments to areas with the lowest probability of flooding*" (Paragraph 158 of the NPPF). Whilst it is for the Local Planning Authority to formally apply the Sequential Test, a sequential approach to masterplanning has been undertaken to ensure no development at this site is located in Flood Zone 2 and 3.
- 4.3.6. A review of the 2017 Aylesbury Vale Level 1 SFRA highlights 18 sites out of a total of 145 where the site is partly within Flood Zone 2, 3a, 3a plus climate change or 3b that were 'taken forward' for 'sustainability reasons' with SWMK being included in the 18 under reference NLV001.
- 4.3.7. The Aylesbury Vale Level 2 SFRA advises on policy for the site, ensuring the development should be located within Flood Zone 1, and areas not in Flood Zone 1 should be reserved for green infrastructure as is the case. It is ensured that if these policies are implemented, the site will pass the Sequential Test.
- 4.3.8. The original FRA the accompanied the planning application for SWMK produced by Pell Frischmann in 2015 states:

"It is considered that the site passes the Sequential Test as all built development is in Flood Zone 1 at low risk of flooding".
- 4.3.9. This statement still remains true. The Environment Agency Flood Zone 2 and 3 is located in the north western corner of the site, with all proposed built development, outlined within the latest Development Framework Parameters Plan, located outside of Flood Zone 2 & 3 (4857_100_A_Development Framework Parameters Plan.dwg).
- 4.3.10. Given this, potential fluvial flood risk to the proposed development may be considered to be low.

Identified Fluvial Flood Risk: Low

4.4. TIDAL FLOOD RISK

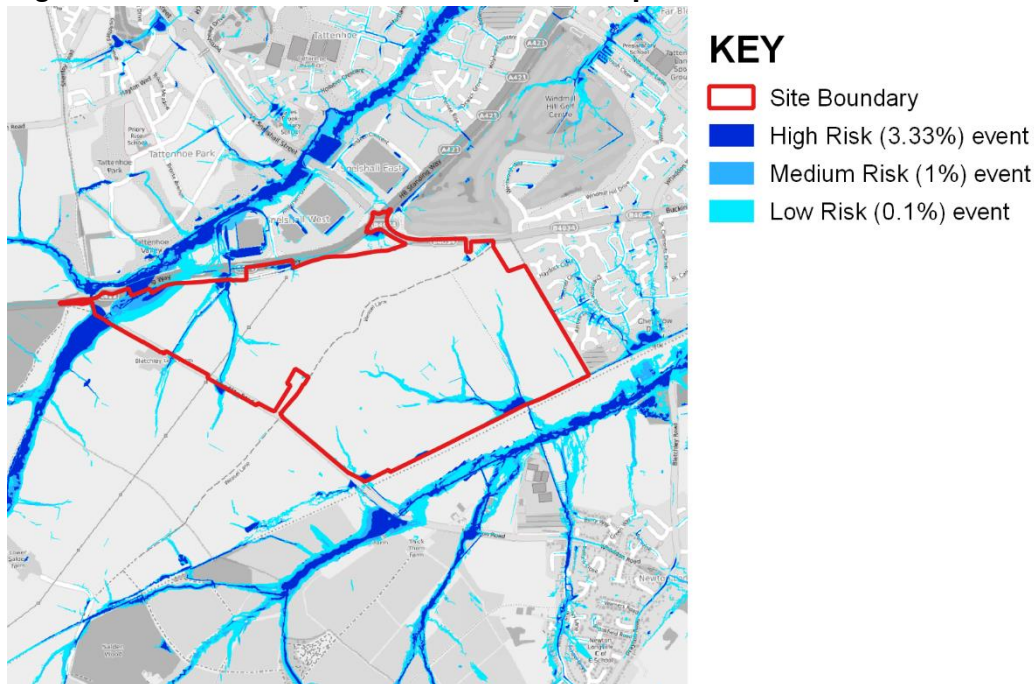
- 4.4.1. Due to its inland location, potential tidal flood risk may be considered to be very low.

Identified Tidal Flood Risk: Very Low

4.5. SURFACE WATER FLOOD RISK

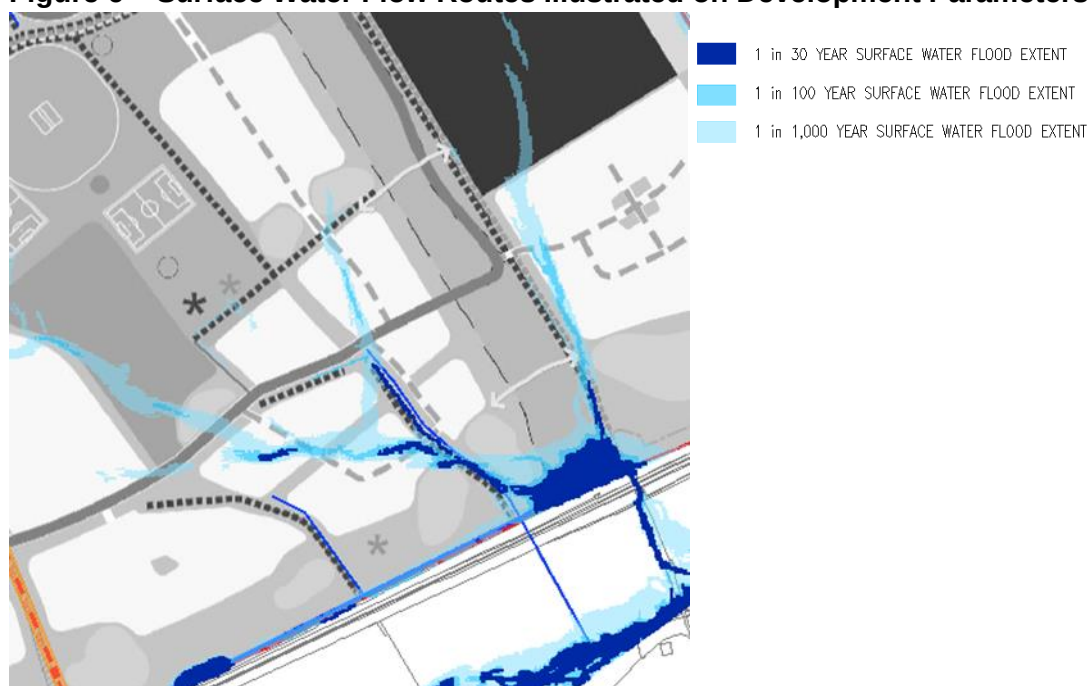
- 4.5.1. The 'Long Term Flood Risk Information,' in particular the 'Flood Risk from Surface Water Map,' identifies a number of existing surface water flow routes within the site, and an area of surface water ponding at the northern and southern boundaries of the site. The Flood Risk from Surface Water map is reprinted as Figure 5.

Figure 5 – Flood Risk from Surface Water Map



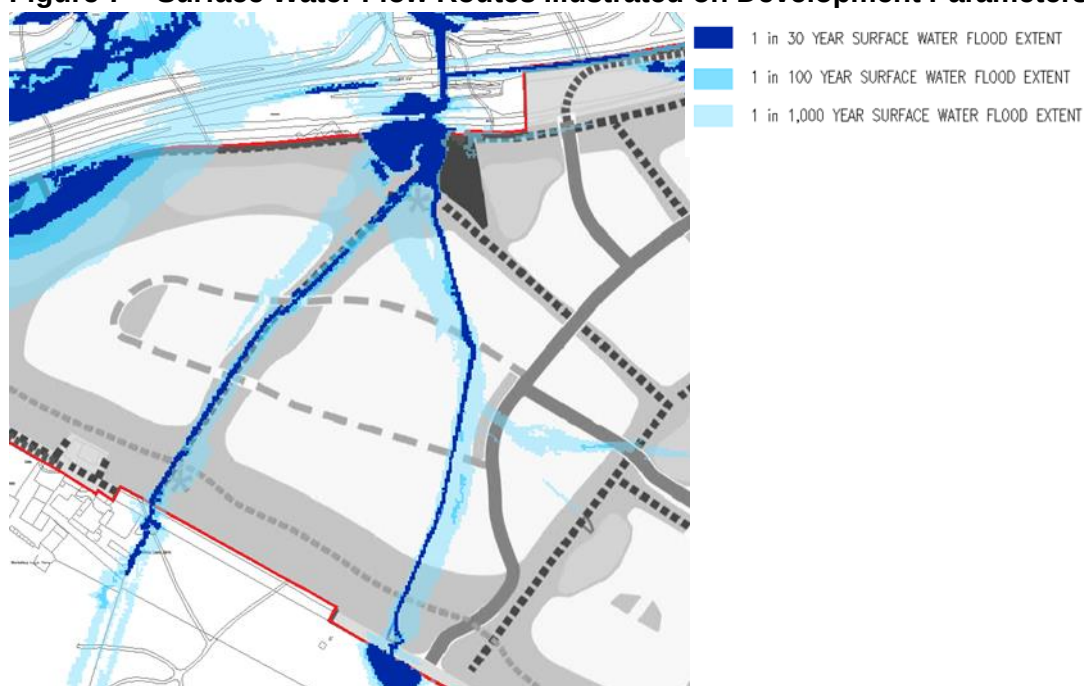
- 4.5.2. The production of this mapping has been undertaken at a national scale to provide the first publicly available generation of surface water flood risk mapping. The two previous generations were primarily developed for regulator use as the approach and risk was refined. For example, the first did not include any allowance for sewers, whilst the second incorporated a national loss coefficient.
- 4.5.3. Although this generation incorporates local estimates of the sewer infiltration loss, generally at a Lead Local Flood Authority (LLFA) level along with various other refinements in runoff estimation, it does not allow for local improvements to the underlying Digital Terrain Model (DTM). This means that local features such as the adjoining highways are represented as determined from the LiDAR without any consideration to existing drainage features such as culverts or small watercourses which typically manage surface water flow routes. There are three small, un-named watercourses identified within the site boundary, which are identified as areas of 'high surface water flood risk,' two in the north west area of the site and one in the south east area of the site.
- 4.5.4. Within the south east area of the site, there are a number of small, unnamed, ordinary watercourses identified with an area of localised, surface water ponding, adjacent to the railway. It is our understanding that there is an existing culvert under the railway line, which is to be retained with the re-opening of the line as part of the East-West Rail project. Following review of the existing land profile within the south of the site, the contributing catchments of these small, unnamed, ordinary watercourses are identified to be wholly located within the site. Given the nature of the proposed development, the contributing catchments, of the small, unnamed, ordinary watercourses, will be managed through the implementation of a sustainable surface water drainage strategy and as a result it may be considered that the currently identified potential surface water flood risk may be reduced. Furthermore, as shown in Figure 6, no development is proposed within the area of currently identified surface water ponding, immediately adjacent to the railway, and it is proposed to manage exceedance/overland flow routes through the integration of strategic green-blue corridors or within highways, wherever reasonably practicable, which will be determined through the detailed design and reserved matters process.

Figure 6 – Surface Water Flow Routes Illustrated on Development Parameters Plan (South)



- 4.5.5. It was further noted in correspondence with Buckinghamshire County Council Lead Local Flood Authority (LLFA) dated 20th April 2020 that the surface water flow routes currently identified in the north-east area of the site should be a consideration within the proposed development. The areas of high surface water flood risk in the north-west of the site are illustrated overlaid on the Development Parameters Plan in Figure 7.

Figure 7 – Surface Water Flow Routes Illustrated on Development Parameters Plan (North)



- 4.5.6. As shown in Figure 7, no development is proposed within the currently identified area of surface water ponding adjacent to the existing highway to the north, with the western small, unnamed, ordinary

watercourse proposed to be retained and enhanced through the implementation of a blue-green corridor.

- 4.5.7. It is currently proposed to integrate, enhance and reprofile the eastern small, unnamed, ordinary watercourse within the development, as far as reasonably practicable. This will be determined through the detailed design and reserved matters, but may include:
- Diversion and enhancement of the small, unnamed, ordinary watercourse within a blue-green corridor.
 - Integration of the small, unnamed, ordinary watercourse within the development parcel within a multi-functional space.
 - Maintaining, and enhancing, the small, unnamed, ordinary watercourse within its current alignment.
- 4.5.8. At the next stage of design, further consideration to the integration of the eastern small, unnamed, ordinary watercourse within the development will be undertaken, ensuring that the proposed development does not exacerbate, and where possible mitigates, existing potential surface water flood risk.
- 4.5.9. Flood risk from surface water may be considered to be low.

Identified Surface Water Flood Risk: Low

4.6. GROUND WATER FLOOD RISK

- 4.6.1. Milton Keynes Council Level 1 SFRA Appendix B contains a Groundwater susceptibility map which identifies that the site has limited potential for groundwater flooding to occur both above and below the surface.
- 4.6.2. The map does not identify any historic Environment Agency groundwater flood records within the vicinity of the proposed development site.
- 4.6.3. There is one publicly available BGS borehole within the site boundary of 3.7m deep which does not identify water within the sample.
- 4.6.4. A Phase I Review and Strategic Phase II Geo-Environmental Assessment was undertaken by Geo Environmental Group (GEG) in December 2017 which identified in the winter of 2017 groundwater depths across the site varied from 2.2m – 6.54m deep below ground level across the proposed development site during installation of monitoring.
- 4.6.5. Given this, the risk of groundwater may be considered to be low.

Identified Groundwater Flood Risk: Low

4.7. SEWER FLOOD RISK

- 4.7.1. Sewer flooding occurs as a result of a number of influencing factors. It is most likely to occur during storms, when large volumes of rainwater enter the sewers. However, it can also occur when pipes become blocked or damaged.
- 4.7.2. Existing sewerage systems are present on land surrounding the site, by way of existing highway and adopted public sewers serving built development.
- 4.7.3. Due to confidentiality agreements, Anglian Water have not been contacted for available sewer maps or historic flood records at this time. A site constraints plan (SWMK03\075, David Lock Associates)

produced in February 2014 identifies a sewer east of the site. However, no other known sewers are identified within the site boundary.

- 4.7.4. Given this, potential flood risk from sewer flooding may be considered to be low.

Identified Sewer Flood Risk: Low

4.8. ARTIFICIAL SOURCE FLOOD RISK

Reservoirs

- 4.8.1. Reservoir flooding is extremely unlikely to happen. There has been no loss of life in the UK from reservoir flooding since 1925. All large reservoirs must be inspected and supervised by reservoir panel engineers. As the enforcement authority for the Reservoirs Act 1975 in England, we ensure that reservoirs are inspected regularly and essential safety work is carried out.
- 4.8.2. The Flood Risk from Reservoir Map shows that the site lies outside of the zone of influence from nearby reservoirs.
- 4.8.3. Given this, the flood risk from reservoirs may be considered to be low.

Identified Flood Risk from Reservoirs: Low

Canals

- 4.8.4. Canal flooding is generally rare and the canal network is designed in such a way to direct all additional water beyond the navigation capacity to impounding areas or surrounding watercourses to be conveyed downstream. The risk from canal flooding becomes more of a concern where the structure is elevated on an earth embankment and if there is a rare instance of a catastrophic breach, leading to a sudden drain-down of the pound and resultant overland flow flood risk to development immediately downstream.
- 4.8.5. The nearest canal is the Grand Union Canal which flows through Bletchley approximately 4km east of the proposed development site.
- 4.8.6. Given this, flood risk from canals may be considered to be low.

Identified Flood Risk from Canals: Low

4.9. DEVELOPMENT EXCEEDANCE FLOWS

- 4.9.1. Careful regard has to be made in respect of potential exceedance flows, being events that are more extreme than current design criteria. Various national guidance has been published on the matter of exceedance flows and measures that should be incorporated into a development to ensure the safety of occupiers and those using the infrastructure.
- 4.9.2. Published guidance in the form of Sewers for Adoption 7th Edition and the Environment Agency document "*Improving the Flood Performance of New Buildings: Flood Resilient Construction*" advocate the design of developments that implement infrastructure routes that will safely convey flood waters resulting from sewer flooding or overland flows away from buildings and along defined corridors.
- 4.9.3. The principal aim is to direct exceedance flows away from properties and along defined corridors. At a local level, this may mean water being conveyed along a length of highway, as long as the predicted

flow depths and velocities are acceptable. More strategically, the implementation of conveyance corridors is important in avoiding deep and high velocity flows that present a high risk.

- 4.9.4. Whilst many of the measures for dealing with exceedance flows must be dealt with at the detailed design stage, the strategic layout for the site provides a framework that can effectively deal with any future exceedance flows. The strategic layout of the exceedance flow routes can be seen in drawing 1442-D-004 in Appendix A .
- 4.9.5. Given the baseline site characteristics and further mitigation measures to be implemented, the risk of flooding from exceedance flows may be considered to be low.

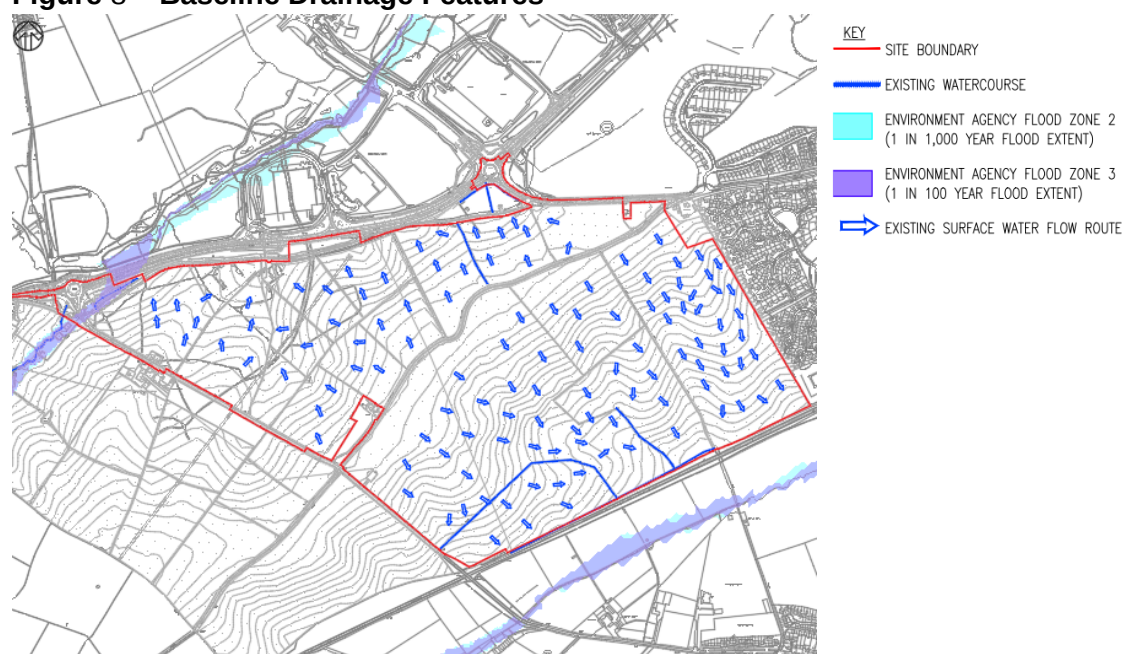
Identified Flood Risk from Exceedance Flows: Low

5. SURFACE WATER DRAINAGE

5.1. EXISTING SURFACE WATER DRAINAGE REGIME

- 5.1.1. The northern area of the site currently drains toward the A421 where there are a number of existing unnamed ordinary watercourses.
- 5.1.2. The southern area of the site currently drains towards the railway line, which forms the southern boundary of site. There are a number of unnamed ordinary watercourses that run from the centre of the site towards the south, which drain into a ditch that runs adjacent to the disused railway line before entering a culvert underneath the disused railway embankment.
- 5.1.3. The baseline drainage features described above are shown indicatively in Figure 8 and drawing 1442-D-001 contained in Appendix A.

Figure 8 – Baseline Drainage Features



5.2. DRAINAGE STRATEGY

Discharge Location

- 5.2.1. In order to determine the most appropriate receptor for storm water discharges from the proposed development, PPG guidance provides the following order of priority, supported by the Environment Agency and Local Authority. Table 5 provides a summary of the SuDS Drainage Hierarchy approach for the proposed development.

Table 5 - SuDS Drainage Hierarchy

		Discharge Location	Availability	Comments
Search Sequence		Re-Use	✓ / ✗	Space for re-use may be further considered at the detailed design stage
		Infiltration	✓ / ✗	The site is underlain by a bedrock of mudstone which is unlikely to have infiltration potential, intrusive investigations, detailed in 2.5.4 also identify infiltration is unlikely.
		Watercourse	✓	The unnamed, ordinary watercourses to the north-west and south of the proposed development site provide suitable receptors for surface water flows from the proposed development.
		Surface Water Sewer	✗	Whilst a connection into the public surface water sewer is not preferred in terms of the surface water drainage hierarchy. Anglian water has confirmed a connection to their system could be made should the need arise.
		Combined Sewer	✗	
		Foul Sewer	✗	

- 5.2.2. There are a number of existing unnamed ordinary watercourses within the site boundary, which are considered to be the most appropriate receptors for surface water from the proposed development site in accordance with the SuDS hierarchy.
- 5.2.3. Further to this, Anglian Water have identified that a connection into the public sewer could be made at the 150mm diameter surface water located in Steinbeck Crescent should the need arise. Anglian Water correspondence is available in Appendix C.
- 5.2.4. In accordance with the above search sequence, it is proposed to discharge surface water flows to the existing unnamed ordinary watercourses on site.

SuDS Proposals

- 5.2.5. Sustainable Drainage Systems (SuDS) proposals are based on the available Development Framework Parameters Plan CSA/4857/100 at the time of production and will be updated to reflect any changes at the detailed design stage.
- 5.2.6. Current guidance requires that all new developments implement 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.
- 5.2.7. 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.”*
- 5.2.8. A surface water drainage strategy has been prepared in conjunction finalisation of the Development Framework Parameters Plan thus making space for multi-function SuDS within the site boundary.

Table 4 provides a summary of the SuDS selection process and identifies the potential features that are proposed as part of the site surface water drainage strategy.

Table 6 - 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.	✓ / ✗ The use of green roofs may be further explored at the detailed design stage for commercial and school buildings.
Filter Strips	These are wide, gently sloping areas of grass or other dense vegetation that treat runoff from adjacent impermeable areas.	✓ / ✗ The use of filter strips may be further considered at detailed design stage.
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.	✓ / ✗ The use of permeable paving may be further considered at detailed design stage.
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).	✓ The use of swales to convey water from basins has been proposed for use on this development.
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 has not been proposed as a means of surface water disposal at this stage.
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.	✓ Attenuation basins have been proposed to manage surface water on site however, the exact wet / dry nature will be confirmed at a later design stage.
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.	✓ Attenuation basins have been proposed to manage surface water on site however, the exact wet / dry nature will be confirmed at a later design stage.

Greenfield Run-Off

- 5.2.9. National policy dictates that new developments control the peak discharge of storm water from a site to the baseline, undeveloped site conditions. Over very large development areas, the baseline rate of run-off is normally estimated using the Flood Estimation Handbook (FEH) methodologies. However, Paragraph 3.1.2 of the FEH guidance states:

"The frequency estimation procedures can be used on any catchment, gauged or ungauged, that drains an area of at least 0.5km². The flood estimation procedure can be applied on smaller catchments only where the catchment is gauged and offers simple flood peak or flood event data"

- 5.2.10. On undeveloped and ungauged catchments of less than 0.5km in area, the accepted methodology is to complete baseline site discharge assessments using the nationally accepted Institute of Hydrology (IoH)124 methodology for small rural catchments in a manner set out by the Environment Agency document SC030219 Rainfall Runoff Management for Developments.
- 5.2.11. This methodology requires that, for catchments of less than 50ha, the IoH assessment is completed for a 50ha area with the results linearly interpolated to determine the flow rate value based on the ratio of the development to 50ha.
- 5.2.12. Whilst the overall application boundary is above the 50ha threshold, given the topography of the site, the catchments are below the 50ha threshold, thus the IoH124 methodology is therefore the most appropriate for appraising the baseline run-off from the development. The baseline IoH run-off rates are shown on Table 7 and summarised in Appendix B.

Table 7 - Greenfield Run-Off Rates

Event	50ha (l/s)	1ha (l/s)
1 Year	135.7	2.71
QBar	156.0	3.12
100 Year	555.3	11.11

Development Run-Off & Attenuation

- 5.2.13. As the site is currently undeveloped, the proposals will result in an increase in impermeable area, which will increase the overall rate of water discharging from the site if left un-attenuated.
- 5.2.14. The surface water drainage strategy drawing 1442-D-003 in Appendix A indicates the indicative site catchments based on the site topography as summarised in Table 8.

Table 8 - Site Run-Off Assessment

Catchment	Developed Area (ha)	Impermeable Area (ha)	1 in 1 Year Runoff (l/s)	QBar Runoff (l/s)	1 in 100 Year Runoff (l/s)
A	3.20	2.08	8.68	9.98	35.54
B	7.40	4.44	20.08	23.09	82.18
C	1.90	1.14	5.16	5.93	21.10
D	2.11	1.27	5.73	6.58	23.43
E	2.40	1.32	6.51	7.49	26.65
F	1.90	1.14	5.16	5.93	21.10
G	1.40	0.84	3.80	4.37	15.55
H	1.20	0.96	3.26	3.74	13.33
I	2.00	1.20	5.43	6.24	22.21
J	1.20	0.96	3.26	3.74	13.33
K	1.30	1.04	3.53	4.06	14.44
L	8.60	5.16	23.34	26.83	95.51
M	4.90	2.94	13.30	15.29	54.42
N	1.80	1.08	4.89	5.62	19.99
O	3.00	1.65	8.14	9.36	33.32
P	2.00	1.20	5.43	6.24	22.21
Q	4.50	2.70	12.21	14.04	49.98
R	4.20	2.52	11.40	13.10	46.65
S	2.40	1.44	6.51	7.49	26.65
T	9.10	5.20	24.70	28.39	101.06
Total	66.51	40.28	180.51	207.51	738.66

5.2.15. Assessments have thereafter been completed to determine the characteristics of the SuDS features required. The Micro Drainage 'Source Control' module has been utilised to provide routing calculations for the 1 in 100 year return period flood event to identify the size and nature of storage required. This ensures the peak outflows are in line with those identified alongside the nature of SuDS proposed on site in Table 9, whilst the drainage strategy is shown on 1442-D-003 in Appendix A and Micro Drainage summary calculations are provided in Appendix B.

Table 9 - Site Attenuation Requirements

Catchment	Proposed QBar Discharge Rate (l/s)	Storage Volume Required (m³)	SuDS Controls
A	10.0	1560.00	Attenuation Basin & Swale
B	23.1	3250.00	Attenuation Basin & Swale
C	5.9	830.00	Attenuation Basin & Swale
D	6.6	1090.00	Attenuation Basin & Swale
E	7.5	950.00	Attenuation Basin & Swale
F	5.9	880.00	Attenuation Basin & Swale
G	4.4	670.00	Attenuation Basin & Swale
H	3.7	740.00	Attenuation Basin & Swale
I	6.2	870.00	Attenuation Basin & Swale
J	3.7	760.00	Attenuation Basin
K	4.1	780.00	Attenuation Basin
L	26.8	3800.00	Attenuation Basin
M	15.3	2200.00	Attenuation Basin & Swale
N	5.6	780.00	Attenuation Basin & Swale
O	9.4	1180.00	Attenuation Basin & Swale
P	6.2	900.00	Attenuation Basin & Swale
Q	14.0	950.00	Attenuation Basin & Swale
R	13.1	1840.00	Attenuation Basin & Swale
S	7.5	1110.00	Attenuation Basin
T	28.4	3550.00	Attenuation Basin & Swale
Total	207.5	28690.00	

- 5.2.16. In accordance with legislative requirements, the attenuation proposals have also been assessed for the potential effects of climate change. The 1 in 100 year return period return events have been modelled for 40% climate change (including peak rainfall intensity). Calculations for the climate change scenarios (including development creep) are contained in Appendix B.
- 5.2.17. Climate change assessments show each attenuation feature to perform adequately by retaining the additional flows within the system without overflow or unacceptable consequences.

- 5.2.18. The surface water drainage system will be designed in accordance with Sewers for Adoption (7th Edition) such that the proposed network will not surcharge during the critical 1 in 2 year return period event and will not flood during the 1 in 30 year return period event. For the 1 in 100 year return period, the sewer network will be designed so that surface flooding may be contained and conveyed within the highway boundary and directed to the attenuation basin.
- 5.2.19. The 1 in 30 year return period criterion meets the requirements of BS EN 752 and is also in accordance with Sewers for Adoption 7th Edition. However, the design of the system exceeds the requirements of these documents by accommodating the volumes and flow rates generated by the 1 in 100 year return period event.
- 5.2.20. The surface water drainage strategy is based upon the site masterplanning details at the time of production. Changes to the site development profile, impermeable areas across the site or other such aspects of the scheme will result in the need to revise the calculations.

Development Creep

- 5.2.21. Over the lifetime of a development, it is possible that the overall impermeable area within the site could increase by as much as 10% through the house buyers undertaking activities such as property extensions and introducing paved gardens.
- 5.2.22. Table 10 shows how this increase in impermeable area relates to the primary catchments within the site.

Table 10 - Development Creep Assessment

Catchment	Impermeable Area (ha)	10% Creep (ha)	Total Impermeable Area (ha)
A	2.08	0.21	2.29
B	4.44	0.44	4.88
C	1.14	0.11	1.25
D	1.27	0.13	1.39
E	1.32	0.13	1.45
F	1.14	0.11	1.25
G	0.84	0.08	0.92
H	0.96	0.10	1.06
I	1.20	0.12	1.32
J	0.96	0.10	1.06
K	1.04	0.10	1.14
L	5.16	0.52	5.68
M	2.94	0.29	3.23
N	1.08	0.11	1.19
O	1.65	0.17	1.82
P	1.20	0.12	1.32
Q	2.70	0.27	2.97
R	2.52	0.25	2.77
S	1.44	0.14	1.58
T	5.20	0.52	5.72
Total	40.28	4.03	44.30

- 5.2.23. Micro Drainage calculations contained in Appendix B confirm that the proposed SuDS system has sufficient capacity to accommodate a 10% increase in impermeable area during the 1 in 100 year return period plus 40% for climate change event without overflow.
- 5.2.24. In addition to this, during the detailed design phase, the positive impacts of the potential source control measures (permeable paving et al.) should be further considered.

- 5.2.25. Without the benefit of a detailed plot level masterplan, it is not possible to appraise the function of the individual source control systems down to plot level. Source control measures should be further considered during detailed design and implemented as far as reasonably practicable.
- 5.2.26. As such, the potential impact of development creep on the proposed SuDS system may not be considered to pose a significant risk to the site.

Climate Change

- 5.2.27. The purpose of the proposed surface water drainage strategy is to ensure that the proposed scheme does not exacerbate any existing flood risks upstream or downstream of the site, in accordance with the principles set out within the NPPF.
- 5.2.28. SuDS will be implemented throughout this development scheme. The conceptual SuDS strategy for the proposed development has been devised using the principles outlined within the current published guidance in the form of the NPPF, PPG and CIRIA amongst others.
- 5.2.29. The impact of climate change is a key factor when determining a drainage strategy. The NPPF and PPG guidance advocate a “development lifespan” approach for dealing with climate change allowances.
- 5.2.30. In light of this and in accordance with local requirements, an increase of 40% in peak rainfall intensity has been used as the allowance for climate change within the proposed drainage design to determine the performance of the drainage system. This has been implemented in accordance with the climate change requirements highlighted in the Planning Practice Guidance enforced by the government, ensuring the most conservative increase of 40% is employed to future-proof the development.
- 5.2.31. Climate change assessments show each attenuation feature to perform adequately by retaining the additional flows within the system without overflow or unacceptable consequences. Calculations for the climate change scenarios are also contained in the Appendix B.

SuDS Management Train

- 5.2.32. 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.
- 5.2.33. 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.
- 5.2.34. 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.
- 5.2.35. 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

- 5.2.36. 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.
- 5.2.37. The proposed development will utilise attenuation basins to provide surface water attenuation management and conveyance swales. Flows are proposed to be limited, via flow control devices (e.g. vortex flow control) to ensure that maximum peak discharge rates do not exceed the QBar event for any event up to and including the 1 in 100 year plus 40% climate change event.

Health and Safety

- 5.2.38. The proposed layout of the SuDS features will be designed in accordance with the best practice SuDS guidance documents and national standards, supplemented, where appropriate, with Aylesbury Vale District Council (now Buckinghamshire Council) and Milton Keynes Council guidance and the requirements of the water company and maintenance company to ensure the features are effective not only in terms of their hydraulic design but also from a safety perspective during construction, operation and maintenance.
- 5.2.39. Outline health and safety risk assessments should be completed for the individual drainage features proposed as part of the final site design, setting out the risks and incorporating proposals for how these are to be managed.

6. FOUL WATER DRAINAGE

6.1. EXISTING FOUL WATER DRAINAGE REGIME

- 6.1.1. Anglian Water have been consulted regarding the foul water connection from the proposed development and they have been provided the right to requisition a new sewer with the required connection point (NGR SP 83529 33644) seen below in Figure 9 and in more detail in the 'Pre-Planning Assessment Report' in Appendix C.

Figure 9 – Anglian Water Foul Water Connection Location



- 6.1.2. No existing foul water drainage network has been identified within the site boundary; hence the necessary infrastructure will need to be provided by the developer to convey flows from the proposed development to the sewer network.

6.2. NETWORK CAPACITY AVAILABILITY

- 6.2.1. Anglian Water have confirmed that the network has available capacity for the proposed development site with the nearest practicable connection being a 450mm diameter sewer at the location shown previously in Figure 9. The response from Anglian Water can be seen in more detail in the 'Pre-Planning Assessment Report' in Appendix C.

6.3. IMPLEMENTATION PROPOSALS

- 6.3.1. It is recommended that further liaison is undertaken based on current proposals when detailed design is undertaken to ensure foul flows can still be received by the surrounding Anglian Water network and any infrastructure upgrades can be implemented should the need arise.

7. OPERATION AND MAINTENANCE

7.1. SURFACE WATER FEATURES

- 7.1.1. The proposed on-site surface water and foul drainage sewerage networks will be designed to the current version of Sewers for Adoption and will be offered for adoption by Anglian Water. Anglian Water will also consider the adoption of SuDS alongside the transfer of land surrounding such features to allow for maintenance. It is recommended that early discussion with Anglian Water is undertaken to confirm site-specific criteria.
- 7.1.2. With regards to SuDS, it is likely that, should the SuDS be offered to the council for adoption and maintenance, commuted sums will be required for all adoptable SuDS processes.
- 7.1.3. 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.
- 7.1.4. A typical maintenance schedule of the swales, attenuation basins and flow control devices proposed on site are shown in the below tables.

Table 11 - Flow Control (e.g Vortex Flow Control) 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.

Table 12 - 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.

Table 13 - Attenuation 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.

- 7.1.5. 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.
- 7.1.6. 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.

8. CONCLUSIONS

- 8.1.1. The potential risk of flooding to and from the proposed development has been assessed in accordance with the NPPF.
- 8.1.2. This assessment demonstrates that the site lies within an appropriate location for the proposed land uses in accordance with the vulnerability classifications of the NPPF and supported by the relevant Local Planning Authorities and the Environment Agency.
- 8.1.1. In addition to the NPPF, the proposed surface water drainage strategy complies with local policy and site-specific requirements. The proposed surface water drainage strategy aims to mimic the behaviour of the site pre-development (greenfield), through the utilisation of attenuation basins and swales and flow control devices. The maximum peak rate of discharge from the site will be 207.5l/s with a cumulative attenuation storage volume of approximately 28,960m³ for all events up to and including the 1 in 100 year return period event plus 40% climate change.
- 8.1.2. Management of extreme event flood risk can be achieved through ensuring the finished floor levels of the proposed building are set at a minimum of 150mm above adjacent roads and open space levels in areas where designated overland flood routes are identified.
- 8.1.3. Safe access and egress will be available to and from the site for events up to and including the 1 in 100 year return period plus climate change (40% increase on peak intensity) rainfall events.
- 8.1.4. The responsibility for the operation and maintenance of each SuDS feature will be confirmed prior to construction and will be undertaken in accordance with manufacturer's recommendations and best practice and guidelines.
- 8.1.5. This report demonstrates that the proposed development may be undertaken in a sustainable manner without increasing the flood risk either at the site or to any third-party land in line with NPPF requirements.



LIMITATIONS

WSP has prepared this report in accordance with the instructions of their client, the SWMK Consortium, for their sole and specific use. Any person who uses any information contained herein do so at their own risk. © WSP UK Ltd 2020.

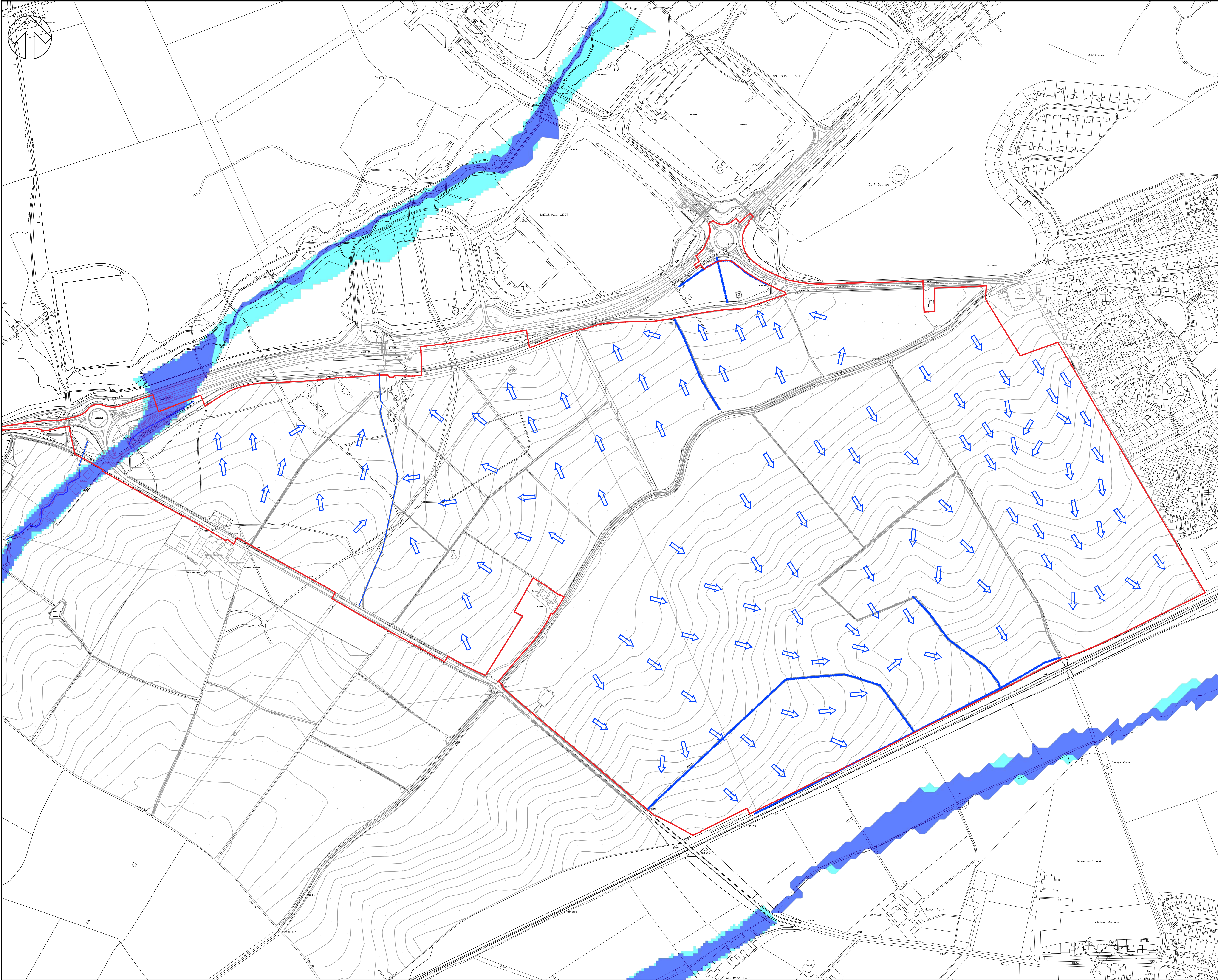
The conclusions and recommendations contained herein are limited by the availability of background information and the planned use for the site.

Third party information has been used in the preparation of this report, which WSP UK Ltd, by necessity assumes is correct at the time of writing. Whilst all reasonable checks have been made on data sources and the accuracy of the data, WSP UK Ltd accepts no liability for same.

Appendix A

DRAWINGS

wsp



DO NOT SCALE

NOTES

1. ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM.
2. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT SCHEME DRAWINGS AND SPECIFICATIONS.
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5. REPRODUCED FROM THE ORDNANCE SURVEY MAP WITH PERMISSION OF THE CONTROLLER OF HER MAJESTY'S STATIONARY OFFICE. LICENSE NO. 100048755. CROWN COPYRIGHT RESERVED.
6. ILLUSTRATIVE DRAWING BASED ON:
6.1. TOPOGRAPHICAL SURVEY PRODUCED BY HALLAM LAND MANAGEMENT DATED SEPTEMBER 2009.
6.2. ENVIRONMENT AGENCY FLOOD MAP FOR PLANNING FLUVIAL FLOOD EXTENTS (DOWNLOADED JULY 2018).

KEY

- SITE BOUNDARY
- EXISTING WATERCOURSE
- ENVIRONMENT AGENCY FLOOD ZONE 2
(1 IN 1,000 YEAR FLOOD EXTENT)
- ENVIRONMENT AGENCY FLOOD ZONE 3
(1 IN 100 YEAR FLOOD EXTENT)
- ⇨ EXISTING SURFACE WATER FLOW ROUTE

P03	22/04/2020	PS	AMENDED BASED ON LLFA COMMENTS	AC	AC
P02	19/03/2020	JG	EXTENDED FOR NEW SITE BOUNDARY	AC	AN
P01	01/11/2018	PS	FIRST ISSUE	AC	DW
REV	DATE	BY	DESCRIPTION	CHK	APP

DRAWING STATUS:

S2 - FOR INFORMATION

The Mailbox - Level 2, 100 Wharfside Street, Birmingham, B1 1RT, UK
T+ 44 (0) 121 352 4700, F+ 44 (0) 121 352 4701
wsp.com

CLIENT:

SOUTH WEST MILTON KEYNES CONSORTIUM

ARCHITECT:

CSA ENVIRONMENTAL

SITE/PROJECT:

SOUTH WEST MILTON KEYNES

TITLE:

EXISTING DRAINAGE FEATURES

SCALE @ A1:	Custom	CHECKED:	AC	APPROVED:	AN
PROJECT NO:	70051442	DESIGNED:	JG	DRAWN:	JG
				DATE:	March 20

DRAWING NO:	1442-D-001_REV02	REV:	P03
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NOTES

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- REPRODUCED FROM THE ORDNANCE SURVEY MAP WITH PERMISSION OF THE CONTROLLER OF HER MAJESTY'S STATIONARY OFFICE. LICENSE NO. 100048755. CROWN COPYRIGHT RESERVED.
- ILLUSTRATIVE DRAINAGE STRATEGY BASED ON:
 1. TOPOGRAPHICAL SURVEY PRODUCED BY HALLAM LAND MANAGEMENT DATED SEPTEMBER 2009.
 2. DEVELOPMENT FRAMEWORK PARAMETERS PLAN REV I, CSA ENVIRONMENTAL DATED 12.05.2020.
- SURFACE WATER CALCULATIONS UNDERTAKEN USING MICRODRAINAGE SOURCE CONTROL AND ARE SUBJECT TO REFINEMENT AT DETAILED DESIGN.
- ASSUMPTIONS USED TO DESIGN INDICATIVE SURFACE WATER DRAINAGE STRATEGY:
 1. BASINS SIZED TO ACCOMMODATE 1 IN 100 YEAR EVENT PLUS 40% CLIMATE CHANGE IN ACCORDANCE WITH ENVIRONMENT AGENCY GUIDANCE 2016.
 2. BASINS DESIGNED 1m DEEP WITH 1 IN 4 SIDE SLOPES AND INCLUDE A 300mm FREEBOARD ALLOWANCE.
 3. DISCHARGE RATE LIMITED TO QBAR FOR ALL EVENTS UP TO THE 1 IN 100 YEAR PLUS 40% CLIMATE CHANGE EVENT.
 4. IMPERMEABLE AREA ASSUMED 60% FOR RESIDENTIAL PARCELS, 80% EMPLOYMENT PARCELS, 55% FOR SCHOOLS.
 5. A SENSITIVITY TEST FOR 10% DEVELOPMENT CREEP HAS BEEN UNDERTAKEN AND APPLIED TO BASIN SIZES.
 6. NO CONSIDERATION HAS BEEN GIVEN TO EARTHWORKS AT THIS STAGE.

KEY

- SITE BOUNDARY
- EXISTING WATERCOURSE
- PROPOSED DRAINAGE CATCHMENT BOUNDARY (PROPOSED OUTFALL NORTH SITE)
- PROPOSED DRAINAGE CATCHMENT BOUNDARY (PROPOSED OUTFALL SOUTH SITE)
- PROPOSED SURFACE WATER ATTENUATION
- PROPOSED CONVEYANCE SWALE
- PROPOSED SURFACE WATER SEWER
- SURFACE WATER FLOW ROUTE
- OIL
- EXISTING OIL PIPELINE (6m OFFSET REQUIRED)
- EXISTING WATERCOURSE TO BE ENHANCED, RE-PROFILED AND / OR INTEGRATED INTO DEVELOPMENT AS FAR AS REASONABLY PRACTICABLE.

P17	22/05/2020	PS	UPDATED MASTERPLAN	CSB	AC
P16	12/05/2020	PS	UPDATED MASTERPLAN	AC	AC
P15	01/05/2020	PS	UPDATED MASTERPLAN	AC	AC
P14	27/04/2020	PS	BASINS MOVED BASED ON UPDATED TREE CONSTRAINTS PLAN	AC	AC
P13	22/04/2020	PS	UPDATED MASTERPLAN	AC	AC
P12	19/03/2020	JG	BASINS ADJUSTED TO ACCOUNT FOR 10% DEVELOPMENT CREEP.	AC	AN
P11	10/03/2020	JG	ALL BASINS REFINED TO ENSURE 1:4 SIDE SLOPES WHILST MINIMISING BASIN SIZES WITH 4M EARTHWORKS BUFFER INSTALLED.	AC	AN
P01	23/10/2018	PS	FIRST ISSUE	AC	FW
REV	DATE	BY	DESCRIPTION	CHK	APP

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ARCHITECT:

CSA ENVIRONMENTAL

SITE/PROJECT:

SOUTH WEST MILTON KEYNES

TITLE:

INDICATIVE SURFACE WATER DRAINAGE STRATEGY

SCALE @ A1:	CHECKED:	APPROVED:
1:3000	AC	AN
PROJECT NO:	DESIGNED:	DRAWN:
70051442	JG	JG
DRAWING NO:	DATE:	REV:
1442-D-003	May 20	P17

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File name: I:\UK\WSP\GROUP\CONCENTRAL\DATA\PROJECTS\70051442\000\70051442_SWM_302\WPFLOODING&DRAINAGE\MODEL\CA01442-D-003_P17.DWG, printed on 22 May 2020 08:17:14, by Riddig, Phoebe



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6. ILLUSTRATIVE DRAINAGE STRATEGY BASED ON:
 - 6.1. TOPOGRAPHICAL SURVEY PRODUCED BY HALLAM LAND MANAGEMENT DATED SEPTEMBER 2009.
 - 6.2. CONCEPT MASTERPLAN PRODUCED BY CSA ENVIRONMENTAL DATED 18.02.2019.
7. SURFACE WATER CALCULATIONS UNDERTAKEN USING MICRODRAINAGE SOURCE CONTROL AND ARE SUBJECT TO REFINEMENT AT DETAILED DESIGN.
8. ASSUMPTIONS USED TO DESIGN INDICATIVE SURFACE WATER DRAINAGE STRATEGY:
 - 8.1. BASINS SIZED TO ACCOMMODATE 1 IN 100 YEAR EVENT PLUS 40% CLIMATE CHANGE IN ACCORDANCE WITH ENVIRONMENT AGENCY GUIDANCE 2016.
 - 8.2. BASINS DESIGNED 1m DEEP WITH 1 IN 4 SIDE SLOPES AND INCLUDE A 300mm FREEBOARD ALLOWANCE.
 - 8.3. DISCHARGE RATE LIMITED TO OBAR FOR ALL EVENTS UP TO THE 1 IN 100 YEAR PLUS 40% CLIMATE CHANGE EVENT.
 - 8.4. IMPERMEABLE AREA ASSUMED 60% FOR RESIDENTIAL PARCELS, 80% EMPLOYMENT PARCELS, 55% FOR PRIMARY SCHOOL. 55% IMPERMEABILITY ASSIGNED TO THE JOINT CATCHMENT CALCULATIONS FOR T, U & V TO ACCOUNT FOR COMBINATION OF 60% RESIDENTIAL AND MUCH LOWER SECONDARY SCHOOL IMPERMEABILITY.
 - 8.5. A SENSITIVITY TEST FOR 10% DEVELOPMENT CREEP HAS BEEN UNDERTAKEN AND APPLIED TO BASIN SIZES.
 - 8.6. NO CONSIDERATION HAS BEEN GIVEN TO THE EARTHWORKS AT THIS STAGE.

KEY

- SITE BOUNDARY
- EXISTING WATERCOURSE
- - - PROPOSED DRAINAGE CATCHMENT BOUNDARY (PROPOSED OUTFALL NORTH SITE)
- - - PROPOSED DRAINAGE CATCHMENT BOUNDARY (PROPOSED OUTFALL SOUTH SITE)
- PROPOSED SURFACE WATER ATTENUATION
- - - PROPOSED CONVEYANCE SWALE
- - - PROPOSED SURFACE WATER SEWER
- SURFACE EXCEEDANCE WATER FLOW ROUTE
- OIL — EXISTING OIL PIPELINE (6m OFFSET REQUIRED)

P08	22/05/2020	PS	UPDATED MASTERPLAN	AC	AN
P07	19/03/2020	JG	BASINS ADJUSTED TO ACCOUNT FOR 10% DEVELOPMENT CREEP.	AC	AN
P06	11/03/2020	JG	ALL BASINS REFINED TO ENSURE 1:4 SIDE SLOPES WHILST MINIMISING BASIN SIZES WITH 4M EARTHWORKS BUFFER INSTALLED.	AC	AN
P05	10/03/2020	JG	POND ALTERATIONS FOR BASINS L, R & TUV WITH SWALES BETTER POSITIONED BETWEEN PLOTS	AC	AN
P04	09/03/2020	JG	POND ALTERATIONS TO THE SOUTH	AC	AN
P03	05/03/2020	JG	ADDITIONAL PLOT TO THE EAST	AC	AN
P02	30/01/2019	PS	UPDATED MASTERPLAN	AC	DW
P01	04/12/2018	PS	FIRST ISSUE	AC	DW
REV	DATE	BY	DESCRIPTION	CHK	APP

DRAWING STATUS: S2 - FOR INFORMATION



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CLIENT: SOUTH WEST MILTON KEYNES CONSORTIUM

ARCHITECT: CSA ENVIRONMENTAL

SITE/PROJECT: SOUTH WEST MILTON KEYNES

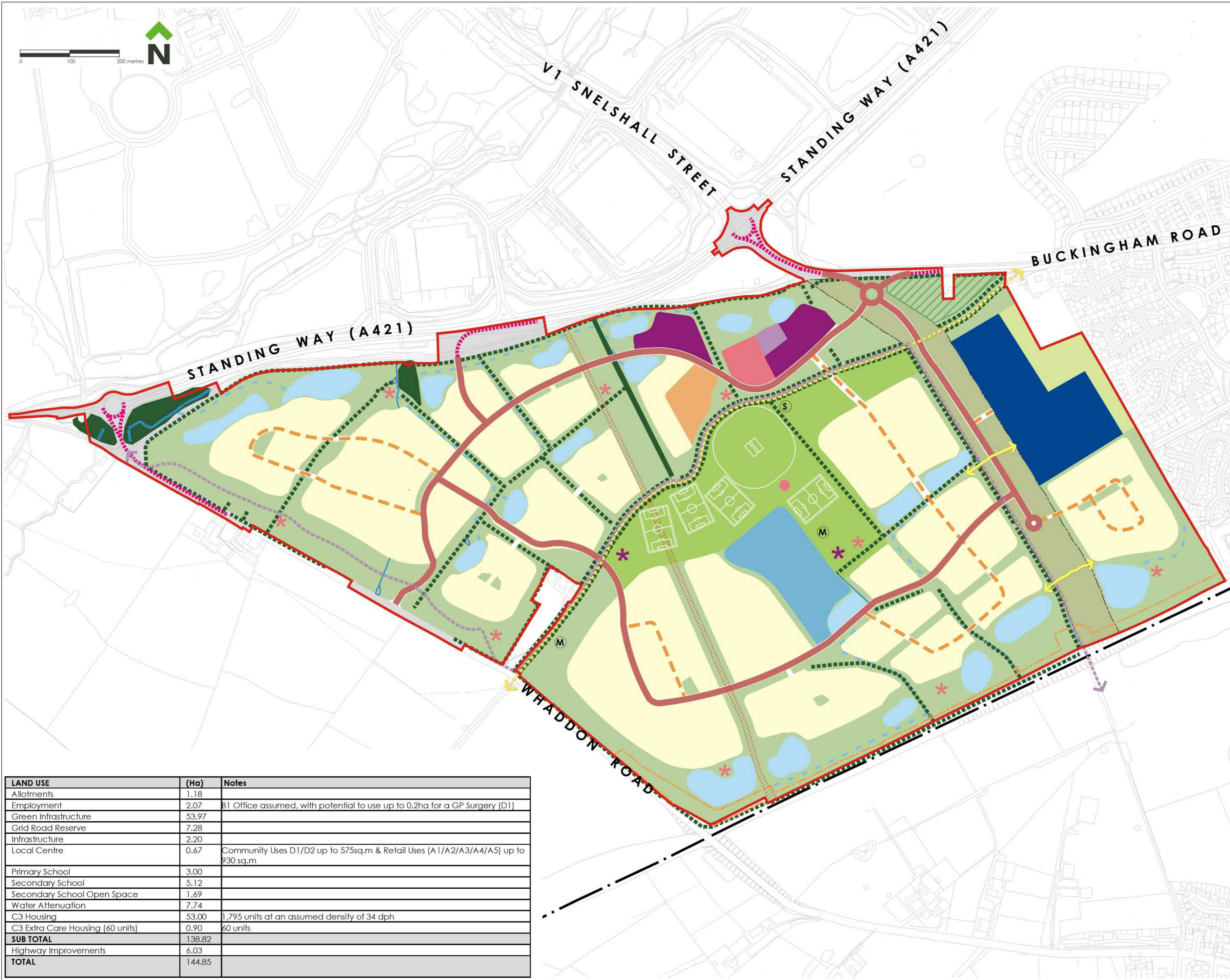
TITLE: INDICATIVE SURFACE WATER EXCEEDANCE FLOW ROUTE PLAN

SCALE @ A1: 1:3000	CHECKED: AC	APPROVED: AN
PROJECT NO: 70051442	DESIGNED: JG	DRAWN: JG
DRAWING NO: 1442-D-004	DATE: March 20	REV: P08

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File name: I:\UK\WSP\GROUP\CONCENTRAL\DATA\PROJECTS\70051442\SWM\302\WPFLOODING\DRAINAGE\MODEL\CA01442-D-004_P07_REV01.DWG, printed on 22 May 2020 08:32:21 by RYding, Pwong

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LAND USE	(Ha)	Notes
Allotments	1.18	
Employment	2.07	B1 Office assumed, with potential to use up to 0.2ha for a GP Surgery (D1)
Green Infrastructure	53.97	
Grid Road Reserve	7.28	
Infrastructure	2.20	
Local Centre	0.67	Community Uses D1/D2 up to 575sq.m & Retail Uses (A1/A2/A3/A4/A5) up to 930 sq.m
Primary School	3.00	
Secondary School	5.12	
Secondary School Open Space	1.69	
Water Attenuation	7.74	
C3 Housing	53.00	1,795 units at an assumed density of 34 dph
C3 Extra Care Housing (60 units)	0.90	60 units
SUB TOTAL	138.82	
Highway Improvements	6.03	
TOTAL	144.85	

Planning Application Boundary

Primary routes - 15m corridor

Secondary routes (Indicative)

Improvements to existing highway

Grid Road Reserve

Existing Infrastructure

Residential developable area

Employment Area

Neighbourhood Centre

Potential site for a 6GP Practice within Employment Area (up to 0.2ha)

Primary Education

Secondary Education

Open space included as part of Secondary Education site

C3 Extra Care Housing Unit

Oil Pipeline exclusion zone

Extent of East/West Rail boundary for proposed works

Amenity greenspace

Central area of public open space including sports fields

Allotments

Indicative green space within residential parcels

Proposed surface water attenuation features

Potential pedestrian/cycle connections

Milton Keynes Boundary Walk (existing restricted public byway & public footpath)

Existing Sustrans Route 51 (existing restricted public byway)

Disused railway line (future route of East/West railway line)

Existing hedgerows to be retained

Existing woodland to be retained

*

Indicative Locations of Local Equipped Area for Play (LEAP) - 400sqm

*

Indicative Locations of Neighbourhood Equipped Area for Play (NEAP) - 1000sqm

*

Indicative location of changing pavilion

(M)

Multi-Use Games Area (MUGA)

(S)

Skateboard park

K	19.05.20	SG	Road realigned in GRR
J	18.05.20	SG	Grid Road centered in reserve
I	12.05.20	SG	Grid Road Reserve moved east and subsequent changes

Rev	Date	By	Description
CSA environmental			
Project Land at South West Milton Keynes			
Title Development Framework Parameters Plan			
Client Taylor Wimpey UK Ltd, William Davis Ltd, Hallam Land Management Ltd, Bellcross Homes and Connolly Homes			
Scale	1:5000 @ A2	Drawn	RC
Date	Feb 2020	Checked	RR
Drawing No.	CSA/4857/100	Rev	K

CSA environmental

Dixies Barrs, High Street, Ashwell, Hertfordshire SG7 5NT
01462 743647
ashwell@csaenvironmental.co.uk
csaenvironmental.co.uk

Project

Land at South West Milton Keynes

Title

Development Framework Parameters Plan

Client

Taylor Wimpey UK Ltd, William Davis Ltd, Hallam Land Management Ltd, Bellcross Homes and Connolly Homes

Scale

1:5000 @ A2

Drawn

RC

Date

Feb 2020

Checked

RR

Drawing No.

CSA/4857/100

Rev

K

Appendix B

CALCULATIONS

wsp

Appendix B.1



GREENFIELD RUN-OFF

WSP Group Ltd		Page 1
.	SWMK	
.	IoH124	
.		
Date 22/10/2018	Designed by PS	
File	Checked by AC	
XP Solutions	Source Control 2018.1	

Appendix B.2



1 IN 100 YEAR

WSP Group Ltd				Page 1	
.		SWMK			
.		CATCHMENT A			
.		1 IN 100 YEAR			
Date 21/04/2020		Designed by PS			
File CATCHMENT A_001.SRCX		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	103.606	0.206	10.0	411.1	O K
30 min Summer	103.661	0.261	10.1	527.8	O K
60 min Summer	103.714	0.314	10.1	642.0	O K
120 min Summer	103.770	0.370	10.1	767.8	O K
180 min Summer	103.798	0.398	10.1	832.3	O K
240 min Summer	103.814	0.414	10.1	869.3	O K
360 min Summer	103.828	0.428	10.1	900.8	O K
480 min Summer	103.829	0.429	10.1	903.6	O K
600 min Summer	103.824	0.424	10.1	892.1	O K
720 min Summer	103.816	0.416	10.1	873.9	O K
960 min Summer	103.801	0.401	10.1	839.0	O K
1440 min Summer	103.773	0.373	10.1	775.7	O K
2160 min Summer	103.736	0.336	10.1	692.0	O K
2880 min Summer	103.703	0.303	10.1	619.7	O K
4320 min Summer	103.651	0.251	10.1	505.2	O K
5760 min Summer	103.612	0.212	10.1	422.5	O K
7200 min Summer	103.584	0.184	9.9	365.2	O K
8640 min Summer	103.565	0.165	9.8	325.5	O K
10080 min Summer	103.554	0.154	9.4	302.2	O K
15 min Winter	103.630	0.230	10.1	461.1	O K
30 min Winter	103.691	0.291	10.1	592.4	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	108.324	0.0	353.2	22	
30 min Summer	69.981	0.0	463.9	37	
60 min Summer	43.110	0.0	628.8	66	
120 min Summer	26.366	0.0	772.6	126	
180 min Summer	19.477	0.0	856.8	186	
240 min Summer	15.586	0.0	914.2	244	
360 min Summer	11.241	0.0	987.7	362	
480 min Summer	8.836	0.0	1033.4	482	
600 min Summer	7.302	0.0	1065.3	600	
720 min Summer	6.235	0.0	1089.1	662	
960 min Summer	4.841	0.0	1122.0	762	
1440 min Summer	3.379	0.0	1159.4	1008	
2160 min Summer	2.364	0.0	1289.3	1404	
2880 min Summer	1.842	0.0	1337.4	1792	
4320 min Summer	1.310	0.0	1414.9	2552	
5760 min Summer	1.038	0.0	1527.3	3280	
7200 min Summer	0.875	0.0	1605.5	3960	
8640 min Summer	0.765	0.0	1680.0	4664	
10080 min Summer	0.687	0.0	1748.0	5344	
15 min Winter	108.324	0.0	399.2	22	
30 min Winter	69.981	0.0	521.4	37	
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT A			
.		1 IN 100 YEAR			
Date 21/04/2020		Designed by PS			
File CATCHMENT A_001.SRCX		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	103.749	0.349	10.1	721.3	O K
120 min Winter	103.812	0.412	10.1	864.3	O K
180 min Winter	103.844	0.444	10.1	939.1	O K
240 min Winter	103.863	0.463	10.1	982.9	O K
360 min Winter	103.880	0.480	10.1	1023.4	O K
480 min Winter	103.883	0.483	10.1	1031.8	O K
600 min Winter	103.880	0.480	10.1	1024.5	O K
720 min Winter	103.873	0.473	10.1	1008.2	O K
960 min Winter	103.853	0.453	10.1	960.5	O K
1440 min Winter	103.816	0.416	10.1	872.5	O K
2160 min Winter	103.763	0.363	10.1	753.3	O K
2880 min Winter	103.716	0.316	10.1	646.5	O K
4320 min Winter	103.638	0.238	10.1	478.1	O K
5760 min Winter	103.585	0.185	10.0	365.9	O K
7200 min Winter	103.556	0.156	9.6	305.9	O K
8640 min Winter	103.541	0.141	8.6	275.8	O K
10080 min Winter	103.530	0.130	7.9	254.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	43.110	0.0	706.5	66	
120 min Winter	26.366	0.0	866.7	124	
180 min Winter	19.477	0.0	960.4	182	
240 min Winter	15.586	0.0	1023.8	240	
360 min Winter	11.241	0.0	1104.8	356	
480 min Winter	8.836	0.0	1154.6	472	
600 min Winter	7.302	0.0	1189.2	584	
720 min Winter	6.235	0.0	1214.7	694	
960 min Winter	4.841	0.0	1249.3	896	
1440 min Winter	3.379	0.0	1285.7	1096	
2160 min Winter	2.364	0.0	1445.6	1536	
2880 min Winter	1.842	0.0	1499.8	1936	
4320 min Winter	1.310	0.0	1589.1	2684	
5760 min Winter	1.038	0.0	1712.1	3352	
7200 min Winter	0.875	0.0	1800.2	3968	
8640 min Winter	0.765	0.0	1884.5	4672	
10080 min Winter	0.687	0.0	1962.7	5352	
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WSP Group Ltd		Page 3																																				
. . .	SWMK CATCHMENT A 1 IN 100 YEAR																																					
Date 21/04/2020 File CATCHMENT A_001.SRCX	Designed by PS Checked by AC																																					
XP Solutions Source Control 2019.1																																						
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WSP Group Ltd		Page 4
. . .	SWMK CATCHMENT A 1 IN 100 YEAR	
Date 21/04/2020 File CATCHMENT A_001.SRCX	Designed by PS Checked by AC	
XP Solutions Source Control 2019.1		

Model Details

Storage is Online Cover Level (m) 104.400

Tank or Pond Structure

Invert Level (m) 103.400

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	1890.0	1.000	2990.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0151-1010-0700-1010
Design Head (m)	0.700
Design Flow (l/s)	10.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	151
Invert Level (m)	103.400
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	10.1
Flush-Flo™	0.247	10.1
Kick-Flo®	0.515	8.7
Mean Flow over Head Range	-	8.4

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	5.4	1.200	13.0	3.000	20.1	7.000	30.3
0.200	10.0	1.400	14.0	3.500	21.7	7.500	31.2
0.300	10.0	1.600	14.9	4.000	23.1	8.000	32.2
0.400	9.7	1.800	15.8	4.500	24.5	8.500	33.2
0.500	9.0	2.000	16.6	5.000	25.8	9.000	34.2
0.600	9.4	2.200	17.4	5.500	27.0	9.500	35.2
0.800	10.8	2.400	18.1	6.000	28.1		
1.000	11.9	2.600	18.8	6.500	29.2		

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WSP Group Ltd				Page 1	
.		SWMK			
.		CATCHMENT B			
.		1 IN 100 YEAR			
Date 21/04/2020		Designed by PS			
File Catchment B_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	103.207	0.207	21.7	888.1	O K
30 min Summer	103.263	0.263	22.9	1138.9	O K
60 min Summer	103.317	0.317	23.1	1384.8	O K
120 min Summer	103.375	0.375	23.1	1655.5	O K
180 min Summer	103.405	0.405	23.1	1794.6	O K
240 min Summer	103.422	0.422	23.1	1874.4	O K
360 min Summer	103.436	0.436	23.1	1942.0	O K
480 min Summer	103.437	0.437	23.1	1947.5	O K
600 min Summer	103.432	0.432	23.1	1922.6	O K
720 min Summer	103.425	0.425	23.1	1891.0	O K
960 min Summer	103.412	0.412	23.1	1828.0	O K
1440 min Summer	103.387	0.387	23.1	1710.4	O K
2160 min Summer	103.352	0.352	23.1	1550.0	O K
2880 min Summer	103.322	0.322	23.1	1409.3	O K
4320 min Summer	103.273	0.273	23.0	1186.6	O K
5760 min Summer	103.238	0.238	22.7	1028.0	O K
7200 min Summer	103.214	0.214	22.3	921.5	O K
8640 min Summer	103.200	0.200	20.9	858.3	O K
10080 min Summer	103.189	0.189	19.7	811.1	O K
15 min Winter	103.231	0.231	22.6	995.3	O K
30 min Winter	103.293	0.293	23.0	1277.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	108.324	0.0	682.5	22	
30 min Summer	69.981	0.0	916.3	37	
60 min Summer	43.110	0.0	1301.4	66	
120 min Summer	26.366	0.0	1607.3	126	
180 min Summer	19.477	0.0	1786.3	184	
240 min Summer	15.586	0.0	1907.8	244	
360 min Summer	11.241	0.0	2063.1	362	
480 min Summer	8.836	0.0	2158.9	482	
600 min Summer	7.302	0.0	2225.3	586	
720 min Summer	6.235	0.0	2274.5	624	
960 min Summer	4.841	0.0	2341.0	740	
1440 min Summer	3.379	0.0	2413.9	986	
2160 min Summer	2.364	0.0	2738.6	1384	
2880 min Summer	1.842	0.0	2837.2	1784	
4320 min Summer	1.310	0.0	2986.1	2516	
5760 min Summer	1.038	0.0	3269.2	3232	
7200 min Summer	0.875	0.0	3433.2	3896	
8640 min Summer	0.765	0.0	3586.7	4664	
10080 min Summer	0.687	0.0	3721.7	5352	
15 min Winter	108.324	0.0	779.8	22	
30 min Winter	69.981	0.0	1038.2	37	
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT B			
.		1 IN 100 YEAR			
Date 21/04/2020		Designed by PS			
File Catchment B_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	103.354	0.354	23.1	1555.7	O K
120 min Winter	103.419	0.419	23.1	1863.6	O K
180 min Winter	103.453	0.453	23.1	2024.5	O K
240 min Winter	103.473	0.473	23.1	2118.5	O K
360 min Winter	103.491	0.491	23.1	2204.5	O K
480 min Winter	103.494	0.494	23.1	2221.7	O K
600 min Winter	103.491	0.491	23.1	2205.4	O K
720 min Winter	103.483	0.483	23.1	2170.1	O K
960 min Winter	103.463	0.463	23.1	2070.6	O K
1440 min Winter	103.428	0.428	23.1	1905.8	O K
2160 min Winter	103.378	0.378	23.1	1667.9	O K
2880 min Winter	103.332	0.332	23.1	1456.7	O K
4320 min Winter	103.261	0.261	22.9	1131.3	O K
5760 min Winter	103.215	0.215	22.4	925.9	O K
7200 min Winter	103.193	0.193	20.1	827.1	O K
8640 min Winter	103.178	0.178	18.3	759.8	O K
10080 min Winter	103.167	0.167	16.8	711.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	43.110	0.0	1467.0	66	
120 min Winter	26.366	0.0	1808.0	124	
180 min Winter	19.477	0.0	2007.0	182	
240 min Winter	15.586	0.0	2141.5	240	
360 min Winter	11.241	0.0	2313.0	356	
480 min Winter	8.836	0.0	2418.2	470	
600 min Winter	7.302	0.0	2490.8	582	
720 min Winter	6.235	0.0	2544.1	688	
960 min Winter	4.841	0.0	2615.6	858	
1440 min Winter	3.379	0.0	2690.5	1080	
2160 min Winter	2.364	0.0	3074.0	1512	
2880 min Winter	1.842	0.0	3186.1	1908	
4320 min Winter	1.310	0.0	3359.7	2644	
5760 min Winter	1.038	0.0	3667.4	3296	
7200 min Winter	0.875	0.0	3852.5	4032	
8640 min Winter	0.765	0.0	4027.0	4752	
10080 min Winter	0.687	0.0	4183.6	5448	
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WSP Group Ltd		Page 3																																				
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WSP Group Ltd				Page 1	
.		SWMK			
.		CATCHMENT C			
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Date 21/04/2020		Designed by PS			
File Catchment C_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	111.210	0.210	5.9	227.0	O K
30 min Summer	111.266	0.266	5.9	291.3	O K
60 min Summer	111.319	0.319	5.9	354.0	O K
120 min Summer	111.375	0.375	5.9	422.3	O K
180 min Summer	111.402	0.402	5.9	456.8	O K
240 min Summer	111.418	0.418	5.9	476.1	O K
360 min Summer	111.429	0.429	5.9	491.2	O K
480 min Summer	111.429	0.429	5.9	490.4	O K
600 min Summer	111.422	0.422	5.9	481.6	O K
720 min Summer	111.413	0.413	5.9	470.0	O K
960 min Summer	111.395	0.395	5.9	447.9	O K
1440 min Summer	111.363	0.363	5.9	408.2	O K
2160 min Summer	111.321	0.321	5.9	356.5	O K
2880 min Summer	111.284	0.284	5.9	312.8	O K
4320 min Summer	111.226	0.226	5.9	245.5	O K
5760 min Summer	111.185	0.185	5.9	198.9	O K
7200 min Summer	111.157	0.157	5.8	167.4	O K
8640 min Summer	111.138	0.138	5.7	146.6	O K
10080 min Summer	111.127	0.127	5.4	134.5	O K
15 min Winter	111.234	0.234	5.9	254.7	O K
30 min Winter	111.296	0.296	5.9	327.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	108.324	0.0	207.8	22	
30 min Summer	69.981	0.0	271.0	37	
60 min Summer	43.110	0.0	355.8	66	
120 min Summer	26.366	0.0	436.4	126	
180 min Summer	19.477	0.0	483.8	186	
240 min Summer	15.586	0.0	516.2	244	
360 min Summer	11.241	0.0	558.0	362	
480 min Summer	8.836	0.0	584.2	482	
600 min Summer	7.302	0.0	602.8	600	
720 min Summer	6.235	0.0	616.8	646	
960 min Summer	4.841	0.0	636.6	750	
1440 min Summer	3.379	0.0	661.3	996	
2160 min Summer	2.364	0.0	719.2	1388	
2880 min Summer	1.842	0.0	746.5	1788	
4320 min Summer	1.310	0.0	791.8	2516	
5760 min Summer	1.038	0.0	848.0	3232	
7200 min Summer	0.875	0.0	891.9	3896	
8640 min Summer	0.765	0.0	934.2	4584	
10080 min Summer	0.687	0.0	973.8	5248	
15 min Winter	108.324	0.0	234.0	22	
30 min Winter	69.981	0.0	303.9	37	
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT C			
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Date 21/04/2020		Designed by PS			
File Catchment C_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	111.355	0.355	5.9	397.9	O K
120 min Winter	111.417	0.417	5.9	475.8	O K
180 min Winter	111.449	0.449	5.9	516.2	O K
240 min Winter	111.467	0.467	5.9	539.5	O K
360 min Winter	111.483	0.483	5.9	560.0	O K
480 min Winter	111.485	0.485	5.9	562.7	O K
600 min Winter	111.480	0.480	5.9	556.6	O K
720 min Winter	111.472	0.472	5.9	545.3	O K
960 min Winter	111.448	0.448	5.9	514.4	O K
1440 min Winter	111.405	0.405	5.9	460.1	O K
2160 min Winter	111.346	0.346	5.9	386.7	O K
2880 min Winter	111.292	0.292	5.9	322.4	O K
4320 min Winter	111.208	0.208	5.9	224.5	O K
5760 min Winter	111.154	0.154	5.8	163.5	O K
7200 min Winter	111.127	0.127	5.4	134.2	O K
8640 min Winter	111.114	0.114	4.9	119.9	O K
10080 min Winter	111.105	0.105	4.4	110.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	43.110	0.0	399.3	66	
120 min Winter	26.366	0.0	489.2	124	
180 min Winter	19.477	0.0	542.1	182	
240 min Winter	15.586	0.0	578.0	240	
360 min Winter	11.241	0.0	624.3	356	
480 min Winter	8.836	0.0	653.1	472	
600 min Winter	7.302	0.0	673.4	584	
720 min Winter	6.235	0.0	688.7	692	
960 min Winter	4.841	0.0	710.2	890	
1440 min Winter	3.379	0.0	735.9	1086	
2160 min Winter	2.364	0.0	806.1	1516	
2880 min Winter	1.842	0.0	836.8	1928	
4320 min Winter	1.310	0.0	888.6	2644	
5760 min Winter	1.038	0.0	950.3	3288	
7200 min Winter	0.875	0.0	999.7	3896	
8640 min Winter	0.765	0.0	1047.4	4664	
10080 min Winter	0.687	0.0	1092.7	5344	
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WSP Group Ltd		Page 3																																				
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Date 21/04/2020 File Catchment C_001.srcx	Designed by PS Checked by AC																																					
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WSP Group Ltd		Page 4
. . .	SWMK CATCHMENT C 1 IN 100 YEAR	
Date 21/04/2020 File Catchment C_001.srcx	Designed by PS Checked by AC	
XP Solutions Source Control 2019.1		

Model Details

Storage is Online Cover Level (m) 112.000

Tank or Pond Structure

Invert Level (m) 111.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	1020.0	1.000	1650.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0119-5900-0700-5900
Design Head (m)	0.700
Design Flow (l/s)	5.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	119
Invert Level (m)	111.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	5.9
Flush-Flo™	0.220	5.9
Kick-Flo®	0.490	5.0
Mean Flow over Head Range	-	5.0

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	4.2	1.200	7.6	3.000	11.7	7.000	17.5
0.200	5.9	1.400	8.2	3.500	12.6	7.500	18.1
0.300	5.8	1.600	8.7	4.000	13.4	8.000	18.7
0.400	5.6	1.800	9.2	4.500	14.2	8.500	19.2
0.500	5.0	2.000	9.6	5.000	14.9	9.000	19.8
0.600	5.5	2.200	10.1	5.500	15.6	9.500	20.4
0.800	6.3	2.400	10.5	6.000	16.3		
1.000	7.0	2.600	10.9	6.500	16.9		

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WSP Group Ltd				Page 1	
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Date 21/04/2020		Designed by PS			
File Catchment D_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	105.210	0.210	7.9	300.8	O K
30 min Summer	105.267	0.267	7.9	386.0	O K
60 min Summer	105.320	0.320	7.9	469.1	O K
120 min Summer	105.377	0.377	7.9	559.8	O K
180 min Summer	105.405	0.405	7.9	605.7	O K
240 min Summer	105.421	0.421	7.9	631.5	O K
360 min Summer	105.433	0.433	7.9	651.8	O K
480 min Summer	105.433	0.433	7.9	651.0	O K
600 min Summer	105.426	0.426	7.9	639.7	O K
720 min Summer	105.417	0.417	7.9	625.2	O K
960 min Summer	105.400	0.400	7.9	597.3	O K
1440 min Summer	105.369	0.369	7.9	546.6	O K
2160 min Summer	105.327	0.327	7.9	479.9	O K
2880 min Summer	105.291	0.291	7.9	422.9	O K
4320 min Summer	105.233	0.233	7.9	335.3	O K
5760 min Summer	105.193	0.193	7.8	274.5	O K
7200 min Summer	105.165	0.165	7.7	233.9	O K
8640 min Summer	105.148	0.148	7.6	207.8	O K
10080 min Summer	105.137	0.137	7.1	192.8	O K
15 min Winter	105.235	0.235	7.9	337.4	O K
30 min Winter	105.297	0.297	7.9	433.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	108.324	0.0	269.3	22	
30 min Summer	69.981	0.0	352.4	37	
60 min Summer	43.110	0.0	467.6	66	
120 min Summer	26.366	0.0	574.0	126	
180 min Summer	19.477	0.0	636.5	184	
240 min Summer	15.586	0.0	679.2	244	
360 min Summer	11.241	0.0	734.2	362	
480 min Summer	8.836	0.0	768.6	482	
600 min Summer	7.302	0.0	792.9	600	
720 min Summer	6.235	0.0	811.3	634	
960 min Summer	4.841	0.0	837.1	746	
1440 min Summer	3.379	0.0	868.7	994	
2160 min Summer	2.364	0.0	950.1	1388	
2880 min Summer	1.842	0.0	985.9	1784	
4320 min Summer	1.310	0.0	1044.6	2512	
5760 min Summer	1.038	0.0	1121.8	3232	
7200 min Summer	0.875	0.0	1179.7	3896	
8640 min Summer	0.765	0.0	1235.1	4584	
10080 min Summer	0.687	0.0	1286.6	5256	
15 min Winter	108.324	0.0	303.8	22	
30 min Winter	69.981	0.0	395.7	37	
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WSP Group Ltd				Page 2	
.		SWMK			
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Date 21/04/2020		Designed by PS			
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<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	105.357	0.357	7.9	527.2	O K
120 min Winter	105.420	0.420	7.9	630.6	O K
180 min Winter	105.453	0.453	7.9	684.1	O K
240 min Winter	105.471	0.471	7.9	715.0	O K
360 min Winter	105.487	0.487	7.9	742.3	O K
480 min Winter	105.490	0.490	7.9	746.0	O K
600 min Winter	105.485	0.485	7.9	738.1	O K
720 min Winter	105.476	0.476	7.9	723.4	O K
960 min Winter	105.452	0.452	7.9	683.3	O K
1440 min Winter	105.410	0.410	7.9	614.0	O K
2160 min Winter	105.351	0.351	7.9	518.6	O K
2880 min Winter	105.298	0.298	7.9	434.7	O K
4320 min Winter	105.215	0.215	7.9	307.4	O K
5760 min Winter	105.162	0.162	7.7	228.7	O K
7200 min Winter	105.137	0.137	7.1	193.1	O K
8640 min Winter	105.124	0.124	6.4	173.6	O K
10080 min Winter	105.115	0.115	5.9	160.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	43.110	0.0	525.0	66	
120 min Winter	26.366	0.0	643.8	124	
180 min Winter	19.477	0.0	713.4	182	
240 min Winter	15.586	0.0	760.8	240	
360 min Winter	11.241	0.0	821.6	356	
480 min Winter	8.836	0.0	859.5	470	
600 min Winter	7.302	0.0	886.1	582	
720 min Winter	6.235	0.0	906.1	692	
960 min Winter	4.841	0.0	934.0	884	
1440 min Winter	3.379	0.0	967.1	1084	
2160 min Winter	2.364	0.0	1065.0	1516	
2880 min Winter	1.842	0.0	1105.4	1912	
4320 min Winter	1.310	0.0	1172.7	2640	
5760 min Winter	1.038	0.0	1257.3	3288	
7200 min Winter	0.875	0.0	1322.4	3960	
8640 min Winter	0.765	0.0	1385.1	4648	
10080 min Winter	0.687	0.0	1444.0	5344	
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WSP Group Ltd		Page 3																																				
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0.600	7.4	2.200	13.6	5.500	21.0	9.500	27.4																																																																			
0.800	8.4	2.400	14.1	6.000	21.9																																																																					
1.000	9.3	2.600	14.7	6.500	22.8																																																																					
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WSP Group Ltd				Page 1	
.		SWMK			
.		CATCHMENT E			
.		1 IN 100 YEAR			
Date 21/04/2020		Designed by PS			
File Catchment E_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	111.210	0.210	6.5	259.1	O K
30 min Summer	111.266	0.266	6.5	332.6	O K
60 min Summer	111.319	0.319	6.5	404.3	O K
120 min Summer	111.377	0.377	6.5	483.0	O K
180 min Summer	111.405	0.405	6.5	523.0	O K
240 min Summer	111.421	0.421	6.5	545.7	O K
360 min Summer	111.434	0.434	6.5	564.3	O K
480 min Summer	111.435	0.435	6.5	564.7	O K
600 min Summer	111.429	0.429	6.5	556.2	O K
720 min Summer	111.420	0.420	6.5	543.3	O K
960 min Summer	111.402	0.402	6.5	518.9	O K
1440 min Summer	111.371	0.371	6.5	475.1	O K
2160 min Summer	111.329	0.329	6.5	418.0	O K
2880 min Summer	111.293	0.293	6.5	369.4	O K
4320 min Summer	111.236	0.236	6.5	293.7	O K
5760 min Summer	111.195	0.195	6.5	240.0	O K
7200 min Summer	111.166	0.166	6.4	203.4	O K
8640 min Summer	111.146	0.146	6.3	178.4	O K
10080 min Summer	111.134	0.134	6.1	163.2	O K
15 min Winter	111.234	0.234	6.5	290.6	O K
30 min Winter	111.296	0.296	6.5	373.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	108.324	0.0	233.6	22	
30 min Summer	69.981	0.0	305.0	37	
60 min Summer	43.110	0.0	403.7	66	
120 min Summer	26.366	0.0	495.2	126	
180 min Summer	19.477	0.0	549.0	186	
240 min Summer	15.586	0.0	585.7	244	
360 min Summer	11.241	0.0	633.0	364	
480 min Summer	8.836	0.0	662.5	482	
600 min Summer	7.302	0.0	683.3	600	
720 min Summer	6.235	0.0	699.0	662	
960 min Summer	4.841	0.0	721.0	762	
1440 min Summer	3.379	0.0	747.5	1002	
2160 min Summer	2.364	0.0	818.6	1392	
2880 min Summer	1.842	0.0	849.6	1792	
4320 min Summer	1.310	0.0	900.7	2552	
5760 min Summer	1.038	0.0	966.3	3232	
7200 min Summer	0.875	0.0	1016.2	3960	
8640 min Summer	0.765	0.0	1064.2	4592	
10080 min Summer	0.687	0.0	1108.8	5256	
15 min Winter	108.324	0.0	263.3	22	
30 min Winter	69.981	0.0	342.0	37	
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT E			
.		1 IN 100 YEAR			
Date 21/04/2020		Designed by PS			
File Catchment E_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	111.356	0.356	6.5	454.4	O K
120 min Winter	111.420	0.420	6.5	544.0	O K
180 min Winter	111.453	0.453	6.5	590.7	O K
240 min Winter	111.472	0.472	6.5	617.9	O K
360 min Winter	111.489	0.489	6.5	642.8	O K
480 min Winter	111.492	0.492	6.5	647.3	O K
600 min Winter	111.488	0.488	6.5	641.6	O K
720 min Winter	111.480	0.480	6.5	630.1	O K
960 min Winter	111.457	0.457	6.5	597.1	O K
1440 min Winter	111.415	0.415	6.5	536.2	O K
2160 min Winter	111.357	0.357	6.5	455.4	O K
2880 min Winter	111.304	0.304	6.5	384.0	O K
4320 min Winter	111.220	0.220	6.5	272.9	O K
5760 min Winter	111.164	0.164	6.4	201.2	O K
7200 min Winter	111.135	0.135	6.1	163.8	O K
8640 min Winter	111.121	0.121	5.5	146.5	O K
10080 min Winter	111.111	0.111	5.0	134.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	43.110	0.0	453.1	66	
120 min Winter	26.366	0.0	555.2	124	
180 min Winter	19.477	0.0	615.1	182	
240 min Winter	15.586	0.0	655.7	240	
360 min Winter	11.241	0.0	707.8	356	
480 min Winter	8.836	0.0	740.1	472	
600 min Winter	7.302	0.0	762.7	584	
720 min Winter	6.235	0.0	779.7	694	
960 min Winter	4.841	0.0	803.1	898	
1440 min Winter	3.379	0.0	829.9	1096	
2160 min Winter	2.364	0.0	917.6	1532	
2880 min Winter	1.842	0.0	952.4	1936	
4320 min Winter	1.310	0.0	1011.0	2680	
5760 min Winter	1.038	0.0	1083.0	3344	
7200 min Winter	0.875	0.0	1139.1	3960	
8640 min Winter	0.765	0.0	1193.3	4664	
10080 min Winter	0.687	0.0	1244.3	5344	
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WSP Group Ltd		Page 3																																				
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Date 21/04/2020 File Catchment E_001.srcx	Designed by PS Checked by AC																																					
XP Solutions Source Control 2019.1																																						
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> </tr> <tr> <td>Site Location</td> <td>GB 483669 232428 SP 83669 32428</td> </tr> <tr> <td>Data Type</td> <td>Point</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> </tr> <tr> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Climate Change %</td> <td>+0</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 1.300 <table> <thead> <tr> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> </tr> <tr> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0 4</td> <td>0.650</td> <td>4 8</td> <td>0.650</td> </tr> </tbody> </table>			Rainfall Model	FEH	Return Period (years)	100	FEH Rainfall Version	2013	Site Location	GB 483669 232428 SP 83669 32428	Data Type	Point	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	0.750	Cv (Winter)	0.840	Shortest Storm (mins)	15	Longest Storm (mins)	10080	Climate Change %	+0	Time (mins)	Area	Time (mins)	Area	From: To:	(ha)	From: To:	(ha)	0 4	0.650	4 8	0.650
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From: To:	(ha)	From: To:	(ha)																																			
0 4	0.650	4 8	0.650																																			
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WSP Group Ltd		Page 4
. . .	SWMK CATCHMENT E 1 IN 100 YEAR	
Date 21/04/2020 File Catchment E_001.srcx	Designed by PS Checked by AC	
XP Solutions Source Control 2019.1		

Model Details

Storage is Online Cover Level (m) 112.000

Tank or Pond Structure

Invert Level (m) 111.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	1180.0	1.000	1770.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0124-6500-0700-6500
Design Head (m)	0.700
Design Flow (l/s)	6.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	124
Invert Level (m)	111.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	6.5
Flush-Flo™	0.222	6.5
Kick-Flo®	0.493	5.5
Mean Flow over Head Range	-	5.5

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	4.4	1.200	8.4	3.000	12.9	7.000	19.3
0.200	6.5	1.400	9.0	3.500	13.9	7.500	19.9
0.300	6.4	1.600	9.6	4.000	14.8	8.000	20.6
0.400	6.2	1.800	10.1	4.500	15.7	8.500	21.2
0.500	5.6	2.000	10.6	5.000	16.5	9.000	21.9
0.600	6.1	2.200	11.1	5.500	17.2	9.500	22.5
0.800	6.9	2.400	11.6	6.000	18.0		
1.000	7.7	2.600	12.1	6.500	18.7		

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WSP Group Ltd				Page 1	
.		SWMK			
.		CATCHMENT F			
.		1 IN 100 YEAR			
Date 22/04/2020		Designed by PS			
File Catchment F_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	110.200	0.200	5.9	239.2	O K
30 min Summer	110.254	0.254	5.9	307.2	O K
60 min Summer	110.306	0.306	5.9	373.5	O K
120 min Summer	110.361	0.361	5.9	446.4	O K
180 min Summer	110.389	0.389	5.9	483.5	O K
240 min Summer	110.405	0.405	5.9	504.7	O K
360 min Summer	110.418	0.418	5.9	522.2	O K
480 min Summer	110.419	0.419	5.9	523.1	O K
600 min Summer	110.413	0.413	5.9	515.6	O K
720 min Summer	110.405	0.405	5.9	504.1	O K
960 min Summer	110.388	0.388	5.9	482.0	O K
1440 min Summer	110.358	0.358	5.9	442.4	O K
2160 min Summer	110.319	0.319	5.9	390.7	O K
2880 min Summer	110.285	0.285	5.9	346.5	O K
4320 min Summer	110.231	0.231	5.9	277.5	O K
5760 min Summer	110.191	0.191	5.9	228.0	O K
7200 min Summer	110.163	0.163	5.8	193.9	O K
8640 min Summer	110.144	0.144	5.7	170.1	O K
10080 min Summer	110.131	0.131	5.6	154.9	O K
15 min Winter	110.223	0.223	5.9	268.4	O K
30 min Winter	110.283	0.283	5.9	344.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	108.324	0.0	214.4	22	
30 min Summer	69.981	0.0	279.9	37	
60 min Summer	43.110	0.0	371.8	66	
120 min Summer	26.366	0.0	456.2	126	
180 min Summer	19.477	0.0	505.7	186	
240 min Summer	15.586	0.0	539.5	244	
360 min Summer	11.241	0.0	583.0	364	
480 min Summer	8.836	0.0	610.1	482	
600 min Summer	7.302	0.0	629.2	600	
720 min Summer	6.235	0.0	643.5	672	
960 min Summer	4.841	0.0	663.5	764	
1440 min Summer	3.379	0.0	687.2	1010	
2160 min Summer	2.364	0.0	755.1	1404	
2880 min Summer	1.842	0.0	783.6	1792	
4320 min Summer	1.310	0.0	830.6	2552	
5760 min Summer	1.038	0.0	891.7	3280	
7200 min Summer	0.875	0.0	937.8	3960	
8640 min Summer	0.765	0.0	981.9	4664	
10080 min Summer	0.687	0.0	1022.9	5336	
15 min Winter	108.324	0.0	241.6	22	
30 min Winter	69.981	0.0	313.9	37	
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT F			
.		1 IN 100 YEAR			
Date 22/04/2020		Designed by PS			
File Catchment F_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	110.341	0.341	5.9	419.7	O K
120 min Winter	110.404	0.404	5.9	502.7	O K
180 min Winter	110.436	0.436	5.9	545.9	O K
240 min Winter	110.454	0.454	5.9	571.1	O K
360 min Winter	110.471	0.471	5.9	594.3	O K
480 min Winter	110.474	0.474	5.9	598.7	O K
600 min Winter	110.471	0.471	5.9	593.8	O K
720 min Winter	110.463	0.463	5.9	583.6	O K
960 min Winter	110.442	0.442	5.9	554.2	O K
1440 min Winter	110.401	0.401	5.9	499.4	O K
2160 min Winter	110.346	0.346	5.9	426.5	O K
2880 min Winter	110.297	0.297	5.9	361.7	O K
4320 min Winter	110.217	0.217	5.9	260.2	O K
5760 min Winter	110.163	0.163	5.8	193.3	O K
7200 min Winter	110.132	0.132	5.6	155.9	O K
8640 min Winter	110.119	0.119	5.1	139.5	O K
10080 min Winter	110.109	0.109	4.6	127.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	43.110	0.0	417.3	66	
120 min Winter	26.366	0.0	511.4	124	
180 min Winter	19.477	0.0	566.6	182	
240 min Winter	15.586	0.0	604.0	240	
360 min Winter	11.241	0.0	651.8	356	
480 min Winter	8.836	0.0	681.5	472	
600 min Winter	7.302	0.0	702.1	584	
720 min Winter	6.235	0.0	717.5	694	
960 min Winter	4.841	0.0	738.7	898	
1440 min Winter	3.379	0.0	762.1	1098	
2160 min Winter	2.364	0.0	846.3	1536	
2880 min Winter	1.842	0.0	878.4	1936	
4320 min Winter	1.310	0.0	932.3	2684	
5760 min Winter	1.038	0.0	999.4	3352	
7200 min Winter	0.875	0.0	1051.2	3960	
8640 min Winter	0.765	0.0	1101.0	4664	
10080 min Winter	0.687	0.0	1148.0	5352	
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WSP Group Ltd		Page 3																								
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Date 22/04/2020 File Catchment F_001.srcx	Designed by PS Checked by AC																									
XP Solutions Source Control 2019.1																										
<u>Rainfall Details</u>																										
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Rainfall Model	FEH																									
Return Period (years)	100																									
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Total Area (ha) 1.200																										
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Time (mins)	Area	Time (mins)	Area																							
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0 4	0.600	4 8	0.600																							
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WSP Group Ltd		Page 4																																																																																															
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Date 22/04/2020		Designed by PS			
File Catchment G_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³) Status
15 min Summer		115.194	0.194	4.4	179.4 O K
30 min Summer		115.245	0.245	4.4	230.3 O K
60 min Summer		115.292	0.292	4.4	280.0 O K
120 min Summer		115.343	0.343	4.4	334.4 O K
180 min Summer		115.368	0.368	4.4	362.1 O K
240 min Summer		115.382	0.382	4.4	377.7 O K
360 min Summer		115.393	0.393	4.4	390.4 O K
480 min Summer		115.393	0.393	4.4	390.7 O K
600 min Summer		115.388	0.388	4.4	384.7 O K
720 min Summer		115.380	0.380	4.4	375.8 O K
960 min Summer		115.365	0.365	4.4	358.8 O K
1440 min Summer		115.337	0.337	4.4	328.2 O K
2160 min Summer		115.300	0.300	4.4	288.7 O K
2880 min Summer		115.269	0.269	4.4	255.2 O K
4320 min Summer		115.218	0.218	4.4	203.1 O K
5760 min Summer		115.180	0.180	4.4	165.9 O K
7200 min Summer		115.154	0.154	4.3	140.1 O K
8640 min Summer		115.135	0.135	4.2	121.9 O K
10080 min Summer		115.122	0.122	4.2	109.6 O K
15 min Winter		115.216	0.216	4.4	201.2 O K
30 min Winter		115.272	0.272	4.4	258.5 O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer		108.324	0.0	164.0	22
30 min Summer		69.981	0.0	213.5	37
60 min Summer		43.110	0.0	280.9	66
120 min Summer		26.366	0.0	344.4	126
180 min Summer		19.477	0.0	381.8	186
240 min Summer		15.586	0.0	407.2	244
360 min Summer		11.241	0.0	440.1	364
480 min Summer		8.836	0.0	460.6	482
600 min Summer		7.302	0.0	475.1	600
720 min Summer		6.235	0.0	486.0	670
960 min Summer		4.841	0.0	501.3	764
1440 min Summer		3.379	0.0	519.7	1010
2160 min Summer		2.364	0.0	567.8	1404
2880 min Summer		1.842	0.0	589.3	1792
4320 min Summer		1.310	0.0	625.3	2552
5760 min Summer		1.038	0.0	669.6	3280
7200 min Summer		0.875	0.0	704.3	3960
8640 min Summer		0.765	0.0	737.7	4664
10080 min Summer		0.687	0.0	769.0	5344
15 min Winter		108.324	0.0	184.5	22
30 min Winter		69.981	0.0	239.1	37
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WSP Group Ltd				Page 2	
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XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	115.325	0.325	4.4	314.6	O K
120 min Winter	115.381	0.381	4.4	376.6	O K
180 min Winter	115.409	0.409	4.4	408.8	O K
240 min Winter	115.425	0.425	4.4	427.5	O K
360 min Winter	115.440	0.440	4.4	444.4	O K
480 min Winter	115.442	0.442	4.4	447.2	O K
600 min Winter	115.439	0.439	4.4	443.1	O K
720 min Winter	115.432	0.432	4.4	435.1	O K
960 min Winter	115.412	0.412	4.4	412.7	O K
1440 min Winter	115.376	0.376	4.4	371.2	O K
2160 min Winter	115.326	0.326	4.4	315.9	O K
2880 min Winter	115.280	0.280	4.4	266.8	O K
4320 min Winter	115.205	0.205	4.4	190.5	O K
5760 min Winter	115.154	0.154	4.3	139.9	O K
7200 min Winter	115.123	0.123	4.2	110.5	O K
8640 min Winter	115.109	0.109	3.8	97.7	O K
10080 min Winter	115.100	0.100	3.5	89.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	43.110	0.0	315.2	66	
120 min Winter	26.366	0.0	386.0	124	
180 min Winter	19.477	0.0	427.6	182	
240 min Winter	15.586	0.0	455.8	240	
360 min Winter	11.241	0.0	492.1	356	
480 min Winter	8.836	0.0	514.6	472	
600 min Winter	7.302	0.0	530.3	584	
720 min Winter	6.235	0.0	542.0	694	
960 min Winter	4.841	0.0	558.3	896	
1440 min Winter	3.379	0.0	576.3	1098	
2160 min Winter	2.364	0.0	636.3	1536	
2880 min Winter	1.842	0.0	660.5	1936	
4320 min Winter	1.310	0.0	701.6	2684	
5760 min Winter	1.038	0.0	750.4	3352	
7200 min Winter	0.875	0.0	789.4	3968	
8640 min Winter	0.765	0.0	827.0	4664	
10080 min Winter	0.687	0.0	862.8	5344	
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WSP Group Ltd		Page 3																																				
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XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	110.193	0.193	3.3	192.3	O K
30 min Summer	110.245	0.245	3.3	247.4	O K
60 min Summer	110.294	0.294	3.3	301.9	O K
120 min Summer	110.348	0.348	3.3	363.2	O K
180 min Summer	110.377	0.377	3.3	396.1	O K
240 min Summer	110.394	0.394	3.3	416.0	O K
360 min Summer	110.411	0.411	3.3	436.4	O K
480 min Summer	110.417	0.417	3.3	443.4	O K
600 min Summer	110.417	0.417	3.3	443.7	O K
720 min Summer	110.414	0.414	3.3	440.2	O K
960 min Summer	110.402	0.402	3.3	426.2	O K
1440 min Summer	110.377	0.377	3.3	396.1	O K
2160 min Summer	110.346	0.346	3.3	361.1	O K
2880 min Summer	110.320	0.320	3.3	331.6	O K
4320 min Summer	110.278	0.278	3.3	283.7	O K
5760 min Summer	110.243	0.243	3.3	245.7	O K
7200 min Summer	110.215	0.215	3.3	215.6	O K
8640 min Summer	110.192	0.192	3.3	191.7	O K
10080 min Summer	110.174	0.174	3.3	172.6	O K
15 min Winter	110.215	0.215	3.3	215.7	O K
30 min Winter	110.272	0.272	3.3	277.6	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	108.324	0.0	167.6	23	
30 min Summer	69.981	0.0	214.8	37	
60 min Summer	43.110	0.0	295.1	68	
120 min Summer	26.366	0.0	360.5	126	
180 min Summer	19.477	0.0	398.0	186	
240 min Summer	15.586	0.0	422.8	246	
360 min Summer	11.241	0.0	453.1	364	
480 min Summer	8.836	0.0	470.2	484	
600 min Summer	7.302	0.0	480.4	602	
720 min Summer	6.235	0.0	486.4	722	
960 min Summer	4.841	0.0	490.0	960	
1440 min Summer	3.379	0.0	476.4	1146	
2160 min Summer	2.364	0.0	601.6	1512	
2880 min Summer	1.842	0.0	623.7	1904	
4320 min Summer	1.310	0.0	660.2	2688	
5760 min Summer	1.038	0.0	713.4	3464	
7200 min Summer	0.875	0.0	750.3	4184	
8640 min Summer	0.765	0.0	785.7	4928	
10080 min Summer	0.687	0.0	818.5	5648	
15 min Winter	108.324	0.0	187.7	23	
30 min Winter	69.981	0.0	237.1	37	
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT H			
.		1 IN 100 YEAR			
Date 22/04/2020		Designed by PS			
File Catchment H_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	110.327	0.327	3.3	339.0	O K
120 min Winter	110.387	0.387	3.3	408.4	O K
180 min Winter	110.419	0.419	3.3	446.2	O K
240 min Winter	110.438	0.438	3.3	469.7	O K
360 min Winter	110.459	0.459	3.3	494.6	O K
480 min Winter	110.467	0.467	3.3	504.7	O K
600 min Winter	110.469	0.469	3.3	507.3	O K
720 min Winter	110.468	0.468	3.3	505.6	O K
960 min Winter	110.459	0.459	3.3	494.3	O K
1440 min Winter	110.429	0.429	3.3	458.6	O K
2160 min Winter	110.388	0.388	3.3	410.0	O K
2880 min Winter	110.353	0.353	3.3	368.9	O K
4320 min Winter	110.290	0.290	3.3	297.9	O K
5760 min Winter	110.238	0.238	3.3	240.4	O K
7200 min Winter	110.196	0.196	3.3	195.8	O K
8640 min Winter	110.164	0.164	3.3	162.0	O K
10080 min Winter	110.140	0.140	3.2	136.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	43.110	0.0	330.6	66	
120 min Winter	26.366	0.0	402.4	124	
180 min Winter	19.477	0.0	442.6	184	
240 min Winter	15.586	0.0	467.9	242	
360 min Winter	11.241	0.0	495.3	360	
480 min Winter	8.836	0.0	506.1	476	
600 min Winter	7.302	0.0	508.3	592	
720 min Winter	6.235	0.0	506.0	706	
960 min Winter	4.841	0.0	496.8	932	
1440 min Winter	3.379	0.0	477.6	1354	
2160 min Winter	2.364	0.0	673.5	1648	
2880 min Winter	1.842	0.0	698.0	2080	
4320 min Winter	1.310	0.0	738.1	2936	
5760 min Winter	1.038	0.0	799.5	3696	
7200 min Winter	0.875	0.0	841.0	4464	
8640 min Winter	0.765	0.0	881.0	5104	
10080 min Winter	0.687	0.0	918.6	5752	
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WSP Group Ltd		Page 3																																				
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Date 22/04/2020 File Catchment H_001.srcx	Designed by PS Checked by AC																																					
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Rainfall Model	FEH																																					
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WSP Group Ltd		Page 4
. . .	SWMK CATCHMENT H 1 IN 100 YEAR	
Date 22/04/2020 File Catchment H_001.srcx	Designed by PS Checked by AC	
XP Solutions Source Control 2019.1		

Model Details

Storage is Online Cover Level (m) 111.000

Tank or Pond Structure

Invert Level (m) 110.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	940.0	1.000	1600.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0091-3300-0700-3300
Design Head (m)	0.700
Design Flow (l/s)	3.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	91
Invert Level (m)	110.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	3.3
Flush-Flo™	0.208	3.3
Kick-Flo®	0.465	2.7
Mean Flow over Head Range	-	2.8

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	2.8	1.200	4.2	3.000	6.5	7.000	9.7
0.200	3.3	1.400	4.5	3.500	7.0	7.500	10.0
0.300	3.2	1.600	4.8	4.000	7.4	8.000	10.3
0.400	3.1	1.800	5.1	4.500	7.9	8.500	10.7
0.500	2.8	2.000	5.4	5.000	8.3	9.000	11.0
0.600	3.1	2.200	5.6	5.500	8.6	9.500	11.3
0.800	3.5	2.400	5.8	6.000	9.0		
1.000	3.9	2.600	6.1	6.500	9.4		

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WSP Group Ltd				Page 1	
.		SWMK			
.		CATCHMENT I			
.		1 IN 100 YEAR			
Date 21/04/2020		Designed by PS			
File Catchment I_001.srcx		Checked by AC			
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<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	110.190	0.190	6.2	239.1	O K
30 min Summer	110.241	0.241	6.2	306.9	O K
60 min Summer	110.289	0.289	6.2	373.0	O K
120 min Summer	110.341	0.341	6.2	445.2	O K
180 min Summer	110.367	0.367	6.2	481.8	O K
240 min Summer	110.381	0.381	6.2	502.3	O K
360 min Summer	110.392	0.392	6.2	518.5	O K
480 min Summer	110.392	0.392	6.2	518.0	O K
600 min Summer	110.386	0.386	6.2	509.3	O K
720 min Summer	110.378	0.378	6.2	498.1	O K
960 min Summer	110.363	0.363	6.2	476.5	O K
1440 min Summer	110.335	0.335	6.2	437.0	O K
2160 min Summer	110.298	0.298	6.2	384.9	O K
2880 min Summer	110.266	0.266	6.2	340.4	O K
4320 min Summer	110.215	0.215	6.2	271.6	O K
5760 min Summer	110.178	0.178	6.1	223.6	O K
7200 min Summer	110.153	0.153	6.1	191.1	O K
8640 min Summer	110.137	0.137	6.0	169.9	O K
10080 min Summer	110.127	0.127	5.6	157.3	O K
15 min Winter	110.212	0.212	6.2	268.2	O K
30 min Winter	110.269	0.269	6.2	344.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	108.324	0.0	213.0	22	
30 min Summer	69.981	0.0	278.7	37	
60 min Summer	43.110	0.0	371.0	66	
120 min Summer	26.366	0.0	455.4	126	
180 min Summer	19.477	0.0	505.1	184	
240 min Summer	15.586	0.0	538.9	244	
360 min Summer	11.241	0.0	582.6	362	
480 min Summer	8.836	0.0	609.8	482	
600 min Summer	7.302	0.0	629.0	598	
720 min Summer	6.235	0.0	643.5	632	
960 min Summer	4.841	0.0	663.8	746	
1440 min Summer	3.379	0.0	688.5	994	
2160 min Summer	2.364	0.0	754.6	1388	
2880 min Summer	1.842	0.0	783.0	1788	
4320 min Summer	1.310	0.0	829.5	2516	
5760 min Summer	1.038	0.0	891.3	3232	
7200 min Summer	0.875	0.0	937.2	3896	
8640 min Summer	0.765	0.0	981.3	4584	
10080 min Summer	0.687	0.0	1022.0	5336	
15 min Winter	108.324	0.0	240.3	22	
30 min Winter	69.981	0.0	313.0	37	
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT I			
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<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	110.322	0.322	6.2	419.2	O K
120 min Winter	110.380	0.380	6.2	501.4	O K
180 min Winter	110.410	0.410	6.2	543.9	O K
240 min Winter	110.426	0.426	6.2	568.4	O K
360 min Winter	110.441	0.441	6.2	589.8	O K
480 min Winter	110.443	0.443	6.2	592.6	O K
600 min Winter	110.438	0.438	6.2	586.3	O K
720 min Winter	110.431	0.431	6.2	574.9	O K
960 min Winter	110.410	0.410	6.2	543.9	O K
1440 min Winter	110.373	0.373	6.2	490.8	O K
2160 min Winter	110.321	0.321	6.2	416.5	O K
2880 min Winter	110.273	0.273	6.2	351.0	O K
4320 min Winter	110.199	0.199	6.2	251.1	O K
5760 min Winter	110.151	0.151	6.1	188.2	O K
7200 min Winter	110.128	0.128	5.6	158.2	O K
8640 min Winter	110.115	0.115	5.1	142.1	O K
10080 min Winter	110.106	0.106	4.6	130.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	43.110	0.0	416.6	66	
120 min Winter	26.366	0.0	510.8	124	
180 min Winter	19.477	0.0	566.1	182	
240 min Winter	15.586	0.0	603.7	240	
360 min Winter	11.241	0.0	652.0	356	
480 min Winter	8.836	0.0	682.0	470	
600 min Winter	7.302	0.0	703.1	582	
720 min Winter	6.235	0.0	718.9	690	
960 min Winter	4.841	0.0	740.8	878	
1440 min Winter	3.379	0.0	766.2	1084	
2160 min Winter	2.364	0.0	845.9	1516	
2880 min Winter	1.842	0.0	877.9	1928	
4320 min Winter	1.310	0.0	931.2	2644	
5760 min Winter	1.038	0.0	999.0	3296	
7200 min Winter	0.875	0.0	1050.7	3960	
8640 min Winter	0.765	0.0	1100.4	4664	
10080 min Winter	0.687	0.0	1147.1	5344	
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WSP Group Ltd		Page 3																																				
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Rainfall Model	FEH																																					
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WSP Group Ltd		Page 4																																																																																																																					
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Design Head (m)	0.700																																																																																																																						
Design Flow (l/s)	6.2																																																																																																																						
Flush-Flo™	Calculated																																																																																																																						
Objective	Minimise upstream storage																																																																																																																						
Application	Surface																																																																																																																						
Sump Available	Yes																																																																																																																						
Diameter (mm)	121																																																																																																																						
Invert Level (m)	110.000																																																																																																																						
Minimum Outlet Pipe Diameter (mm)	150																																																																																																																						
Suggested Manhole Diameter (mm)	1200																																																																																																																						
Control Points	Head (m)	Flow (l/s)																																																																																																																					
Design Point (Calculated)	0.700	6.2																																																																																																																					
Flush-Flo™	0.221	6.2																																																																																																																					
Kick-Flo®	0.493	5.3																																																																																																																					
Mean Flow over Head Range	-	5.3																																																																																																																					
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)																																																																																																																
0.100	4.3	1.200	8.0	3.000	12.3	7.000	18.4																																																																																																																
0.200	6.2	1.400	8.6	3.500	13.2	7.500	19.0																																																																																																																
0.300	6.1	1.600	9.1	4.000	14.1	8.000	19.6																																																																																																																
0.400	5.9	1.800	9.7	4.500	14.9	8.500	20.2																																																																																																																
0.500	5.3	2.000	10.1	5.000	15.7	9.000	20.8																																																																																																																
0.600	5.8	2.200	10.6	5.500	16.4	9.500	21.4																																																																																																																
0.800	6.6	2.400	11.1	6.000	17.1																																																																																																																		
1.000	7.3	2.600	11.5	6.500	17.8																																																																																																																		
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WSP Group Ltd				Page 1	
.		SWMK			
.		CATCHMENT J			
.		1 IN 100 YEAR			
Date 22/04/2020		Designed by PS			
File Catchment J.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
Summary of Results for 100 year Return Period					
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³) Status
15 min Summer		113.089	0.189	3.8	200.1 O K
30 min Summer		113.140	0.240	3.8	257.3 O K
60 min Summer		113.189	0.289	3.8	313.7 O K
120 min Summer		113.242	0.342	3.8	376.9 O K
180 min Summer		113.270	0.370	3.8	410.4 O K
240 min Summer		113.287	0.387	3.8	430.4 O K
360 min Summer		113.303	0.403	3.8	450.1 O K
480 min Summer		113.307	0.407	3.8	455.7 O K
600 min Summer		113.307	0.407	3.8	454.6 O K
720 min Summer		113.302	0.402	3.8	449.4 O K
960 min Summer		113.288	0.388	3.8	432.3 O K
1440 min Summer		113.263	0.363	3.8	401.5 O K
2160 min Summer		113.232	0.332	3.8	364.0 O K
2880 min Summer		113.204	0.304	3.8	331.9 O K
4320 min Summer		113.159	0.259	3.8	279.8 O K
5760 min Summer		113.124	0.224	3.8	239.1 O K
7200 min Summer		113.096	0.196	3.8	207.7 O K
8640 min Summer		113.074	0.174	3.8	183.4 O K
10080 min Summer		113.057	0.157	3.7	164.6 O K
15 min Winter		113.111	0.211	3.8	224.4 O K
30 min Winter		113.167	0.267	3.8	288.7 O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer		108.324	0.0	174.9	23
30 min Summer		69.981	0.0	226.0	37
60 min Summer		43.110	0.0	307.5	66
120 min Summer		26.366	0.0	376.4	126
180 min Summer		19.477	0.0	416.3	186
240 min Summer		15.586	0.0	443.2	246
360 min Summer		11.241	0.0	476.8	364
480 min Summer		8.836	0.0	497.0	484
600 min Summer		7.302	0.0	510.3	602
720 min Summer		6.235	0.0	519.6	722
960 min Summer		4.841	0.0	530.3	898
1440 min Summer		3.379	0.0	532.5	1100
2160 min Summer		2.364	0.0	627.1	1472
2880 min Summer		1.842	0.0	650.4	1876
4320 min Summer		1.310	0.0	689.2	2644
5760 min Summer		1.038	0.0	742.9	3408
7200 min Summer		0.875	0.0	781.2	4176
8640 min Summer		0.765	0.0	817.9	4848
10080 min Summer		0.687	0.0	852.0	5552
15 min Winter		108.324	0.0	196.4	22
30 min Winter		69.981	0.0	251.4	37
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT J			
.		1 IN 100 YEAR			
Date 22/04/2020		Designed by PS			
File Catchment J.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	113.222	0.322	3.8	352.4	O K
120 min Winter	113.281	0.381	3.8	423.9	O K
180 min Winter	113.313	0.413	3.8	462.5	O K
240 min Winter	113.332	0.432	3.8	486.1	O K
360 min Winter	113.351	0.451	3.8	510.4	O K
480 min Winter	113.358	0.458	3.8	519.2	O K
600 min Winter	113.359	0.459	3.8	520.3	O K
720 min Winter	113.357	0.457	3.8	516.8	O K
960 min Winter	113.345	0.445	3.8	501.8	O K
1440 min Winter	113.311	0.411	3.8	459.8	O K
2160 min Winter	113.270	0.370	3.8	409.6	O K
2880 min Winter	113.232	0.332	3.8	364.0	O K
4320 min Winter	113.165	0.265	3.8	286.4	O K
5760 min Winter	113.112	0.212	3.8	225.7	O K
7200 min Winter	113.072	0.172	3.8	181.0	O K
8640 min Winter	113.042	0.142	3.7	148.9	O K
10080 min Winter	113.022	0.122	3.6	127.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	43.110	0.0	344.8	66	
120 min Winter	26.366	0.0	421.0	124	
180 min Winter	19.477	0.0	464.6	182	
240 min Winter	15.586	0.0	493.4	242	
360 min Winter	11.241	0.0	528.0	358	
480 min Winter	8.836	0.0	546.9	474	
600 min Winter	7.302	0.0	557.9	590	
720 min Winter	6.235	0.0	563.8	704	
960 min Winter	4.841	0.0	566.3	926	
1440 min Winter	3.379	0.0	550.0	1296	
2160 min Winter	2.364	0.0	702.4	1608	
2880 min Winter	1.842	0.0	728.4	2048	
4320 min Winter	1.310	0.0	772.0	2856	
5760 min Winter	1.038	0.0	832.6	3632	
7200 min Winter	0.875	0.0	875.7	4320	
8640 min Winter	0.765	0.0	917.2	5008	
10080 min Winter	0.687	0.0	956.2	5552	
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WSP Group Ltd		Page 3																																				
. . .	SWMK CATCHMENT J 1 IN 100 YEAR																																					
Date 22/04/2020 File Catchment J.srcx	Designed by PS Checked by AC																																					
XP Solutions Source Control 2019.1																																						
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> </tr> <tr> <td>Site Location</td> <td>GB 483669 232428 SP 83669 32428</td> </tr> <tr> <td>Data Type</td> <td>Point</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> </tr> <tr> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Climate Change %</td> <td>+0</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 1.000 <table> <thead> <tr> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> </tr> <tr> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0 4</td> <td>0.500</td> <td>4 8</td> <td>0.500</td> </tr> </tbody> </table>			Rainfall Model	FEH	Return Period (years)	100	FEH Rainfall Version	2013	Site Location	GB 483669 232428 SP 83669 32428	Data Type	Point	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	0.750	Cv (Winter)	0.840	Shortest Storm (mins)	15	Longest Storm (mins)	10080	Climate Change %	+0	Time (mins)	Area	Time (mins)	Area	From: To:	(ha)	From: To:	(ha)	0 4	0.500	4 8	0.500
Rainfall Model	FEH																																					
Return Period (years)	100																																					
FEH Rainfall Version	2013																																					
Site Location	GB 483669 232428 SP 83669 32428																																					
Data Type	Point																																					
Summer Storms	Yes																																					
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Climate Change %	+0																																					
Time (mins)	Area	Time (mins)	Area																																			
From: To:	(ha)	From: To:	(ha)																																			
0 4	0.500	4 8	0.500																																			
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WSP Group Ltd		Page 4
. . .	SWMK CATCHMENT J 1 IN 100 YEAR	
Date 22/04/2020 File Catchment J.srcx	Designed by PS Checked by AC	
XP Solutions Source Control 2019.1		

Model Details

Storage is Online Cover Level (m) 113.900

Tank or Pond Structure

Invert Level (m) 112.900

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	1010.0	1.000	1590.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0097-3800-0700-3800
Design Head (m)	0.700
Design Flow (l/s)	3.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	97
Invert Level (m)	112.900
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	3.8
Flush-Flo™	0.210	3.8
Kick-Flo®	0.469	3.2
Mean Flow over Head Range	-	3.3

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	3.1	1.200	4.9	3.000	7.5	7.000	11.2
0.200	3.8	1.400	5.2	3.500	8.0	7.500	11.5
0.300	3.7	1.600	5.6	4.000	8.6	8.000	11.9
0.400	3.5	1.800	5.9	4.500	9.1	8.500	12.3
0.500	3.3	2.000	6.2	5.000	9.5	9.000	12.6
0.600	3.5	2.200	6.5	5.500	10.0	9.500	13.0
0.800	4.0	2.400	6.7	6.000	10.4		
1.000	4.5	2.600	7.0	6.500	10.8		

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WSP Group Ltd				Page 1	
.		SWMK			
.		CATCHMENT L			
.		1 IN 100 YEAR			
Date 21/04/2020		Designed by PS			
File Catchment L_002.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³) Status
15 min Summer		104.197	0.197	22.5	1034.1 O K
30 min Summer		104.251	0.251	26.3	1325.1 O K
60 min Summer		104.303	0.303	26.7	1611.3 O K
120 min Summer		104.360	0.360	26.8	1926.9 O K
180 min Summer		104.388	0.388	26.8	2089.7 O K
240 min Summer		104.405	0.405	26.8	2183.3 O K
360 min Summer		104.419	0.419	26.8	2264.1 O K
480 min Summer		104.420	0.420	26.8	2272.6 O K
600 min Summer		104.416	0.416	26.8	2246.1 O K
720 min Summer		104.410	0.410	26.8	2212.5 O K
960 min Summer		104.398	0.398	26.8	2145.0 O K
1440 min Summer		104.376	0.376	26.8	2018.2 O K
2160 min Summer		104.345	0.345	26.8	1844.2 O K
2880 min Summer		104.317	0.317	26.8	1690.5 O K
4320 min Summer		104.273	0.273	26.5	1445.6 O K
5760 min Summer		104.241	0.241	26.2	1269.9 O K
7200 min Summer		104.220	0.220	25.5	1156.9 O K
8640 min Summer		104.207	0.207	23.8	1084.0 O K
10080 min Summer		104.196	0.196	22.4	1027.1 O K
15 min Winter		104.220	0.220	25.5	1158.1 O K
30 min Winter		104.280	0.280	26.6	1486.4 O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer		108.324	0.0	750.8	23
30 min Summer		69.981	0.0	1018.2	37
60 min Summer		43.110	0.0	1480.8	66
120 min Summer		26.366	0.0	1833.8	126
180 min Summer		19.477	0.0	2040.1	184
240 min Summer		15.586	0.0	2179.8	244
360 min Summer		11.241	0.0	2358.1	362
480 min Summer		8.836	0.0	2467.5	482
600 min Summer		7.302	0.0	2543.1	584
720 min Summer		6.235	0.0	2598.6	622
960 min Summer		4.841	0.0	2672.7	736
1440 min Summer		3.379	0.0	2750.7	986
2160 min Summer		2.364	0.0	3158.0	1384
2880 min Summer		1.842	0.0	3269.3	1784
4320 min Summer		1.310	0.0	3432.8	2516
5760 min Summer		1.038	0.0	3785.7	3232
7200 min Summer		0.875	0.0	3973.8	3960
8640 min Summer		0.765	0.0	4148.4	4672
10080 min Summer		0.687	0.0	4299.6	5352
15 min Winter		108.324	0.0	861.6	22
30 min Winter		69.981	0.0	1158.2	37
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT L			
.		1 IN 100 YEAR			
Date 21/04/2020		Designed by PS			
File Catchment L_002.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	104.339	0.339	26.8	1810.0	O K
120 min Winter	104.402	0.402	26.8	2168.9	O K
180 min Winter	104.435	0.435	26.8	2356.8	O K
240 min Winter	104.454	0.454	26.8	2467.0	O K
360 min Winter	104.472	0.472	26.8	2568.8	O K
480 min Winter	104.475	0.475	26.8	2590.6	O K
600 min Winter	104.473	0.473	26.8	2573.8	O K
720 min Winter	104.466	0.466	26.8	2535.1	O K
960 min Winter	104.447	0.447	26.8	2426.0	O K
1440 min Winter	104.416	0.416	26.8	2246.0	O K
2160 min Winter	104.370	0.370	26.8	1984.6	O K
2880 min Winter	104.328	0.328	26.8	1752.0	O K
4320 min Winter	104.263	0.263	26.5	1392.4	O K
5760 min Winter	104.222	0.222	25.7	1168.7	O K
7200 min Winter	104.201	0.201	23.0	1053.2	O K
8640 min Winter	104.186	0.186	20.9	972.0	O K
10080 min Winter	104.175	0.175	19.2	912.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	43.110	0.0	1672.2	66	
120 min Winter	26.366	0.0	2065.6	124	
180 min Winter	19.477	0.0	2294.7	182	
240 min Winter	15.586	0.0	2449.5	240	
360 min Winter	11.241	0.0	2646.2	356	
480 min Winter	8.836	0.0	2766.4	470	
600 min Winter	7.302	0.0	2849.0	580	
720 min Winter	6.235	0.0	2909.2	688	
960 min Winter	4.841	0.0	2988.8	800	
1440 min Winter	3.379	0.0	3068.8	1074	
2160 min Winter	2.364	0.0	3546.6	1512	
2880 min Winter	1.842	0.0	3673.7	1908	
4320 min Winter	1.310	0.0	3865.3	2676	
5760 min Winter	1.038	0.0	4248.2	3336	
7200 min Winter	0.875	0.0	4460.8	4040	
8640 min Winter	0.765	0.0	4659.7	4760	
10080 min Winter	0.687	0.0	4835.5	5456	
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WSP Group Ltd		Page 3																																				
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Date 21/04/2020 File Catchment L_002.srcx	Designed by PS Checked by AC																																					
XP Solutions Source Control 2019.1																																						
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Rainfall Model	FEH																																					
Return Period (years)	100																																					
FEH Rainfall Version	2013																																					
Site Location	GB 483669 232428 SP 83669 32428																																					
Data Type	Point																																					
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Shortest Storm (mins)	15																																					
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Climate Change %	+0																																					
Time (mins)	Area	Time (mins)	Area																																			
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WSP Group Ltd		Page 4																																																																																															
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Model Details Storage is Online Cover Level (m) 105.000 Tank or Pond Structure Invert Level (m) 104.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>5090.0</td><td>1.000</td><td>6670.0</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0229-2680-0700-2680 Design Head (m) 0.700 Design Flow (l/s) 26.8 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 229 Invert Level (m) 104.000 Minimum Outlet Pipe Diameter (mm) 300 Suggested Manhole Diameter (mm) 1500 <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>0.700</td><td>26.8</td></tr><tr><td>Flush-Flo™</td><td>0.335</td><td>26.8</td></tr><tr><td>Kick-Flo®</td><td>0.564</td><td>24.2</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>21.1</td></tr></table> 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 <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>7.6</td><td>1.200</td><td>34.7</td><td>3.000</td><td>54.0</td><td>7.000</td><td>81.5</td></tr><tr><td>0.200</td><td>22.9</td><td>1.400</td><td>37.4</td><td>3.500</td><td>58.2</td><td>7.500</td><td>83.7</td></tr><tr><td>0.300</td><td>26.7</td><td>1.600</td><td>39.8</td><td>4.000</td><td>62.1</td><td>8.000</td><td>86.5</td></tr><tr><td>0.400</td><td>26.6</td><td>1.800</td><td>42.2</td><td>4.500</td><td>65.7</td><td>8.500</td><td>89.2</td></tr><tr><td>0.500</td><td>25.6</td><td>2.000</td><td>44.4</td><td>5.000</td><td>69.2</td><td>9.000</td><td>91.8</td></tr><tr><td>0.600</td><td>24.9</td><td>2.200</td><td>46.5</td><td>5.500</td><td>72.5</td><td>9.500</td><td>94.4</td></tr><tr><td>0.800</td><td>28.6</td><td>2.400</td><td>48.4</td><td>6.000</td><td>75.6</td><td></td><td></td></tr><tr><td>1.000</td><td>31.8</td><td>2.600</td><td>50.4</td><td>6.500</td><td>78.6</td><td></td><td></td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	5090.0	1.000	6670.0	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	0.700	26.8	Flush-Flo™	0.335	26.8	Kick-Flo®	0.564	24.2	Mean Flow over Head Range	-	21.1	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	34.7	3.000	54.0	7.000	81.5	0.200	22.9	1.400	37.4	3.500	58.2	7.500	83.7	0.300	26.7	1.600	39.8	4.000	62.1	8.000	86.5	0.400	26.6	1.800	42.2	4.500	65.7	8.500	89.2	0.500	25.6	2.000	44.4	5.000	69.2	9.000	91.8	0.600	24.9	2.200	46.5	5.500	72.5	9.500	94.4	0.800	28.6	2.400	48.4	6.000	75.6			1.000	31.8	2.600	50.4	6.500	78.6		
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WSP Group Ltd				Page 1	
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Date 22/04/2020		Designed by PS			
File Catchment M_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³) Status
15 min Summer		104.205	0.205	15.0	599.1 O K
30 min Summer		104.261	0.261	15.3	768.9 O K
60 min Summer		104.315	0.315	15.3	935.0 O K
120 min Summer		104.374	0.374	15.3	1117.8 O K
180 min Summer		104.404	0.404	15.3	1211.6 O K
240 min Summer		104.420	0.420	15.3	1265.3 O K
360 min Summer		104.435	0.435	15.3	1310.7 O K
480 min Summer		104.436	0.436	15.3	1314.2 O K
600 min Summer		104.430	0.430	15.3	1296.9 O K
720 min Summer		104.423	0.423	15.3	1272.7 O K
960 min Summer		104.408	0.408	15.3	1226.1 O K
1440 min Summer		104.381	0.381	15.3	1139.8 O K
2160 min Summer		104.344	0.344	15.3	1023.7 O K
2880 min Summer		104.311	0.311	15.3	922.6 O K
4320 min Summer		104.259	0.259	15.3	762.8 O K
5760 min Summer		104.222	0.222	15.1	648.8 O K
7200 min Summer		104.196	0.196	14.9	570.5 O K
8640 min Summer		104.180	0.180	14.5	522.1 O K
10080 min Summer		104.169	0.169	13.6	490.8 O K
15 min Winter		104.230	0.230	15.2	671.8 O K
30 min Winter		104.292	0.292	15.3	862.8 O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer		108.324	0.0	489.2	22
30 min Summer		69.981	0.0	649.2	37
60 min Summer		43.110	0.0	898.8	66
120 min Summer		26.366	0.0	1107.0	126
180 min Summer		19.477	0.0	1228.9	184
240 min Summer		15.586	0.0	1311.8	244
360 min Summer		11.241	0.0	1417.9	362
480 min Summer		8.836	0.0	1483.7	482
600 min Summer		7.302	0.0	1529.6	600
720 min Summer		6.235	0.0	1563.6	640
960 min Summer		4.841	0.0	1610.3	746
1440 min Summer		3.379	0.0	1663.0	996
2160 min Summer		2.364	0.0	1865.2	1388
2880 min Summer		1.842	0.0	1933.7	1788
4320 min Summer		1.310	0.0	2040.7	2548
5760 min Summer		1.038	0.0	2217.1	3232
7200 min Summer		0.875	0.0	2329.5	3960
8640 min Summer		0.765	0.0	2435.7	4592
10080 min Summer		0.687	0.0	2530.9	5344
15 min Winter		108.324	0.0	555.7	22
30 min Winter		69.981	0.0	732.4	37
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT M			
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<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	104.352	0.352	15.3	1050.5	O K
120 min Winter	104.418	0.418	15.3	1258.4	O K
180 min Winter	104.452	0.452	15.3	1367.0	O K
240 min Winter	104.472	0.472	15.3	1430.5	O K
360 min Winter	104.490	0.490	15.3	1488.7	O K
480 min Winter	104.493	0.493	15.3	1500.1	O K
600 min Winter	104.490	0.490	15.3	1488.9	O K
720 min Winter	104.482	0.482	15.3	1464.5	O K
960 min Winter	104.461	0.461	15.3	1395.0	O K
1440 min Winter	104.423	0.423	15.3	1274.8	O K
2160 min Winter	104.370	0.370	15.3	1105.8	O K
2880 min Winter	104.322	0.322	15.3	955.2	O K
4320 min Winter	104.246	0.246	15.2	721.6	O K
5760 min Winter	104.196	0.196	14.9	570.7	O K
7200 min Winter	104.172	0.172	13.8	498.0	O K
8640 min Winter	104.157	0.157	12.5	453.8	O K
10080 min Winter	104.146	0.146	11.4	422.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	43.110	0.0	1011.4	66	
120 min Winter	26.366	0.0	1243.4	124	
180 min Winter	19.477	0.0	1378.9	182	
240 min Winter	15.586	0.0	1470.7	240	
360 min Winter	11.241	0.0	1587.8	356	
480 min Winter	8.836	0.0	1659.9	470	
600 min Winter	7.302	0.0	1709.9	582	
720 min Winter	6.235	0.0	1746.7	690	
960 min Winter	4.841	0.0	1796.6	884	
1440 min Winter	3.379	0.0	1850.0	1084	
2160 min Winter	2.364	0.0	2092.3	1516	
2880 min Winter	1.842	0.0	2169.8	1932	
4320 min Winter	1.310	0.0	2293.9	2680	
5760 min Winter	1.038	0.0	2486.2	3336	
7200 min Winter	0.875	0.0	2613.0	3968	
8640 min Winter	0.765	0.0	2733.4	4672	
10080 min Winter	0.687	0.0	2843.4	5440	
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WSP Group Ltd		Page 3																																				
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WSP Group Ltd				Page 1	
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<u>Summary of Results for 100 year Return Period</u>					
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³) Status
15 min Summer		100.217	0.217	5.6	215.0 O K
30 min Summer		100.274	0.274	5.6	275.9 O K
60 min Summer		100.328	0.328	5.6	335.2 O K
120 min Summer		100.385	0.385	5.6	399.9 O K
180 min Summer		100.413	0.413	5.6	432.5 O K
240 min Summer		100.429	0.429	5.6	450.7 O K
360 min Summer		100.441	0.441	5.6	465.0 O K
480 min Summer		100.440	0.440	5.6	464.2 O K
600 min Summer		100.433	0.433	5.6	455.8 O K
720 min Summer		100.423	0.423	5.6	444.3 O K
960 min Summer		100.405	0.405	5.6	422.7 O K
1440 min Summer		100.371	0.371	5.6	384.1 O K
2160 min Summer		100.327	0.327	5.6	334.4 O K
2880 min Summer		100.289	0.289	5.6	292.5 O K
4320 min Summer		100.230	0.230	5.6	228.1 O K
5760 min Summer		100.187	0.187	5.6	183.5 O K
7200 min Summer		100.158	0.158	5.5	153.5 O K
8640 min Summer		100.138	0.138	5.4	133.5 O K
10080 min Summer		100.126	0.126	5.2	121.8 O K
15 min Winter		100.242	0.242	5.6	241.2 O K
30 min Winter		100.305	0.305	5.6	309.8 O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer		108.324	0.0	198.9	22
30 min Summer		69.981	0.0	259.0	37
60 min Summer		43.110	0.0	338.3	66
120 min Summer		26.366	0.0	414.8	126
180 min Summer		19.477	0.0	459.8	186
240 min Summer		15.586	0.0	490.5	244
360 min Summer		11.241	0.0	530.3	364
480 min Summer		8.836	0.0	555.2	482
600 min Summer		7.302	0.0	572.9	600
720 min Summer		6.235	0.0	586.2	654
960 min Summer		4.841	0.0	605.3	754
1440 min Summer		3.379	0.0	629.1	996
2160 min Summer		2.364	0.0	682.2	1388
2880 min Summer		1.842	0.0	708.2	1788
4320 min Summer		1.310	0.0	751.5	2516
5760 min Summer		1.038	0.0	803.8	3232
7200 min Summer		0.875	0.0	845.5	3896
8640 min Summer		0.765	0.0	885.8	4584
10080 min Summer		0.687	0.0	923.6	5248
15 min Winter		108.324	0.0	223.8	22
30 min Winter		69.981	0.0	290.3	37
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT N			
.		1 IN 100 YEAR			
Date 21/04/2020		Designed by PS			
File Catchment N_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	100.365	0.365	5.6	376.8	O K
120 min Winter	100.429	0.429	5.6	450.7	O K
180 min Winter	100.461	0.461	5.6	488.9	O K
240 min Winter	100.480	0.480	5.6	511.1	O K
360 min Winter	100.496	0.496	5.6	530.7	O K
480 min Winter	100.498	0.498	5.6	533.3	O K
600 min Winter	100.493	0.493	5.6	527.7	O K
720 min Winter	100.485	0.485	5.6	517.2	O K
960 min Winter	100.460	0.460	5.6	487.3	O K
1440 min Winter	100.414	0.414	5.6	433.8	O K
2160 min Winter	100.353	0.353	5.6	363.3	O K
2880 min Winter	100.298	0.298	5.6	301.6	O K
4320 min Winter	100.210	0.210	5.6	207.8	O K
5760 min Winter	100.154	0.154	5.5	149.4	O K
7200 min Winter	100.126	0.126	5.2	121.2	O K
8640 min Winter	100.112	0.112	4.6	108.0	O K
10080 min Winter	100.103	0.103	4.2	98.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	43.110	0.0	379.5	66	
120 min Winter	26.366	0.0	464.9	124	
180 min Winter	19.477	0.0	515.1	182	
240 min Winter	15.586	0.0	549.2	240	
360 min Winter	11.241	0.0	593.1	356	
480 min Winter	8.836	0.0	620.5	472	
600 min Winter	7.302	0.0	639.8	584	
720 min Winter	6.235	0.0	654.4	694	
960 min Winter	4.841	0.0	675.0	896	
1440 min Winter	3.379	0.0	700.0	1086	
2160 min Winter	2.364	0.0	764.5	1516	
2880 min Winter	1.842	0.0	793.7	1932	
4320 min Winter	1.310	0.0	843.2	2644	
5760 min Winter	1.038	0.0	900.7	3288	
7200 min Winter	0.875	0.0	947.6	3896	
8640 min Winter	0.765	0.0	993.0	4592	
10080 min Winter	0.687	0.0	1036.2	5344	
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WSP Group Ltd		Page 3																								
. . .	SWMK CATCHMENT N 1 IN 100 YEAR																									
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WSP Group Ltd		Page 4
. . .	SWMK CATCHMENT N 1 IN 100 YEAR	
Date 21/04/2020 File Catchment N_001.srcx	Designed by PS Checked by AC	
XP Solutions Source Control 2019.1		

Model Details

Storage is Online Cover Level (m) 101.000

Tank or Pond Structure

Invert Level (m) 100.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	930.0	1.000	1550.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0116-5600-0700-5600
Design Head (m)	0.700
Design Flow (l/s)	5.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	116
Invert Level (m)	100.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	5.6
Flush-Flo™	0.217	5.6
Kick-Flo®	0.485	4.7
Mean Flow over Head Range	-	4.7

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	4.1	1.200	7.2	3.000	11.1	7.000	16.6
0.200	5.6	1.400	7.7	3.500	11.9	7.500	17.1
0.300	5.5	1.600	8.2	4.000	12.7	8.000	17.7
0.400	5.3	1.800	8.7	4.500	13.5	8.500	18.3
0.500	4.8	2.000	9.2	5.000	14.1	9.000	18.8
0.600	5.2	2.200	9.6	5.500	14.8	9.500	19.3
0.800	6.0	2.400	10.0	6.000	15.4		
1.000	6.6	2.600	10.4	6.500	16.0		

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WSP Group Ltd				Page 1	
.		SWMK			
.		CATCHMENT O			
.		1 IN 100 YEAR			
Date 22/04/2020		Designed by PS			
File Catchment O_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	102.218	0.218	9.4	328.2	O K
30 min Summer	102.276	0.276	9.4	420.9	O K
60 min Summer	102.331	0.331	9.4	510.9	O K
120 min Summer	102.389	0.389	9.4	608.5	O K
180 min Summer	102.417	0.417	9.4	657.1	O K
240 min Summer	102.433	0.433	9.4	683.5	O K
360 min Summer	102.443	0.443	9.4	702.5	O K
480 min Summer	102.441	0.441	9.4	698.2	O K
600 min Summer	102.433	0.433	9.4	683.4	O K
720 min Summer	102.424	0.424	9.4	667.8	O K
960 min Summer	102.405	0.405	9.4	636.6	O K
1440 min Summer	102.371	0.371	9.4	578.8	O K
2160 min Summer	102.326	0.326	9.4	502.5	O K
2880 min Summer	102.287	0.287	9.4	438.3	O K
4320 min Summer	102.227	0.227	9.4	341.8	O K
5760 min Summer	102.186	0.186	9.3	278.5	O K
7200 min Summer	102.161	0.161	9.1	238.4	O K
8640 min Summer	102.147	0.147	8.6	216.8	O K
10080 min Summer	102.137	0.137	8.0	202.1	O K
15 min Winter	102.243	0.243	9.4	368.2	O K
30 min Winter	102.308	0.308	9.4	472.6	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	108.324	0.0	296.2	22	
30 min Summer	69.981	0.0	388.0	37	
60 min Summer	43.110	0.0	512.2	66	
120 min Summer	26.366	0.0	628.8	126	
180 min Summer	19.477	0.0	697.5	184	
240 min Summer	15.586	0.0	744.5	244	
360 min Summer	11.241	0.0	805.1	362	
480 min Summer	8.836	0.0	843.2	480	
600 min Summer	7.302	0.0	870.2	564	
720 min Summer	6.235	0.0	890.7	608	
960 min Summer	4.841	0.0	919.8	718	
1440 min Summer	3.379	0.0	956.6	972	
2160 min Summer	2.364	0.0	1039.1	1368	
2880 min Summer	1.842	0.0	1078.3	1760	
4320 min Summer	1.310	0.0	1142.4	2472	
5760 min Summer	1.038	0.0	1226.1	3176	
7200 min Summer	0.875	0.0	1289.3	3824	
8640 min Summer	0.765	0.0	1350.0	4576	
10080 min Summer	0.687	0.0	1406.4	5248	
15 min Winter	108.324	0.0	334.2	22	
30 min Winter	69.981	0.0	436.1	37	
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT O			
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<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	102.369	0.369	9.4	574.4	O K
120 min Winter	102.434	0.434	9.4	685.8	O K
180 min Winter	102.466	0.466	9.4	742.6	O K
240 min Winter	102.485	0.485	9.4	774.8	O K
360 min Winter	102.500	0.500	9.4	801.4	O K
480 min Winter	102.500	0.500	9.4	802.1	O K
600 min Winter	102.493	0.493	9.4	790.2	O K
720 min Winter	102.482	0.482	9.4	771.0	O K
960 min Winter	102.456	0.456	9.4	724.4	O K
1440 min Winter	102.411	0.411	9.4	645.5	O K
2160 min Winter	102.345	0.345	9.4	535.1	O K
2880 min Winter	102.288	0.288	9.4	440.5	O K
4320 min Winter	102.203	0.203	9.3	303.9	O K
5760 min Winter	102.155	0.155	9.1	229.9	O K
7200 min Winter	102.136	0.136	7.9	200.9	O K
8640 min Winter	102.124	0.124	7.1	181.8	O K
10080 min Winter	102.115	0.115	6.4	168.7	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	43.110	0.0	575.1	66	
120 min Winter	26.366	0.0	705.4	124	
180 min Winter	19.477	0.0	782.0	182	
240 min Winter	15.586	0.0	834.3	240	
360 min Winter	11.241	0.0	901.7	356	
480 min Winter	8.836	0.0	943.9	470	
600 min Winter	7.302	0.0	973.7	580	
720 min Winter	6.235	0.0	996.3	686	
960 min Winter	4.841	0.0	1028.4	780	
1440 min Winter	3.379	0.0	1068.4	1066	
2160 min Winter	2.364	0.0	1164.8	1492	
2880 min Winter	1.842	0.0	1209.1	1876	
4320 min Winter	1.310	0.0	1282.4	2596	
5760 min Winter	1.038	0.0	1374.2	3176	
7200 min Winter	0.875	0.0	1445.3	3888	
8640 min Winter	0.765	0.0	1513.9	4584	
10080 min Winter	0.687	0.0	1578.4	5344	
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WSP Group Ltd		Page 3																																				
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WSP Group Ltd		Page 4																																																																								
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WSP Group Ltd				Page 1	
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Date 21/04/2020		Designed by PS			
File Catchment R_002.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
Summary of Results for 100 year Return Period					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	97.221	0.221	13.0	553.3	O K
30 min Summer	97.282	0.282	13.1	710.5	O K
60 min Summer	97.340	0.340	13.1	864.7	O K
120 min Summer	97.403	0.403	13.1	1035.3	O K
180 min Summer	97.435	0.435	13.1	1123.7	O K
240 min Summer	97.454	0.454	13.1	1175.1	O K
360 min Summer	97.471	0.471	13.1	1220.9	O K
480 min Summer	97.473	0.473	13.1	1228.0	O K
600 min Summer	97.469	0.469	13.1	1215.7	O K
720 min Summer	97.460	0.460	13.1	1192.7	O K
960 min Summer	97.443	0.443	13.1	1146.0	O K
1440 min Summer	97.413	0.413	13.1	1063.3	O K
2160 min Summer	97.373	0.373	13.1	954.7	O K
2880 min Summer	97.338	0.338	13.1	860.2	O K
4320 min Summer	97.281	0.281	13.1	709.0	O K
5760 min Summer	97.238	0.238	13.1	598.0	O K
7200 min Summer	97.208	0.208	13.0	519.2	O K
8640 min Summer	97.186	0.186	12.8	463.8	O K
10080 min Summer	97.172	0.172	12.5	428.1	O K
15 min Winter	97.247	0.247	13.1	620.5	O K
30 min Winter	97.314	0.314	13.1	797.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	108.324	0.0	465.3	23	
30 min Summer	69.981	0.0	612.7	37	
60 min Summer	43.110	0.0	838.8	66	
120 min Summer	26.366	0.0	1031.1	126	
180 min Summer	19.477	0.0	1143.6	186	
240 min Summer	15.586	0.0	1219.9	244	
360 min Summer	11.241	0.0	1317.5	364	
480 min Summer	8.836	0.0	1377.8	482	
600 min Summer	7.302	0.0	1419.7	600	
720 min Summer	6.235	0.0	1450.8	690	
960 min Summer	4.841	0.0	1493.0	780	
1440 min Summer	3.379	0.0	1539.0	1014	
2160 min Summer	2.364	0.0	1728.4	1408	
2880 min Summer	1.842	0.0	1792.6	1812	
4320 min Summer	1.310	0.0	1895.1	2556	
5760 min Summer	1.038	0.0	2051.2	3288	
7200 min Summer	0.875	0.0	2155.8	3968	
8640 min Summer	0.765	0.0	2255.2	4664	
10080 min Summer	0.687	0.0	2345.3	5344	
15 min Winter	108.324	0.0	526.7	22	
30 min Winter	69.981	0.0	688.8	37	
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WSP Group Ltd				Page 2	
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.		1 IN 100 YEAR			
Date 21/04/2020		Designed by PS			
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XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	97.379	0.379	13.1	971.5	O K
120 min Winter	97.450	0.450	13.1	1165.3	O K
180 min Winter	97.487	0.487	13.1	1267.7	O K
240 min Winter	97.509	0.509	13.1	1328.6	O K
360 min Winter	97.530	0.530	13.1	1387.3	O K
480 min Winter	97.535	0.535	13.1	1402.4	O K
600 min Winter	97.533	0.533	13.1	1396.4	O K
720 min Winter	97.527	0.527	13.1	1377.9	O K
960 min Winter	97.506	0.506	13.1	1318.6	O K
1440 min Winter	97.463	0.463	13.1	1199.0	O K
2160 min Winter	97.406	0.406	13.1	1044.0	O K
2880 min Winter	97.354	0.354	13.1	904.1	O K
4320 min Winter	97.270	0.270	13.1	680.0	O K
5760 min Winter	97.211	0.211	13.0	525.9	O K
7200 min Winter	97.175	0.175	12.7	434.6	O K
8640 min Winter	97.159	0.159	11.5	392.8	O K
10080 min Winter	97.147	0.147	10.5	363.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	43.110	0.0	942.8	66	
120 min Winter	26.366	0.0	1156.9	124	
180 min Winter	19.477	0.0	1281.5	182	
240 min Winter	15.586	0.0	1365.6	240	
360 min Winter	11.241	0.0	1472.2	358	
480 min Winter	8.836	0.0	1537.3	472	
600 min Winter	7.302	0.0	1581.9	586	
720 min Winter	6.235	0.0	1614.5	698	
960 min Winter	4.841	0.0	1657.9	906	
1440 min Winter	3.379	0.0	1700.1	1110	
2160 min Winter	2.364	0.0	1938.1	1540	
2880 min Winter	1.842	0.0	2010.3	1960	
4320 min Winter	1.310	0.0	2128.8	2724	
5760 min Winter	1.038	0.0	2299.7	3400	
7200 min Winter	0.875	0.0	2417.6	3968	
8640 min Winter	0.765	0.0	2530.1	4672	
10080 min Winter	0.687	0.0	2634.0	5440	
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WSP Group Ltd		Page 3																								
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Date 21/04/2020 File Catchment R_002.srcx	Designed by PS Checked by AC																									
XP Solutions Source Control 2019.1																										
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WSP Group Ltd				Page 1	
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Date 12/05/2020		Designed by PS			
File CATCHMENT S_001.SRCX		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	95.169	0.169	7.4	287.3	O K
30 min Summer	95.215	0.215	7.5	368.7	O K
60 min Summer	95.259	0.259	7.5	448.2	O K
120 min Summer	95.306	0.306	7.5	535.3	O K
180 min Summer	95.330	0.330	7.5	579.7	O K
240 min Summer	95.344	0.344	7.5	604.8	O K
360 min Summer	95.355	0.355	7.5	625.2	O K
480 min Summer	95.355	0.355	7.5	625.5	O K
600 min Summer	95.350	0.350	7.5	615.9	O K
720 min Summer	95.343	0.343	7.5	604.1	O K
960 min Summer	95.331	0.331	7.5	580.8	O K
1440 min Summer	95.308	0.308	7.5	537.6	O K
2160 min Summer	95.276	0.276	7.5	479.6	O K
2880 min Summer	95.248	0.248	7.5	429.3	O K
4320 min Summer	95.205	0.205	7.5	351.0	O K
5760 min Summer	95.174	0.174	7.4	295.9	O K
7200 min Summer	95.152	0.152	7.3	258.8	O K
8640 min Summer	95.140	0.140	7.0	236.3	O K
10080 min Summer	95.131	0.131	6.6	221.2	O K
15 min Winter	95.189	0.189	7.4	322.2	O K
30 min Winter	95.240	0.240	7.5	413.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	108.324	0.0	242.1	22	
30 min Summer	69.981	0.0	319.7	37	
60 min Summer	43.110	0.0	436.4	66	
120 min Summer	26.366	0.0	536.9	126	
180 min Summer	19.477	0.0	595.9	184	
240 min Summer	15.586	0.0	636.0	244	
360 min Summer	11.241	0.0	687.6	362	
480 min Summer	8.836	0.0	719.7	482	
600 min Summer	7.302	0.0	742.1	588	
720 min Summer	6.235	0.0	758.9	626	
960 min Summer	4.841	0.0	782.1	742	
1440 min Summer	3.379	0.0	809.1	986	
2160 min Summer	2.364	0.0	899.1	1388	
2880 min Summer	1.842	0.0	932.4	1784	
4320 min Summer	1.310	0.0	985.3	2512	
5760 min Summer	1.038	0.0	1066.2	3232	
7200 min Summer	0.875	0.0	1120.6	3896	
8640 min Summer	0.765	0.0	1172.2	4584	
10080 min Summer	0.687	0.0	1218.9	5344	
15 min Winter	108.324	0.0	274.3	22	
30 min Winter	69.981	0.0	360.1	37	
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WSP Group Ltd				Page 2	
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Date 12/05/2020		Designed by PS			
File CATCHMENT S_001.SRCX		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	95.289	0.289	7.5	503.6	O K
120 min Winter	95.343	0.343	7.5	602.8	O K
180 min Winter	95.370	0.370	7.5	654.1	O K
240 min Winter	95.386	0.386	7.5	683.8	O K
360 min Winter	95.399	0.399	7.5	710.0	O K
480 min Winter	95.402	0.402	7.5	713.9	O K
600 min Winter	95.398	0.398	7.5	707.1	O K
720 min Winter	95.391	0.391	7.5	694.2	O K
960 min Winter	95.373	0.373	7.5	659.3	O K
1440 min Winter	95.342	0.342	7.5	600.8	O K
2160 min Winter	95.296	0.296	7.5	516.9	O K
2880 min Winter	95.256	0.256	7.5	442.6	O K
4320 min Winter	95.192	0.192	7.5	328.9	O K
5760 min Winter	95.152	0.152	7.3	257.4	O K
7200 min Winter	95.132	0.132	6.6	224.0	O K
8640 min Winter	95.120	0.120	6.0	202.9	O K
10080 min Winter	95.112	0.112	5.5	187.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	43.110	0.0	490.8	66	
120 min Winter	26.366	0.0	602.8	124	
180 min Winter	19.477	0.0	668.5	182	
240 min Winter	15.586	0.0	713.0	240	
360 min Winter	11.241	0.0	770.1	356	
480 min Winter	8.836	0.0	805.4	470	
600 min Winter	7.302	0.0	830.0	580	
720 min Winter	6.235	0.0	848.2	688	
960 min Winter	4.841	0.0	873.2	858	
1440 min Winter	3.379	0.0	901.0	1080	
2160 min Winter	2.364	0.0	1008.4	1516	
2880 min Winter	1.842	0.0	1046.1	1908	
4320 min Winter	1.310	0.0	1107.1	2644	
5760 min Winter	1.038	0.0	1195.4	3288	
7200 min Winter	0.875	0.0	1256.6	3968	
8640 min Winter	0.765	0.0	1315.1	4672	
10080 min Winter	0.687	0.0	1369.0	5352	
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WSP Group Ltd		Page 3																																				
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Model Details Storage is Online Cover Level (m) 96.000 Tank or Pond Structure Invert Level (m) 95.000 <table><tr><td>Depth (m)</td><td>Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td></tr><tr><td>0.000</td><td>1650.0</td><td>1.000</td><td>2330.0</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0132-7500-0700-7500 Design Head (m) 0.700 Design Flow (l/s) 7.5 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 132 Invert Level (m) 95.000 Minimum Outlet Pipe Diameter (mm) 150 Suggested Manhole Diameter (mm) 1200 Control Points <table><tr><td></td><td>Head (m)</td><td>Flow (l/s)</td></tr><tr><td>Design Point (Calculated)</td><td>0.700</td><td>7.5</td></tr><tr><td>Flush-Flo™</td><td>0.227</td><td>7.5</td></tr><tr><td>Kick-Flo®</td><td>0.499</td><td>6.4</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>6.3</td></tr></table> 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 <table><tr><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td></tr><tr><td>0.100</td><td>4.7</td><td>1.200</td><td>9.7</td><td>3.000</td><td>14.9</td><td>7.000</td><td>22.4</td></tr><tr><td>0.200</td><td>7.5</td><td>1.400</td><td>10.4</td><td>3.500</td><td>16.0</td><td>7.500</td><td>23.1</td></tr><tr><td>0.300</td><td>7.4</td><td>1.600</td><td>11.1</td><td>4.000</td><td>17.1</td><td>8.000</td><td>23.8</td></tr><tr><td>0.400</td><td>7.1</td><td>1.800</td><td>11.7</td><td>4.500</td><td>18.1</td><td>8.500</td><td>24.6</td></tr><tr><td>0.500</td><td>6.4</td><td>2.000</td><td>12.3</td><td>5.000</td><td>19.0</td><td>9.000</td><td>25.3</td></tr><tr><td>0.600</td><td>7.0</td><td>2.200</td><td>12.9</td><td>5.500</td><td>19.9</td><td>9.500</td><td>26.0</td></tr><tr><td>0.800</td><td>8.0</td><td>2.400</td><td>13.4</td><td>6.000</td><td>20.8</td><td></td><td></td></tr><tr><td>1.000</td><td>8.9</td><td>2.600</td><td>13.9</td><td>6.500</td><td>21.6</td><td></td><td></td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	1650.0	1.000	2330.0		Head (m)	Flow (l/s)	Design Point (Calculated)	0.700	7.5	Flush-Flo™	0.227	7.5	Kick-Flo®	0.499	6.4	Mean Flow over Head Range	-	6.3	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	4.7	1.200	9.7	3.000	14.9	7.000	22.4	0.200	7.5	1.400	10.4	3.500	16.0	7.500	23.1	0.300	7.4	1.600	11.1	4.000	17.1	8.000	23.8	0.400	7.1	1.800	11.7	4.500	18.1	8.500	24.6	0.500	6.4	2.000	12.3	5.000	19.0	9.000	25.3	0.600	7.0	2.200	12.9	5.500	19.9	9.500	26.0	0.800	8.0	2.400	13.4	6.000	20.8			1.000	8.9	2.600	13.9	6.500	21.6		
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WSP Group Ltd				Page 1		
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<u>Summary of Results for 100 year Return Period</u>						
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer		106.117	0.117	4.7	240.8	O K
30 min Summer		106.149	0.149	5.3	308.9	O K
60 min Summer		106.181	0.181	5.4	376.3	O K
120 min Summer		106.215	0.215	5.4	451.3	O K
180 min Summer		106.234	0.234	5.4	490.7	O K
240 min Summer		106.244	0.244	5.4	514.0	O K
360 min Summer		106.254	0.254	5.4	535.9	O K
480 min Summer		106.257	0.257	5.4	541.0	O K
600 min Summer		106.255	0.255	5.4	537.8	O K
720 min Summer		106.252	0.252	5.4	530.2	O K
960 min Summer		106.245	0.245	5.4	514.5	O K
1440 min Summer		106.232	0.232	5.4	486.5	O K
2160 min Summer		106.214	0.214	5.4	449.2	O K
2880 min Summer		106.199	0.199	5.4	416.2	O K
4320 min Summer		106.174	0.174	5.4	361.5	O K
5760 min Summer		106.154	0.154	5.3	319.3	O K
7200 min Summer		106.139	0.139	5.2	288.3	O K
8640 min Summer		106.129	0.129	5.2	266.2	O K
10080 min Summer		106.122	0.122	4.9	251.6	O K
15 min Winter		106.130	0.130	5.2	269.6	O K
30 min Winter		106.167	0.167	5.3	346.5	O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer		108.324	0.0	173.6	23	
30 min Summer		69.981	0.0	233.9	37	
60 min Summer		43.110	0.0	343.1	66	
120 min Summer		26.366	0.0	424.1	126	
180 min Summer		19.477	0.0	471.2	186	
240 min Summer		15.586	0.0	502.9	244	
360 min Summer		11.241	0.0	543.1	364	
480 min Summer		8.836	0.0	567.4	482	
600 min Summer		7.302	0.0	583.9	600	
720 min Summer		6.235	0.0	595.8	688	
960 min Summer		4.841	0.0	610.9	782	
1440 min Summer		3.379	0.0	623.7	1022	
2160 min Summer		2.364	0.0	732.6	1412	
2880 min Summer		1.842	0.0	758.3	1820	
4320 min Summer		1.310	0.0	796.3	2596	
5760 min Summer		1.038	0.0	880.5	3344	
7200 min Summer		0.875	0.0	924.3	4032	
8640 min Summer		0.765	0.0	965.0	4752	
10080 min Summer		0.687	0.0	1000.1	5448	
15 min Winter		108.324	0.0	198.7	22	
30 min Winter		69.981	0.0	265.1	37	
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT P			
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<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	106.202	0.202	5.4	422.5	O K
120 min Winter	106.241	0.241	5.4	507.6	O K
180 min Winter	106.262	0.262	5.4	552.8	O K
240 min Winter	106.274	0.274	5.4	579.9	O K
360 min Winter	106.287	0.287	5.4	606.6	O K
480 min Winter	106.290	0.290	5.4	614.6	O K
600 min Winter	106.290	0.290	5.4	613.6	O K
720 min Winter	106.287	0.287	5.4	607.5	O K
960 min Winter	106.278	0.278	5.4	586.7	O K
1440 min Winter	106.259	0.259	5.4	546.0	O K
2160 min Winter	106.234	0.234	5.4	491.6	O K
2880 min Winter	106.211	0.211	5.4	441.7	O K
4320 min Winter	106.173	0.173	5.4	359.7	O K
5760 min Winter	106.145	0.145	5.3	299.8	O K
7200 min Winter	106.127	0.127	5.1	262.1	O K
8640 min Winter	106.116	0.116	4.7	239.5	O K
10080 min Winter	106.108	0.108	4.3	222.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	43.110	0.0	387.1	66	
120 min Winter	26.366	0.0	477.1	124	
180 min Winter	19.477	0.0	529.1	182	
240 min Winter	15.586	0.0	564.0	240	
360 min Winter	11.241	0.0	607.9	356	
480 min Winter	8.836	0.0	634.1	472	
600 min Winter	7.302	0.0	651.6	584	
720 min Winter	6.235	0.0	663.9	694	
960 min Winter	4.841	0.0	678.9	900	
1440 min Winter	3.379	0.0	688.8	1104	
2160 min Winter	2.364	0.0	822.4	1544	
2880 min Winter	1.842	0.0	851.4	1964	
4320 min Winter	1.310	0.0	895.8	2768	
5760 min Winter	1.038	0.0	988.0	3464	
7200 min Winter	0.875	0.0	1037.5	4112	
8640 min Winter	0.765	0.0	1083.8	4848	
10080 min Winter	0.687	0.0	1124.7	5552	
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WSP Group Ltd		Page 3																																				
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WSP Group Ltd		Page 4																																																																								
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WSP Group Ltd				Page 1	
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.		CATCHMENT Q			
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Date 12/05/2020		Designed by PS			
File Catchment Q_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	94.137	0.137	10.0	542.3	O K
30 min Summer	94.175	0.175	13.3	694.9	O K
60 min Summer	94.212	0.212	13.8	844.7	O K
120 min Summer	94.252	0.252	13.9	1010.6	O K
180 min Summer	94.273	0.273	13.9	1096.6	O K
240 min Summer	94.285	0.285	13.9	1146.3	O K
360 min Summer	94.296	0.296	13.9	1190.1	O K
480 min Summer	94.297	0.297	13.9	1196.1	O K
600 min Summer	94.294	0.294	13.9	1183.9	O K
720 min Summer	94.291	0.291	13.9	1168.3	O K
960 min Summer	94.283	0.283	13.9	1136.6	O K
1440 min Summer	94.269	0.269	13.9	1076.7	O K
2160 min Summer	94.248	0.248	13.9	993.9	O K
2880 min Summer	94.230	0.230	13.9	920.4	O K
4320 min Summer	94.201	0.201	13.7	802.2	O K
5760 min Summer	94.181	0.181	13.5	717.8	O K
7200 min Summer	94.168	0.168	12.7	665.3	O K
8640 min Summer	94.158	0.158	11.9	625.9	O K
10080 min Summer	94.150	0.150	11.3	595.8	O K
15 min Winter	94.153	0.153	11.5	607.2	O K
30 min Winter	94.196	0.196	13.7	778.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	108.324	0.0	364.5	23	
30 min Summer	69.981	0.0	500.1	37	
60 min Summer	43.110	0.0	751.8	66	
120 min Summer	26.366	0.0	934.7	126	
180 min Summer	19.477	0.0	1041.3	184	
240 min Summer	15.586	0.0	1113.5	244	
360 min Summer	11.241	0.0	1205.2	362	
480 min Summer	8.836	0.0	1261.1	482	
600 min Summer	7.302	0.0	1299.5	582	
720 min Summer	6.235	0.0	1327.4	622	
960 min Summer	4.841	0.0	1363.9	736	
1440 min Summer	3.379	0.0	1400.0	986	
2160 min Summer	2.364	0.0	1633.7	1388	
2880 min Summer	1.842	0.0	1689.6	1788	
4320 min Summer	1.310	0.0	1768.5	2548	
5760 min Summer	1.038	0.0	1970.5	3232	
7200 min Summer	0.875	0.0	2067.1	3968	
8640 min Summer	0.765	0.0	2155.9	4672	
10080 min Summer	0.687	0.0	2231.2	5448	
15 min Winter	108.324	0.0	420.4	22	
30 min Winter	69.981	0.0	572.2	37	
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT Q			
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<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	94.237	0.237	13.9	948.6	O K
120 min Winter	94.283	0.283	13.9	1137.3	O K
180 min Winter	94.307	0.307	13.9	1236.3	O K
240 min Winter	94.321	0.321	13.9	1294.6	O K
360 min Winter	94.334	0.334	13.9	1349.1	O K
480 min Winter	94.337	0.337	13.9	1361.8	O K
600 min Winter	94.335	0.335	13.9	1354.4	O K
720 min Winter	94.331	0.331	13.9	1335.9	O K
960 min Winter	94.318	0.318	13.9	1283.5	O K
1440 min Winter	94.298	0.298	13.9	1197.4	O K
2160 min Winter	94.267	0.267	13.9	1071.4	O K
2880 min Winter	94.240	0.240	13.9	958.7	O K
4320 min Winter	94.197	0.197	13.7	783.7	O K
5760 min Winter	94.171	0.171	13.0	678.1	O K
7200 min Winter	94.155	0.155	11.7	615.0	O K
8640 min Winter	94.144	0.144	10.7	569.6	O K
10080 min Winter	94.135	0.135	9.8	535.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	43.110	0.0	851.1	66	
120 min Winter	26.366	0.0	1054.8	124	
180 min Winter	19.477	0.0	1173.3	182	
240 min Winter	15.586	0.0	1253.2	240	
360 min Winter	11.241	0.0	1354.4	356	
480 min Winter	8.836	0.0	1415.9	468	
600 min Winter	7.302	0.0	1457.8	580	
720 min Winter	6.235	0.0	1488.1	686	
960 min Winter	4.841	0.0	1527.3	792	
1440 min Winter	3.379	0.0	1563.9	1072	
2160 min Winter	2.364	0.0	1836.2	1512	
2880 min Winter	1.842	0.0	1900.3	1928	
4320 min Winter	1.310	0.0	1993.3	2680	
5760 min Winter	1.038	0.0	2212.3	3352	
7200 min Winter	0.875	0.0	2321.7	4104	
8640 min Winter	0.765	0.0	2423.0	4840	
10080 min Winter	0.687	0.0	2510.9	5552	
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WSP Group Ltd		Page 3																																				
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WSP Group Ltd		Page 4																																																																																															
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Model Details Storage is Online Cover Level (m) 95.000 Tank or Pond Structure Invert Level (m) 94.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>3900.0</td><td>1.000</td><td>4750.0</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0173-1400-0700-1400 Design Head (m) 0.700 Design Flow (l/s) 14.0 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 173 Invert Level (m) 94.000 Minimum Outlet Pipe Diameter (mm) 225 Suggested Manhole Diameter (mm) 1200 Control Points <table><tr><th></th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>0.700</td><td>14.0</td></tr><tr><td>Flush-Flo™</td><td>0.272</td><td>13.9</td></tr><tr><td>Kick-Flo®</td><td>0.527</td><td>12.2</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>11.4</td></tr></table> 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 <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>6.1</td><td>1.200</td><td>18.1</td><td>3.000</td><td>28.0</td><td>7.000</td><td>42.2</td></tr><tr><td>0.200</td><td>13.7</td><td>1.400</td><td>19.4</td><td>3.500</td><td>30.2</td><td>7.500</td><td>43.4</td></tr><tr><td>0.300</td><td>13.9</td><td>1.600</td><td>20.7</td><td>4.000</td><td>32.2</td><td>8.000</td><td>44.9</td></tr><tr><td>0.400</td><td>13.6</td><td>1.800</td><td>21.9</td><td>4.500</td><td>34.1</td><td>8.500</td><td>46.3</td></tr><tr><td>0.500</td><td>12.7</td><td>2.000</td><td>23.1</td><td>5.000</td><td>35.8</td><td>9.000</td><td>47.6</td></tr><tr><td>0.600</td><td>13.0</td><td>2.200</td><td>24.1</td><td>5.500</td><td>37.5</td><td>9.500</td><td>48.9</td></tr><tr><td>0.800</td><td>14.9</td><td>2.400</td><td>25.2</td><td>6.000</td><td>39.1</td><td></td><td></td></tr><tr><td>1.000</td><td>16.6</td><td>2.600</td><td>26.2</td><td>6.500</td><td>40.7</td><td></td><td></td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	3900.0	1.000	4750.0		Head (m)	Flow (l/s)	Design Point (Calculated)	0.700	14.0	Flush-Flo™	0.272	13.9	Kick-Flo®	0.527	12.2	Mean Flow over Head Range	-	11.4	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	6.1	1.200	18.1	3.000	28.0	7.000	42.2	0.200	13.7	1.400	19.4	3.500	30.2	7.500	43.4	0.300	13.9	1.600	20.7	4.000	32.2	8.000	44.9	0.400	13.6	1.800	21.9	4.500	34.1	8.500	46.3	0.500	12.7	2.000	23.1	5.000	35.8	9.000	47.6	0.600	13.0	2.200	24.1	5.500	37.5	9.500	48.9	0.800	14.9	2.400	25.2	6.000	39.1			1.000	16.6	2.600	26.2	6.500	40.7		
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WSP Group Ltd				Page 1	
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Date 21/04/2020		Designed by PS			
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XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	113.207	0.207	4.0	208.0	O K
30 min Summer	113.262	0.262	4.0	267.5	O K
60 min Summer	113.316	0.316	4.0	326.0	O K
120 min Summer	113.374	0.374	4.0	391.5	O K
180 min Summer	113.404	0.404	4.0	426.1	O K
240 min Summer	113.422	0.422	4.0	446.8	O K
360 min Summer	113.440	0.440	4.0	467.1	O K
480 min Summer	113.445	0.445	4.0	472.8	O K
600 min Summer	113.444	0.444	4.0	471.3	O K
720 min Summer	113.439	0.439	4.0	465.6	O K
960 min Summer	113.422	0.422	4.0	446.8	O K
1440 min Summer	113.393	0.393	4.0	412.9	O K
2160 min Summer	113.357	0.357	4.0	372.2	O K
2880 min Summer	113.326	0.326	4.0	337.7	O K
4320 min Summer	113.276	0.276	4.0	282.0	O K
5760 min Summer	113.236	0.236	4.0	238.8	O K
7200 min Summer	113.204	0.204	4.0	205.5	O K
8640 min Summer	113.180	0.180	4.0	180.1	O K
10080 min Summer	113.161	0.161	4.0	160.5	O K
15 min Winter	113.230	0.230	4.0	233.3	O K
30 min Winter	113.292	0.292	4.0	300.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	108.324	0.0	185.3	23	
30 min Summer	69.981	0.0	239.3	37	
60 min Summer	43.110	0.0	322.0	66	
120 min Summer	26.366	0.0	394.1	126	
180 min Summer	19.477	0.0	436.0	186	
240 min Summer	15.586	0.0	464.2	246	
360 min Summer	11.241	0.0	499.7	364	
480 min Summer	8.836	0.0	521.0	484	
600 min Summer	7.302	0.0	535.3	602	
720 min Summer	6.235	0.0	545.4	722	
960 min Summer	4.841	0.0	557.5	912	
1440 min Summer	3.379	0.0	562.3	1100	
2160 min Summer	2.364	0.0	653.9	1472	
2880 min Summer	1.842	0.0	678.3	1872	
4320 min Summer	1.310	0.0	719.6	2640	
5760 min Summer	1.038	0.0	773.3	3400	
7200 min Summer	0.875	0.0	813.3	4112	
8640 min Summer	0.765	0.0	851.8	4840	
10080 min Summer	0.687	0.0	887.7	5544	
15 min Winter	108.324	0.0	208.0	22	
30 min Winter	69.981	0.0	266.1	37	
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WSP Group Ltd				Page 2	
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Date 21/04/2020		Designed by PS			
File Catchment K_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	113.352	0.352	4.0	366.2	O K
120 min Winter	113.417	0.417	4.0	440.5	O K
180 min Winter	113.451	0.451	4.0	480.5	O K
240 min Winter	113.472	0.472	4.0	505.2	O K
360 min Winter	113.493	0.493	4.0	530.4	O K
480 min Winter	113.501	0.501	4.0	539.1	O K
600 min Winter	113.502	0.502	4.0	540.0	O K
720 min Winter	113.498	0.498	4.0	536.3	O K
960 min Winter	113.486	0.486	4.0	521.1	O K
1440 min Winter	113.447	0.447	4.0	475.3	O K
2160 min Winter	113.399	0.399	4.0	419.5	O K
2880 min Winter	113.355	0.355	4.0	370.2	O K
4320 min Winter	113.280	0.280	4.0	287.0	O K
5760 min Winter	113.220	0.220	4.0	222.5	O K
7200 min Winter	113.176	0.176	4.0	175.6	O K
8640 min Winter	113.144	0.144	3.9	142.8	O K
10080 min Winter	113.123	0.123	3.8	121.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	43.110	0.0	361.0	66	
120 min Winter	26.366	0.0	440.8	124	
180 min Winter	19.477	0.0	486.6	184	
240 min Winter	15.586	0.0	516.7	242	
360 min Winter	11.241	0.0	553.2	358	
480 min Winter	8.836	0.0	573.3	474	
600 min Winter	7.302	0.0	585.0	590	
720 min Winter	6.235	0.0	591.3	704	
960 min Winter	4.841	0.0	592.9	928	
1440 min Winter	3.379	0.0	577.4	1316	
2160 min Winter	2.364	0.0	732.4	1608	
2880 min Winter	1.842	0.0	759.8	2048	
4320 min Winter	1.310	0.0	806.3	2856	
5760 min Winter	1.038	0.0	866.6	3584	
7200 min Winter	0.875	0.0	911.6	4320	
8640 min Winter	0.765	0.0	955.0	4928	
10080 min Winter	0.687	0.0	996.1	5544	
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WSP Group Ltd		Page 3																																				
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WSP Group Ltd		Page 4																																																																																															
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Model Details Storage is Online Cover Level (m) 114.000 Tank or Pond Structure Invert Level (m) 113.000 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>960.0</td><td>1.000</td><td>1460.0</td></tr></tbody></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0099-4000-0700-4000 Design Head (m) 0.700 Design Flow (l/s) 4.0 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 99 Invert Level (m) 113.000 Minimum Outlet Pipe Diameter (mm) 150 Suggested Manhole Diameter (mm) 1200 Control Points <table><thead><tr><th></th><th>Head (m)</th><th>Flow (l/s)</th></tr></thead><tbody><tr><td>Design Point (Calculated)</td><td>0.700</td><td>4.0</td></tr><tr><td>Flush-Flo™</td><td>0.210</td><td>4.0</td></tr><tr><td>Kick-Flo®</td><td>0.474</td><td>3.3</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>3.4</td></tr></tbody></table> 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 <table><thead><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr></thead><tbody><tr><td>0.100</td><td>3.3</td><td>1.200</td><td>5.1</td><td>3.000</td><td>7.9</td><td>7.000</td><td>11.8</td></tr><tr><td>0.200</td><td>4.0</td><td>1.400</td><td>5.5</td><td>3.500</td><td>8.5</td><td>7.500</td><td>12.2</td></tr><tr><td>0.300</td><td>3.9</td><td>1.600</td><td>5.9</td><td>4.000</td><td>9.0</td><td>8.000</td><td>12.6</td></tr><tr><td>0.400</td><td>3.7</td><td>1.800</td><td>6.2</td><td>4.500</td><td>9.6</td><td>8.500</td><td>13.0</td></tr><tr><td>0.500</td><td>3.4</td><td>2.000</td><td>6.5</td><td>5.000</td><td>10.0</td><td>9.000</td><td>13.3</td></tr><tr><td>0.600</td><td>3.7</td><td>2.200</td><td>6.8</td><td>5.500</td><td>10.5</td><td>9.500</td><td>13.7</td></tr><tr><td>0.800</td><td>4.3</td><td>2.400</td><td>7.1</td><td>6.000</td><td>11.0</td><td></td><td></td></tr><tr><td>1.000</td><td>4.7</td><td>2.600</td><td>7.4</td><td>6.500</td><td>11.4</td><td></td><td></td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	960.0	1.000	1460.0		Head (m)	Flow (l/s)	Design Point (Calculated)	0.700	4.0	Flush-Flo™	0.210	4.0	Kick-Flo®	0.474	3.3	Mean Flow over Head Range	-	3.4	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	3.3	1.200	5.1	3.000	7.9	7.000	11.8	0.200	4.0	1.400	5.5	3.500	8.5	7.500	12.2	0.300	3.9	1.600	5.9	4.000	9.0	8.000	12.6	0.400	3.7	1.800	6.2	4.500	9.6	8.500	13.0	0.500	3.4	2.000	6.5	5.000	10.0	9.000	13.3	0.600	3.7	2.200	6.8	5.500	10.5	9.500	13.7	0.800	4.3	2.400	7.1	6.000	11.0			1.000	4.7	2.600	7.4	6.500	11.4		
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WSP Group Ltd				Page 1	
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Date 12/05/2020		Designed by PS			
File Catchment T_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
Summary of Results for 100 year Return Period					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	96.185	0.185	28.3	1017.8	O K
30 min Summer	96.235	0.235	28.3	1302.3	O K
60 min Summer	96.283	0.283	28.3	1569.8	O K
120 min Summer	96.332	0.332	28.3	1848.3	O K
180 min Summer	96.354	0.354	28.3	1973.0	O K
240 min Summer	96.363	0.363	28.3	2029.1	O K
360 min Summer	96.364	0.364	28.3	2033.1	O K
480 min Summer	96.352	0.352	28.3	1963.3	O K
600 min Summer	96.334	0.334	28.3	1860.0	O K
720 min Summer	96.318	0.318	28.3	1767.8	O K
960 min Summer	96.291	0.291	28.3	1617.1	O K
1440 min Summer	96.251	0.251	28.3	1388.2	O K
2160 min Summer	96.202	0.202	28.3	1116.5	O K
2880 min Summer	96.162	0.162	28.3	893.5	O K
4320 min Summer	96.101	0.101	28.3	550.4	O K
5760 min Summer	96.057	0.057	28.3	311.6	O K
7200 min Summer	96.029	0.029	28.2	156.6	O K
8640 min Summer	96.011	0.011	28.1	61.9	O K
10080 min Summer	96.002	0.002	28.0	13.0	O K
15 min Winter	96.208	0.208	28.3	1145.2	O K
30 min Winter	96.265	0.265	28.3	1467.6	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	108.324	0.0	1052.8	22	
30 min Summer	69.981	0.0	1361.4	37	
60 min Summer	43.110	0.0	1678.3	66	
120 min Summer	26.366	0.0	2052.4	126	
180 min Summer	19.477	0.0	2274.7	184	
240 min Summer	15.586	0.0	2429.7	244	
360 min Summer	11.241	0.0	2628.7	362	
480 min Summer	8.836	0.0	2753.1	482	
600 min Summer	7.302	0.0	2843.9	584	
720 min Summer	6.235	0.0	2913.6	620	
960 min Summer	4.841	0.0	3018.7	730	
1440 min Summer	3.379	0.0	3160.2	982	
2160 min Summer	2.364	0.0	3316.1	1384	
2880 min Summer	1.842	0.0	3445.7	1764	
4320 min Summer	1.310	0.0	3673.0	2508	
5760 min Summer	1.038	0.0	3887.7	3176	
7200 min Summer	0.875	0.0	4092.0	3888	
8640 min Summer	0.765	0.0	4293.5	4496	
10080 min Summer	0.687	0.0	4498.1	5144	
15 min Winter	108.324	0.0	1179.9	22	
30 min Winter	69.981	0.0	1525.7	37	
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT T			
.		1 in 100 Year			
Date 12/05/2020		Designed by PS			
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<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	96.319	0.319	28.3	1775.0	O K
120 min Winter	96.376	0.376	28.3	2101.9	O K
180 min Winter	96.403	0.403	28.3	2258.1	O K
240 min Winter	96.417	0.417	28.3	2336.2	O K
360 min Winter	96.423	0.423	28.3	2373.1	O K
480 min Winter	96.415	0.415	28.3	2329.0	O K
600 min Winter	96.401	0.401	28.3	2245.9	O K
720 min Winter	96.383	0.383	28.3	2141.6	O K
960 min Winter	96.345	0.345	28.3	1921.7	O K
1440 min Winter	96.291	0.291	28.3	1618.2	O K
2160 min Winter	96.221	0.221	28.3	1223.6	O K
2880 min Winter	96.162	0.162	28.3	891.3	O K
4320 min Winter	96.072	0.072	28.3	393.4	O K
5760 min Winter	96.017	0.017	28.1	91.3	O K
7200 min Winter	96.000	0.000	26.8	0.0	O K
8640 min Winter	96.000	0.000	23.5	0.0	O K
10080 min Winter	96.000	0.000	21.1	0.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	43.110	0.0	1881.7	66	
120 min Winter	26.366	0.0	2299.0	124	
180 min Winter	19.477	0.0	2549.1	182	
240 min Winter	15.586	0.0	2719.9	240	
360 min Winter	11.241	0.0	2942.7	356	
480 min Winter	8.836	0.0	3084.8	470	
600 min Winter	7.302	0.0	3187.2	582	
720 min Winter	6.235	0.0	3266.5	688	
960 min Winter	4.841	0.0	3380.4	794	
1440 min Winter	3.379	0.0	3539.3	1072	
2160 min Winter	2.364	0.0	3713.3	1496	
2880 min Winter	1.842	0.0	3857.3	1904	
4320 min Winter	1.310	0.0	4117.4	2632	
5760 min Winter	1.038	0.0	4353.5	3224	
7200 min Winter	0.875	0.0	4585.0	0	
8640 min Winter	0.765	0.0	4811.8	0	
10080 min Winter	0.687	0.0	5037.8	0	
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WSP Group Ltd		Page 3																																				
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WSP Group Ltd		Page 4																																																																																															
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Appendix B.3



1 IN 100 YEAR + CLIMATE CHANGE

WSP Group Ltd				Page 1	
.		SWMK			
.		CATCHMENT A			
.		1 IN 100 YEAR + CC			
Date 21/04/2020		Designed by PS			
File Catchment A_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	103.684	0.284	10.1	577.6	O K
30 min Summer	103.759	0.359	10.1	743.0	O K
60 min Summer	103.830	0.430	10.1	906.9	O K
120 min Summer	103.908	0.508	10.1	1091.9	O K
180 min Summer	103.949	0.549	10.1	1191.5	O K
240 min Summer	103.973	0.573	10.1	1251.4	O K
360 min Summer	103.997	0.597	10.1	1311.3	O K
480 min Summer	104.005	0.605	10.1	1331.1	O K
600 min Summer	104.005	0.605	10.1	1331.4	O K
720 min Summer	104.001	0.601	10.1	1320.8	O K
960 min Summer	103.985	0.585	10.1	1280.6	O K
1440 min Summer	103.951	0.551	10.1	1195.2	O K
2160 min Summer	103.906	0.506	10.1	1086.8	O K
2880 min Summer	103.866	0.466	10.1	991.5	O K
4320 min Summer	103.802	0.402	10.1	840.5	O K
5760 min Summer	103.749	0.349	10.1	721.8	O K
7200 min Summer	103.707	0.307	10.1	627.2	O K
8640 min Summer	103.673	0.273	10.1	552.1	O K
10080 min Summer	103.645	0.245	10.1	492.3	O K
15 min Winter	103.716	0.316	10.1	647.6	O K
30 min Winter	103.799	0.399	10.1	833.7	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	504.5	23	
30 min Summer	97.974	0.0	648.6	37	
60 min Summer	60.354	0.0	886.3	68	
120 min Summer	36.913	0.0	1082.6	126	
180 min Summer	27.268	0.0	1194.9	186	
240 min Summer	21.821	0.0	1269.5	246	
360 min Summer	15.737	0.0	1361.1	364	
480 min Summer	12.370	0.0	1413.1	484	
600 min Summer	10.223	0.0	1444.8	602	
720 min Summer	8.729	0.0	1463.4	722	
960 min Summer	6.777	0.0	1473.4	960	
1440 min Summer	4.731	0.0	1416.9	1170	
2160 min Summer	3.309	0.0	1806.5	1536	
2880 min Summer	2.578	0.0	1873.4	1908	
4320 min Summer	1.834	0.0	1984.6	2688	
5760 min Summer	1.454	0.0	2142.9	3464	
7200 min Summer	1.225	0.0	2253.6	4184	
8640 min Summer	1.071	0.0	2359.6	4928	
10080 min Summer	0.961	0.0	2457.9	5648	
15 min Winter	151.654	0.0	565.7	23	
30 min Winter	97.974	0.0	717.5	37	
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT A			
.		1 IN 100 YEAR + CC			
Date 21/04/2020		Designed by PS			
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	103.878	0.478	10.1	1018.5	O K
120 min Winter	103.964	0.564	10.1	1227.7	O K
180 min Winter	104.009	0.609	10.1	1340.1	O K
240 min Winter	104.036	0.636	10.1	1408.8	O K
360 min Winter	104.063	0.663	10.1	1479.6	O K
480 min Winter	104.073	0.673	10.1	1505.5	O K
600 min Winter	104.075	0.675	10.1	1509.9	O K
720 min Winter	104.072	0.672	10.1	1502.0	O K
960 min Winter	104.058	0.658	10.1	1465.6	O K
1440 min Winter	104.018	0.618	10.1	1364.5	O K
2160 min Winter	103.966	0.566	10.1	1233.2	O K
2880 min Winter	103.916	0.516	10.1	1110.3	O K
4320 min Winter	103.818	0.418	10.1	879.0	O K
5760 min Winter	103.738	0.338	10.1	696.7	O K
7200 min Winter	103.674	0.274	10.1	555.7	O K
8640 min Winter	103.625	0.225	10.1	450.4	O K
10080 min Winter	103.589	0.189	10.0	375.6	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	992.9	66	
120 min Winter	36.913	0.0	1208.2	124	
180 min Winter	27.268	0.0	1329.4	184	
240 min Winter	21.821	0.0	1407.5	242	
360 min Winter	15.737	0.0	1497.0	358	
480 min Winter	12.370	0.0	1539.4	474	
600 min Winter	10.223	0.0	1556.0	590	
720 min Winter	8.729	0.0	1555.3	702	
960 min Winter	6.777	0.0	1524.5	924	
1440 min Winter	4.731	0.0	1443.1	1330	
2160 min Winter	3.309	0.0	2022.3	1648	
2880 min Winter	2.578	0.0	2095.8	2108	
4320 min Winter	1.834	0.0	2219.4	2940	
5760 min Winter	1.454	0.0	2401.6	3696	
7200 min Winter	1.225	0.0	2526.1	4400	
8640 min Winter	1.071	0.0	2646.0	5096	
10080 min Winter	0.961	0.0	2758.6	5656	
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WSP Group Ltd		Page 3																								
. . .	SWMK CATCHMENT A 1 IN 100 YEAR + CC																									
Date 21/04/2020 File Catchment A_001.srcx	Designed by PS Checked by AC																									
XP Solutions Source Control 2019.1																										
<u>Rainfall Details</u>																										
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<u>Time Area Diagram</u>																										
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WSP Group Ltd				Page 1	
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Date 21/04/2020		Designed by PS			
File Catchment B_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	103.286	0.286	23.0	1245.7	O K
30 min Summer	103.364	0.364	23.1	1601.7	O K
60 min Summer	103.438	0.438	23.1	1954.4	O K
120 min Summer	103.521	0.521	23.1	2352.5	O K
180 min Summer	103.565	0.565	23.1	2567.6	O K
240 min Summer	103.591	0.591	23.1	2697.5	O K
360 min Summer	103.617	0.617	23.1	2827.5	O K
480 min Summer	103.626	0.626	23.1	2870.2	O K
600 min Summer	103.626	0.626	23.1	2870.9	O K
720 min Summer	103.621	0.621	23.1	2847.5	O K
960 min Summer	103.604	0.604	23.1	2761.6	O K
1440 min Summer	103.571	0.571	23.1	2596.5	O K
2160 min Summer	103.526	0.526	23.1	2378.0	O K
2880 min Summer	103.487	0.487	23.1	2189.4	O K
4320 min Summer	103.423	0.423	23.1	1879.1	O K
5760 min Summer	103.370	0.370	23.1	1632.3	O K
7200 min Summer	103.329	0.329	23.1	1440.6	O K
8640 min Summer	103.296	0.296	23.1	1290.3	O K
10080 min Summer	103.270	0.270	22.9	1173.5	O K
15 min Winter	103.319	0.319	23.1	1396.4	O K
30 min Winter	103.405	0.405	23.1	1796.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	1002.7	23	
30 min Summer	97.974	0.0	1311.9	37	
60 min Summer	60.354	0.0	1850.5	68	
120 min Summer	36.913	0.0	2268.6	126	
180 min Summer	27.268	0.0	2508.3	186	
240 min Summer	21.821	0.0	2668.0	246	
360 min Summer	15.737	0.0	2866.8	364	
480 min Summer	12.370	0.0	2983.3	484	
600 min Summer	10.223	0.0	3058.6	602	
720 min Summer	8.729	0.0	3108.6	722	
960 min Summer	6.777	0.0	3159.4	918	
1440 min Summer	4.731	0.0	3138.1	1138	
2160 min Summer	3.309	0.0	3846.7	1496	
2880 min Summer	2.578	0.0	3985.2	1880	
4320 min Summer	1.834	0.0	4207.4	2680	
5760 min Summer	1.454	0.0	4595.0	3408	
7200 min Summer	1.225	0.0	4828.6	4176	
8640 min Summer	1.071	0.0	5049.1	4848	
10080 min Summer	0.961	0.0	5246.9	5552	
15 min Winter	151.654	0.0	1133.0	23	
30 min Winter	97.974	0.0	1465.7	37	
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.		SWMK			
.		CATCHMENT B			
.		1 IN 100 YEAR + 40% CC			
Date 21/04/2020		Designed by PS			
File Catchment B_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	103.489	0.489	23.1	2194.9	O K
120 min Winter	103.581	0.581	23.1	2645.6	O K
180 min Winter	103.629	0.629	23.1	2887.9	O K
240 min Winter	103.658	0.658	23.1	3035.5	O K
360 min Winter	103.688	0.688	23.1	3187.0	O K
480 min Winter	103.699	0.699	23.1	3241.7	O K
600 min Winter	103.700	0.700	23.1	3249.9	Flood Risk
720 min Winter	103.697	0.697	23.1	3231.9	O K
960 min Winter	103.681	0.681	23.1	3151.8	O K
1440 min Winter	103.639	0.639	23.1	2936.6	O K
2160 min Winter	103.586	0.586	23.1	2673.3	O K
2880 min Winter	103.532	0.532	23.1	2406.3	O K
4320 min Winter	103.434	0.434	23.1	1932.6	O K
5760 min Winter	103.355	0.355	23.1	1560.0	O K
7200 min Winter	103.294	0.294	23.0	1281.8	O K
8640 min Winter	103.250	0.250	22.8	1080.8	O K
10080 min Winter	103.220	0.220	22.4	945.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	2077.8	66	
120 min Winter	36.913	0.0	2537.6	124	
180 min Winter	27.268	0.0	2798.7	182	
240 min Winter	21.821	0.0	2970.6	242	
360 min Winter	15.737	0.0	3178.6	358	
480 min Winter	12.370	0.0	3293.9	474	
600 min Winter	10.223	0.0	3361.8	588	
720 min Winter	8.729	0.0	3399.7	700	
960 min Winter	6.777	0.0	3414.4	920	
1440 min Winter	4.731	0.0	3281.9	1196	
2160 min Winter	3.309	0.0	4308.4	1624	
2880 min Winter	2.578	0.0	4462.7	2076	
4320 min Winter	1.834	0.0	4713.5	2896	
5760 min Winter	1.454	0.0	5152.3	3632	
7200 min Winter	1.225	0.0	5415.9	4328	
8640 min Winter	1.071	0.0	5666.0	5008	
10080 min Winter	0.961	0.0	5894.4	5552	
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Date 21/04/2020 File Catchment B_001.srcx	Designed by PS Checked by AC																																					
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<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> </tr> <tr> <td>Site Location</td> <td>GB 483669 232428 SP 83669 32428</td> </tr> <tr> <td>Data Type</td> <td>Point</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> </tr> <tr> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 4.440 <table> <thead> <tr> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> </tr> <tr> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0 4</td> <td>2.220</td> <td>4 8</td> <td>2.220</td> </tr> </tbody> </table>			Rainfall Model	FEH	Return Period (years)	100	FEH Rainfall Version	2013	Site Location	GB 483669 232428 SP 83669 32428	Data Type	Point	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	0.750	Cv (Winter)	0.840	Shortest Storm (mins)	15	Longest Storm (mins)	10080	Climate Change %	+40	Time (mins)	Area	Time (mins)	Area	From: To:	(ha)	From: To:	(ha)	0 4	2.220	4 8	2.220
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Model Details Storage is Online Cover Level (m) 104.000 Tank or Pond Structure Invert Level (m) 103.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>4160.0</td><td>1.000</td><td>5590.0</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0215-2310-0700-2310 Design Head (m) 0.700 Design Flow (l/s) 23.1 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 215 Invert Level (m) 103.000 Minimum Outlet Pipe Diameter (mm) 300 Suggested Manhole Diameter (mm) 1500 <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>0.700</td><td>23.1</td></tr><tr><td>Flush-Flo™</td><td>0.321</td><td>23.1</td></tr><tr><td>Kick-Flo®</td><td>0.556</td><td>20.7</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>18.4</td></tr></table> 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 <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>7.3</td><td>1.200</td><td>29.9</td><td>3.000</td><td>46.5</td><td>7.000</td><td>70.1</td></tr><tr><td>0.200</td><td>21.0</td><td>1.400</td><td>32.2</td><td>3.500</td><td>50.1</td><td>7.500</td><td>72.1</td></tr><tr><td>0.300</td><td>23.1</td><td>1.600</td><td>34.3</td><td>4.000</td><td>53.4</td><td>8.000</td><td>74.5</td></tr><tr><td>0.400</td><td>22.8</td><td>1.800</td><td>36.3</td><td>4.500</td><td>56.6</td><td>8.500</td><td>76.8</td></tr><tr><td>0.500</td><td>21.8</td><td>2.000</td><td>38.2</td><td>5.000</td><td>59.5</td><td>9.000</td><td>79.0</td></tr><tr><td>0.600</td><td>21.5</td><td>2.200</td><td>40.0</td><td>5.500</td><td>62.4</td><td>9.500</td><td>81.2</td></tr><tr><td>0.800</td><td>24.6</td><td>2.400</td><td>41.7</td><td>6.000</td><td>65.0</td><td></td><td></td></tr><tr><td>1.000</td><td>27.4</td><td>2.600</td><td>43.4</td><td>6.500</td><td>67.6</td><td></td><td></td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	4160.0	1.000	5590.0	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	0.700	23.1	Flush-Flo™	0.321	23.1	Kick-Flo®	0.556	20.7	Mean Flow over Head Range	-	18.4	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	29.9	3.000	46.5	7.000	70.1	0.200	21.0	1.400	32.2	3.500	50.1	7.500	72.1	0.300	23.1	1.600	34.3	4.000	53.4	8.000	74.5	0.400	22.8	1.800	36.3	4.500	56.6	8.500	76.8	0.500	21.8	2.000	38.2	5.000	59.5	9.000	79.0	0.600	21.5	2.200	40.0	5.500	62.4	9.500	81.2	0.800	24.6	2.400	41.7	6.000	65.0			1.000	27.4	2.600	43.4	6.500	67.6		
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.		CATCHMENT C				
.		1 IN 100 YEAR + 40% CC				
Date 21/04/2020		Designed by PS				
File CATCHMENT C_001.SRCX		Checked by AC				
XP Solutions		Source Control 2019.1				
<u>Summary of Results for 100 year Return Period (+40%)</u>						
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³) Status	
15 min Summer		111.290	0.290	5.9	319.2 O K	
30 min Summer		111.365	0.365	5.9	410.5 O K	
60 min Summer		111.437	0.437	5.9	500.6 O K	
120 min Summer		111.515	0.515	5.9	602.0 O K	
180 min Summer		111.555	0.555	5.9	655.4 O K	
240 min Summer		111.578	0.578	5.9	686.9 O K	
360 min Summer		111.600	0.600	5.9	717.2 O K	
480 min Summer		111.606	0.606	5.9	725.4 O K	
600 min Summer		111.604	0.604	5.9	723.0 O K	
720 min Summer		111.598	0.598	5.9	714.6 O K	
960 min Summer		111.579	0.579	5.9	688.0 O K	
1440 min Summer		111.541	0.541	5.9	637.0 O K	
2160 min Summer		111.493	0.493	5.9	573.1 O K	
2880 min Summer		111.448	0.448	5.9	514.8 O K	
4320 min Summer		111.377	0.377	5.9	425.8 O K	
5760 min Summer		111.321	0.321	5.9	356.9 O K	
7200 min Summer		111.276	0.276	5.9	303.0 O K	
8640 min Summer		111.240	0.240	5.9	260.6 O K	
10080 min Summer		111.211	0.211	5.9	228.0 O K	
15 min Winter		111.322	0.322	5.9	358.0 O K	
30 min Winter		111.405	0.405	5.9	460.7 O K	
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer		151.654	0.0	294.2	23	
30 min Summer		97.974	0.0	377.5	37	
60 min Summer		60.354	0.0	500.2	68	
120 min Summer		36.913	0.0	611.0	126	
180 min Summer		27.268	0.0	675.4	186	
240 min Summer		21.821	0.0	718.7	246	
360 min Summer		15.737	0.0	773.1	364	
480 min Summer		12.370	0.0	805.4	484	
600 min Summer		10.223	0.0	826.4	602	
720 min Summer		8.729	0.0	840.2	722	
960 min Summer		6.777	0.0	853.1	934	
1440 min Summer		4.731	0.0	833.6	1144	
2160 min Summer		3.309	0.0	1007.5	1532	
2880 min Summer		2.578	0.0	1045.7	1904	
4320 min Summer		1.834	0.0	1111.2	2684	
5760 min Summer		1.454	0.0	1188.9	3456	
7200 min Summer		1.225	0.0	1250.8	4176	
8640 min Summer		1.071	0.0	1310.6	4848	
10080 min Summer		0.961	0.0	1367.4	5552	
15 min Winter		151.654	0.0	329.3	23	
30 min Winter		97.974	0.0	417.9	37	
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.		SWMK			
.		CATCHMENT C			
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XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	111.485	0.485	5.9	562.6	O K
120 min Winter	111.571	0.571	5.9	676.8	O K
180 min Winter	111.615	0.615	5.9	737.6	O K
240 min Winter	111.641	0.641	5.9	774.2	O K
360 min Winter	111.667	0.667	5.9	810.7	O K
480 min Winter	111.675	0.675	5.9	822.4	O K
600 min Winter	111.675	0.675	5.9	822.4	O K
720 min Winter	111.670	0.670	5.9	815.6	O K
960 min Winter	111.653	0.653	5.9	791.1	O K
1440 min Winter	111.608	0.608	5.9	728.2	O K
2160 min Winter	111.551	0.551	5.9	650.6	O K
2880 min Winter	111.496	0.496	5.9	577.1	O K
4320 min Winter	111.388	0.388	5.9	439.0	O K
5760 min Winter	111.302	0.302	5.9	334.0	O K
7200 min Winter	111.235	0.235	5.9	255.2	O K
8640 min Winter	111.186	0.186	5.9	199.3	O K
10080 min Winter	111.152	0.152	5.8	162.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	560.2	66	
120 min Winter	36.913	0.0	682.8	124	
180 min Winter	27.268	0.0	753.2	182	
240 min Winter	21.821	0.0	799.6	242	
360 min Winter	15.737	0.0	855.4	358	
480 min Winter	12.370	0.0	884.8	474	
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960 min Winter	6.777	0.0	892.8	922	
1440 min Winter	4.731	0.0	848.4	1304	
2160 min Winter	3.309	0.0	1128.2	1640	
2880 min Winter	2.578	0.0	1170.5	2104	
4320 min Winter	1.834	0.0	1244.0	2900	
5760 min Winter	1.454	0.0	1332.1	3640	
7200 min Winter	1.225	0.0	1401.6	4328	
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WSP Group Ltd					Page 1	
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.		CATCHMENT D				
.		1 IN 100 YEAR + 40% CC				
Date 21/04/2020		Designed by PS				
File Catchment D_001.srcx		Checked by AC				
XP Solutions		Source Control 2019.1				
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		105.290	0.290	7.9	422.8	O K
30 min Summer		105.367	0.367	7.9	543.8	O K
60 min Summer		105.440	0.440	7.9	663.2	O K
120 min Summer		105.520	0.520	7.9	797.7	O K
180 min Summer		105.561	0.561	7.9	868.7	O K
240 min Summer		105.585	0.585	7.9	910.7	O K
360 min Summer		105.608	0.608	7.9	951.1	O K
480 min Summer		105.614	0.614	7.9	962.2	O K
600 min Summer		105.612	0.612	7.9	959.3	O K
720 min Summer		105.606	0.606	7.9	948.4	O K
960 min Summer		105.587	0.587	7.9	913.7	O K
1440 min Summer		105.549	0.549	7.9	848.4	O K
2160 min Summer		105.501	0.501	7.9	765.1	O K
2880 min Summer		105.456	0.456	7.9	689.5	O K
4320 min Summer		105.385	0.385	7.9	572.4	O K
5760 min Summer		105.328	0.328	7.9	481.3	O K
7200 min Summer		105.283	0.283	7.9	410.6	O K
8640 min Summer		105.247	0.247	7.9	355.3	O K
10080 min Summer		105.218	0.218	7.9	312.6	O K
15 min Winter		105.323	0.323	7.9	474.2	O K
30 min Winter		105.408	0.408	7.9	610.3	O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer		151.654	0.0	382.9	23	
30 min Summer		97.974	0.0	492.6	37	
60 min Summer		60.354	0.0	658.2	68	
120 min Summer		36.913	0.0	804.4	126	
180 min Summer		27.268	0.0	889.2	186	
240 min Summer		21.821	0.0	946.2	246	
360 min Summer		15.737	0.0	1017.8	364	
480 min Summer		12.370	0.0	1060.5	484	
600 min Summer		10.223	0.0	1088.4	602	
720 min Summer		8.729	0.0	1107.1	722	
960 min Summer		6.777	0.0	1126.0	920	
1440 min Summer		4.731	0.0	1109.3	1140	
2160 min Summer		3.309	0.0	1331.2	1516	
2880 min Summer		2.578	0.0	1381.5	1904	
4320 min Summer		1.834	0.0	1466.9	2680	
5760 min Summer		1.454	0.0	1573.3	3456	
7200 min Summer		1.225	0.0	1654.9	4176	
8640 min Summer		1.071	0.0	1733.6	4848	
10080 min Summer		0.961	0.0	1807.5	5552	
15 min Winter		151.654	0.0	429.1	23	
30 min Winter		97.974	0.0	546.3	37	
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WSP Group Ltd				Page 2	
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	105.489	0.489	7.9	745.2	O K
120 min Winter	105.577	0.577	7.9	896.8	O K
180 min Winter	105.622	0.622	7.9	977.4	O K
240 min Winter	105.649	0.649	7.9	1026.0	O K
360 min Winter	105.676	0.676	7.9	1074.4	O K
480 min Winter	105.685	0.685	7.9	1090.1	O K
600 min Winter	105.685	0.685	7.9	1090.1	O K
720 min Winter	105.680	0.680	7.9	1081.3	O K
960 min Winter	105.662	0.662	7.9	1049.1	O K
1440 min Winter	105.616	0.616	7.9	966.7	O K
2160 min Winter	105.560	0.560	7.9	866.1	O K
2880 min Winter	105.503	0.503	7.9	768.9	O K
4320 min Winter	105.394	0.394	7.9	587.9	O K
5760 min Winter	105.308	0.308	7.9	449.6	O K
7200 min Winter	105.241	0.241	7.9	346.6	O K
8640 min Winter	105.193	0.193	7.8	274.0	O K
10080 min Winter	105.160	0.160	7.7	226.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	737.4	66	
120 min Winter	36.913	0.0	899.0	124	
180 min Winter	27.268	0.0	991.8	182	
240 min Winter	21.821	0.0	1053.2	242	
360 min Winter	15.737	0.0	1127.5	358	
480 min Winter	12.370	0.0	1168.0	474	
600 min Winter	10.223	0.0	1190.3	588	
720 min Winter	8.729	0.0	1200.4	700	
960 min Winter	6.777	0.0	1193.7	920	
1440 min Winter	4.731	0.0	1134.1	1212	
2160 min Winter	3.309	0.0	1490.8	1628	
2880 min Winter	2.578	0.0	1546.5	2104	
4320 min Winter	1.834	0.0	1642.5	2896	
5760 min Winter	1.454	0.0	1762.9	3632	
7200 min Winter	1.225	0.0	1854.7	4328	
8640 min Winter	1.071	0.0	1943.5	4936	
10080 min Winter	0.961	0.0	2027.9	5552	
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WSP Group Ltd		Page 3																																				
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	111.289	0.289	6.5	364.2	O K
30 min Summer	111.366	0.366	6.5	468.5	O K
60 min Summer	111.440	0.440	6.5	571.6	O K
120 min Summer	111.520	0.520	6.5	687.9	O K
180 min Summer	111.561	0.561	6.5	749.4	O K
240 min Summer	111.586	0.586	6.5	786.1	O K
360 min Summer	111.609	0.609	6.5	821.9	O K
480 min Summer	111.616	0.616	6.5	832.5	O K
600 min Summer	111.615	0.615	6.5	831.0	O K
720 min Summer	111.610	0.610	6.5	822.6	O K
960 min Summer	111.591	0.591	6.5	794.3	O K
1440 min Summer	111.554	0.554	6.5	737.8	O K
2160 min Summer	111.507	0.507	6.5	668.3	O K
2880 min Summer	111.462	0.462	6.5	604.1	O K
4320 min Summer	111.392	0.392	6.5	504.0	O K
5760 min Summer	111.336	0.336	6.5	426.7	O K
7200 min Summer	111.290	0.290	6.5	365.4	O K
8640 min Summer	111.254	0.254	6.5	316.8	O K
10080 min Summer	111.224	0.224	6.5	278.4	O K
15 min Winter	111.322	0.322	6.5	408.5	O K
30 min Winter	111.407	0.407	6.5	525.7	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	331.1	23	
30 min Summer	97.974	0.0	424.3	37	
60 min Summer	60.354	0.0	567.6	68	
120 min Summer	36.913	0.0	693.1	126	
180 min Summer	27.268	0.0	765.6	186	
240 min Summer	21.821	0.0	814.0	246	
360 min Summer	15.737	0.0	874.2	364	
480 min Summer	12.370	0.0	909.1	484	
600 min Summer	10.223	0.0	930.9	602	
720 min Summer	8.729	0.0	944.2	722	
960 min Summer	6.777	0.0	952.7	952	
1440 min Summer	4.731	0.0	917.3	1156	
2160 min Summer	3.309	0.0	1146.6	1536	
2880 min Summer	2.578	0.0	1189.8	1928	
4320 min Summer	1.834	0.0	1263.3	2688	
5760 min Summer	1.454	0.0	1355.0	3464	
7200 min Summer	1.225	0.0	1425.4	4184	
8640 min Summer	1.071	0.0	1493.4	4928	
10080 min Summer	0.961	0.0	1557.4	5640	
15 min Winter	151.654	0.0	370.6	23	
30 min Winter	97.974	0.0	468.7	37	
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT E			
.		1 IN 100 YEAR + 40% CC			
Date 21/04/2020		Designed by PS			
File Catchment E_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	111.489	0.489	6.5	642.2	O K
120 min Winter	111.577	0.577	6.5	773.2	O K
180 min Winter	111.623	0.623	6.5	843.1	O K
240 min Winter	111.651	0.651	6.5	885.6	O K
360 min Winter	111.678	0.678	6.5	928.4	O K
480 min Winter	111.688	0.688	6.5	943.1	O K
600 min Winter	111.688	0.688	6.5	944.2	O K
720 min Winter	111.684	0.684	6.5	937.7	O K
960 min Winter	111.668	0.668	6.5	911.9	O K
1440 min Winter	111.623	0.623	6.5	843.6	O K
2160 min Winter	111.567	0.567	6.5	758.0	O K
2880 min Winter	111.514	0.514	6.5	678.7	O K
4320 min Winter	111.407	0.407	6.5	525.2	O K
5760 min Winter	111.321	0.321	6.5	406.4	O K
7200 min Winter	111.253	0.253	6.5	315.3	O K
8640 min Winter	111.202	0.202	6.5	248.8	O K
10080 min Winter	111.166	0.166	6.4	202.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	635.6	66	
120 min Winter	36.913	0.0	774.0	124	
180 min Winter	27.268	0.0	852.7	184	
240 min Winter	21.821	0.0	903.9	242	
360 min Winter	15.737	0.0	963.6	358	
480 min Winter	12.370	0.0	992.5	474	
600 min Winter	10.223	0.0	1004.1	588	
720 min Winter	8.729	0.0	1003.7	702	
960 min Winter	6.777	0.0	984.1	924	
1440 min Winter	4.731	0.0	933.8	1324	
2160 min Winter	3.309	0.0	1283.9	1644	
2880 min Winter	2.578	0.0	1331.4	2108	
4320 min Winter	1.834	0.0	1413.5	2936	
5760 min Winter	1.454	0.0	1518.3	3688	
7200 min Winter	1.225	0.0	1597.4	4392	
8640 min Winter	1.071	0.0	1674.1	5016	
10080 min Winter	0.961	0.0	1747.1	5648	
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WSP Group Ltd		Page 3																																				
. . .	SWMK CATCHMENT E 1 IN 100 YEAR + 40% CC																																					
Date 21/04/2020 File Catchment E_001.srcx	Designed by PS Checked by AC																																					
XP Solutions Source Control 2019.1																																						
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Rainfall Model	FEH																																					
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From: To:	(ha)	From: To:	(ha)																																			
0 4	0.650	4 8	0.650																																			
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WSP Group Ltd		Page 4
. . .	SWMK CATCHMENT E 1 IN 100 YEAR + 40% CC	
Date 21/04/2020 File Catchment E_001.srcx	Designed by PS Checked by AC	
XP Solutions Source Control 2019.1		

Model Details

Storage is Online Cover Level (m) 112.000

Tank or Pond Structure

Invert Level (m) 111.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	1180.0	1.000	1770.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0124-6500-0700-6500
Design Head (m)	0.700
Design Flow (l/s)	6.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	124
Invert Level (m)	111.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	6.5
Flush-Flo™	0.222	6.5
Kick-Flo®	0.493	5.5
Mean Flow over Head Range	-	5.5

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

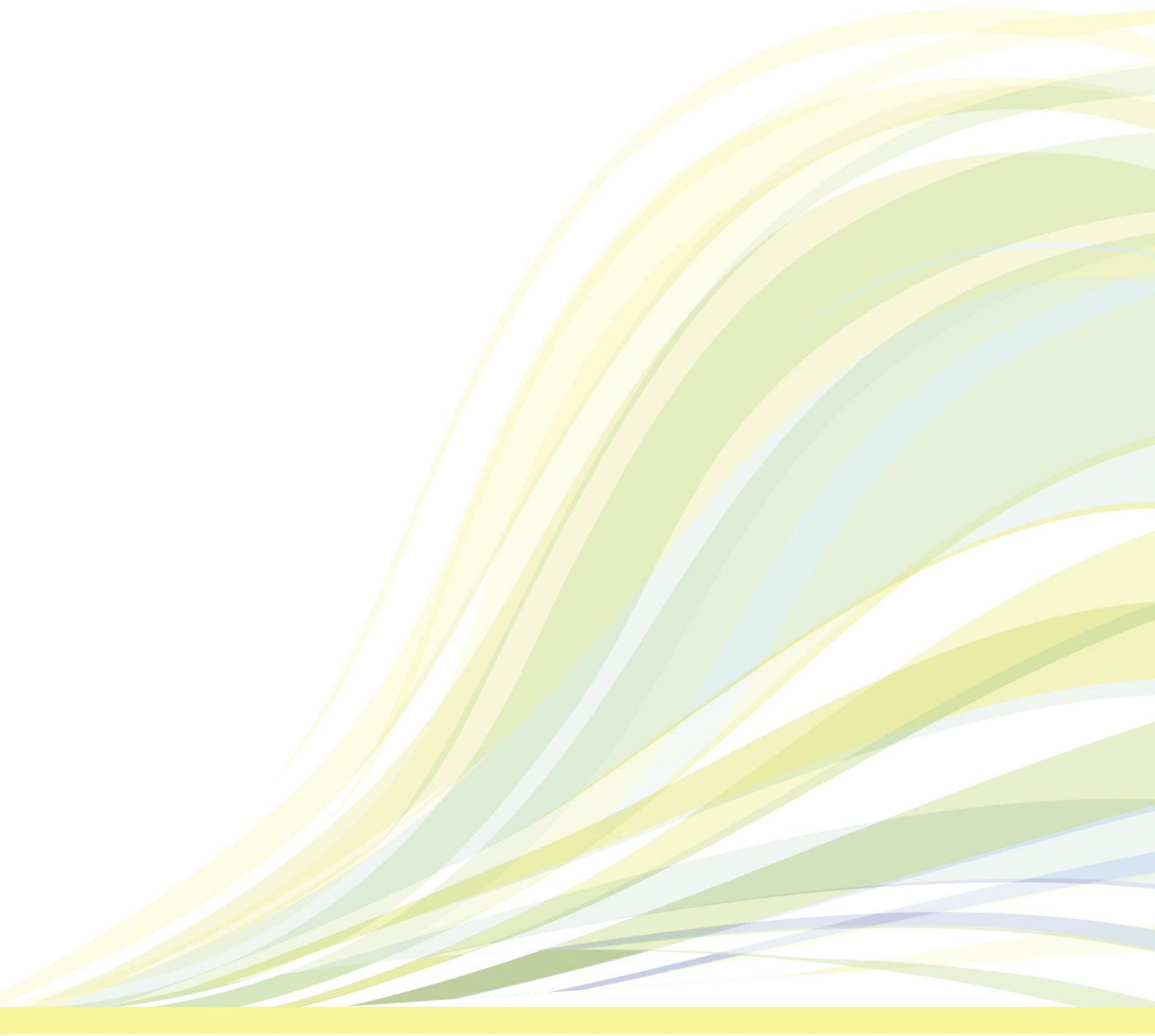
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.4	1.200	8.4	3.000	12.9	7.000	19.3
0.200	6.5	1.400	9.0	3.500	13.9	7.500	19.9
0.300	6.4	1.600	9.6	4.000	14.8	8.000	20.6
0.400	6.2	1.800	10.1	4.500	15.7	8.500	21.2
0.500	5.6	2.000	10.6	5.000	16.5	9.000	21.9
0.600	6.1	2.200	11.1	5.500	17.2	9.500	22.5
0.800	6.9	2.400	11.6	6.000	18.0		
1.000	7.7	2.600	12.1	6.500	18.7		

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.		SWMK				
.		CATCHMENT F				
.		1 IN 100 YEAR + 40% CC				
Date 22/04/2020		Designed by PS				
File Catchment F_001.srcx		Checked by AC				
XP Solutions		Source Control 2019.1				
<u>Summary of Results for 100 year Return Period (+40%)</u>						
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer		110.277	0.277	5.9	336.3	O K
30 min Summer		110.351	0.351	5.9	432.6	O K
60 min Summer		110.422	0.422	5.9	527.9	O K
120 min Summer		110.501	0.501	5.9	635.4	O K
180 min Summer		110.542	0.542	5.9	692.9	O K
240 min Summer		110.566	0.566	5.9	727.2	O K
360 min Summer		110.590	0.590	5.9	761.1	O K
480 min Summer		110.597	0.597	5.9	771.7	O K
600 min Summer		110.597	0.597	5.9	771.1	O K
720 min Summer		110.592	0.592	5.9	764.1	O K
960 min Summer		110.575	0.575	5.9	739.4	O K
1440 min Summer		110.538	0.538	5.9	687.2	O K
2160 min Summer		110.491	0.491	5.9	622.3	O K
2880 min Summer		110.449	0.449	5.9	563.4	O K
4320 min Summer		110.381	0.381	5.9	472.9	O K
5760 min Summer		110.328	0.328	5.9	402.5	O K
7200 min Summer		110.285	0.285	5.9	346.5	O K
8640 min Summer		110.250	0.250	5.9	301.9	O K
10080 min Summer		110.222	0.222	5.9	266.5	O K
15 min Winter		110.309	0.309	5.9	377.1	O K
30 min Winter		110.391	0.391	5.9	485.4	O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer		151.654	0.0	303.9	23	
30 min Summer		97.974	0.0	389.0	37	
60 min Summer		60.354	0.0	522.9	68	
120 min Summer		36.913	0.0	638.4	126	
180 min Summer		27.268	0.0	704.7	186	
240 min Summer		21.821	0.0	749.0	246	
360 min Summer		15.737	0.0	803.4	364	
480 min Summer		12.370	0.0	834.4	484	
600 min Summer		10.223	0.0	853.1	602	
720 min Summer		8.729	0.0	863.8	722	
960 min Summer		6.777	0.0	867.7	960	
1440 min Summer		4.731	0.0	830.1	1174	
2160 min Summer		3.309	0.0	1057.5	1556	
2880 min Summer		2.578	0.0	1097.2	1928	
4320 min Summer		1.834	0.0	1164.4	2688	
5760 min Summer		1.454	0.0	1250.5	3464	
7200 min Summer		1.225	0.0	1315.4	4184	
8640 min Summer		1.071	0.0	1378.1	4928	
10080 min Summer		0.961	0.0	1437.0	5648	
15 min Winter		151.654	0.0	340.0	23	
30 min Winter		97.974	0.0	429.3	37	
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WSP Group Ltd			Page 2		
.		SWMK			
.		CATCHMENT F			
.		1 IN 100 YEAR + 40% CC			
Date 22/04/2020		Designed by PS			
File Catchment F_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	110.470	0.470	5.9	593.0	O K
120 min Winter	110.557	0.557	5.9	714.4	O K
180 min Winter	110.602	0.602	5.9	779.5	O K
240 min Winter	110.630	0.630	5.9	819.0	O K
360 min Winter	110.657	0.657	5.9	859.5	O K
480 min Winter	110.667	0.667	5.9	873.8	O K
600 min Winter	110.668	0.668	5.9	875.6	O K
720 min Winter	110.665	0.665	5.9	870.3	O K
960 min Winter	110.649	0.649	5.9	847.9	O K
1440 min Winter	110.608	0.608	5.9	786.9	O K
2160 min Winter	110.552	0.552	5.9	707.6	O K
2880 min Winter	110.500	0.500	5.9	634.6	O K
4320 min Winter	110.398	0.398	5.9	495.1	O K
5760 min Winter	110.316	0.316	5.9	386.9	O K
7200 min Winter	110.251	0.251	5.9	303.3	O K
8640 min Winter	110.202	0.202	5.9	241.2	O K
10080 min Winter	110.166	0.166	5.8	197.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	585.5	66	
120 min Winter	36.913	0.0	712.5	124	
180 min Winter	27.268	0.0	784.2	184	
240 min Winter	21.821	0.0	830.4	242	
360 min Winter	15.737	0.0	882.7	358	
480 min Winter	12.370	0.0	906.0	474	
600 min Winter	10.223	0.0	912.7	590	
720 min Winter	8.729	0.0	909.0	702	
960 min Winter	6.777	0.0	889.0	926	
1440 min Winter	4.731	0.0	843.5	1332	
2160 min Winter	3.309	0.0	1183.9	1652	
2880 min Winter	2.578	0.0	1227.6	2112	
4320 min Winter	1.834	0.0	1302.5	2940	
5760 min Winter	1.454	0.0	1401.2	3696	
7200 min Winter	1.225	0.0	1474.2	4400	
8640 min Winter	1.071	0.0	1544.8	5096	
10080 min Winter	0.961	0.0	1612.1	5656	
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WSP Group Ltd		Page 3																																				
. . .	SWMK CATCHMENT F 1 IN 100 YEAR + 40% CC																																					
Date 22/04/2020 File Catchment F_001.srcx	Designed by PS Checked by AC																																					
XP Solutions Source Control 2019.1																																						
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Rainfall Model	FEH																																					
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From: To:	(ha)	From: To:	(ha)																																			
0 4	0.600	4 8	0.600																																			
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South West Milton Keynes

Updated Flood Risk Assessment

Author: WSP

MAY 2020

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. . .	SWMK CATCHMENT F 1 IN 100 YEAR + 40% CC																																																																									
Date 22/04/2020 File Catchment F_001.srcx	Designed by PS Checked by AC																																																																									
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<u>Hydro-Brake® Optimum Outflow Control</u>																																																																										
Unit Reference MD-SHE-0119-5900-0700-5900 Design Head (m) 0.700 Design Flow (l/s) 5.9 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 119 Invert Level (m) 110.000 Minimum Outlet Pipe Diameter (mm) 150 Suggested Manhole Diameter (mm) 1200																																																																										
<table border="1"> <thead> <tr> <th>Control Points</th> <th>Head (m)</th> <th>Flow (l/s)</th> </tr> </thead> <tbody> <tr> <td>Design Point (Calculated)</td> <td>0.700</td> <td>5.9</td> </tr> <tr> <td>Flush-Flo™</td> <td>0.220</td> <td>5.9</td> </tr> <tr> <td>Kick-Flo®</td> <td>0.490</td> <td>5.0</td> </tr> <tr> <td>Mean Flow over Head Range</td> <td>-</td> <td>5.0</td> </tr> </tbody> </table>			Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	0.700	5.9	Flush-Flo™	0.220	5.9	Kick-Flo®	0.490	5.0	Mean Flow over Head Range	-	5.0																																																									
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WSP Group Ltd				Page 1		
.		SWMK				
.		CATCHMENT G				
.		1 IN 100 YEAR + 40% CC				
Date 22/04/2020		Designed by PS				
File Catchment G_001.srcx		Checked by AC				
XP Solutions		Source Control 2019.1				
<u>Summary of Results for 100 year Return Period (+40%)</u>						
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer		115.266	0.266	4.4	252.2	O K
30 min Summer		115.334	0.334	4.4	324.4	O K
60 min Summer		115.398	0.398	4.4	395.7	O K
120 min Summer		115.467	0.467	4.4	476.0	O K
180 min Summer		115.503	0.503	4.4	519.2	O K
240 min Summer		115.524	0.524	4.4	545.1	O K
360 min Summer		115.544	0.544	4.4	570.8	O K
480 min Summer		115.551	0.551	4.4	578.9	O K
600 min Summer		115.551	0.551	4.4	578.6	O K
720 min Summer		115.547	0.547	4.4	573.5	O K
960 min Summer		115.532	0.532	4.4	555.1	O K
1440 min Summer		115.498	0.498	4.4	513.6	O K
2160 min Summer		115.453	0.453	4.4	459.9	O K
2880 min Summer		115.416	0.416	4.4	416.6	O K
4320 min Summer		115.356	0.356	4.4	349.2	O K
5760 min Summer		115.308	0.308	4.4	296.6	O K
7200 min Summer		115.268	0.268	4.4	254.7	O K
8640 min Summer		115.236	0.236	4.4	221.5	O K
10080 min Summer		115.210	0.210	4.4	195.0	O K
15 min Winter		115.295	0.295	4.4	282.8	O K
30 min Winter		115.369	0.369	4.4	364.0	O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer		151.654	0.0	231.5	23	
30 min Summer		97.974	0.0	295.8	37	
60 min Summer		60.354	0.0	394.6	68	
120 min Summer		36.913	0.0	481.8	126	
180 min Summer		27.268	0.0	531.9	186	
240 min Summer		21.821	0.0	565.2	246	
360 min Summer		15.737	0.0	606.1	364	
480 min Summer		12.370	0.0	629.1	484	
600 min Summer		10.223	0.0	642.6	602	
720 min Summer		8.729	0.0	649.8	722	
960 min Summer		6.777	0.0	650.5	960	
1440 min Summer		4.731	0.0	621.6	1200	
2160 min Summer		3.309	0.0	795.2	1536	
2880 min Summer		2.578	0.0	825.2	1908	
4320 min Summer		1.834	0.0	876.3	2688	
5760 min Summer		1.454	0.0	938.7	3464	
7200 min Summer		1.225	0.0	987.6	4184	
8640 min Summer		1.071	0.0	1034.9	4928	
10080 min Summer		0.961	0.0	1079.7	5648	
15 min Winter		151.654	0.0	258.8	23	
30 min Winter		97.974	0.0	325.9	37	
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT G			
.		1 IN 100 YEAR + 40% CC			
Date 22/04/2020		Designed by PS			
File Catchment G_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	115.440	0.440	4.4	444.5	O K
120 min Winter	115.516	0.516	4.4	535.7	O K
180 min Winter	115.555	0.555	4.4	584.6	O K
240 min Winter	115.579	0.579	4.4	614.4	O K
360 min Winter	115.603	0.603	4.4	645.0	O K
480 min Winter	115.611	0.611	4.4	656.0	O K
600 min Winter	115.612	0.612	4.4	657.6	O K
720 min Winter	115.610	0.610	4.4	653.8	O K
960 min Winter	115.597	0.597	4.4	637.2	O K
1440 min Winter	115.561	0.561	4.4	591.4	O K
2160 min Winter	115.510	0.510	4.4	528.4	O K
2880 min Winter	115.461	0.461	4.4	468.8	O K
4320 min Winter	115.371	0.371	4.4	366.1	O K
5760 min Winter	115.297	0.297	4.4	285.4	O K
7200 min Winter	115.237	0.237	4.4	223.1	O K
8640 min Winter	115.191	0.191	4.4	176.7	O K
10080 min Winter	115.157	0.157	4.3	143.6	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	441.9	66	
120 min Winter	36.913	0.0	537.6	124	
180 min Winter	27.268	0.0	591.5	184	
240 min Winter	21.821	0.0	625.9	242	
360 min Winter	15.737	0.0	663.5	358	
480 min Winter	12.370	0.0	677.9	474	
600 min Winter	10.223	0.0	679.2	590	
720 min Winter	8.729	0.0	673.7	704	
960 min Winter	6.777	0.0	658.8	928	
1440 min Winter	4.731	0.0	626.8	1344	
2160 min Winter	3.309	0.0	890.0	1668	
2880 min Winter	2.578	0.0	923.5	2108	
4320 min Winter	1.834	0.0	980.3	2940	
5760 min Winter	1.454	0.0	1051.7	3696	
7200 min Winter	1.225	0.0	1106.7	4400	
8640 min Winter	1.071	0.0	1160.0	5096	
10080 min Winter	0.961	0.0	1211.0	5744	
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WSP Group Ltd		Page 3																								
. . .	SWMK CATCHMENT G 1 IN 100 YEAR + 40% CC																									
Date 22/04/2020 File Catchment G_001.srcx	Designed by PS Checked by AC																									
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<u>Rainfall Details</u>																										
<table> <tr> <td>Rainfall Model</td> <td>FEH</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> </tr> <tr> <td>Site Location</td> <td>GB 483669 232428 SP 83669 32428</td> </tr> <tr> <td>Data Type</td> <td>Point</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> </tr> <tr> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Climate Change %</td> <td>+40</td> </tr> </table>			Rainfall Model	FEH	Return Period (years)	100	FEH Rainfall Version	2013	Site Location	GB 483669 232428 SP 83669 32428	Data Type	Point	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	0.750	Cv (Winter)	0.840	Shortest Storm (mins)	15	Longest Storm (mins)	10080	Climate Change %	+40
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<u>Time Area Diagram</u>																										
Total Area (ha) 0.900																										
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Model Details Storage is Online Cover Level (m) 116.000 Tank or Pond Structure Invert Level (m) 115.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>860.0</td><td>1.000</td><td>1630.0</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0104-4400-0700-4400 Design Head (m) 0.700 Design Flow (l/s) 4.4 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 104 Invert Level (m) 115.000 Minimum Outlet Pipe Diameter (mm) 150 Suggested Manhole Diameter (mm) 1200 Control Points <table><tr><th></th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>0.700</td><td>4.4</td></tr><tr><td>Flush-Flo™</td><td>0.214</td><td>4.4</td></tr><tr><td>Kick-Flo®</td><td>0.480</td><td>3.7</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>3.8</td></tr></table> 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 <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>3.5</td><td>1.200</td><td>5.6</td><td>3.000</td><td>8.7</td><td>7.000</td><td>13.0</td></tr><tr><td>0.200</td><td>4.4</td><td>1.400</td><td>6.1</td><td>3.500</td><td>9.3</td><td>7.500</td><td>13.4</td></tr><tr><td>0.300</td><td>4.3</td><td>1.600</td><td>6.5</td><td>4.000</td><td>9.9</td><td>8.000</td><td>13.8</td></tr><tr><td>0.400</td><td>4.1</td><td>1.800</td><td>6.8</td><td>4.500</td><td>10.5</td><td>8.500</td><td>14.3</td></tr><tr><td>0.500</td><td>3.8</td><td>2.000</td><td>7.2</td><td>5.000</td><td>11.1</td><td>9.000</td><td>14.7</td></tr><tr><td>0.600</td><td>4.1</td><td>2.200</td><td>7.5</td><td>5.500</td><td>11.6</td><td>9.500</td><td>15.1</td></tr><tr><td>0.800</td><td>4.7</td><td>2.400</td><td>7.8</td><td>6.000</td><td>12.1</td><td></td><td></td></tr><tr><td>1.000</td><td>5.2</td><td>2.600</td><td>8.1</td><td>6.500</td><td>12.5</td><td></td><td></td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	860.0	1.000	1630.0		Head (m)	Flow (l/s)	Design Point (Calculated)	0.700	4.4	Flush-Flo™	0.214	4.4	Kick-Flo®	0.480	3.7	Mean Flow over Head Range	-	3.8	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	3.5	1.200	5.6	3.000	8.7	7.000	13.0	0.200	4.4	1.400	6.1	3.500	9.3	7.500	13.4	0.300	4.3	1.600	6.5	4.000	9.9	8.000	13.8	0.400	4.1	1.800	6.8	4.500	10.5	8.500	14.3	0.500	3.8	2.000	7.2	5.000	11.1	9.000	14.7	0.600	4.1	2.200	7.5	5.500	11.6	9.500	15.1	0.800	4.7	2.400	7.8	6.000	12.1			1.000	5.2	2.600	8.1	6.500	12.5		
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WSP Group Ltd				Page 1	
.		SWMK			
.		CATCHMENT H			
.		1 IN 100 YEAR + 40% CC			
Date 22/04/2020		Designed by PS			
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XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	110.265	0.265	3.3	270.1	O K
30 min Summer	110.335	0.335	3.3	347.9	O K
60 min Summer	110.402	0.402	3.3	425.7	O K
120 min Summer	110.475	0.475	3.3	514.7	O K
180 min Summer	110.515	0.515	3.3	563.9	O K
240 min Summer	110.539	0.539	3.3	594.8	O K
360 min Summer	110.566	0.566	3.3	628.7	O K
480 min Summer	110.577	0.577	3.3	643.8	O K
600 min Summer	110.582	0.582	3.3	649.8	O K
720 min Summer	110.583	0.583	3.3	650.6	O K
960 min Summer	110.577	0.577	3.3	642.9	O K
1440 min Summer	110.554	0.554	3.3	613.0	O K
2160 min Summer	110.518	0.518	3.3	567.8	O K
2880 min Summer	110.489	0.489	3.3	532.1	O K
4320 min Summer	110.440	0.440	3.3	471.5	O K
5760 min Summer	110.400	0.400	3.3	423.6	O K
7200 min Summer	110.367	0.367	3.3	385.4	O K
8640 min Summer	110.340	0.340	3.3	353.5	O K
10080 min Summer	110.316	0.316	3.3	326.2	O K
15 min Winter	110.295	0.295	3.3	302.8	O K
30 min Winter	110.371	0.371	3.3	390.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	230.9	23	
30 min Summer	97.974	0.0	272.5	38	
60 min Summer	60.354	0.0	411.1	68	
120 min Summer	36.913	0.0	489.8	128	
180 min Summer	27.268	0.0	518.4	186	
240 min Summer	21.821	0.0	521.3	246	
360 min Summer	15.737	0.0	513.3	366	
480 min Summer	12.370	0.0	505.9	484	
600 min Summer	10.223	0.0	499.2	604	
720 min Summer	8.729	0.0	493.0	724	
960 min Summer	6.777	0.0	481.1	962	
1440 min Summer	4.731	0.0	457.8	1440	
2160 min Summer	3.309	0.0	834.6	1776	
2880 min Summer	2.578	0.0	858.3	2140	
4320 min Summer	1.834	0.0	869.9	2900	
5760 min Summer	1.454	0.0	999.7	3688	
7200 min Summer	1.225	0.0	1051.9	4472	
8640 min Summer	1.071	0.0	1102.4	5272	
10080 min Summer	0.961	0.0	1149.6	6048	
15 min Winter	151.654	0.0	252.7	23	
30 min Winter	97.974	0.0	277.0	37	
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.		SWMK			
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XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	110.445	0.445	3.3	477.8	O K
120 min Winter	110.526	0.526	3.3	578.2	O K
180 min Winter	110.570	0.570	3.3	633.8	O K
240 min Winter	110.597	0.597	3.3	669.0	O K
360 min Winter	110.627	0.627	3.3	708.5	O K
480 min Winter	110.640	0.640	3.3	727.0	O K
600 min Winter	110.647	0.647	3.3	735.4	O K
720 min Winter	110.648	0.648	3.3	737.7	O K
960 min Winter	110.644	0.644	3.3	732.3	O K
1440 min Winter	110.624	0.624	3.3	705.1	O K
2160 min Winter	110.585	0.585	3.3	653.6	O K
2880 min Winter	110.550	0.550	3.3	609.0	O K
4320 min Winter	110.492	0.492	3.3	535.1	O K
5760 min Winter	110.431	0.431	3.3	461.2	O K
7200 min Winter	110.379	0.379	3.3	398.9	O K
8640 min Winter	110.334	0.334	3.3	346.9	O K
10080 min Winter	110.295	0.295	3.3	302.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	456.3	66	
120 min Winter	36.913	0.0	522.0	126	
180 min Winter	27.268	0.0	522.8	184	
240 min Winter	21.821	0.0	517.6	242	
360 min Winter	15.737	0.0	510.0	360	
480 min Winter	12.370	0.0	504.4	478	
600 min Winter	10.223	0.0	499.4	594	
720 min Winter	8.729	0.0	494.6	710	
960 min Winter	6.777	0.0	485.4	940	
1440 min Winter	4.731	0.0	467.3	1386	
2160 min Winter	3.309	0.0	924.1	2008	
2880 min Winter	2.578	0.0	936.3	2256	
4320 min Winter	1.834	0.0	877.1	3200	
5760 min Winter	1.454	0.0	1119.7	4040	
7200 min Winter	1.225	0.0	1178.4	4832	
8640 min Winter	1.071	0.0	1235.4	5624	
10080 min Winter	0.961	0.0	1289.5	6360	
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Date 22/04/2020 File Catchment H_001.srcx	Designed by PS Checked by AC																																					
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Model Details Storage is Online Cover Level (m) 111.000 Tank or Pond Structure Invert Level (m) 110.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>940.0</td><td>1.000</td><td>1600.0</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0091-3300-0700-3300 Design Head (m) 0.700 Design Flow (l/s) 3.3 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 91 Invert Level (m) 110.000 Minimum Outlet Pipe Diameter (mm) 150 Suggested Manhole Diameter (mm) 1200 <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>0.700</td><td>3.3</td></tr><tr><td>Flush-Flo™</td><td>0.208</td><td>3.3</td></tr><tr><td>Kick-Flo®</td><td>0.465</td><td>2.7</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>2.8</td></tr></table> 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 <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>2.8</td><td>1.200</td><td>4.2</td><td>3.000</td><td>6.5</td><td>7.000</td><td>9.7</td></tr><tr><td>0.200</td><td>3.3</td><td>1.400</td><td>4.5</td><td>3.500</td><td>7.0</td><td>7.500</td><td>10.0</td></tr><tr><td>0.300</td><td>3.2</td><td>1.600</td><td>4.8</td><td>4.000</td><td>7.4</td><td>8.000</td><td>10.3</td></tr><tr><td>0.400</td><td>3.1</td><td>1.800</td><td>5.1</td><td>4.500</td><td>7.9</td><td>8.500</td><td>10.7</td></tr><tr><td>0.500</td><td>2.8</td><td>2.000</td><td>5.4</td><td>5.000</td><td>8.3</td><td>9.000</td><td>11.0</td></tr><tr><td>0.600</td><td>3.1</td><td>2.200</td><td>5.6</td><td>5.500</td><td>8.6</td><td>9.500</td><td>11.3</td></tr><tr><td>0.800</td><td>3.5</td><td>2.400</td><td>5.8</td><td>6.000</td><td>9.0</td><td></td><td></td></tr><tr><td>1.000</td><td>3.9</td><td>2.600</td><td>6.1</td><td>6.500</td><td>9.4</td><td></td><td></td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	940.0	1.000	1600.0	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	0.700	3.3	Flush-Flo™	0.208	3.3	Kick-Flo®	0.465	2.7	Mean Flow over Head Range	-	2.8	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	2.8	1.200	4.2	3.000	6.5	7.000	9.7	0.200	3.3	1.400	4.5	3.500	7.0	7.500	10.0	0.300	3.2	1.600	4.8	4.000	7.4	8.000	10.3	0.400	3.1	1.800	5.1	4.500	7.9	8.500	10.7	0.500	2.8	2.000	5.4	5.000	8.3	9.000	11.0	0.600	3.1	2.200	5.6	5.500	8.6	9.500	11.3	0.800	3.5	2.400	5.8	6.000	9.0			1.000	3.9	2.600	6.1	6.500	9.4		
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XP Solutions		Source Control 2019.1				
<u>Summary of Results for 100 year Return Period (+40%)</u>						
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer		110.262	0.262	6.2	336.1	O K
30 min Summer		110.332	0.332	6.2	432.3	O K
60 min Summer		110.398	0.398	6.2	527.2	O K
120 min Summer		110.470	0.470	6.2	633.8	O K
180 min Summer		110.508	0.508	6.2	691.1	O K
240 min Summer		110.530	0.530	6.2	725.3	O K
360 min Summer		110.552	0.552	6.2	758.8	O K
480 min Summer		110.558	0.558	6.2	768.8	O K
600 min Summer		110.558	0.558	6.2	767.5	O K
720 min Summer		110.553	0.553	6.2	759.9	O K
960 min Summer		110.536	0.536	6.2	733.8	O K
1440 min Summer		110.500	0.500	6.2	679.4	O K
2160 min Summer		110.453	0.453	6.2	608.3	O K
2880 min Summer		110.414	0.414	6.2	551.0	O K
4320 min Summer		110.351	0.351	6.2	460.2	O K
5760 min Summer		110.301	0.301	6.2	389.0	O K
7200 min Summer		110.260	0.260	6.2	333.5	O K
8640 min Summer		110.228	0.228	6.2	289.8	O K
10080 min Summer		110.203	0.203	6.2	256.1	O K
15 min Winter		110.292	0.292	6.2	376.9	O K
30 min Winter		110.369	0.369	6.2	485.1	O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer		151.654	0.0	302.9	23	
30 min Summer		97.974	0.0	389.6	37	
60 min Summer		60.354	0.0	522.3	68	
120 min Summer		36.913	0.0	638.4	126	
180 min Summer		27.268	0.0	705.5	186	
240 min Summer		21.821	0.0	750.4	246	
360 min Summer		15.737	0.0	806.5	364	
480 min Summer		12.370	0.0	839.5	484	
600 min Summer		10.223	0.0	860.8	602	
720 min Summer		8.729	0.0	874.8	722	
960 min Summer		6.777	0.0	887.6	956	
1440 min Summer		4.731	0.0	870.8	1168	
2160 min Summer		3.309	0.0	1057.5	1500	
2880 min Summer		2.578	0.0	1097.2	1900	
4320 min Summer		1.834	0.0	1164.6	2680	
5760 min Summer		1.454	0.0	1250.1	3456	
7200 min Summer		1.225	0.0	1314.9	4176	
8640 min Summer		1.071	0.0	1377.4	4848	
10080 min Summer		0.961	0.0	1435.9	5552	
15 min Winter		151.654	0.0	339.5	23	
30 min Winter		97.974	0.0	431.8	37	
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	110.442	0.442	6.2	592.2	O K
120 min Winter	110.523	0.523	6.2	713.3	O K
180 min Winter	110.564	0.564	6.2	778.1	O K
240 min Winter	110.589	0.589	6.2	817.4	O K
360 min Winter	110.614	0.614	6.2	857.0	O K
480 min Winter	110.623	0.623	6.2	870.7	O K
600 min Winter	110.624	0.624	6.2	871.7	O K
720 min Winter	110.620	0.620	6.2	865.7	O K
960 min Winter	110.605	0.605	6.2	841.9	O K
1440 min Winter	110.564	0.564	6.2	778.1	O K
2160 min Winter	110.510	0.510	6.2	694.7	O K
2880 min Winter	110.456	0.456	6.2	611.7	O K
4320 min Winter	110.361	0.361	6.2	474.1	O K
5760 min Winter	110.284	0.284	6.2	366.0	O K
7200 min Winter	110.225	0.225	6.2	285.0	O K
8640 min Winter	110.181	0.181	6.2	227.2	O K
10080 min Winter	110.151	0.151	6.1	188.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	585.2	66	
120 min Winter	36.913	0.0	713.2	124	
180 min Winter	27.268	0.0	786.2	184	
240 min Winter	21.821	0.0	834.1	242	
360 min Winter	15.737	0.0	891.1	358	
480 min Winter	12.370	0.0	920.9	474	
600 min Winter	10.223	0.0	935.8	590	
720 min Winter	8.729	0.0	940.7	702	
960 min Winter	6.777	0.0	929.9	924	
1440 min Winter	4.731	0.0	882.9	1328	
2160 min Winter	3.309	0.0	1183.9	1648	
2880 min Winter	2.578	0.0	1228.4	2080	
4320 min Winter	1.834	0.0	1303.9	2896	
5760 min Winter	1.454	0.0	1400.8	3640	
7200 min Winter	1.225	0.0	1473.7	4328	
8640 min Winter	1.071	0.0	1544.1	5008	
10080 min Winter	0.961	0.0	1611.1	5552	
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WSP Group Ltd				Page 1	
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File Catchment J.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	113.161	0.261	3.8	281.1	O K
30 min Summer	113.230	0.330	3.8	362.0	O K
60 min Summer	113.297	0.397	3.8	442.6	O K
120 min Summer	113.371	0.471	3.8	534.6	O K
180 min Summer	113.410	0.510	3.8	585.2	O K
240 min Summer	113.434	0.534	3.8	616.6	O K
360 min Summer	113.460	0.560	3.8	650.4	O K
480 min Summer	113.471	0.571	3.8	664.6	O K
600 min Summer	113.475	0.575	3.8	669.4	O K
720 min Summer	113.474	0.574	3.8	668.8	O K
960 min Summer	113.466	0.566	3.8	658.0	O K
1440 min Summer	113.439	0.539	3.8	621.9	O K
2160 min Summer	113.401	0.501	3.8	573.8	O K
2880 min Summer	113.370	0.470	3.8	533.6	O K
4320 min Summer	113.316	0.416	3.8	465.9	O K
5760 min Summer	113.274	0.374	3.8	414.3	O K
7200 min Summer	113.239	0.339	3.8	372.6	O K
8640 min Summer	113.209	0.309	3.8	337.5	O K
10080 min Summer	113.184	0.284	3.8	307.7	O K
15 min Winter	113.190	0.290	3.8	315.2	O K
30 min Winter	113.267	0.367	3.8	406.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	244.1	23	
30 min Summer	97.974	0.0	299.6	38	
60 min Summer	60.354	0.0	430.3	68	
120 min Summer	36.913	0.0	519.3	126	
180 min Summer	27.268	0.0	563.5	186	
240 min Summer	21.821	0.0	585.2	246	
360 min Summer	15.737	0.0	592.5	366	
480 min Summer	12.370	0.0	585.5	484	
600 min Summer	10.223	0.0	578.0	604	
720 min Summer	8.729	0.0	570.5	724	
960 min Summer	6.777	0.0	555.8	962	
1440 min Summer	4.731	0.0	526.6	1374	
2160 min Summer	3.309	0.0	874.0	1708	
2880 min Summer	2.578	0.0	903.6	2080	
4320 min Summer	1.834	0.0	945.4	2848	
5760 min Summer	1.454	0.0	1041.4	3632	
7200 min Summer	1.225	0.0	1095.7	4400	
8640 min Summer	1.071	0.0	1148.0	5184	
10080 min Summer	0.961	0.0	1196.9	5944	
15 min Winter	151.654	0.0	270.0	23	
30 min Winter	97.974	0.0	314.8	37	
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WSP Group Ltd				Page 2	
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	113.341	0.441	3.8	496.8	O K
120 min Winter	113.422	0.522	3.8	600.8	O K
180 min Winter	113.466	0.566	3.8	657.9	O K
240 min Winter	113.493	0.593	3.8	693.8	O K
360 min Winter	113.522	0.622	3.8	733.3	O K
480 min Winter	113.535	0.635	3.8	750.9	O K
600 min Winter	113.540	0.640	3.8	758.0	O K
720 min Winter	113.541	0.641	3.8	758.9	O K
960 min Winter	113.535	0.635	3.8	750.3	O K
1440 min Winter	113.510	0.610	3.8	716.6	O K
2160 min Winter	113.465	0.565	3.8	656.8	O K
2880 min Winter	113.429	0.529	3.8	609.7	O K
4320 min Winter	113.360	0.460	3.8	520.7	O K
5760 min Winter	113.293	0.393	3.8	438.1	O K
7200 min Winter	113.238	0.338	3.8	371.6	O K
8640 min Winter	113.191	0.291	3.8	316.0	O K
10080 min Winter	113.151	0.251	3.8	269.7	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	479.7	66	
120 min Winter	36.913	0.0	568.9	126	
180 min Winter	27.268	0.0	598.3	184	
240 min Winter	21.821	0.0	599.1	242	
360 min Winter	15.737	0.0	591.3	360	
480 min Winter	12.370	0.0	584.2	476	
600 min Winter	10.223	0.0	577.7	594	
720 min Winter	8.729	0.0	571.5	708	
960 min Winter	6.777	0.0	559.3	936	
1440 min Winter	4.731	0.0	534.9	1376	
2160 min Winter	3.309	0.0	974.4	1820	
2880 min Winter	2.578	0.0	1002.7	2220	
4320 min Winter	1.834	0.0	1015.4	3120	
5760 min Winter	1.454	0.0	1166.6	3928	
7200 min Winter	1.225	0.0	1227.8	4752	
8640 min Winter	1.071	0.0	1286.9	5456	
10080 min Winter	0.961	0.0	1342.8	6248	
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0.300	3.7	1.600	5.6	4.000	8.6	8.000	11.9																																																																			
0.400	3.5	1.800	5.9	4.500	9.1	8.500	12.3																																																																			
0.500	3.3	2.000	6.2	5.000	9.5	9.000	12.6																																																																			
0.600	3.5	2.200	6.5	5.500	10.0	9.500	13.0																																																																			
0.800	4.0	2.400	6.7	6.000	10.4																																																																					
1.000	4.5	2.600	7.0	6.500	10.8																																																																					
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WSP Group Ltd				Page 1	
.		SWMK			
.		CATCHMENT K			
.		1 in 100 year + 40%CC			
Date 21/04/2020		Designed by PS			
File Catchment K_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	113.285	0.285	4.0	292.3	O K
30 min Summer	113.361	0.361	4.0	376.3	O K
60 min Summer	113.434	0.434	4.0	460.1	O K
120 min Summer	113.515	0.515	4.0	555.6	O K
180 min Summer	113.557	0.557	4.0	607.5	O K
240 min Summer	113.583	0.583	4.0	639.5	O K
360 min Summer	113.611	0.611	4.0	673.6	O K
480 min Summer	113.622	0.622	4.0	687.4	O K
600 min Summer	113.625	0.625	4.0	691.5	O K
720 min Summer	113.623	0.623	4.0	689.8	O K
960 min Summer	113.613	0.613	4.0	676.9	O K
1440 min Summer	113.581	0.581	4.0	637.2	O K
2160 min Summer	113.541	0.541	4.0	587.5	O K
2880 min Summer	113.508	0.508	4.0	547.2	O K
4320 min Summer	113.448	0.448	4.0	477.2	O K
5760 min Summer	113.400	0.400	4.0	420.9	O K
7200 min Summer	113.361	0.361	4.0	376.1	O K
8640 min Summer	113.327	0.327	4.0	338.7	O K
10080 min Summer	113.299	0.299	4.0	307.0	O K
15 min Winter	113.317	0.317	4.0	327.7	O K
30 min Winter	113.401	0.401	4.0	422.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	258.4	23	
30 min Summer	97.974	0.0	317.3	38	
60 min Summer	60.354	0.0	450.5	68	
120 min Summer	36.913	0.0	544.0	126	
180 min Summer	27.268	0.0	591.9	186	
240 min Summer	21.821	0.0	616.6	246	
360 min Summer	15.737	0.0	627.7	366	
480 min Summer	12.370	0.0	621.6	484	
600 min Summer	10.223	0.0	614.4	604	
720 min Summer	8.729	0.0	607.1	724	
960 min Summer	6.777	0.0	592.3	962	
1440 min Summer	4.731	0.0	562.1	1340	
2160 min Summer	3.309	0.0	912.3	1668	
2880 min Summer	2.578	0.0	943.5	2052	
4320 min Summer	1.834	0.0	989.5	2852	
5760 min Summer	1.454	0.0	1083.9	3632	
7200 min Summer	1.225	0.0	1140.5	4392	
8640 min Summer	1.071	0.0	1195.1	5184	
10080 min Summer	0.961	0.0	1246.6	5856	
15 min Winter	151.654	0.0	285.8	23	
30 min Winter	97.974	0.0	332.6	37	
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT K			
.		1 in 100 year + 40%CC			
Date 21/04/2020		Designed by PS			
File Catchment K_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	113.482	0.482	4.0	516.7	O K
120 min Winter	113.571	0.571	4.0	624.0	O K
180 min Winter	113.618	0.618	4.0	682.9	O K
240 min Winter	113.647	0.647	4.0	719.7	O K
360 min Winter	113.678	0.678	4.0	759.8	O K
480 min Winter	113.692	0.692	4.0	777.2	O K
600 min Winter	113.697	0.697	4.0	783.6	O K
720 min Winter	113.697	0.697	4.0	783.7	O K
960 min Winter	113.689	0.689	4.0	773.1	O K
1440 min Winter	113.659	0.659	4.0	735.2	O K
2160 min Winter	113.610	0.610	4.0	672.3	O K
2880 min Winter	113.570	0.570	4.0	622.9	O K
4320 min Winter	113.496	0.496	4.0	533.8	O K
5760 min Winter	113.420	0.420	4.0	444.2	O K
7200 min Winter	113.357	0.357	4.0	372.3	O K
8640 min Winter	113.304	0.304	4.0	313.2	O K
10080 min Winter	113.259	0.259	4.0	264.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	502.2	66	
120 min Winter	36.913	0.0	597.7	126	
180 min Winter	27.268	0.0	632.3	184	
240 min Winter	21.821	0.0	635.7	242	
360 min Winter	15.737	0.0	629.7	360	
480 min Winter	12.370	0.0	623.5	476	
600 min Winter	10.223	0.0	617.5	592	
720 min Winter	8.729	0.0	611.6	708	
960 min Winter	6.777	0.0	599.4	936	
1440 min Winter	4.731	0.0	574.7	1372	
2160 min Winter	3.309	0.0	1018.4	1752	
2880 min Winter	2.578	0.0	1050.1	2192	
4320 min Winter	1.834	0.0	1063.6	3116	
5760 min Winter	1.454	0.0	1214.2	3928	
7200 min Winter	1.225	0.0	1277.9	4688	
8640 min Winter	1.071	0.0	1339.6	5448	
10080 min Winter	0.961	0.0	1398.3	6160	
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WSP Group Ltd		Page 3																								
. . .	SWMK CATCHMENT K 1 in 100 year + 40%CC																									
Date 21/04/2020 File Catchment K_001.srcx	Designed by PS Checked by AC																									
XP Solutions Source Control 2019.1																										
<u>Rainfall Details</u>																										
<table> <tr> <td>Rainfall Model</td> <td>FEH</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> </tr> <tr> <td>Site Location</td> <td>GB 483669 232428 SP 83669 32428</td> </tr> <tr> <td>Data Type</td> <td>Point</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> </tr> <tr> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Climate Change %</td> <td>+40</td> </tr> </table>			Rainfall Model	FEH	Return Period (years)	100	FEH Rainfall Version	2013	Site Location	GB 483669 232428 SP 83669 32428	Data Type	Point	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	0.750	Cv (Winter)	0.840	Shortest Storm (mins)	15	Longest Storm (mins)	10080	Climate Change %	+40
Rainfall Model	FEH																									
Return Period (years)	100																									
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Climate Change %	+40																									
<u>Time Area Diagram</u>																										
Total Area (ha) 1.040																										
<table> <thead> <tr> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> </tr> <tr> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0 4</td> <td>0.510</td> <td>4 8</td> <td>0.530</td> </tr> </tbody> </table>			Time (mins)	Area	Time (mins)	Area	From: To:	(ha)	From: To:	(ha)	0 4	0.510	4 8	0.530												
Time (mins)	Area	Time (mins)	Area																							
From: To:	(ha)	From: To:	(ha)																							
0 4	0.510	4 8	0.530																							
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WSP Group Ltd		Page 4																																																																																															
. . .	SWMK CATCHMENT K 1 in 100 year + 40%CC																																																																																																
Date 21/04/2020	Designed by PS																																																																																																
File Catchment K_001.srcx	Checked by AC																																																																																																
XP Solutions	Source Control 2019.1																																																																																																
Model Details Storage is Online Cover Level (m) 114.000 Tank or Pond Structure Invert Level (m) 113.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>960.0</td><td>1.000</td><td>1460.0</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0099-4000-0700-4000 Design Head (m) 0.700 Design Flow (l/s) 4.0 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 99 Invert Level (m) 113.000 Minimum Outlet Pipe Diameter (mm) 150 Suggested Manhole Diameter (mm) 1200 <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>0.700</td><td>4.0</td></tr><tr><td>Flush-Flo™</td><td>0.210</td><td>4.0</td></tr><tr><td>Kick-Flo®</td><td>0.474</td><td>3.3</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>3.4</td></tr></table> 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 <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>3.3</td><td>1.200</td><td>5.1</td><td>3.000</td><td>7.9</td><td>7.000</td><td>11.8</td></tr><tr><td>0.200</td><td>4.0</td><td>1.400</td><td>5.5</td><td>3.500</td><td>8.5</td><td>7.500</td><td>12.2</td></tr><tr><td>0.300</td><td>3.9</td><td>1.600</td><td>5.9</td><td>4.000</td><td>9.0</td><td>8.000</td><td>12.6</td></tr><tr><td>0.400</td><td>3.7</td><td>1.800</td><td>6.2</td><td>4.500</td><td>9.6</td><td>8.500</td><td>13.0</td></tr><tr><td>0.500</td><td>3.4</td><td>2.000</td><td>6.5</td><td>5.000</td><td>10.0</td><td>9.000</td><td>13.3</td></tr><tr><td>0.600</td><td>3.7</td><td>2.200</td><td>6.8</td><td>5.500</td><td>10.5</td><td>9.500</td><td>13.7</td></tr><tr><td>0.800</td><td>4.3</td><td>2.400</td><td>7.1</td><td>6.000</td><td>11.0</td><td></td><td></td></tr><tr><td>1.000</td><td>4.7</td><td>2.600</td><td>7.4</td><td>6.500</td><td>11.4</td><td></td><td></td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	960.0	1.000	1460.0	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	0.700	4.0	Flush-Flo™	0.210	4.0	Kick-Flo®	0.474	3.3	Mean Flow over Head Range	-	3.4	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	3.3	1.200	5.1	3.000	7.9	7.000	11.8	0.200	4.0	1.400	5.5	3.500	8.5	7.500	12.2	0.300	3.9	1.600	5.9	4.000	9.0	8.000	12.6	0.400	3.7	1.800	6.2	4.500	9.6	8.500	13.0	0.500	3.4	2.000	6.5	5.000	10.0	9.000	13.3	0.600	3.7	2.200	6.8	5.500	10.5	9.500	13.7	0.800	4.3	2.400	7.1	6.000	11.0			1.000	4.7	2.600	7.4	6.500	11.4		
Depth (m)	Area (m²)	Depth (m)	Area (m²)																																																																																														
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0.100	3.3	1.200	5.1	3.000	7.9	7.000	11.8																																																																																										
0.200	4.0	1.400	5.5	3.500	8.5	7.500	12.2																																																																																										
0.300	3.9	1.600	5.9	4.000	9.0	8.000	12.6																																																																																										
0.400	3.7	1.800	6.2	4.500	9.6	8.500	13.0																																																																																										
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0.600	3.7	2.200	6.8	5.500	10.5	9.500	13.7																																																																																										
0.800	4.3	2.400	7.1	6.000	11.0																																																																																												
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WSP Group Ltd				Page 1	
.		SWMK			
.		CATCHMENT L			
.		1 IN 100 YEAR + 40% CC			
Date 21/04/2020		Designed by PS			
File Catchment L_002.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	104.274	0.274	26.6	1448.6	O K
30 min Summer	104.348	0.348	26.8	1862.4	O K
60 min Summer	104.420	0.420	26.8	2272.6	O K
120 min Summer	104.500	0.500	26.8	2735.7	O K
180 min Summer	104.543	0.543	26.8	2985.8	O K
240 min Summer	104.569	0.569	26.8	3139.3	O K
360 min Summer	104.595	0.595	26.8	3295.7	O K
480 min Summer	104.604	0.604	26.8	3349.8	O K
600 min Summer	104.605	0.605	26.8	3354.6	O K
720 min Summer	104.601	0.601	26.8	3331.0	O K
960 min Summer	104.585	0.585	26.8	3236.3	O K
1440 min Summer	104.552	0.552	26.8	3041.9	O K
2160 min Summer	104.511	0.511	26.8	2801.0	O K
2880 min Summer	104.476	0.476	26.8	2594.0	O K
4320 min Summer	104.416	0.416	26.8	2248.8	O K
5760 min Summer	104.368	0.368	26.8	1972.2	O K
7200 min Summer	104.329	0.329	26.8	1756.2	O K
8640 min Summer	104.299	0.299	26.7	1586.1	O K
10080 min Summer	104.275	0.275	26.6	1453.8	O K
15 min Winter	104.305	0.305	26.7	1623.7	O K
30 min Winter	104.388	0.388	26.8	2089.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	1117.6	23	
30 min Summer	97.974	0.0	1472.9	37	
60 min Summer	60.354	0.0	2114.9	68	
120 min Summer	36.913	0.0	2597.0	126	
180 min Summer	27.268	0.0	2873.3	186	
240 min Summer	21.821	0.0	3056.4	246	
360 min Summer	15.737	0.0	3283.1	364	
480 min Summer	12.370	0.0	3415.4	484	
600 min Summer	10.223	0.0	3500.6	602	
720 min Summer	8.729	0.0	3557.0	722	
960 min Summer	6.777	0.0	3614.1	934	
1440 min Summer	4.731	0.0	3605.8	1130	
2160 min Summer	3.309	0.0	4441.0	1492	
2880 min Summer	2.578	0.0	4597.9	1876	
4320 min Summer	1.834	0.0	4844.0	2680	
5760 min Summer	1.454	0.0	5325.7	3408	
7200 min Summer	1.225	0.0	5594.4	4176	
8640 min Summer	1.071	0.0	5846.4	4848	
10080 min Summer	0.961	0.0	6069.3	5552	
15 min Winter	151.654	0.0	1267.3	23	
30 min Winter	97.974	0.0	1650.6	37	
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WSP Group Ltd			Page 2		
.		SWMK			
.		CATCHMENT L			
.		1 IN 100 YEAR + 40% CC			
Date 21/04/2020		Designed by PS			
File Catchment L_002.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	104.469	0.469	26.8	2552.1	O K
120 min Winter	104.558	0.558	26.8	3076.4	O K
180 min Winter	104.606	0.606	26.8	3361.1	O K
240 min Winter	104.634	0.634	26.8	3535.0	O K
360 min Winter	104.664	0.664	26.8	3715.1	O K
480 min Winter	104.675	0.675	26.8	3782.5	O K
600 min Winter	104.677	0.677	26.8	3795.8	O K
720 min Winter	104.674	0.674	26.8	3778.2	O K
960 min Winter	104.660	0.660	26.8	3691.4	O K
1440 min Winter	104.620	0.620	26.8	3448.3	O K
2160 min Winter	104.570	0.570	26.8	3147.0	O K
2880 min Winter	104.518	0.518	26.8	2840.6	O K
4320 min Winter	104.428	0.428	26.8	2314.2	O K
5760 min Winter	104.354	0.354	26.8	1896.7	O K
7200 min Winter	104.298	0.298	26.7	1582.5	O K
8640 min Winter	104.256	0.256	26.4	1354.4	O K
10080 min Winter	104.228	0.228	26.0	1200.7	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	2377.3	66	
120 min Winter	36.913	0.0	2907.3	124	
180 min Winter	27.268	0.0	3206.4	182	
240 min Winter	21.821	0.0	3402.9	242	
360 min Winter	15.737	0.0	3640.2	358	
480 min Winter	12.370	0.0	3771.5	474	
600 min Winter	10.223	0.0	3849.1	588	
720 min Winter	8.729	0.0	3892.9	702	
960 min Winter	6.777	0.0	3913.2	922	
1440 min Winter	4.731	0.0	3778.4	1288	
2160 min Winter	3.309	0.0	4974.4	1628	
2880 min Winter	2.578	0.0	5150.4	2072	
4320 min Winter	1.834	0.0	5428.5	2892	
5760 min Winter	1.454	0.0	5973.2	3632	
7200 min Winter	1.225	0.0	6276.7	4328	
8640 min Winter	1.071	0.0	6563.0	5008	
10080 min Winter	0.961	0.0	6821.0	5552	
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. . .	SWMK CATCHMENT L 1 IN 100 YEAR + 40% CC																																					
Date 21/04/2020 File Catchment L_002.srcx	Designed by PS Checked by AC																																					
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<u>Summary of Results for 100 year Return Period (+40%)</u>						
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³) Status	
15 min Summer		104.285	0.285	15.3	841.3 O K	
30 min Summer		104.363	0.363	15.3	1082.0 O K	
60 min Summer		104.438	0.438	15.3	1320.4 O K	
120 min Summer		104.521	0.521	15.3	1589.5 O K	
180 min Summer		104.564	0.564	15.3	1734.5 O K	
240 min Summer		104.591	0.591	15.3	1821.5 O K	
360 min Summer		104.616	0.616	15.3	1908.1 O K	
480 min Summer		104.625	0.625	15.3	1936.0 O K	
600 min Summer		104.625	0.625	15.3	1935.8 O K	
720 min Summer		104.620	0.620	15.3	1919.4 O K	
960 min Summer		104.602	0.602	15.3	1859.7 O K	
1440 min Summer		104.567	0.567	15.3	1742.9 O K	
2160 min Summer		104.521	0.521	15.3	1590.7 O K	
2880 min Summer		104.480	0.480	15.3	1456.1 O K	
4320 min Summer		104.412	0.412	15.3	1238.9 O K	
5760 min Summer		104.358	0.358	15.3	1067.2 O K	
7200 min Summer		104.315	0.315	15.3	932.8 O K	
8640 min Summer		104.280	0.280	15.3	826.4 O K	
10080 min Summer		104.253	0.253	15.3	744.1 O K	
15 min Winter		104.318	0.318	15.3	943.2 O K	
30 min Winter		104.404	0.404	15.3	1213.9 O K	
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer		151.654	0.0	708.1	23	
30 min Summer		97.974	0.0	918.3	37	
60 min Summer		60.354	0.0	1272.1	68	
120 min Summer		36.913	0.0	1556.5	126	
180 min Summer		27.268	0.0	1719.7	186	
240 min Summer		21.821	0.0	1828.5	246	
360 min Summer		15.737	0.0	1963.6	364	
480 min Summer		12.370	0.0	2042.5	484	
600 min Summer		10.223	0.0	2092.8	602	
720 min Summer		8.729	0.0	2125.5	722	
960 min Summer		6.777	0.0	2155.4	934	
1440 min Summer		4.731	0.0	2119.7	1142	
2160 min Summer		3.309	0.0	2616.3	1516	
2880 min Summer		2.578	0.0	2712.0	1904	
4320 min Summer		1.834	0.0	2869.2	2684	
5760 min Summer		1.454	0.0	3113.4	3456	
7200 min Summer		1.225	0.0	3272.9	4176	
8640 min Summer		1.071	0.0	3424.8	4848	
10080 min Summer		0.961	0.0	3563.3	5552	
15 min Winter		151.654	0.0	796.9	23	
30 min Winter		97.974	0.0	1021.6	37	
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Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	104.488	0.488	15.3	1482.9	O K
120 min Winter	104.580	0.580	15.3	1787.2	O K
180 min Winter	104.629	0.629	15.3	1950.4	O K
240 min Winter	104.658	0.658	15.3	2049.8	O K
360 min Winter	104.688	0.688	15.3	2151.5	O K
480 min Winter	104.698	0.698	15.3	2187.9	O K
600 min Winter	104.700	0.700	15.3	2193.0	O K
720 min Winter	104.696	0.696	15.3	2180.3	O K
960 min Winter	104.680	0.680	15.3	2125.3	O K
1440 min Winter	104.637	0.637	15.3	1976.4	O K
2160 min Winter	104.582	0.582	15.3	1793.5	O K
2880 min Winter	104.528	0.528	15.3	1613.4	O K
4320 min Winter	104.425	0.425	15.3	1280.9	O K
5760 min Winter	104.343	0.343	15.3	1019.7	O K
7200 min Winter	104.279	0.279	15.3	822.6	O K
8640 min Winter	104.232	0.232	15.2	679.6	O K
10080 min Winter	104.199	0.199	15.0	581.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	1426.6	66	
120 min Winter	36.913	0.0	1739.3	124	
180 min Winter	27.268	0.0	1916.9	182	
240 min Winter	21.821	0.0	2033.2	242	
360 min Winter	15.737	0.0	2172.4	358	
480 min Winter	12.370	0.0	2247.2	474	
600 min Winter	10.223	0.0	2288.2	588	
720 min Winter	8.729	0.0	2307.4	702	
960 min Winter	6.777	0.0	2299.4	922	
1440 min Winter	4.731	0.0	2183.5	1298	
2160 min Winter	3.309	0.0	2929.8	1628	
2880 min Winter	2.578	0.0	3035.6	2084	
4320 min Winter	1.834	0.0	3211.8	2900	
5760 min Winter	1.454	0.0	3490.0	3640	
7200 min Winter	1.225	0.0	3669.8	4328	
8640 min Winter	1.071	0.0	3841.7	5016	
10080 min Winter	0.961	0.0	4001.0	5648	
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WSP Group Ltd				Page 1	
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.		1 IN 100 YEAR + 40% CC			
Date 21/04/2020		Designed by PS			
File Catchment N_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	100.298	0.298	5.6	302.4	O K
30 min Summer	100.376	0.376	5.6	388.8	O K
60 min Summer	100.449	0.449	5.6	474.2	O K
120 min Summer	100.528	0.528	5.6	570.1	O K
180 min Summer	100.568	0.568	5.6	620.3	O K
240 min Summer	100.591	0.591	5.6	649.9	O K
360 min Summer	100.613	0.613	5.6	678.1	O K
480 min Summer	100.619	0.619	5.6	685.3	O K
600 min Summer	100.617	0.617	5.6	682.7	O K
720 min Summer	100.610	0.610	5.6	674.3	O K
960 min Summer	100.590	0.590	5.6	648.5	O K
1440 min Summer	100.552	0.552	5.6	600.0	O K
2160 min Summer	100.503	0.503	5.6	540.2	O K
2880 min Summer	100.458	0.458	5.6	485.2	O K
4320 min Summer	100.385	0.385	5.6	399.5	O K
5760 min Summer	100.327	0.327	5.6	333.8	O K
7200 min Summer	100.280	0.280	5.6	282.5	O K
8640 min Summer	100.243	0.243	5.6	241.9	O K
10080 min Summer	100.213	0.213	5.6	210.7	O K
15 min Winter	100.332	0.332	5.6	339.1	O K
30 min Winter	100.417	0.417	5.6	436.4	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	281.0	23	
30 min Summer	97.974	0.0	360.3	37	
60 min Summer	60.354	0.0	475.3	68	
120 min Summer	36.913	0.0	580.5	126	
180 min Summer	27.268	0.0	641.8	186	
240 min Summer	21.821	0.0	683.0	246	
360 min Summer	15.737	0.0	734.9	364	
480 min Summer	12.370	0.0	765.8	484	
600 min Summer	10.223	0.0	786.0	602	
720 min Summer	8.729	0.0	799.3	722	
960 min Summer	6.777	0.0	811.7	932	
1440 min Summer	4.731	0.0	791.8	1142	
2160 min Summer	3.309	0.0	955.5	1520	
2880 min Summer	2.578	0.0	991.8	1908	
4320 min Summer	1.834	0.0	1054.4	2684	
5760 min Summer	1.454	0.0	1126.8	3456	
7200 min Summer	1.225	0.0	1185.5	4176	
8640 min Summer	1.071	0.0	1242.4	4848	
10080 min Summer	0.961	0.0	1296.6	5552	
15 min Winter	151.654	0.0	314.5	23	
30 min Winter	97.974	0.0	398.5	37	
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WSP Group Ltd				Page 2	
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	100.498	0.498	5.6	533.0	O K
120 min Winter	100.584	0.584	5.6	640.9	O K
180 min Winter	100.629	0.629	5.6	698.2	O K
240 min Winter	100.655	0.655	5.6	732.6	O K
360 min Winter	100.681	0.681	5.6	766.8	O K
480 min Winter	100.689	0.689	5.6	777.5	O K
600 min Winter	100.688	0.688	5.6	777.1	O K
720 min Winter	100.683	0.683	5.6	770.3	O K
960 min Winter	100.665	0.665	5.6	746.5	O K
1440 min Winter	100.619	0.619	5.6	686.1	O K
2160 min Winter	100.562	0.562	5.6	612.8	O K
2880 min Winter	100.507	0.507	5.6	544.2	O K
4320 min Winter	100.396	0.396	5.6	412.4	O K
5760 min Winter	100.307	0.307	5.6	312.0	O K
7200 min Winter	100.238	0.238	5.6	236.6	O K
8640 min Winter	100.187	0.187	5.6	183.1	O K
10080 min Winter	100.152	0.152	5.5	147.6	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	532.2	66	
120 min Winter	36.913	0.0	648.8	124	
180 min Winter	27.268	0.0	715.9	182	
240 min Winter	21.821	0.0	760.2	242	
360 min Winter	15.737	0.0	813.5	358	
480 min Winter	12.370	0.0	841.6	474	
600 min Winter	10.223	0.0	855.7	588	
720 min Winter	8.729	0.0	859.8	700	
960 min Winter	6.777	0.0	848.1	922	
1440 min Winter	4.731	0.0	806.5	1290	
2160 min Winter	3.309	0.0	1070.1	1628	
2880 min Winter	2.578	0.0	1110.2	2104	
4320 min Winter	1.834	0.0	1180.4	2900	
5760 min Winter	1.454	0.0	1262.4	3640	
7200 min Winter	1.225	0.0	1328.4	4328	
8640 min Winter	1.071	0.0	1392.5	5008	
10080 min Winter	0.961	0.0	1454.1	5552	
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WSP Group Ltd		Page 3																								
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Date 21/04/2020 File Catchment N_001.srcx	Designed by PS Checked by AC																									
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Model Details Storage is Online Cover Level (m) 101.000 Tank or Pond Structure Invert Level (m) 100.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>930.0</td><td>1.000</td><td>1550.0</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0116-5600-0700-5600 Design Head (m) 0.700 Design Flow (l/s) 5.6 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 116 Invert Level (m) 100.000 Minimum Outlet Pipe Diameter (mm) 150 Suggested Manhole Diameter (mm) 1200 <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>0.700</td><td>5.6</td></tr><tr><td>Flush-Flo™</td><td>0.217</td><td>5.6</td></tr><tr><td>Kick-Flo®</td><td>0.485</td><td>4.7</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>4.7</td></tr></table> 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 <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>4.1</td><td>1.200</td><td>7.2</td><td>3.000</td><td>11.1</td><td>7.000</td><td>16.6</td></tr><tr><td>0.200</td><td>5.6</td><td>1.400</td><td>7.7</td><td>3.500</td><td>11.9</td><td>7.500</td><td>17.1</td></tr><tr><td>0.300</td><td>5.5</td><td>1.600</td><td>8.2</td><td>4.000</td><td>12.7</td><td>8.000</td><td>17.7</td></tr><tr><td>0.400</td><td>5.3</td><td>1.800</td><td>8.7</td><td>4.500</td><td>13.5</td><td>8.500</td><td>18.3</td></tr><tr><td>0.500</td><td>4.8</td><td>2.000</td><td>9.2</td><td>5.000</td><td>14.1</td><td>9.000</td><td>18.8</td></tr><tr><td>0.600</td><td>5.2</td><td>2.200</td><td>9.6</td><td>5.500</td><td>14.8</td><td>9.500</td><td>19.3</td></tr><tr><td>0.800</td><td>6.0</td><td>2.400</td><td>10.0</td><td>6.000</td><td>15.4</td><td></td><td></td></tr><tr><td>1.000</td><td>6.6</td><td>2.600</td><td>10.4</td><td>6.500</td><td>16.0</td><td></td><td></td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	930.0	1.000	1550.0	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	0.700	5.6	Flush-Flo™	0.217	5.6	Kick-Flo®	0.485	4.7	Mean Flow over Head Range	-	4.7	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	4.1	1.200	7.2	3.000	11.1	7.000	16.6	0.200	5.6	1.400	7.7	3.500	11.9	7.500	17.1	0.300	5.5	1.600	8.2	4.000	12.7	8.000	17.7	0.400	5.3	1.800	8.7	4.500	13.5	8.500	18.3	0.500	4.8	2.000	9.2	5.000	14.1	9.000	18.8	0.600	5.2	2.200	9.6	5.500	14.8	9.500	19.3	0.800	6.0	2.400	10.0	6.000	15.4			1.000	6.6	2.600	10.4	6.500	16.0		
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WSP Group Ltd				Page 1	
.		SWMK			
.		CATCHMENT O			
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Date 22/04/2020		Designed by PS			
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XP Solutions		Source Control 2019.1			
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		102.301	0.301	9.4	461.5 O K
30 min Summer		102.380	0.380	9.4	593.3 O K
60 min Summer		102.455	0.455	9.4	723.0 O K
120 min Summer		102.537	0.537	9.4	868.3 O K
180 min Summer		102.578	0.578	9.4	943.8 O K
240 min Summer		102.602	0.602	9.4	987.7 O K
360 min Summer		102.623	0.623	9.4	1028.0 O K
480 min Summer		102.628	0.628	9.4	1036.4 O K
600 min Summer		102.624	0.624	9.4	1029.6 O K
720 min Summer		102.616	0.616	9.4	1014.2 O K
960 min Summer		102.594	0.594	9.4	972.8 O K
1440 min Summer		102.554	0.554	9.4	900.1 O K
2160 min Summer		102.501	0.501	9.4	804.2 O K
2880 min Summer		102.453	0.453	9.4	718.6 O K
4320 min Summer		102.376	0.376	9.4	585.8 O K
5760 min Summer		102.315	0.315	9.4	484.2 O K
7200 min Summer		102.268	0.268	9.4	407.5 O K
8640 min Summer		102.232	0.232	9.4	349.7 O K
10080 min Summer		102.205	0.205	9.3	306.7 O K
15 min Winter		102.335	0.335	9.4	517.6 O K
30 min Winter		102.422	0.422	9.4	665.9 O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer		151.654	0.0	421.8	23
30 min Summer		97.974	0.0	545.0	37
60 min Summer		60.354	0.0	721.3	66
120 min Summer		36.913	0.0	882.4	126
180 min Summer		27.268	0.0	976.6	186
240 min Summer		21.821	0.0	1040.5	246
360 min Summer		15.737	0.0	1121.9	364
480 min Summer		12.370	0.0	1171.7	482
600 min Summer		10.223	0.0	1205.8	602
720 min Summer		8.729	0.0	1230.4	720
960 min Summer		6.777	0.0	1261.5	860
1440 min Summer		4.731	0.0	1279.6	1096
2160 min Summer		3.309	0.0	1456.7	1476
2880 min Summer		2.578	0.0	1511.9	1872
4320 min Summer		1.834	0.0	1605.9	2640
5760 min Summer		1.454	0.0	1719.4	3400
7200 min Summer		1.225	0.0	1808.6	4104
8640 min Summer		1.071	0.0	1894.7	4760
10080 min Summer		0.961	0.0	1975.7	5448
15 min Winter		151.654	0.0	473.4	22
30 min Winter		97.974	0.0	606.9	37
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.		SWMK			
.		CATCHMENT O			
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	102.506	0.506	9.4	812.6	O K
120 min Winter	102.596	0.596	9.4	976.2	O K
180 min Winter	102.641	0.641	9.4	1062.3	O K
240 min Winter	102.668	0.668	9.4	1113.2	O K
360 min Winter	102.694	0.694	9.4	1162.1	O K
480 min Winter	102.700	0.700	9.4	1175.4	Flood Risk
600 min Winter	102.699	0.699	9.4	1171.7	O K
720 min Winter	102.692	0.692	9.4	1158.6	O K
960 min Winter	102.670	0.670	9.4	1117.0	O K
1440 min Winter	102.621	0.621	9.4	1023.5	O K
2160 min Winter	102.557	0.557	9.4	906.0	O K
2880 min Winter	102.492	0.492	9.4	788.1	O K
4320 min Winter	102.375	0.375	9.4	584.4	O K
5760 min Winter	102.284	0.284	9.4	433.2	O K
7200 min Winter	102.218	0.218	9.4	327.7	O K
8640 min Winter	102.174	0.174	9.2	259.8	O K
10080 min Winter	102.152	0.152	8.9	225.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	808.4	66	
120 min Winter	36.913	0.0	987.5	124	
180 min Winter	27.268	0.0	1091.6	182	
240 min Winter	21.821	0.0	1161.6	240	
360 min Winter	15.737	0.0	1249.6	358	
480 min Winter	12.370	0.0	1301.8	472	
600 min Winter	10.223	0.0	1335.8	586	
720 min Winter	8.729	0.0	1358.4	698	
960 min Winter	6.777	0.0	1380.0	914	
1440 min Winter	4.731	0.0	1352.9	1152	
2160 min Winter	3.309	0.0	1631.7	1604	
2880 min Winter	2.578	0.0	1693.4	2048	
4320 min Winter	1.834	0.0	1800.3	2848	
5760 min Winter	1.454	0.0	1926.7	3568	
7200 min Winter	1.225	0.0	2027.0	4184	
8640 min Winter	1.071	0.0	2124.1	4840	
10080 min Winter	0.961	0.0	2216.5	5352	
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WSP Group Ltd		Page 3																								
. . .	SWMK CATCHMENT O 1 IN 100 YEAR + 40% CC																									
Date 22/04/2020 File Catchment O_001.srcx	Designed by PS Checked by AC																									
XP Solutions Source Control 2019.1																										
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WSP Group Ltd		Page 4
. . .	SWMK CATCHMENT O 1 IN 100 YEAR + 40% CC	
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XP Solutions Source Control 2019.1		

Model Details

Storage is Online Cover Level (m) 103.000

Tank or Pond Structure

Invert Level (m) 102.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	1430.0	1.000	2180.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0146-9400-0700-9400
Design Head (m)	0.700
Design Flow (l/s)	9.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	146
Invert Level (m)	102.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	9.4
Flush-Flo™	0.242	9.4
Kick-Flo®	0.510	8.1
Mean Flow over Head Range	-	7.8

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	5.3	1.200	12.1	3.000	18.7	7.000	28.2
0.200	9.3	1.400	13.0	3.500	20.2	7.500	29.0
0.300	9.3	1.600	13.9	4.000	21.5	8.000	30.0
0.400	9.0	1.800	14.7	4.500	22.8	8.500	30.9
0.500	8.3	2.000	15.4	5.000	23.9	9.000	31.8
0.600	8.7	2.200	16.2	5.500	25.1	9.500	32.7
0.800	10.0	2.400	16.8	6.000	26.1		
1.000	11.1	2.600	17.5	6.500	27.2		

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.		CATCHMENT P			
.		1 in 100 Year + 40% CC			
Date 12/05/2020		Designed by PS			
File Catchment P_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	106.162	0.162	5.3	337.4	O K
30 min Summer	106.207	0.207	5.4	434.0	O K
60 min Summer	106.252	0.252	5.4	530.3	O K
120 min Summer	106.301	0.301	5.4	639.3	O K
180 min Summer	106.328	0.328	5.4	698.5	O K
240 min Summer	106.344	0.344	5.4	735.1	O K
360 min Summer	106.362	0.362	5.4	773.9	O K
480 min Summer	106.368	0.368	5.4	789.2	O K
600 min Summer	106.370	0.370	5.4	792.9	O K
720 min Summer	106.369	0.369	5.4	790.0	O K
960 min Summer	106.361	0.361	5.4	772.0	O K
1440 min Summer	106.342	0.342	5.4	728.6	O K
2160 min Summer	106.319	0.319	5.4	678.2	O K
2880 min Summer	106.300	0.300	5.4	635.2	O K
4320 min Summer	106.267	0.267	5.4	563.0	O K
5760 min Summer	106.239	0.239	5.4	503.4	O K
7200 min Summer	106.217	0.217	5.4	455.0	O K
8640 min Summer	106.199	0.199	5.4	415.4	O K
10080 min Summer	106.184	0.184	5.4	383.0	O K
15 min Winter	106.181	0.181	5.4	378.1	O K
30 min Winter	106.232	0.232	5.4	486.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	256.1	23	
30 min Summer	97.974	0.0	333.5	37	
60 min Summer	60.354	0.0	488.4	68	
120 min Summer	36.913	0.0	597.6	126	
180 min Summer	27.268	0.0	659.1	186	
240 min Summer	21.821	0.0	699.0	246	
360 min Summer	15.737	0.0	746.4	364	
480 min Summer	12.370	0.0	771.8	484	
600 min Summer	10.223	0.0	786.0	602	
720 min Summer	8.729	0.0	793.4	722	
960 min Summer	6.777	0.0	794.8	960	
1440 min Summer	4.731	0.0	766.4	1172	
2160 min Summer	3.309	0.0	1028.2	1532	
2880 min Summer	2.578	0.0	1062.9	1932	
4320 min Summer	1.834	0.0	1114.2	2724	
5760 min Summer	1.454	0.0	1238.2	3512	
7200 min Summer	1.225	0.0	1300.9	4256	
8640 min Summer	1.071	0.0	1359.7	5016	
10080 min Summer	0.961	0.0	1411.5	5744	
15 min Winter	151.654	0.0	289.2	23	
30 min Winter	97.974	0.0	370.5	37	
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.		SWMK			
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.		1 in 100 Year + 40% CC			
Date 12/05/2020		Designed by PS			
File Catchment P_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	106.281	0.281	5.4	595.2	O K
120 min Winter	106.337	0.337	5.4	718.2	O K
180 min Winter	106.367	0.367	5.4	785.8	O K
240 min Winter	106.386	0.386	5.4	828.0	O K
360 min Winter	106.406	0.406	5.4	873.9	O K
480 min Winter	106.415	0.415	5.4	893.7	O K
600 min Winter	106.418	0.418	5.4	900.6	O K
720 min Winter	106.417	0.417	5.4	900.0	O K
960 min Winter	106.411	0.411	5.4	885.7	O K
1440 min Winter	106.389	0.389	5.4	835.9	O K
2160 min Winter	106.358	0.358	5.4	765.4	O K
2880 min Winter	106.331	0.331	5.4	705.1	O K
4320 min Winter	106.282	0.282	5.4	597.2	O K
5760 min Winter	106.241	0.241	5.4	506.3	O K
7200 min Winter	106.207	0.207	5.4	432.7	O K
8640 min Winter	106.180	0.180	5.4	374.3	O K
10080 min Winter	106.158	0.158	5.3	328.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	548.1	66	
120 min Winter	36.913	0.0	666.9	124	
180 min Winter	27.268	0.0	731.8	184	
240 min Winter	21.821	0.0	772.0	242	
360 min Winter	15.737	0.0	815.3	358	
480 min Winter	12.370	0.0	833.2	476	
600 min Winter	10.223	0.0	838.4	592	
720 min Winter	8.729	0.0	836.4	706	
960 min Winter	6.777	0.0	820.5	932	
1440 min Winter	4.731	0.0	778.2	1354	
2160 min Winter	3.309	0.0	1150.5	1664	
2880 min Winter	2.578	0.0	1188.4	2104	
4320 min Winter	1.834	0.0	1241.9	2948	
5760 min Winter	1.454	0.0	1388.5	3752	
7200 min Winter	1.225	0.0	1459.4	4536	
8640 min Winter	1.071	0.0	1526.2	5192	
10080 min Winter	0.961	0.0	1586.3	5944	
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. . .	SWMK CATCHMENT P 1 in 100 Year + 40% CC																																					
Date 12/05/2020 File Catchment P_001.srcx	Designed by PS Checked by AC																																					
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From: To:	(ha)	From: To:	(ha)																																			
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Unit Reference MD-SHE-0114-5400-0700-5400 Design Head (m) 0.700 Design Flow (l/s) 5.4 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 114 Invert Level (m) 106.000 Minimum Outlet Pipe Diameter (mm) 150 Suggested Manhole Diameter (mm) 1200																																																																										
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WSP Group Ltd				Page 1	
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Date 12/05/2020		Designed by PS			
File Catchment Q_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	94.191	0.191	13.6	758.7	O K
30 min Summer	94.244	0.244	13.9	975.3	O K
60 min Summer	94.296	0.296	13.9	1190.2	O K
120 min Summer	94.354	0.354	13.9	1432.7	O K
180 min Summer	94.385	0.385	13.9	1563.1	O K
240 min Summer	94.404	0.404	13.9	1642.7	O K
360 min Summer	94.423	0.423	13.9	1724.4	O K
480 min Summer	94.430	0.430	13.9	1753.1	O K
600 min Summer	94.431	0.431	13.9	1755.9	O K
720 min Summer	94.428	0.428	13.9	1743.3	O K
960 min Summer	94.416	0.416	13.9	1693.0	O K
1440 min Summer	94.394	0.394	13.9	1601.3	O K
2160 min Summer	94.368	0.368	13.9	1488.9	O K
2880 min Summer	94.344	0.344	13.9	1389.8	O K
4320 min Summer	94.304	0.304	13.9	1222.0	O K
5760 min Summer	94.271	0.271	13.9	1085.8	O K
7200 min Summer	94.245	0.245	13.9	978.4	O K
8640 min Summer	94.224	0.224	13.8	892.4	O K
10080 min Summer	94.207	0.207	13.7	825.5	O K
15 min Winter	94.213	0.213	13.8	850.2	O K
30 min Winter	94.273	0.273	13.9	1093.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	551.4	23	
30 min Summer	97.974	0.0	734.3	37	
60 min Summer	60.354	0.0	1080.7	66	
120 min Summer	36.913	0.0	1330.4	126	
180 min Summer	27.268	0.0	1473.5	186	
240 min Summer	21.821	0.0	1568.7	246	
360 min Summer	15.737	0.0	1686.4	364	
480 min Summer	12.370	0.0	1755.0	484	
600 min Summer	10.223	0.0	1799.3	602	
720 min Summer	8.729	0.0	1828.9	722	
960 min Summer	6.777	0.0	1860.5	898	
1440 min Summer	4.731	0.0	1861.7	1102	
2160 min Summer	3.309	0.0	2302.1	1476	
2880 min Summer	2.578	0.0	2381.1	1876	
4320 min Summer	1.834	0.0	2500.5	2676	
5760 min Summer	1.454	0.0	2775.6	3408	
7200 min Summer	1.225	0.0	2914.3	4176	
8640 min Summer	1.071	0.0	3043.1	4848	
10080 min Summer	0.961	0.0	3155.0	5552	
15 min Winter	151.654	0.0	628.5	23	
30 min Winter	97.974	0.0	826.2	37	
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT Q			
.		1 in 100 Year + 40% CC			
Date 12/05/2020		Designed by PS			
File Catchment Q_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	94.331	0.331	13.9	1336.3	O K
120 min Winter	94.396	0.396	13.9	1610.3	O K
180 min Winter	94.432	0.432	13.9	1759.2	O K
240 min Winter	94.453	0.453	13.9	1851.5	O K
360 min Winter	94.476	0.476	13.9	1949.3	O K
480 min Winter	94.485	0.485	13.9	1988.2	O K
600 min Winter	94.487	0.487	13.9	1998.2	O K
720 min Winter	94.486	0.486	13.9	1991.2	O K
960 min Winter	94.476	0.476	13.9	1947.7	O K
1440 min Winter	94.445	0.445	13.9	1816.6	O K
2160 min Winter	94.408	0.408	13.9	1661.1	O K
2880 min Winter	94.374	0.374	13.9	1515.4	O K
4320 min Winter	94.313	0.313	13.9	1260.4	O K
5760 min Winter	94.263	0.263	13.9	1054.4	O K
7200 min Winter	94.225	0.225	13.8	897.2	O K
8640 min Winter	94.196	0.196	13.7	781.5	O K
10080 min Winter	94.177	0.177	13.5	704.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	1216.7	66	
120 min Winter	36.913	0.0	1491.7	124	
180 min Winter	27.268	0.0	1647.2	182	
240 min Winter	21.821	0.0	1748.8	242	
360 min Winter	15.737	0.0	1870.5	358	
480 min Winter	12.370	0.0	1937.5	474	
600 min Winter	10.223	0.0	1977.2	590	
720 min Winter	8.729	0.0	2000.4	704	
960 min Winter	6.777	0.0	2015.6	924	
1440 min Winter	4.731	0.0	1971.5	1214	
2160 min Winter	3.309	0.0	2580.6	1608	
2880 min Winter	2.578	0.0	2668.8	2048	
4320 min Winter	1.834	0.0	2803.6	2860	
5760 min Winter	1.454	0.0	3114.1	3632	
7200 min Winter	1.225	0.0	3271.0	4328	
8640 min Winter	1.071	0.0	3417.8	5016	
10080 min Winter	0.961	0.0	3547.7	5640	
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WSP Group Ltd		Page 3																																				
. . .	SWMK CATCHMENT Q 1 in 100 Year + 40% CC																																					
Date 12/05/2020 File Catchment Q_001.srcx	Designed by PS Checked by AC																																					
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<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> </tr> <tr> <td>Site Location</td> <td>GB 483669 232428 SP 83669 32428</td> </tr> <tr> <td>Data Type</td> <td>Point</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> </tr> <tr> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 2.700 <table> <thead> <tr> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> </tr> <tr> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0 4</td> <td>1.350</td> <td>4 8</td> <td>1.350</td> </tr> </tbody> </table>			Rainfall Model	FEH	Return Period (years)	100	FEH Rainfall Version	2013	Site Location	GB 483669 232428 SP 83669 32428	Data Type	Point	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	0.750	Cv (Winter)	0.840	Shortest Storm (mins)	15	Longest Storm (mins)	10080	Climate Change %	+40	Time (mins)	Area	Time (mins)	Area	From: To:	(ha)	From: To:	(ha)	0 4	1.350	4 8	1.350
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WSP Group Ltd		Page 4																																																																																															
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Model Details Storage is Online Cover Level (m) 95.000 Tank or Pond Structure Invert Level (m) 94.000 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>3900.0</td><td>1.000</td><td>4750.0</td></tr></tbody></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0173-1400-0700-1400 Design Head (m)0.700 Design Flow (l/s)14.0 Flush-Flo™Calculated ObjectiveMinimise upstream storage ApplicationSurface Sump AvailableYes Diameter (mm)173 Invert Level (m)94.000 Minimum Outlet Pipe Diameter (mm)225 Suggested Manhole Diameter (mm)1200 <table><thead><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr></thead><tbody><tr><td>Design Point (Calculated)</td><td>0.700</td><td>14.0</td></tr><tr><td>Flush-Flo™</td><td>0.272</td><td>13.9</td></tr><tr><td>Kick-Flo®</td><td>0.527</td><td>12.2</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>11.4</td></tr></tbody></table> 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 <table><thead><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr></thead><tbody><tr><td>0.100</td><td>6.1</td><td>1.200</td><td>18.1</td><td>3.000</td><td>28.0</td><td>7.000</td><td>42.2</td></tr><tr><td>0.200</td><td>13.7</td><td>1.400</td><td>19.4</td><td>3.500</td><td>30.2</td><td>7.500</td><td>43.4</td></tr><tr><td>0.300</td><td>13.9</td><td>1.600</td><td>20.7</td><td>4.000</td><td>32.2</td><td>8.000</td><td>44.9</td></tr><tr><td>0.400</td><td>13.6</td><td>1.800</td><td>21.9</td><td>4.500</td><td>34.1</td><td>8.500</td><td>46.3</td></tr><tr><td>0.500</td><td>12.7</td><td>2.000</td><td>23.1</td><td>5.000</td><td>35.8</td><td>9.000</td><td>47.6</td></tr><tr><td>0.600</td><td>13.0</td><td>2.200</td><td>24.1</td><td>5.500</td><td>37.5</td><td>9.500</td><td>48.9</td></tr><tr><td>0.800</td><td>14.9</td><td>2.400</td><td>25.2</td><td>6.000</td><td>39.1</td><td></td><td></td></tr><tr><td>1.000</td><td>16.6</td><td>2.600</td><td>26.2</td><td>6.500</td><td>40.7</td><td></td><td></td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	3900.0	1.000	4750.0	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	0.700	14.0	Flush-Flo™	0.272	13.9	Kick-Flo®	0.527	12.2	Mean Flow over Head Range	-	11.4	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	6.1	1.200	18.1	3.000	28.0	7.000	42.2	0.200	13.7	1.400	19.4	3.500	30.2	7.500	43.4	0.300	13.9	1.600	20.7	4.000	32.2	8.000	44.9	0.400	13.6	1.800	21.9	4.500	34.1	8.500	46.3	0.500	12.7	2.000	23.1	5.000	35.8	9.000	47.6	0.600	13.0	2.200	24.1	5.500	37.5	9.500	48.9	0.800	14.9	2.400	25.2	6.000	39.1			1.000	16.6	2.600	26.2	6.500	40.7		
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WSP Group Ltd					Page 1	
.		SWMK				
.		CATCHMENT R				
.		1 IN 100 YEAR + 40% CC				
Date 21/04/2020		Designed by PS				
File Catchment R_002.srcx		Checked by AC				
XP Solutions		Source Control 2019.1				
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	97.280	0.280	13.1	706.4	O K	
30 min Summer	97.356	0.356	13.1	908.4	O K	
60 min Summer	97.430	0.430	13.1	1108.3	O K	
120 min Summer	97.511	0.511	13.1	1333.6	O K	
180 min Summer	97.554	0.554	13.1	1454.7	O K	
240 min Summer	97.579	0.579	13.1	1527.1	O K	
360 min Summer	97.604	0.604	13.1	1598.5	O K	
480 min Summer	97.612	0.612	13.1	1620.6	O K	
600 min Summer	97.611	0.611	13.1	1619.2	O K	
720 min Summer	97.606	0.606	13.1	1604.1	O K	
960 min Summer	97.588	0.588	13.1	1551.8	O K	
1440 min Summer	97.552	0.552	13.1	1450.6	O K	
2160 min Summer	97.505	0.505	13.1	1316.8	O K	
2880 min Summer	97.463	0.463	13.1	1201.1	O K	
4320 min Summer	97.396	0.396	13.1	1015.3	O K	
5760 min Summer	97.341	0.341	13.1	868.8	O K	
7200 min Summer	97.298	0.298	13.1	755.2	O K	
8640 min Summer	97.265	0.265	13.1	666.2	O K	
10080 min Summer	97.238	0.238	13.1	597.3	O K	
15 min Winter	97.312	0.312	13.1	792.0	O K	
30 min Winter	97.397	0.397	13.1	1019.2	O K	
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)		
15 min Summer	151.654	0.0	604.1	23		
30 min Summer	97.974	0.0	782.8	37		
60 min Summer	60.354	0.0	1075.1	68		
120 min Summer	36.913	0.0	1315.6	126		
180 min Summer	27.268	0.0	1453.9	186		
240 min Summer	21.821	0.0	1546.5	246		
360 min Summer	15.737	0.0	1662.0	364		
480 min Summer	12.370	0.0	1730.0	484		
600 min Summer	10.223	0.0	1774.1	602		
720 min Summer	8.729	0.0	1803.3	722		
960 min Summer	6.777	0.0	1832.4	932		
1440 min Summer	4.731	0.0	1811.7	1140		
2160 min Summer	3.309	0.0	2203.5	1500		
2880 min Summer	2.578	0.0	2284.7	1900		
4320 min Summer	1.834	0.0	2419.3	2680		
5760 min Summer	1.454	0.0	2617.4	3456		
7200 min Summer	1.225	0.0	2751.9	4176		
8640 min Summer	1.071	0.0	2880.2	4848		
10080 min Summer	0.961	0.0	2997.9	5552		
15 min Winter	151.654	0.0	679.5	23		
30 min Winter	97.974	0.0	871.0	37		
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT R			
.		1 IN 100 YEAR + 40% CC			
Date 21/04/2020		Designed by PS			
File Catchment R_002.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	97.479	0.479	13.1	1244.8	O K
120 min Winter	97.570	0.570	13.1	1499.8	O K
180 min Winter	97.617	0.617	13.1	1636.1	O K
240 min Winter	97.646	0.646	13.1	1718.9	O K
360 min Winter	97.675	0.675	13.1	1803.0	O K
480 min Winter	97.684	0.684	13.1	1832.3	O K
600 min Winter	97.686	0.686	13.1	1835.3	O K
720 min Winter	97.681	0.681	13.1	1823.4	O K
960 min Winter	97.665	0.665	13.1	1774.9	O K
1440 min Winter	97.621	0.621	13.1	1645.8	O K
2160 min Winter	97.565	0.565	13.1	1487.4	O K
2880 min Winter	97.509	0.509	13.1	1327.9	O K
4320 min Winter	97.406	0.406	13.1	1044.0	O K
5760 min Winter	97.324	0.324	13.1	822.4	O K
7200 min Winter	97.261	0.261	13.1	657.0	O K
8640 min Winter	97.216	0.216	13.0	538.6	O K
10080 min Winter	97.185	0.185	12.8	460.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	1205.6	66	
120 min Winter	36.913	0.0	1470.4	124	
180 min Winter	27.268	0.0	1621.4	182	
240 min Winter	21.821	0.0	1720.8	242	
360 min Winter	15.737	0.0	1840.7	358	
480 min Winter	12.370	0.0	1906.3	474	
600 min Winter	10.223	0.0	1943.6	588	
720 min Winter	8.729	0.0	1962.5	700	
960 min Winter	6.777	0.0	1961.3	922	
1440 min Winter	4.731	0.0	1867.9	1284	
2160 min Winter	3.309	0.0	2467.5	1628	
2880 min Winter	2.578	0.0	2558.0	2080	
4320 min Winter	1.834	0.0	2709.3	2896	
5760 min Winter	1.454	0.0	2933.9	3632	
7200 min Winter	1.225	0.0	3085.3	4328	
8640 min Winter	1.071	0.0	3230.5	5008	
10080 min Winter	0.961	0.0	3365.7	5552	
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WSP Group Ltd		Page 3																								
. . .	SWMK CATCHMENT R 1 IN 100 YEAR + 40% CC																									
Date 21/04/2020 File Catchment R_002.srcx	Designed by PS Checked by AC																									
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Date 12/05/2020		Designed by PS			
File CATCHMENT S_001.SRCX		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	95.234	0.234	7.5	403.6	O K
30 min Summer	95.298	0.298	7.5	519.0	O K
60 min Summer	95.359	0.359	7.5	633.1	O K
120 min Summer	95.426	0.426	7.5	761.1	O K
180 min Summer	95.462	0.462	7.5	829.7	O K
240 min Summer	95.483	0.483	7.5	871.3	O K
360 min Summer	95.504	0.504	7.5	913.7	O K
480 min Summer	95.511	0.511	7.5	927.6	O K
600 min Summer	95.511	0.511	7.5	927.6	O K
720 min Summer	95.507	0.507	7.5	919.6	O K
960 min Summer	95.491	0.491	7.5	887.7	O K
1440 min Summer	95.457	0.457	7.5	821.3	O K
2160 min Summer	95.418	0.418	7.5	744.9	O K
2880 min Summer	95.384	0.384	7.5	680.4	O K
4320 min Summer	95.328	0.328	7.5	575.3	O K
5760 min Summer	95.283	0.283	7.5	492.1	O K
7200 min Summer	95.247	0.247	7.5	427.5	O K
8640 min Summer	95.219	0.219	7.5	376.9	O K
10080 min Summer	95.197	0.197	7.5	337.8	O K
15 min Winter	95.261	0.261	7.5	452.5	O K
30 min Winter	95.332	0.332	7.5	582.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	348.2	23	
30 min Summer	97.974	0.0	450.6	37	
60 min Summer	60.354	0.0	616.6	68	
120 min Summer	36.913	0.0	754.6	126	
180 min Summer	27.268	0.0	834.3	186	
240 min Summer	21.821	0.0	887.5	246	
360 min Summer	15.737	0.0	953.4	364	
480 min Summer	12.370	0.0	992.1	484	
600 min Summer	10.223	0.0	1017.1	602	
720 min Summer	8.729	0.0	1033.8	722	
960 min Summer	6.777	0.0	1051.9	958	
1440 min Summer	4.731	0.0	1050.2	1130	
2160 min Summer	3.309	0.0	1261.3	1492	
2880 min Summer	2.578	0.0	1307.8	1876	
4320 min Summer	1.834	0.0	1385.2	2680	
5760 min Summer	1.454	0.0	1496.5	3408	
7200 min Summer	1.225	0.0	1573.5	4176	
8640 min Summer	1.071	0.0	1647.1	4848	
10080 min Summer	0.961	0.0	1714.9	5552	
15 min Winter	151.654	0.0	391.4	23	
30 min Winter	97.974	0.0	501.0	37	
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	95.400	0.400	7.5	711.0	O K
120 min Winter	95.475	0.475	7.5	856.3	O K
180 min Winter	95.515	0.515	7.5	935.3	O K
240 min Winter	95.539	0.539	7.5	983.6	O K
360 min Winter	95.564	0.564	7.5	1033.0	O K
480 min Winter	95.573	0.573	7.5	1050.9	O K
600 min Winter	95.574	0.574	7.5	1053.7	O K
720 min Winter	95.571	0.571	7.5	1047.9	O K
960 min Winter	95.558	0.558	7.5	1021.6	O K
1440 min Winter	95.522	0.522	7.5	947.9	O K
2160 min Winter	95.468	0.468	7.5	842.1	O K
2880 min Winter	95.420	0.420	7.5	748.9	O K
4320 min Winter	95.337	0.337	7.5	591.2	O K
5760 min Winter	95.269	0.269	7.5	465.9	O K
7200 min Winter	95.216	0.216	7.5	372.0	O K
8640 min Winter	95.179	0.179	7.4	304.7	O K
10080 min Winter	95.153	0.153	7.3	259.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	691.4	66	
120 min Winter	36.913	0.0	843.7	124	
180 min Winter	27.268	0.0	929.7	184	
240 min Winter	21.821	0.0	986.0	242	
360 min Winter	15.737	0.0	1053.1	358	
480 min Winter	12.370	0.0	1088.9	474	
600 min Winter	10.223	0.0	1108.1	590	
720 min Winter	8.729	0.0	1116.6	704	
960 min Winter	6.777	0.0	1111.4	926	
1440 min Winter	4.731	0.0	1058.5	1340	
2160 min Winter	3.309	0.0	1412.4	1628	
2880 min Winter	2.578	0.0	1464.6	2056	
4320 min Winter	1.834	0.0	1551.3	2896	
5760 min Winter	1.454	0.0	1677.4	3632	
7200 min Winter	1.225	0.0	1764.1	4328	
8640 min Winter	1.071	0.0	1847.3	5008	
10080 min Winter	0.961	0.0	1925.1	5552	
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0.800	8.0	2.400	13.4	6.000	20.8																																																																					
1.000	8.9	2.600	13.9	6.500	21.6																																																																					
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WSP Group Ltd				Page 1	
.		SWMK			
.		CATCHMENT T			
.		1 in 100 Year + 40% CC			
Date 12/05/2020		Designed by PS			
File Catchment T_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	96.260	0.260	28.3	1441.0	O K
30 min Summer	96.332	0.332	28.3	1848.1	O K
60 min Summer	96.400	0.400	28.3	2242.8	O K
120 min Summer	96.475	0.475	28.3	2676.0	O K
180 min Summer	96.512	0.512	28.3	2891.6	O K
240 min Summer	96.532	0.532	28.3	3008.7	O K
360 min Summer	96.546	0.546	28.3	3093.8	O K
480 min Summer	96.544	0.544	28.3	3078.4	O K
600 min Summer	96.533	0.533	28.3	3014.9	O K
720 min Summer	96.517	0.517	28.3	2923.1	O K
960 min Summer	96.480	0.480	28.3	2707.9	O K
1440 min Summer	96.424	0.424	28.3	2377.8	O K
2160 min Summer	96.364	0.364	28.3	2032.1	O K
2880 min Summer	96.317	0.317	28.3	1763.0	O K
4320 min Summer	96.241	0.241	28.3	1336.2	O K
5760 min Summer	96.182	0.182	28.3	1000.3	O K
7200 min Summer	96.134	0.134	28.3	737.4	O K
8640 min Summer	96.098	0.098	28.3	534.1	O K
10080 min Summer	96.069	0.069	28.3	376.5	O K
15 min Winter	96.291	0.291	28.3	1617.7	O K
30 min Winter	96.372	0.372	28.3	2079.4	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	1476.7	23	
30 min Summer	97.974	0.0	1906.9	37	
60 min Summer	60.354	0.0	2349.1	68	
120 min Summer	36.913	0.0	2876.0	126	
180 min Summer	27.268	0.0	3189.1	186	
240 min Summer	21.821	0.0	3400.7	246	
360 min Summer	15.737	0.0	3679.7	364	
480 min Summer	12.370	0.0	3857.0	484	
600 min Summer	10.223	0.0	3983.0	602	
720 min Summer	8.729	0.0	4083.5	722	
960 min Summer	6.777	0.0	4225.7	918	
1440 min Summer	4.731	0.0	4426.1	1124	
2160 min Summer	3.309	0.0	4645.5	1476	
2880 min Summer	2.578	0.0	4821.9	1876	
4320 min Summer	1.834	0.0	5144.5	2644	
5760 min Summer	1.454	0.0	5437.4	3400	
7200 min Summer	1.225	0.0	5729.6	4112	
8640 min Summer	1.071	0.0	6014.7	4840	
10080 min Summer	0.961	0.0	6296.9	5544	
15 min Winter	151.654	0.0	1652.2	23	
30 min Winter	97.974	0.0	2136.7	37	
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WSP Group Ltd					Page 2
.		SWMK			
.		CATCHMENT T			
.		1 in 100 Year + 40% CC			
Date 12/05/2020		Designed by PS			
File Catchment T_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	96.450	0.450	28.3	2530.1	O K
120 min Winter	96.535	0.535	28.3	3025.3	O K
180 min Winter	96.577	0.577	28.3	3278.8	O K
240 min Winter	96.602	0.602	28.3	3423.1	O K
360 min Winter	96.622	0.622	28.3	3544.3	O K
480 min Winter	96.624	0.624	28.3	3553.6	O K
600 min Winter	96.616	0.616	28.3	3509.7	O K
720 min Winter	96.604	0.604	28.3	3436.1	O K
960 min Winter	96.571	0.571	28.3	3240.9	O K
1440 min Winter	96.500	0.500	28.3	2823.7	O K
2160 min Winter	96.425	0.425	28.3	2383.8	O K
2880 min Winter	96.355	0.355	28.3	1983.9	O K
4320 min Winter	96.241	0.241	28.3	1333.1	O K
5760 min Winter	96.151	0.151	28.3	828.8	O K
7200 min Winter	96.083	0.083	28.3	455.4	O K
8640 min Winter	96.035	0.035	28.2	193.1	O K
10080 min Winter	96.007	0.007	28.1	36.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	2632.9	66	
120 min Winter	36.913	0.0	3221.7	124	
180 min Winter	27.268	0.0	3571.4	182	
240 min Winter	21.821	0.0	3810.3	242	
360 min Winter	15.737	0.0	4122.0	358	
480 min Winter	12.370	0.0	4321.5	474	
600 min Winter	10.223	0.0	4463.4	588	
720 min Winter	8.729	0.0	4574.1	700	
960 min Winter	6.777	0.0	4613.5	920	
1440 min Winter	4.731	0.0	4521.7	1284	
2160 min Winter	3.309	0.0	5203.0	1624	
2880 min Winter	2.578	0.0	5401.6	2048	
4320 min Winter	1.834	0.0	5765.4	2856	
5760 min Winter	1.454	0.0	6098.3	3584	
7200 min Winter	1.225	0.0	6414.3	4256	
8640 min Winter	1.071	0.0	6731.4	4848	
10080 min Winter	0.961	0.0	7050.2	5352	
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WSP Group Ltd		Page 3																																				
. . .	SWMK CATCHMENT T 1 in 100 Year + 40% CC																																					
Date 12/05/2020 File Catchment T_001.srcx	Designed by PS Checked by AC																																					
XP Solutions Source Control 2019.1																																						
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> </tr> <tr> <td>Site Location</td> <td>GB 483669 232428 SP 83669 32428</td> </tr> <tr> <td>Data Type</td> <td>Point</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> </tr> <tr> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 5.200 <table> <thead> <tr> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> </tr> <tr> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0 4</td> <td>2.600</td> <td>4 8</td> <td>2.600</td> </tr> </tbody> </table>			Rainfall Model	FEH	Return Period (years)	100	FEH Rainfall Version	2013	Site Location	GB 483669 232428 SP 83669 32428	Data Type	Point	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	0.750	Cv (Winter)	0.840	Shortest Storm (mins)	15	Longest Storm (mins)	10080	Climate Change %	+40	Time (mins)	Area	Time (mins)	Area	From: To:	(ha)	From: To:	(ha)	0 4	2.600	4 8	2.600
Rainfall Model	FEH																																					
Return Period (years)	100																																					
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Time (mins)	Area	Time (mins)	Area																																			
From: To:	(ha)	From: To:	(ha)																																			
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WSP Group Ltd		Page 4																																																																																															
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Date 12/05/2020 File Catchment T_001.srcx	Designed by PS Checked by AC																																																																																																
XP SolutionsSource Control 2019.1																																																																																																	
Model Details Storage is Online Cover Level (m) 97.000 Tank or Pond Structure Invert Level (m) 96.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>5430.0</td><td>1.000</td><td>6310.0</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0231-2840-1000-2840 Design Head (m)1.000 Design Flow (l/s)28.4 Flush-Flo™Calculated ObjectiveMinimise upstream storage ApplicationSurface Sump AvailableYes Diameter (mm)231 Invert Level (m)95.700 Minimum Outlet Pipe Diameter (mm)300 Suggested Manhole Diameter (mm)1500 <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>1.000</td><td>28.4</td></tr><tr><td>Flush-Flo™</td><td>0.374</td><td>28.3</td></tr><tr><td>Kick-Flo®</td><td>0.740</td><td>24.6</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>23.5</td></tr></table> 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 <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>7.7</td><td>1.200</td><td>31.0</td><td>3.000</td><td>48.2</td><td>7.000</td><td>72.7</td></tr><tr><td>0.200</td><td>23.2</td><td>1.400</td><td>33.4</td><td>3.500</td><td>51.9</td><td>7.500</td><td>75.1</td></tr><tr><td>0.300</td><td>28.0</td><td>1.600</td><td>35.6</td><td>4.000</td><td>55.4</td><td>8.000</td><td>77.5</td></tr><tr><td>0.400</td><td>28.2</td><td>1.800</td><td>37.6</td><td>4.500</td><td>58.6</td><td>8.500</td><td>79.9</td></tr><tr><td>0.500</td><td>27.9</td><td>2.000</td><td>39.6</td><td>5.000</td><td>61.7</td><td>9.000</td><td>82.1</td></tr><tr><td>0.600</td><td>27.1</td><td>2.200</td><td>41.5</td><td>5.500</td><td>64.6</td><td>9.500</td><td>84.3</td></tr><tr><td>0.800</td><td>25.5</td><td>2.400</td><td>43.2</td><td>6.000</td><td>67.4</td><td></td><td></td></tr><tr><td>1.000</td><td>28.4</td><td>2.600</td><td>44.9</td><td>6.500</td><td>70.1</td><td></td><td></td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	5430.0	1.000	6310.0	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.000	28.4	Flush-Flo™	0.374	28.3	Kick-Flo®	0.740	24.6	Mean Flow over Head Range	-	23.5	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	7.7	1.200	31.0	3.000	48.2	7.000	72.7	0.200	23.2	1.400	33.4	3.500	51.9	7.500	75.1	0.300	28.0	1.600	35.6	4.000	55.4	8.000	77.5	0.400	28.2	1.800	37.6	4.500	58.6	8.500	79.9	0.500	27.9	2.000	39.6	5.000	61.7	9.000	82.1	0.600	27.1	2.200	41.5	5.500	64.6	9.500	84.3	0.800	25.5	2.400	43.2	6.000	67.4			1.000	28.4	2.600	44.9	6.500	70.1		
Depth (m)	Area (m²)	Depth (m)	Area (m²)																																																																																														
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0.600	27.1	2.200	41.5	5.500	64.6	9.500	84.3																																																																																										
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Appendix B.4



1 IN 100 YEAR + CLIMATE CHANGE & CREEP

WSP Group Ltd				Page 1	
.		SWMK			
.		CATCHMENT A			
.		DEVELOPMENT CREEP			
Date 21/04/2020		Designed by PS			
File CATCHMENT A_001.SRCX		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	103.715	0.315	10.1	645.7	O K
30 min Summer	103.798	0.398	10.1	830.9	O K
60 min Summer	103.876	0.476	10.1	1015.3	O K
120 min Summer	103.962	0.562	10.1	1224.2	O K
180 min Summer	104.007	0.607	10.1	1336.2	O K
240 min Summer	104.034	0.634	10.1	1404.3	O K
360 min Summer	104.061	0.661	10.1	1474.2	O K
480 min Summer	104.071	0.671	10.1	1499.4	O K
600 min Summer	104.072	0.672	10.1	1502.9	O K
720 min Summer	104.069	0.669	10.1	1494.1	O K
960 min Summer	104.054	0.654	10.1	1455.4	O K
1440 min Summer	104.018	0.618	10.1	1363.7	O K
2160 min Summer	103.975	0.575	10.1	1254.8	O K
2880 min Summer	103.937	0.537	10.1	1163.0	O K
4320 min Summer	103.869	0.469	10.1	998.4	O K
5760 min Summer	103.814	0.414	10.1	867.9	O K
7200 min Summer	103.768	0.368	10.1	763.8	O K
8640 min Summer	103.730	0.330	10.1	678.2	O K
10080 min Summer	103.698	0.298	10.1	607.7	O K
15 min Winter	103.750	0.350	10.1	723.9	O K
30 min Winter	103.841	0.441	10.1	932.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	563.9	23	
30 min Summer	97.974	0.0	715.5	37	
60 min Summer	60.354	0.0	989.8	68	
120 min Summer	36.913	0.0	1204.5	126	
180 min Summer	27.268	0.0	1325.3	186	
240 min Summer	21.821	0.0	1403.3	246	
360 min Summer	15.737	0.0	1492.7	364	
480 min Summer	12.370	0.0	1535.1	484	
600 min Summer	10.223	0.0	1551.6	602	
720 min Summer	8.729	0.0	1550.7	722	
960 min Summer	6.777	0.0	1518.3	960	
1440 min Summer	4.731	0.0	1431.7	1204	
2160 min Summer	3.309	0.0	2015.4	1564	
2880 min Summer	2.578	0.0	2087.5	1968	
4320 min Summer	1.834	0.0	2206.2	2768	
5760 min Summer	1.454	0.0	2393.7	3520	
7200 min Summer	1.225	0.0	2517.8	4320	
8640 min Summer	1.071	0.0	2636.9	5016	
10080 min Summer	0.961	0.0	2747.6	5752	
15 min Winter	151.654	0.0	629.6	23	
30 min Winter	97.974	0.0	781.0	37	
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT A			
.		DEVELOPMENT CREEP			
Date 21/04/2020		Designed by PS			
File CATCHMENT A_001.SRCX		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	103.928	0.528	10.1	1140.2	O K
120 min Winter	104.022	0.622	10.1	1374.8	O K
180 min Winter	104.072	0.672	10.1	1502.0	O K
240 min Winter	104.102	0.702	10.1	1580.5	Flood Risk
360 min Winter	104.133	0.733	10.3	1663.1	Flood Risk
480 min Winter	104.145	0.745	10.4	1695.6	Flood Risk
600 min Winter	104.148	0.748	10.4	1704.1	Flood Risk
720 min Winter	104.146	0.746	10.4	1698.7	Flood Risk
960 min Winter	104.133	0.733	10.3	1664.6	Flood Risk
1440 min Winter	104.095	0.695	10.1	1563.0	O K
2160 min Winter	104.042	0.642	10.1	1424.4	O K
2880 min Winter	103.995	0.595	10.1	1305.5	O K
4320 min Winter	103.904	0.504	10.1	1080.6	O K
5760 min Winter	103.816	0.416	10.1	874.4	O K
7200 min Winter	103.745	0.345	10.1	712.3	O K
8640 min Winter	103.687	0.287	10.1	583.0	O K
10080 min Winter	103.640	0.240	10.1	483.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	1106.9	66	
120 min Winter	36.913	0.0	1340.0	124	
180 min Winter	27.268	0.0	1465.4	184	
240 min Winter	21.821	0.0	1539.5	242	
360 min Winter	15.737	0.0	1604.7	358	
480 min Winter	12.370	0.0	1611.1	476	
600 min Winter	10.223	0.0	1596.9	590	
720 min Winter	8.729	0.0	1580.1	704	
960 min Winter	6.777	0.0	1543.7	928	
1440 min Winter	4.731	0.0	1466.9	1346	
2160 min Winter	3.309	0.0	2255.1	1668	
2880 min Winter	2.578	0.0	2333.4	2136	
4320 min Winter	1.834	0.0	2453.6	3028	
5760 min Winter	1.454	0.0	2682.2	3808	
7200 min Winter	1.225	0.0	2822.1	4544	
8640 min Winter	1.071	0.0	2956.5	5272	
10080 min Winter	0.961	0.0	3083.3	5944	
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WSP Group Ltd		Page 3																																				
. . .	SWMK CATCHMENT A DEVELOPMENT CREEP																																					
Date 21/04/2020 File CATCHMENT A_001.SRCX	Designed by PS Checked by AC																																					
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	103.313	0.313	23.1	1370.2	O K
30 min Summer	103.398	0.398	23.1	1762.6	O K
60 min Summer	103.480	0.480	23.1	2153.0	O K
120 min Summer	103.571	0.571	23.1	2595.8	O K
180 min Summer	103.618	0.618	23.1	2834.0	O K
240 min Summer	103.647	0.647	23.1	2978.4	O K
360 min Summer	103.676	0.676	23.1	3125.9	O K
480 min Summer	103.686	0.686	23.1	3178.1	O K
600 min Summer	103.687	0.687	23.1	3184.2	O K
720 min Summer	103.683	0.683	23.1	3163.9	O K
960 min Summer	103.667	0.667	23.1	3078.4	O K
1440 min Summer	103.632	0.632	23.1	2902.7	O K
2160 min Summer	103.589	0.589	23.1	2688.5	O K
2880 min Summer	103.550	0.550	23.1	2495.2	O K
4320 min Summer	103.481	0.481	23.1	2157.1	O K
5760 min Summer	103.424	0.424	23.1	1886.9	O K
7200 min Summer	103.379	0.379	23.1	1672.2	O K
8640 min Summer	103.342	0.342	23.1	1499.5	O K
10080 min Summer	103.312	0.312	23.1	1362.0	O K
15 min Winter	103.349	0.349	23.1	1536.0	O K
30 min Winter	103.443	0.443	23.1	1977.4	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	1110.6	23	
30 min Summer	97.974	0.0	1439.6	37	
60 min Summer	60.354	0.0	2038.3	68	
120 min Summer	36.913	0.0	2490.9	126	
180 min Summer	27.268	0.0	2748.2	186	
240 min Summer	21.821	0.0	2918.1	246	
360 min Summer	15.737	0.0	3124.5	364	
480 min Summer	12.370	0.0	3240.0	484	
600 min Summer	10.223	0.0	3308.9	602	
720 min Summer	8.729	0.0	3348.4	722	
960 min Summer	6.777	0.0	3367.1	952	
1440 min Summer	4.731	0.0	3238.6	1154	
2160 min Summer	3.309	0.0	4226.1	1536	
2880 min Summer	2.578	0.0	4375.2	1936	
4320 min Summer	1.834	0.0	4614.8	2724	
5760 min Summer	1.454	0.0	5054.6	3464	
7200 min Summer	1.225	0.0	5312.6	4248	
8640 min Summer	1.071	0.0	5556.6	4936	
10080 min Summer	0.961	0.0	5776.5	5648	
15 min Winter	151.654	0.0	1250.5	23	
30 min Winter	97.974	0.0	1597.5	37	
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.		CATCHMENT B			
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Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	103.534	0.534	23.1	2417.5	O K
120 min Winter	103.635	0.635	23.1	2915.5	O K
180 min Winter	103.687	0.687	23.1	3184.3	O K
240 min Winter	103.720	0.720	23.4	3349.5	Flood Risk
360 min Winter	103.753	0.753	23.9	3522.1	Flood Risk
480 min Winter	103.765	0.765	24.1	3588.3	Flood Risk
600 min Winter	103.768	0.768	24.1	3603.4	Flood Risk
720 min Winter	103.766	0.766	24.1	3589.3	Flood Risk
960 min Winter	103.751	0.751	23.9	3512.4	Flood Risk
1440 min Winter	103.708	0.708	23.2	3291.7	Flood Risk
2160 min Winter	103.655	0.655	23.1	3019.2	O K
2880 min Winter	103.605	0.605	23.1	2768.0	O K
4320 min Winter	103.505	0.505	23.1	2275.1	O K
5760 min Winter	103.418	0.418	23.1	1857.9	O K
7200 min Winter	103.349	0.349	23.1	1533.8	O K
8640 min Winter	103.295	0.295	23.1	1286.4	O K
10080 min Winter	103.255	0.255	22.8	1104.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	2285.2	66	
120 min Winter	36.913	0.0	2780.4	124	
180 min Winter	27.268	0.0	3057.3	184	
240 min Winter	21.821	0.0	3235.1	242	
360 min Winter	15.737	0.0	3439.3	358	
480 min Winter	12.370	0.0	3538.8	474	
600 min Winter	10.223	0.0	3582.8	588	
720 min Winter	8.729	0.0	3590.9	702	
960 min Winter	6.777	0.0	3535.0	924	
1440 min Winter	4.731	0.0	3336.3	1316	
2160 min Winter	3.309	0.0	4732.8	1644	
2880 min Winter	2.578	0.0	4893.9	2104	
4320 min Winter	1.834	0.0	5152.4	2944	
5760 min Winter	1.454	0.0	5666.8	3744	
7200 min Winter	1.225	0.0	5958.0	4464	
8640 min Winter	1.071	0.0	6234.6	5104	
10080 min Winter	0.961	0.0	6488.4	5752	
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0.100	7.3	1.200	29.9	3.000	46.5	7.000	70.1																																																																																										
0.200	21.0	1.400	32.2	3.500	50.1	7.500	72.1																																																																																										
0.300	23.1	1.600	34.3	4.000	53.4	8.000	74.5																																																																																										
0.400	22.8	1.800	36.3	4.500	56.6	8.500	76.8																																																																																										
0.500	21.8	2.000	38.2	5.000	59.5	9.000	79.0																																																																																										
0.600	21.5	2.200	40.0	5.500	62.4	9.500	81.2																																																																																										
0.800	24.6	2.400	41.7	6.000	65.0																																																																																												
1.000	27.4	2.600	43.4	6.500	67.6																																																																																												
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WSP Group Ltd				Page 1	
.		SWMK			
.		CATCHMENT C			
.		DEVELOPMENT CREEP			
Date 21/04/2020		Designed by PS			
File Catchment C_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	111.316	0.316	5.9	350.4	O K
30 min Summer	111.397	0.397	5.9	450.8	O K
60 min Summer	111.475	0.475	5.9	550.4	O K
120 min Summer	111.560	0.560	5.9	662.2	O K
180 min Summer	111.603	0.603	5.9	721.4	O K
240 min Summer	111.628	0.628	5.9	756.7	O K
360 min Summer	111.653	0.653	5.9	791.5	O K
480 min Summer	111.661	0.661	5.9	802.1	O K
600 min Summer	111.660	0.660	5.9	801.1	O K
720 min Summer	111.655	0.655	5.9	793.5	O K
960 min Summer	111.636	0.636	5.9	767.2	O K
1440 min Summer	111.597	0.597	5.9	712.8	O K
2160 min Summer	111.549	0.549	5.9	648.1	O K
2880 min Summer	111.508	0.508	5.9	593.4	O K
4320 min Summer	111.433	0.433	5.9	496.1	O K
5760 min Summer	111.374	0.374	5.9	421.6	O K
7200 min Summer	111.326	0.326	5.9	362.7	O K
8640 min Summer	111.286	0.286	5.9	314.6	O K
10080 min Summer	111.253	0.253	5.9	276.3	O K
15 min Winter	111.351	0.351	5.9	392.9	O K
30 min Winter	111.441	0.441	5.9	505.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	322.5	23	
30 min Summer	97.974	0.0	410.3	37	
60 min Summer	60.354	0.0	548.4	68	
120 min Summer	36.913	0.0	668.8	126	
180 min Summer	27.268	0.0	738.1	186	
240 min Summer	21.821	0.0	784.1	246	
360 min Summer	15.737	0.0	839.9	364	
480 min Summer	12.370	0.0	870.5	484	
600 min Summer	10.223	0.0	887.2	602	
720 min Summer	8.729	0.0	894.5	722	
960 min Summer	6.777	0.0	888.0	960	
1440 min Summer	4.731	0.0	841.5	1170	
2160 min Summer	3.309	0.0	1104.4	1544	
2880 min Summer	2.578	0.0	1145.6	1960	
4320 min Summer	1.834	0.0	1216.6	2728	
5760 min Summer	1.454	0.0	1304.0	3512	
7200 min Summer	1.225	0.0	1372.0	4248	
8640 min Summer	1.071	0.0	1437.8	4936	
10080 min Summer	0.961	0.0	1500.3	5648	
15 min Winter	151.654	0.0	360.1	23	
30 min Winter	97.974	0.0	449.5	37	
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT C			
.		DEVELOPMENT CREEP			
Date 21/04/2020		Designed by PS			
File Catchment C_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	111.527	0.527	5.9	618.2	O K
120 min Winter	111.619	0.619	5.9	744.1	O K
180 min Winter	111.667	0.667	5.9	811.7	O K
240 min Winter	111.696	0.696	5.9	852.7	O K
360 min Winter	111.725	0.725	6.0	894.6	Flood Risk
480 min Winter	111.735	0.735	6.0	909.3	Flood Risk
600 min Winter	111.736	0.736	6.0	911.0	Flood Risk
720 min Winter	111.732	0.732	6.0	905.3	Flood Risk
960 min Winter	111.716	0.716	6.0	881.7	Flood Risk
1440 min Winter	111.672	0.672	5.9	818.0	O K
2160 min Winter	111.614	0.614	5.9	737.2	O K
2880 min Winter	111.562	0.562	5.9	665.9	O K
4320 min Winter	111.459	0.459	5.9	528.4	O K
5760 min Winter	111.366	0.366	5.9	411.7	O K
7200 min Winter	111.292	0.292	5.9	321.6	O K
8640 min Winter	111.232	0.232	5.9	252.4	O K
10080 min Winter	111.189	0.189	5.9	202.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	613.7	66	
120 min Winter	36.913	0.0	746.2	124	
180 min Winter	27.268	0.0	820.5	184	
240 min Winter	21.821	0.0	867.5	242	
360 min Winter	15.737	0.0	917.1	358	
480 min Winter	12.370	0.0	932.9	474	
600 min Winter	10.223	0.0	930.5	590	
720 min Winter	8.729	0.0	922.0	702	
960 min Winter	6.777	0.0	902.2	924	
1440 min Winter	4.731	0.0	859.0	1330	
2160 min Winter	3.309	0.0	1236.5	1648	
2880 min Winter	2.578	0.0	1282.0	2108	
4320 min Winter	1.834	0.0	1359.4	2984	
5760 min Winter	1.454	0.0	1460.9	3744	
7200 min Winter	1.225	0.0	1537.4	4472	
8640 min Winter	1.071	0.0	1611.5	5112	
10080 min Winter	0.961	0.0	1682.7	5752	
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WSP Group Ltd		Page 3																																				
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Date 21/04/2020 File Catchment C_001.srcx	Designed by PS Checked by AC																																					
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<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> </tr> <tr> <td>Site Location</td> <td>GB 483669 232428 SP 83669 32428</td> </tr> <tr> <td>Data Type</td> <td>Point</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> </tr> <tr> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 1.250 <table> <thead> <tr> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> </tr> <tr> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0 4</td> <td>0.625</td> <td>4 8</td> <td>0.625</td> </tr> </tbody> </table>			Rainfall Model	FEH	Return Period (years)	100	FEH Rainfall Version	2013	Site Location	GB 483669 232428 SP 83669 32428	Data Type	Point	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	0.750	Cv (Winter)	0.840	Shortest Storm (mins)	15	Longest Storm (mins)	10080	Climate Change %	+40	Time (mins)	Area	Time (mins)	Area	From: To:	(ha)	From: To:	(ha)	0 4	0.625	4 8	0.625
Rainfall Model	FEH																																					
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WSP Group Ltd		Page 4																																																																																															
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Model Details Storage is Online Cover Level (m) 112.000 Tank or Pond Structure Invert Level (m) 111.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>1020.0</td><td>1.000</td><td>1650.0</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0119-5900-0700-5900 Design Head (m) 0.700 Design Flow (l/s) 5.9 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 119 Invert Level (m) 111.000 Minimum Outlet Pipe Diameter (mm) 150 Suggested Manhole Diameter (mm) 1200 <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>0.700</td><td>5.9</td></tr><tr><td>Flush-Flo™</td><td>0.220</td><td>5.9</td></tr><tr><td>Kick-Flo®</td><td>0.490</td><td>5.0</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>5.0</td></tr></table> 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 <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>4.2</td><td>1.200</td><td>7.6</td><td>3.000</td><td>11.7</td><td>7.000</td><td>17.5</td></tr><tr><td>0.200</td><td>5.9</td><td>1.400</td><td>8.2</td><td>3.500</td><td>12.6</td><td>7.500</td><td>18.1</td></tr><tr><td>0.300</td><td>5.8</td><td>1.600</td><td>8.7</td><td>4.000</td><td>13.4</td><td>8.000</td><td>18.7</td></tr><tr><td>0.400</td><td>5.6</td><td>1.800</td><td>9.2</td><td>4.500</td><td>14.2</td><td>8.500</td><td>19.2</td></tr><tr><td>0.500</td><td>5.0</td><td>2.000</td><td>9.6</td><td>5.000</td><td>14.9</td><td>9.000</td><td>19.8</td></tr><tr><td>0.600</td><td>5.5</td><td>2.200</td><td>10.1</td><td>5.500</td><td>15.6</td><td>9.500</td><td>20.4</td></tr><tr><td>0.800</td><td>6.3</td><td>2.400</td><td>10.5</td><td>6.000</td><td>16.3</td><td></td><td></td></tr><tr><td>1.000</td><td>7.0</td><td>2.600</td><td>10.9</td><td>6.500</td><td>16.9</td><td></td><td></td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	1020.0	1.000	1650.0	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	0.700	5.9	Flush-Flo™	0.220	5.9	Kick-Flo®	0.490	5.0	Mean Flow over Head Range	-	5.0	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	4.2	1.200	7.6	3.000	11.7	7.000	17.5	0.200	5.9	1.400	8.2	3.500	12.6	7.500	18.1	0.300	5.8	1.600	8.7	4.000	13.4	8.000	18.7	0.400	5.6	1.800	9.2	4.500	14.2	8.500	19.2	0.500	5.0	2.000	9.6	5.000	14.9	9.000	19.8	0.600	5.5	2.200	10.1	5.500	15.6	9.500	20.4	0.800	6.3	2.400	10.5	6.000	16.3			1.000	7.0	2.600	10.9	6.500	16.9		
Depth (m)	Area (m²)	Depth (m)	Area (m²)																																																																																														
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WSP Group Ltd				Page 1	
.		SWMK			
.		CATCHMENT D			
.		DEVELOPMENT CREEP			
Date 21/04/2020		Designed by PS			
File Catchment D_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	105.290	0.290	7.9	422.8	O K
30 min Summer	105.367	0.367	7.9	543.8	O K
60 min Summer	105.440	0.440	7.9	663.2	O K
120 min Summer	105.520	0.520	7.9	797.7	O K
180 min Summer	105.561	0.561	7.9	868.7	O K
240 min Summer	105.585	0.585	7.9	910.7	O K
360 min Summer	105.608	0.608	7.9	951.1	O K
480 min Summer	105.614	0.614	7.9	962.2	O K
600 min Summer	105.612	0.612	7.9	959.3	O K
720 min Summer	105.606	0.606	7.9	948.4	O K
960 min Summer	105.587	0.587	7.9	913.7	O K
1440 min Summer	105.549	0.549	7.9	848.4	O K
2160 min Summer	105.501	0.501	7.9	765.1	O K
2880 min Summer	105.456	0.456	7.9	689.5	O K
4320 min Summer	105.385	0.385	7.9	572.4	O K
5760 min Summer	105.328	0.328	7.9	481.3	O K
7200 min Summer	105.283	0.283	7.9	410.6	O K
8640 min Summer	105.247	0.247	7.9	355.3	O K
10080 min Summer	105.218	0.218	7.9	312.6	O K
15 min Winter	105.323	0.323	7.9	474.2	O K
30 min Winter	105.408	0.408	7.9	610.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	382.9	23	
30 min Summer	97.974	0.0	492.6	37	
60 min Summer	60.354	0.0	658.2	68	
120 min Summer	36.913	0.0	804.4	126	
180 min Summer	27.268	0.0	889.2	186	
240 min Summer	21.821	0.0	946.2	246	
360 min Summer	15.737	0.0	1017.8	364	
480 min Summer	12.370	0.0	1060.5	484	
600 min Summer	10.223	0.0	1088.4	602	
720 min Summer	8.729	0.0	1107.1	722	
960 min Summer	6.777	0.0	1126.0	920	
1440 min Summer	4.731	0.0	1109.3	1140	
2160 min Summer	3.309	0.0	1331.2	1516	
2880 min Summer	2.578	0.0	1381.5	1904	
4320 min Summer	1.834	0.0	1466.9	2680	
5760 min Summer	1.454	0.0	1573.3	3456	
7200 min Summer	1.225	0.0	1654.9	4176	
8640 min Summer	1.071	0.0	1733.6	4848	
10080 min Summer	0.961	0.0	1807.5	5552	
15 min Winter	151.654	0.0	429.1	23	
30 min Winter	97.974	0.0	546.3	37	
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT D			
.		DEVELOPMENT CREEP			
Date 21/04/2020		Designed by PS			
File Catchment D_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	105.489	0.489	7.9	745.2	O K
120 min Winter	105.577	0.577	7.9	896.8	O K
180 min Winter	105.622	0.622	7.9	977.4	O K
240 min Winter	105.649	0.649	7.9	1026.0	O K
360 min Winter	105.676	0.676	7.9	1074.4	O K
480 min Winter	105.685	0.685	7.9	1090.1	O K
600 min Winter	105.685	0.685	7.9	1090.1	O K
720 min Winter	105.680	0.680	7.9	1081.3	O K
960 min Winter	105.662	0.662	7.9	1049.1	O K
1440 min Winter	105.616	0.616	7.9	966.7	O K
2160 min Winter	105.560	0.560	7.9	866.1	O K
2880 min Winter	105.503	0.503	7.9	768.9	O K
4320 min Winter	105.394	0.394	7.9	587.9	O K
5760 min Winter	105.308	0.308	7.9	449.6	O K
7200 min Winter	105.241	0.241	7.9	346.6	O K
8640 min Winter	105.193	0.193	7.8	274.0	O K
10080 min Winter	105.160	0.160	7.7	226.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	737.4	66	
120 min Winter	36.913	0.0	899.0	124	
180 min Winter	27.268	0.0	991.8	182	
240 min Winter	21.821	0.0	1053.2	242	
360 min Winter	15.737	0.0	1127.5	358	
480 min Winter	12.370	0.0	1168.0	474	
600 min Winter	10.223	0.0	1190.3	588	
720 min Winter	8.729	0.0	1200.4	700	
960 min Winter	6.777	0.0	1193.7	920	
1440 min Winter	4.731	0.0	1134.1	1212	
2160 min Winter	3.309	0.0	1490.8	1628	
2880 min Winter	2.578	0.0	1546.5	2104	
4320 min Winter	1.834	0.0	1642.5	2896	
5760 min Winter	1.454	0.0	1762.9	3632	
7200 min Winter	1.225	0.0	1854.7	4328	
8640 min Winter	1.071	0.0	1943.5	4936	
10080 min Winter	0.961	0.0	2027.9	5552	
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WSP Group Ltd		Page 3																																				
. . .	SWMK CATCHMENT D DEVELOPMENT CREEP																																					
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	111.321	0.321	6.5	406.8	O K
30 min Summer	111.406	0.406	6.5	523.5	O K
60 min Summer	111.487	0.487	6.5	639.6	O K
120 min Summer	111.575	0.575	6.5	770.0	O K
180 min Summer	111.621	0.621	6.5	839.4	O K
240 min Summer	111.648	0.648	6.5	881.3	O K
360 min Summer	111.675	0.675	6.5	923.3	O K
480 min Summer	111.684	0.684	6.5	937.3	O K
600 min Summer	111.684	0.684	6.5	937.6	O K
720 min Summer	111.679	0.679	6.5	930.3	O K
960 min Summer	111.662	0.662	6.5	902.7	O K
1440 min Summer	111.622	0.622	6.5	841.7	O K
2160 min Summer	111.575	0.575	6.5	769.7	O K
2880 min Summer	111.535	0.535	6.5	709.8	O K
4320 min Summer	111.462	0.462	6.5	603.5	O K
5760 min Summer	111.401	0.401	6.5	517.7	O K
7200 min Summer	111.353	0.353	6.5	450.0	O K
8640 min Summer	111.312	0.312	6.5	394.9	O K
10080 min Summer	111.278	0.278	6.5	349.3	O K
15 min Winter	111.357	0.357	6.5	456.1	O K
30 min Winter	111.451	0.451	6.5	587.4	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	369.1	23	
30 min Summer	97.974	0.0	467.1	37	
60 min Summer	60.354	0.0	633.0	68	
120 min Summer	36.913	0.0	770.9	126	
180 min Summer	27.268	0.0	849.3	186	
240 min Summer	21.821	0.0	900.5	246	
360 min Summer	15.737	0.0	960.3	364	
480 min Summer	12.370	0.0	989.5	484	
600 min Summer	10.223	0.0	1001.4	602	
720 min Summer	8.729	0.0	1001.4	722	
960 min Summer	6.777	0.0	981.4	960	
1440 min Summer	4.731	0.0	928.2	1188	
2160 min Summer	3.309	0.0	1278.4	1560	
2880 min Summer	2.578	0.0	1325.2	1964	
4320 min Summer	1.834	0.0	1404.6	2768	
5760 min Summer	1.454	0.0	1511.9	3520	
7200 min Summer	1.225	0.0	1590.6	4256	
8640 min Summer	1.071	0.0	1666.7	5016	
10080 min Summer	0.961	0.0	1738.7	5744	
15 min Winter	151.654	0.0	411.5	23	
30 min Winter	97.974	0.0	508.2	37	
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	111.540	0.540	6.5	718.1	O K
120 min Winter	111.637	0.637	6.5	865.0	O K
180 min Winter	111.688	0.688	6.5	944.2	O K
240 min Winter	111.719	0.719	6.6	992.7	Flood Risk
360 min Winter	111.750	0.750	6.7	1042.9	Flood Risk
480 min Winter	111.762	0.762	6.8	1061.6	Flood Risk
600 min Winter	111.764	0.764	6.8	1065.2	Flood Risk
720 min Winter	111.761	0.761	6.8	1060.1	Flood Risk
960 min Winter	111.746	0.746	6.7	1035.6	Flood Risk
1440 min Winter	111.702	0.702	6.5	966.6	Flood Risk
2160 min Winter	111.645	0.645	6.5	876.0	O K
2880 min Winter	111.594	0.594	6.5	797.9	O K
4320 min Winter	111.497	0.497	6.5	654.9	O K
5760 min Winter	111.401	0.401	6.5	517.2	O K
7200 min Winter	111.325	0.325	6.5	412.2	O K
8640 min Winter	111.263	0.263	6.5	329.1	O K
10080 min Winter	111.215	0.215	6.5	266.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	707.9	66	
120 min Winter	36.913	0.0	858.6	124	
180 min Winter	27.268	0.0	940.9	184	
240 min Winter	21.821	0.0	990.3	242	
360 min Winter	15.737	0.0	1034.1	358	
480 min Winter	12.370	0.0	1037.9	474	
600 min Winter	10.223	0.0	1029.5	590	
720 min Winter	8.729	0.0	1019.5	704	
960 min Winter	6.777	0.0	997.5	926	
1440 min Winter	4.731	0.0	950.9	1342	
2160 min Winter	3.309	0.0	1430.8	1664	
2880 min Winter	2.578	0.0	1482.4	2132	
4320 min Winter	1.834	0.0	1564.4	3032	
5760 min Winter	1.454	0.0	1693.9	3808	
7200 min Winter	1.225	0.0	1782.5	4536	
8640 min Winter	1.071	0.0	1868.2	5192	
10080 min Winter	0.961	0.0	1950.3	5856	
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WSP Group Ltd		Page 3																								
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0.100	4.4	1.200	8.4	3.000	12.9	7.000	19.3																																																																																										
0.200	6.5	1.400	9.0	3.500	13.9	7.500	19.9																																																																																										
0.300	6.4	1.600	9.6	4.000	14.8	8.000	20.6																																																																																										
0.400	6.2	1.800	10.1	4.500	15.7	8.500	21.2																																																																																										
0.500	5.6	2.000	10.6	5.000	16.5	9.000	21.9																																																																																										
0.600	6.1	2.200	11.1	5.500	17.2	9.500	22.5																																																																																										
0.800	6.9	2.400	11.6	6.000	18.0																																																																																												
1.000	7.7	2.600	12.1	6.500	18.7																																																																																												
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WSP Group Ltd				Page 1	
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.		CATCHMENT F			
.		DEVELOPMENT CREEP			
Date 22/04/2020		Designed by PS			
File Catchment F_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	110.288	0.288	5.9	350.5	O K
30 min Summer	110.365	0.365	5.9	450.9	O K
60 min Summer	110.439	0.439	5.9	550.5	O K
120 min Summer	110.521	0.521	5.9	663.0	O K
180 min Summer	110.563	0.563	5.9	723.0	O K
240 min Summer	110.588	0.588	5.9	759.0	O K
360 min Summer	110.613	0.613	5.9	795.0	O K
480 min Summer	110.621	0.621	5.9	806.7	O K
600 min Summer	110.621	0.621	5.9	806.8	O K
720 min Summer	110.617	0.617	5.9	800.2	O K
960 min Summer	110.600	0.600	5.9	775.7	O K
1440 min Summer	110.562	0.562	5.9	722.2	O K
2160 min Summer	110.517	0.517	5.9	657.7	O K
2880 min Summer	110.475	0.475	5.9	599.4	O K
4320 min Summer	110.405	0.405	5.9	505.0	O K
5760 min Summer	110.351	0.351	5.9	432.1	O K
7200 min Summer	110.306	0.306	5.9	374.2	O K
8640 min Summer	110.270	0.270	5.9	327.0	O K
10080 min Summer	110.240	0.240	5.9	289.3	O K
15 min Winter	110.321	0.321	5.9	393.0	O K
30 min Winter	110.406	0.406	5.9	506.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	316.5	23	
30 min Summer	97.974	0.0	403.6	37	
60 min Summer	60.354	0.0	544.7	68	
120 min Summer	36.913	0.0	664.3	126	
180 min Summer	27.268	0.0	732.7	186	
240 min Summer	21.821	0.0	777.9	246	
360 min Summer	15.737	0.0	832.5	364	
480 min Summer	12.370	0.0	862.1	484	
600 min Summer	10.223	0.0	878.1	602	
720 min Summer	8.729	0.0	885.1	722	
960 min Summer	6.777	0.0	879.1	960	
1440 min Summer	4.731	0.0	832.4	1186	
2160 min Summer	3.309	0.0	1101.3	1560	
2880 min Summer	2.578	0.0	1142.4	1960	
4320 min Summer	1.834	0.0	1211.8	2724	
5760 min Summer	1.454	0.0	1302.8	3512	
7200 min Summer	1.225	0.0	1370.5	4248	
8640 min Summer	1.071	0.0	1435.8	4936	
10080 min Summer	0.961	0.0	1497.4	5648	
15 min Winter	151.654	0.0	353.8	23	
30 min Winter	97.974	0.0	443.3	37	
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT F			
.		DEVELOPMENT CREEP			
Date 22/04/2020		Designed by PS			
File Catchment F_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	110.489	0.489	5.9	618.4	O K
120 min Winter	110.578	0.578	5.9	745.1	O K
180 min Winter	110.626	0.626	5.9	813.2	O K
240 min Winter	110.654	0.654	5.9	854.8	O K
360 min Winter	110.683	0.683	5.9	897.7	O K
480 min Winter	110.694	0.694	5.9	913.4	O K
600 min Winter	110.696	0.696	5.9	916.0	O K
720 min Winter	110.692	0.692	5.9	911.2	O K
960 min Winter	110.678	0.678	5.9	889.3	O K
1440 min Winter	110.636	0.636	5.9	828.2	O K
2160 min Winter	110.580	0.580	5.9	747.5	O K
2880 min Winter	110.530	0.530	5.9	676.1	O K
4320 min Winter	110.428	0.428	5.9	535.4	O K
5760 min Winter	110.343	0.343	5.9	422.7	O K
7200 min Winter	110.275	0.275	5.9	334.4	O K
8640 min Winter	110.222	0.222	5.9	266.6	O K
10080 min Winter	110.182	0.182	5.9	217.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	609.6	66	
120 min Winter	36.913	0.0	740.7	124	
180 min Winter	27.268	0.0	813.8	184	
240 min Winter	21.821	0.0	859.7	242	
360 min Winter	15.737	0.0	908.0	358	
480 min Winter	12.370	0.0	923.7	474	
600 min Winter	10.223	0.0	922.0	590	
720 min Winter	8.729	0.0	913.1	704	
960 min Winter	6.777	0.0	892.3	926	
1440 min Winter	4.731	0.0	847.5	1342	
2160 min Winter	3.309	0.0	1232.9	1664	
2880 min Winter	2.578	0.0	1277.7	2132	
4320 min Winter	1.834	0.0	1354.1	2980	
5760 min Winter	1.454	0.0	1459.7	3744	
7200 min Winter	1.225	0.0	1535.9	4464	
8640 min Winter	1.071	0.0	1609.6	5112	
10080 min Winter	0.961	0.0	1679.8	5752	
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WSP Group Ltd		Page 3																																				
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Date 22/04/2020 File Catchment F_001.srcx	Designed by PS Checked by AC																																					
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<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> </tr> <tr> <td>Site Location</td> <td>GB 483669 232428 SP 83669 32428</td> </tr> <tr> <td>Data Type</td> <td>Point</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> </tr> <tr> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 1.250 <table> <thead> <tr> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> </tr> <tr> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0 4</td> <td>0.625</td> <td>4 8</td> <td>0.625</td> </tr> </tbody> </table>			Rainfall Model	FEH	Return Period (years)	100	FEH Rainfall Version	2013	Site Location	GB 483669 232428 SP 83669 32428	Data Type	Point	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	0.750	Cv (Winter)	0.840	Shortest Storm (mins)	15	Longest Storm (mins)	10080	Climate Change %	+40	Time (mins)	Area	Time (mins)	Area	From: To:	(ha)	From: To:	(ha)	0 4	0.625	4 8	0.625
Rainfall Model	FEH																																					
Return Period (years)	100																																					
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WSP Group Ltd		Page 4																																																																																															
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Model Details Storage is Online Cover Level (m) 111.000 Tank or Pond Structure Invert Level (m) 110.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>1150.0</td><td>1.000</td><td>1655.0</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0119-5900-0700-5900 Design Head (m) 0.700 Design Flow (l/s) 5.9 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 119 Invert Level (m) 110.000 Minimum Outlet Pipe Diameter (mm) 150 Suggested Manhole Diameter (mm) 1200 <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>0.700</td><td>5.9</td></tr><tr><td>Flush-Flo™</td><td>0.220</td><td>5.9</td></tr><tr><td>Kick-Flo®</td><td>0.490</td><td>5.0</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>5.0</td></tr></table> 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 <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>4.2</td><td>1.200</td><td>7.6</td><td>3.000</td><td>11.7</td><td>7.000</td><td>17.5</td></tr><tr><td>0.200</td><td>5.9</td><td>1.400</td><td>8.2</td><td>3.500</td><td>12.6</td><td>7.500</td><td>18.1</td></tr><tr><td>0.300</td><td>5.8</td><td>1.600</td><td>8.7</td><td>4.000</td><td>13.4</td><td>8.000</td><td>18.7</td></tr><tr><td>0.400</td><td>5.6</td><td>1.800</td><td>9.2</td><td>4.500</td><td>14.2</td><td>8.500</td><td>19.2</td></tr><tr><td>0.500</td><td>5.0</td><td>2.000</td><td>9.6</td><td>5.000</td><td>14.9</td><td>9.000</td><td>19.8</td></tr><tr><td>0.600</td><td>5.5</td><td>2.200</td><td>10.1</td><td>5.500</td><td>15.6</td><td>9.500</td><td>20.4</td></tr><tr><td>0.800</td><td>6.3</td><td>2.400</td><td>10.5</td><td>6.000</td><td>16.3</td><td></td><td></td></tr><tr><td>1.000</td><td>7.0</td><td>2.600</td><td>10.9</td><td>6.500</td><td>16.9</td><td></td><td></td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	1150.0	1.000	1655.0	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	0.700	5.9	Flush-Flo™	0.220	5.9	Kick-Flo®	0.490	5.0	Mean Flow over Head Range	-	5.0	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	4.2	1.200	7.6	3.000	11.7	7.000	17.5	0.200	5.9	1.400	8.2	3.500	12.6	7.500	18.1	0.300	5.8	1.600	8.7	4.000	13.4	8.000	18.7	0.400	5.6	1.800	9.2	4.500	14.2	8.500	19.2	0.500	5.0	2.000	9.6	5.000	14.9	9.000	19.8	0.600	5.5	2.200	10.1	5.500	15.6	9.500	20.4	0.800	6.3	2.400	10.5	6.000	16.3			1.000	7.0	2.600	10.9	6.500	16.9		
Depth (m)	Area (m²)	Depth (m)	Area (m²)																																																																																														
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0.200	5.9	1.400	8.2	3.500	12.6	7.500	18.1																																																																																										
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WSP Group Ltd				Page 1	
.		SWMK			
.		CATCHMENT G			
.		DEVELOPMENT CREEP			
Date 22/04/2020		Designed by PS			
File Catchment G_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	115.277	0.277	4.4	263.5	O K
30 min Summer	115.347	0.347	4.4	339.0	O K
60 min Summer	115.413	0.413	4.4	413.8	O K
120 min Summer	115.485	0.485	4.4	498.2	O K
180 min Summer	115.522	0.522	4.4	543.5	O K
240 min Summer	115.544	0.544	4.4	570.8	O K
360 min Summer	115.566	0.566	4.4	598.1	O K
480 min Summer	115.573	0.573	4.4	607.1	O K
600 min Summer	115.573	0.573	4.4	607.4	O K
720 min Summer	115.570	0.570	4.4	602.6	O K
960 min Summer	115.555	0.555	4.4	584.6	O K
1440 min Summer	115.522	0.522	4.4	542.5	O K
2160 min Summer	115.479	0.479	4.4	490.4	O K
2880 min Summer	115.440	0.440	4.4	444.6	O K
4320 min Summer	115.379	0.379	4.4	374.7	O K
5760 min Summer	115.330	0.330	4.4	320.3	O K
7200 min Summer	115.289	0.289	4.4	276.9	O K
8640 min Summer	115.255	0.255	4.4	241.5	O K
10080 min Summer	115.228	0.228	4.4	213.2	O K
15 min Winter	115.307	0.307	4.4	295.5	O K
30 min Winter	115.384	0.384	4.4	380.4	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	241.8	23	
30 min Summer	97.974	0.0	307.4	37	
60 min Summer	60.354	0.0	412.2	68	
120 min Summer	36.913	0.0	502.6	126	
180 min Summer	27.268	0.0	554.3	186	
240 min Summer	21.821	0.0	588.3	246	
360 min Summer	15.737	0.0	628.9	364	
480 min Summer	12.370	0.0	650.2	484	
600 min Summer	10.223	0.0	660.7	602	
720 min Summer	8.729	0.0	663.8	722	
960 min Summer	6.777	0.0	655.3	960	
1440 min Summer	4.731	0.0	621.3	1214	
2160 min Summer	3.309	0.0	830.2	1580	
2880 min Summer	2.578	0.0	861.5	1936	
4320 min Summer	1.834	0.0	914.5	2724	
5760 min Summer	1.454	0.0	980.5	3512	
7200 min Summer	1.225	0.0	1031.6	4248	
8640 min Summer	1.071	0.0	1081.1	4936	
10080 min Summer	0.961	0.0	1128.1	5656	
15 min Winter	151.654	0.0	269.9	23	
30 min Winter	97.974	0.0	336.8	37	
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT G			
.		DEVELOPMENT CREEP			
Date 22/04/2020		Designed by PS			
File Catchment G_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	115.457	0.457	4.4	464.8	O K
120 min Winter	115.536	0.536	4.4	560.3	O K
180 min Winter	115.577	0.577	4.4	611.7	O K
240 min Winter	115.601	0.601	4.4	643.1	O K
360 min Winter	115.626	0.626	4.4	675.7	O K
480 min Winter	115.636	0.636	4.4	687.8	O K
600 min Winter	115.637	0.637	4.4	690.1	O K
720 min Winter	115.635	0.635	4.4	686.8	O K
960 min Winter	115.622	0.622	4.4	670.7	O K
1440 min Winter	115.587	0.587	4.4	625.0	O K
2160 min Winter	115.537	0.537	4.4	561.3	O K
2880 min Winter	115.491	0.491	4.4	505.3	O K
4320 min Winter	115.399	0.399	4.4	397.9	O K
5760 min Winter	115.324	0.324	4.4	314.0	O K
7200 min Winter	115.262	0.262	4.4	248.0	O K
8640 min Winter	115.212	0.212	4.4	197.2	O K
10080 min Winter	115.174	0.174	4.4	159.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	461.3	66	
120 min Winter	36.913	0.0	560.3	124	
180 min Winter	27.268	0.0	615.0	184	
240 min Winter	21.821	0.0	648.7	242	
360 min Winter	15.737	0.0	681.0	358	
480 min Winter	12.370	0.0	687.0	476	
600 min Winter	10.223	0.0	681.8	590	
720 min Winter	8.729	0.0	674.7	704	
960 min Winter	6.777	0.0	659.6	928	
1440 min Winter	4.731	0.0	628.0	1354	
2160 min Winter	3.309	0.0	929.2	1672	
2880 min Winter	2.578	0.0	963.5	2136	
4320 min Winter	1.834	0.0	1022.0	2980	
5760 min Winter	1.454	0.0	1098.6	3744	
7200 min Winter	1.225	0.0	1156.0	4472	
8640 min Winter	1.071	0.0	1211.8	5184	
10080 min Winter	0.961	0.0	1265.2	5760	
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WSP Group Ltd		Page 3																								
. . .	SWMK CATCHMENT G DEVELOPMENT CREEP																									
Date 22/04/2020 File Catchment G_001.srcx	Designed by PS Checked by AC																									
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Date 22/04/2020		Designed by PS			
File Catchment H_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	110.277	0.277	3.3	283.2	O K
30 min Summer	110.350	0.350	3.3	364.8	O K
60 min Summer	110.419	0.419	3.3	446.5	O K
120 min Summer	110.496	0.496	3.3	540.1	O K
180 min Summer	110.537	0.537	3.3	591.8	O K
240 min Summer	110.562	0.562	3.3	624.3	O K
360 min Summer	110.590	0.590	3.3	660.3	O K
480 min Summer	110.603	0.603	3.3	676.7	O K
600 min Summer	110.608	0.608	3.3	683.5	O K
720 min Summer	110.609	0.609	3.3	684.8	O K
960 min Summer	110.603	0.603	3.3	677.7	O K
1440 min Summer	110.581	0.581	3.3	648.1	O K
2160 min Summer	110.545	0.545	3.3	601.7	O K
2880 min Summer	110.516	0.516	3.3	565.6	O K
4320 min Summer	110.470	0.470	3.3	508.4	O K
5760 min Summer	110.428	0.428	3.3	457.7	O K
7200 min Summer	110.395	0.395	3.3	418.1	O K
8640 min Summer	110.367	0.367	3.3	385.2	O K
10080 min Summer	110.343	0.343	3.3	357.2	O K
15 min Winter	110.308	0.308	3.3	317.5	O K
30 min Winter	110.388	0.388	3.3	409.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	240.1	23	
30 min Summer	97.974	0.0	275.8	38	
60 min Summer	60.354	0.0	429.6	68	
120 min Summer	36.913	0.0	505.7	128	
180 min Summer	27.268	0.0	523.5	186	
240 min Summer	21.821	0.0	519.9	246	
360 min Summer	15.737	0.0	511.5	366	
480 min Summer	12.370	0.0	504.6	486	
600 min Summer	10.223	0.0	498.5	604	
720 min Summer	8.729	0.0	492.8	724	
960 min Summer	6.777	0.0	481.8	962	
1440 min Summer	4.731	0.0	460.1	1440	
2160 min Summer	3.309	0.0	871.4	1796	
2880 min Summer	2.578	0.0	892.0	2164	
4320 min Summer	1.834	0.0	862.8	2980	
5760 min Summer	1.454	0.0	1047.5	3744	
7200 min Summer	1.225	0.0	1102.3	4536	
8640 min Summer	1.071	0.0	1155.3	5280	
10080 min Summer	0.961	0.0	1205.1	6056	
15 min Winter	151.654	0.0	260.7	23	
30 min Winter	97.974	0.0	276.7	37	
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WSP Group Ltd				Page 2	
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Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	110.464	0.464	3.3	501.1	O K
120 min Winter	110.549	0.549	3.3	606.6	O K
180 min Winter	110.594	0.594	3.3	665.1	O K
240 min Winter	110.622	0.622	3.3	702.2	O K
360 min Winter	110.653	0.653	3.3	744.2	O K
480 min Winter	110.668	0.668	3.3	764.1	O K
600 min Winter	110.675	0.675	3.3	773.4	O K
720 min Winter	110.677	0.677	3.3	776.4	O K
960 min Winter	110.673	0.673	3.3	771.7	O K
1440 min Winter	110.654	0.654	3.3	745.2	O K
2160 min Winter	110.615	0.615	3.3	693.7	O K
2880 min Winter	110.581	0.581	3.3	647.9	O K
4320 min Winter	110.524	0.524	3.3	575.2	O K
5760 min Winter	110.470	0.470	3.3	507.6	O K
7200 min Winter	110.414	0.414	3.3	440.5	O K
8640 min Winter	110.368	0.368	3.3	385.8	O K
10080 min Winter	110.327	0.327	3.3	339.4	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	474.9	66	
120 min Winter	36.913	0.0	526.4	126	
180 min Winter	27.268	0.0	521.0	184	
240 min Winter	21.821	0.0	516.1	242	
360 min Winter	15.737	0.0	509.8	360	
480 min Winter	12.370	0.0	505.2	478	
600 min Winter	10.223	0.0	501.1	594	
720 min Winter	8.729	0.0	497.1	710	
960 min Winter	6.777	0.0	489.2	940	
1440 min Winter	4.731	0.0	474.1	1388	
2160 min Winter	3.309	0.0	958.3	2012	
2880 min Winter	2.578	0.0	954.4	2280	
4320 min Winter	1.834	0.0	878.4	3200	
5760 min Winter	1.454	0.0	1173.2	4144	
7200 min Winter	1.225	0.0	1234.6	4904	
8640 min Winter	1.071	0.0	1294.4	5704	
10080 min Winter	0.961	0.0	1351.5	6456	
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WSP Group Ltd		Page 3																																				
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0.200	3.3	1.400	4.5	3.500	7.0	7.500	10.0																																																																																										
0.300	3.2	1.600	4.8	4.000	7.4	8.000	10.3																																																																																										
0.400	3.1	1.800	5.1	4.500	7.9	8.500	10.7																																																																																										
0.500	2.8	2.000	5.4	5.000	8.3	9.000	11.0																																																																																										
0.600	3.1	2.200	5.6	5.500	8.6	9.500	11.3																																																																																										
0.800	3.5	2.400	5.8	6.000	9.0																																																																																												
1.000	3.9	2.600	6.1	6.500	9.4																																																																																												
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WSP Group Ltd				Page 1	
.		SWMK			
.		CATCHMENT I			
.		DEVELOPMENT CREEP			
Date 21/04/2020		Designed by PS			
File Catchment I_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	110.287	0.287	6.2	370.1	O K
30 min Summer	110.363	0.363	6.2	476.2	O K
60 min Summer	110.435	0.435	6.2	581.4	O K
120 min Summer	110.514	0.514	6.2	700.3	O K
180 min Summer	110.555	0.555	6.2	763.8	O K
240 min Summer	110.580	0.580	6.2	802.0	O K
360 min Summer	110.604	0.604	6.2	840.4	O K
480 min Summer	110.612	0.612	6.2	853.1	O K
600 min Summer	110.612	0.612	6.2	853.4	O K
720 min Summer	110.608	0.608	6.2	846.8	O K
960 min Summer	110.592	0.592	6.2	821.4	O K
1440 min Summer	110.556	0.556	6.2	764.9	O K
2160 min Summer	110.512	0.512	6.2	696.5	O K
2880 min Summer	110.471	0.471	6.2	634.2	O K
4320 min Summer	110.404	0.404	6.2	535.7	O K
5760 min Summer	110.351	0.351	6.2	459.0	O K
7200 min Summer	110.307	0.307	6.2	398.0	O K
8640 min Summer	110.271	0.271	6.2	348.2	O K
10080 min Summer	110.242	0.242	6.2	308.5	O K
15 min Winter	110.320	0.320	6.2	415.1	O K
30 min Winter	110.403	0.403	6.2	534.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	333.4	23	
30 min Summer	97.974	0.0	425.0	37	
60 min Summer	60.354	0.0	574.7	68	
120 min Summer	36.913	0.0	700.8	126	
180 min Summer	27.268	0.0	772.9	186	
240 min Summer	21.821	0.0	820.4	246	
360 min Summer	15.737	0.0	877.5	364	
480 min Summer	12.370	0.0	908.2	484	
600 min Summer	10.223	0.0	924.7	602	
720 min Summer	8.729	0.0	931.4	722	
960 min Summer	6.777	0.0	924.1	960	
1440 min Summer	4.731	0.0	874.6	1196	
2160 min Summer	3.309	0.0	1162.5	1560	
2880 min Summer	2.578	0.0	1206.0	1956	
4320 min Summer	1.834	0.0	1278.9	2724	
5760 min Summer	1.454	0.0	1375.6	3512	
7200 min Summer	1.225	0.0	1447.1	4248	
8640 min Summer	1.071	0.0	1516.0	4936	
10080 min Summer	0.961	0.0	1580.9	5656	
15 min Winter	151.654	0.0	372.6	23	
30 min Winter	97.974	0.0	466.9	37	
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT I			
.		DEVELOPMENT CREEP			
Date 21/04/2020		Designed by PS			
File Catchment I_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	110.483	0.483	6.2	653.0	O K
120 min Winter	110.570	0.570	6.2	787.0	O K
180 min Winter	110.616	0.616	6.2	859.1	O K
240 min Winter	110.643	0.643	6.2	903.2	O K
360 min Winter	110.671	0.671	6.2	948.8	O K
480 min Winter	110.681	0.681	6.2	965.7	O K
600 min Winter	110.683	0.683	6.2	968.9	O K
720 min Winter	110.680	0.680	6.2	964.1	O K
960 min Winter	110.666	0.666	6.2	941.4	O K
1440 min Winter	110.627	0.627	6.2	877.6	O K
2160 min Winter	110.573	0.573	6.2	792.1	O K
2880 min Winter	110.525	0.525	6.2	716.4	O K
4320 min Winter	110.426	0.426	6.2	568.1	O K
5760 min Winter	110.344	0.344	6.2	449.7	O K
7200 min Winter	110.277	0.277	6.2	356.6	O K
8640 min Winter	110.225	0.225	6.2	285.0	O K
10080 min Winter	110.185	0.185	6.2	232.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	643.2	66	
120 min Winter	36.913	0.0	781.3	124	
180 min Winter	27.268	0.0	858.1	184	
240 min Winter	21.821	0.0	906.1	242	
360 min Winter	15.737	0.0	955.7	358	
480 min Winter	12.370	0.0	971.0	474	
600 min Winter	10.223	0.0	968.1	590	
720 min Winter	8.729	0.0	958.4	704	
960 min Winter	6.777	0.0	936.3	926	
1440 min Winter	4.731	0.0	889.3	1342	
2160 min Winter	3.309	0.0	1301.3	1668	
2880 min Winter	2.578	0.0	1348.6	2132	
4320 min Winter	1.834	0.0	1428.9	2980	
5760 min Winter	1.454	0.0	1541.3	3744	
7200 min Winter	1.225	0.0	1621.7	4464	
8640 min Winter	1.071	0.0	1699.5	5112	
10080 min Winter	0.961	0.0	1773.5	5752	
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WSP Group Ltd		Page 3																																				
. . .	SWMK CATCHMENT I DEVELOPMENT CREEP																																					
Date 21/04/2020 File Catchment I_001.srcx	Designed by PS Checked by AC																																					
XP Solutions Source Control 2019.1																																						
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> </tr> <tr> <td>Site Location</td> <td>GB 483669 232428 SP 83669 32428</td> </tr> <tr> <td>Data Type</td> <td>Point</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> </tr> <tr> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 1.320 <table> <thead> <tr> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> </tr> <tr> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0 4</td> <td>0.660</td> <td>4 8</td> <td>0.660</td> </tr> </tbody> </table>			Rainfall Model	FEH	Return Period (years)	100	FEH Rainfall Version	2013	Site Location	GB 483669 232428 SP 83669 32428	Data Type	Point	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	0.750	Cv (Winter)	0.840	Shortest Storm (mins)	15	Longest Storm (mins)	10080	Climate Change %	+40	Time (mins)	Area	Time (mins)	Area	From: To:	(ha)	From: To:	(ha)	0 4	0.660	4 8	0.660
Rainfall Model	FEH																																					
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WSP Group Ltd		Page 4																																																																																															
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Model Details Storage is Online Cover Level (m) 111.000 Tank or Pond Structure Invert Level (m) 110.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>1200.0</td><td>1.000</td><td>1880.0</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0121-6200-0700-6200 Design Head (m) 0.700 Design Flow (l/s) 6.2 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 121 Invert Level (m) 110.000 Minimum Outlet Pipe Diameter (mm) 150 Suggested Manhole Diameter (mm) 1200 <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>0.700</td><td>6.2</td></tr><tr><td>Flush-Flo™</td><td>0.221</td><td>6.2</td></tr><tr><td>Kick-Flo®</td><td>0.493</td><td>5.3</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>5.3</td></tr></table> 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 <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>4.3</td><td>1.200</td><td>8.0</td><td>3.000</td><td>12.3</td><td>7.000</td><td>18.4</td></tr><tr><td>0.200</td><td>6.2</td><td>1.400</td><td>8.6</td><td>3.500</td><td>13.2</td><td>7.500</td><td>19.0</td></tr><tr><td>0.300</td><td>6.1</td><td>1.600</td><td>9.1</td><td>4.000</td><td>14.1</td><td>8.000</td><td>19.6</td></tr><tr><td>0.400</td><td>5.9</td><td>1.800</td><td>9.7</td><td>4.500</td><td>14.9</td><td>8.500</td><td>20.2</td></tr><tr><td>0.500</td><td>5.3</td><td>2.000</td><td>10.1</td><td>5.000</td><td>15.7</td><td>9.000</td><td>20.8</td></tr><tr><td>0.600</td><td>5.8</td><td>2.200</td><td>10.6</td><td>5.500</td><td>16.4</td><td>9.500</td><td>21.4</td></tr><tr><td>0.800</td><td>6.6</td><td>2.400</td><td>11.1</td><td>6.000</td><td>17.1</td><td></td><td></td></tr><tr><td>1.000</td><td>7.3</td><td>2.600</td><td>11.5</td><td>6.500</td><td>17.8</td><td></td><td></td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	1200.0	1.000	1880.0	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	0.700	6.2	Flush-Flo™	0.221	6.2	Kick-Flo®	0.493	5.3	Mean Flow over Head Range	-	5.3	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	4.3	1.200	8.0	3.000	12.3	7.000	18.4	0.200	6.2	1.400	8.6	3.500	13.2	7.500	19.0	0.300	6.1	1.600	9.1	4.000	14.1	8.000	19.6	0.400	5.9	1.800	9.7	4.500	14.9	8.500	20.2	0.500	5.3	2.000	10.1	5.000	15.7	9.000	20.8	0.600	5.8	2.200	10.6	5.500	16.4	9.500	21.4	0.800	6.6	2.400	11.1	6.000	17.1			1.000	7.3	2.600	11.5	6.500	17.8		
Depth (m)	Area (m²)	Depth (m)	Area (m²)																																																																																														
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WSP Group Ltd				Page 1	
.		SWMK			
.		CATCHMENT J			
.		DEVELOPMENT CREEP			
Date 22/04/2020		Designed by PS			
File Catchment J.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	113.162	0.262	3.8	282.8	O K
30 min Summer	113.232	0.332	3.8	364.2	O K
60 min Summer	113.299	0.399	3.8	445.3	O K
120 min Summer	113.373	0.473	3.8	537.9	O K
180 min Summer	113.413	0.513	3.8	588.8	O K
240 min Summer	113.437	0.537	3.8	620.4	O K
360 min Summer	113.463	0.563	3.8	654.5	O K
480 min Summer	113.474	0.574	3.8	668.9	O K
600 min Summer	113.478	0.578	3.8	673.8	O K
720 min Summer	113.477	0.577	3.8	673.2	O K
960 min Summer	113.469	0.569	3.8	662.5	O K
1440 min Summer	113.442	0.542	3.8	626.4	O K
2160 min Summer	113.405	0.505	3.8	578.2	O K
2880 min Summer	113.374	0.474	3.8	538.4	O K
4320 min Summer	113.319	0.419	3.8	470.3	O K
5760 min Summer	113.277	0.377	3.8	418.4	O K
7200 min Summer	113.242	0.342	3.8	376.5	O K
8640 min Summer	113.212	0.312	3.8	341.3	O K
10080 min Summer	113.187	0.287	3.8	311.4	O K
15 min Winter	113.192	0.292	3.8	317.1	O K
30 min Winter	113.269	0.369	3.8	408.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	245.5	23	
30 min Summer	97.974	0.0	300.6	38	
60 min Summer	60.354	0.0	432.8	68	
120 min Summer	36.913	0.0	522.0	126	
180 min Summer	27.268	0.0	565.9	186	
240 min Summer	21.821	0.0	586.8	246	
360 min Summer	15.737	0.0	592.5	366	
480 min Summer	12.370	0.0	585.3	484	
600 min Summer	10.223	0.0	577.8	604	
720 min Summer	8.729	0.0	570.4	724	
960 min Summer	6.777	0.0	555.8	962	
1440 min Summer	4.731	0.0	526.7	1376	
2160 min Summer	3.309	0.0	879.1	1708	
2880 min Summer	2.578	0.0	908.5	2080	
4320 min Summer	1.834	0.0	949.7	2852	
5760 min Summer	1.454	0.0	1047.6	3632	
7200 min Summer	1.225	0.0	1102.3	4400	
8640 min Summer	1.071	0.0	1154.9	5184	
10080 min Summer	0.961	0.0	1204.1	5944	
15 min Winter	151.654	0.0	271.3	23	
30 min Winter	97.974	0.0	315.3	37	
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT J			
.		DEVELOPMENT CREEP			
Date 22/04/2020		Designed by PS			
File Catchment J.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	113.343	0.443	3.8	499.9	O K
120 min Winter	113.425	0.525	3.8	604.5	O K
180 min Winter	113.469	0.569	3.8	661.9	O K
240 min Winter	113.496	0.596	3.8	698.1	O K
360 min Winter	113.526	0.626	3.8	737.9	O K
480 min Winter	113.539	0.639	3.8	755.7	O K
600 min Winter	113.544	0.644	3.8	762.9	O K
720 min Winter	113.545	0.645	3.8	763.9	O K
960 min Winter	113.538	0.638	3.8	755.4	O K
1440 min Winter	113.514	0.614	3.8	721.7	O K
2160 min Winter	113.469	0.569	3.8	661.9	O K
2880 min Winter	113.433	0.533	3.8	614.7	O K
4320 min Winter	113.364	0.464	3.8	526.6	O K
5760 min Winter	113.297	0.397	3.8	443.2	O K
7200 min Winter	113.242	0.342	3.8	376.5	O K
8640 min Winter	113.195	0.295	3.8	320.5	O K
10080 min Winter	113.154	0.254	3.8	273.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	482.4	66	
120 min Winter	36.913	0.0	571.3	126	
180 min Winter	27.268	0.0	599.2	184	
240 min Winter	21.821	0.0	599.0	242	
360 min Winter	15.737	0.0	591.2	360	
480 min Winter	12.370	0.0	584.2	476	
600 min Winter	10.223	0.0	577.8	594	
720 min Winter	8.729	0.0	571.6	708	
960 min Winter	6.777	0.0	559.5	936	
1440 min Winter	4.731	0.0	535.4	1382	
2160 min Winter	3.309	0.0	979.9	1928	
2880 min Winter	2.578	0.0	1007.8	2220	
4320 min Winter	1.834	0.0	1014.9	3152	
5760 min Winter	1.454	0.0	1173.6	3928	
7200 min Winter	1.225	0.0	1235.1	4752	
8640 min Winter	1.071	0.0	1294.6	5528	
10080 min Winter	0.961	0.0	1350.9	6248	
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WSP Group Ltd		Page 3																																				
. . .	SWMK CATCHMENT J DEVELOPMENT CREEP																																					
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WSP Group Ltd		Page 4
. . .	SWMK CATCHMENT J DEVELOPMENT CREEP	
Date 22/04/2020 File Catchment J.srcx	Designed by PS Checked by AC	
XP Solutions Source Control 2019.1		

Model Details

Storage is Online Cover Level (m) 113.900

Tank or Pond Structure

Invert Level (m) 112.900

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	1010.0	1.000	1590.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0097-3800-0700-3800
Design Head (m)	0.700
Design Flow (l/s)	3.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	97
Invert Level (m)	112.900
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	3.8
Flush-Flo™	0.210	3.8
Kick-Flo®	0.469	3.2
Mean Flow over Head Range	-	3.3

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	3.1	1.200	4.9	3.000	7.5	7.000	11.2
0.200	3.8	1.400	5.2	3.500	8.0	7.500	11.5
0.300	3.7	1.600	5.6	4.000	8.6	8.000	11.9
0.400	3.5	1.800	5.9	4.500	9.1	8.500	12.3
0.500	3.3	2.000	6.2	5.000	9.5	9.000	12.6
0.600	3.5	2.200	6.5	5.500	10.0	9.500	13.0
0.800	4.0	2.400	6.7	6.000	10.4		
1.000	4.5	2.600	7.0	6.500	10.8		

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WSP Group Ltd				Page 1	
.		SWMK			
.		CATCHMENT K			
.		DEVELOPMENT CREEP			
Date 21/04/2020		Designed by PS			
File Catchment K_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	113.311	0.311	4.0	320.7	O K
30 min Summer	113.393	0.393	4.0	413.0	O K
60 min Summer	113.473	0.473	4.0	505.5	O K
120 min Summer	113.560	0.560	4.0	610.4	O K
180 min Summer	113.606	0.606	4.0	667.7	O K
240 min Summer	113.634	0.634	4.0	703.4	O K
360 min Summer	113.665	0.665	4.0	742.0	O K
480 min Summer	113.677	0.677	4.0	758.3	O K
600 min Summer	113.682	0.682	4.0	763.9	O K
720 min Summer	113.681	0.681	4.0	763.3	O K
960 min Summer	113.672	0.672	4.0	751.3	O K
1440 min Summer	113.640	0.640	4.0	711.0	O K
2160 min Summer	113.598	0.598	4.0	658.2	O K
2880 min Summer	113.565	0.565	4.0	616.8	O K
4320 min Summer	113.511	0.511	4.0	551.6	O K
5760 min Summer	113.463	0.463	4.0	494.3	O K
7200 min Summer	113.421	0.421	4.0	444.8	O K
8640 min Summer	113.386	0.386	4.0	404.5	O K
10080 min Summer	113.356	0.356	4.0	370.5	O K
15 min Winter	113.346	0.346	4.0	359.5	O K
30 min Winter	113.437	0.437	4.0	463.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	280.6	23	
30 min Summer	97.974	0.0	330.8	38	
60 min Summer	60.354	0.0	492.1	68	
120 min Summer	36.913	0.0	587.9	126	
180 min Summer	27.268	0.0	626.8	186	
240 min Summer	21.821	0.0	635.0	246	
360 min Summer	15.737	0.0	629.3	366	
480 min Summer	12.370	0.0	622.8	484	
600 min Summer	10.223	0.0	616.4	604	
720 min Summer	8.729	0.0	610.1	724	
960 min Summer	6.777	0.0	597.3	962	
1440 min Summer	4.731	0.0	570.7	1374	
2160 min Summer	3.309	0.0	997.3	1708	
2880 min Summer	2.578	0.0	1028.5	2080	
4320 min Summer	1.834	0.0	1038.7	2900	
5760 min Summer	1.454	0.0	1188.1	3696	
7200 min Summer	1.225	0.0	1250.4	4472	
8640 min Summer	1.071	0.0	1310.6	5272	
10080 min Summer	0.961	0.0	1367.4	6048	
15 min Winter	151.654	0.0	307.3	23	
30 min Winter	97.974	0.0	332.9	37	
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT K			
.		DEVELOPMENT CREEP			
Date 21/04/2020		Designed by PS			
File Catchment K_001.srcx		Checked by AC			
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	113.524	0.524	4.0	567.2	O K
120 min Winter	113.620	0.620	4.0	685.4	O K
180 min Winter	113.671	0.671	4.0	750.6	O K
240 min Winter	113.703	0.703	4.0	791.6	Flood Risk
360 min Winter	113.738	0.738	4.1	836.9	Flood Risk
480 min Winter	113.753	0.753	4.1	857.3	Flood Risk
600 min Winter	113.759	0.759	4.2	865.6	Flood Risk
720 min Winter	113.760	0.760	4.2	867.0	Flood Risk
960 min Winter	113.753	0.753	4.1	857.7	Flood Risk
1440 min Winter	113.725	0.725	4.1	820.6	Flood Risk
2160 min Winter	113.675	0.675	4.0	754.9	O K
2880 min Winter	113.635	0.635	4.0	704.6	O K
4320 min Winter	113.565	0.565	4.0	617.3	O K
5760 min Winter	113.501	0.501	4.0	539.1	O K
7200 min Winter	113.433	0.433	4.0	458.8	O K
8640 min Winter	113.375	0.375	4.0	392.3	O K
10080 min Winter	113.326	0.326	4.0	337.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	546.3	66	
120 min Winter	36.913	0.0	631.9	126	
180 min Winter	27.268	0.0	639.6	184	
240 min Winter	21.821	0.0	637.0	242	
360 min Winter	15.737	0.0	632.6	360	
480 min Winter	12.370	0.0	628.6	476	
600 min Winter	10.223	0.0	624.5	594	
720 min Winter	8.729	0.0	620.1	708	
960 min Winter	6.777	0.0	610.9	936	
1440 min Winter	4.731	0.0	592.2	1376	
2160 min Winter	3.309	0.0	1109.6	1816	
2880 min Winter	2.578	0.0	1134.8	2220	
4320 min Winter	1.834	0.0	1075.7	3156	
5760 min Winter	1.454	0.0	1330.8	4040	
7200 min Winter	1.225	0.0	1400.7	4896	
8640 min Winter	1.071	0.0	1468.8	5624	
10080 min Winter	0.961	0.0	1533.6	6352	
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WSP Group Ltd		Page 3																																				
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Date 21/04/2020 File Catchment K_001.srcx	Designed by PS Checked by AC																																					
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WSP Group Ltd		Page 4																																																																																															
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WSP Group Ltd				Page 1	
.		SWMK			
.		CATCHMENT L			
.		DEVELOPMENT CREEP			
Date 21/04/2020		Designed by PS			
File Catchment L_002.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	104.300	0.300	26.7	1595.6	O K
30 min Summer	104.382	0.382	26.8	2052.5	O K
60 min Summer	104.461	0.461	26.8	2507.1	O K
120 min Summer	104.549	0.549	26.8	3022.8	O K
180 min Summer	104.596	0.596	26.8	3303.5	O K
240 min Summer	104.624	0.624	26.8	3474.5	O K
360 min Summer	104.654	0.654	26.8	3651.1	O K
480 min Summer	104.664	0.664	26.8	3716.3	O K
600 min Summer	104.666	0.666	26.8	3727.7	O K
720 min Summer	104.663	0.663	26.8	3708.1	O K
960 min Summer	104.648	0.648	26.8	3615.9	O K
1440 min Summer	104.615	0.615	26.8	3417.5	O K
2160 min Summer	104.575	0.575	26.8	3174.6	O K
2880 min Summer	104.537	0.537	26.8	2949.9	O K
4320 min Summer	104.473	0.473	26.8	2575.2	O K
5760 min Summer	104.420	0.420	26.8	2271.6	O K
7200 min Summer	104.378	0.378	26.8	2029.1	O K
8640 min Summer	104.343	0.343	26.8	1833.2	O K
10080 min Summer	104.315	0.315	26.8	1676.7	O K
15 min Winter	104.335	0.335	26.8	1788.6	O K
30 min Winter	104.426	0.426	26.8	2302.4	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	1243.6	23	
30 min Summer	97.974	0.0	1622.8	37	
60 min Summer	60.354	0.0	2335.4	68	
120 min Summer	36.913	0.0	2857.9	126	
180 min Summer	27.268	0.0	3153.1	186	
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360 min Summer	15.737	0.0	3582.6	364	
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600 min Summer	10.223	0.0	3791.7	602	
720 min Summer	8.729	0.0	3836.5	722	
960 min Summer	6.777	0.0	3859.1	956	
1440 min Summer	4.731	0.0	3724.2	1160	
2160 min Summer	3.309	0.0	4886.0	1540	
2880 min Summer	2.578	0.0	5056.5	1932	
4320 min Summer	1.834	0.0	5321.5	2724	
5760 min Summer	1.454	0.0	5868.4	3464	
7200 min Summer	1.225	0.0	6166.0	4248	
8640 min Summer	1.071	0.0	6445.6	4936	
10080 min Summer	0.961	0.0	6694.1	5648	
15 min Winter	151.654	0.0	1404.7	23	
30 min Winter	97.974	0.0	1806.6	37	
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.		SWMK			
.		CATCHMENT L			
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Date 21/04/2020		Designed by PS			
File Catchment L_002.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	104.514	0.514	26.8	2814.8	O K
120 min Winter	104.612	0.612	26.8	3396.9	O K
180 min Winter	104.664	0.664	26.8	3712.2	O K
240 min Winter	104.695	0.695	26.8	3906.8	O K
360 min Winter	104.728	0.728	27.3	4111.9	Flood Risk
480 min Winter	104.741	0.741	27.5	4193.1	Flood Risk
600 min Winter	104.745	0.745	27.6	4214.6	Flood Risk
720 min Winter	104.743	0.743	27.6	4202.0	Flood Risk
960 min Winter	104.730	0.730	27.3	4119.4	Flood Risk
1440 min Winter	104.690	0.690	26.8	3873.6	O K
2160 min Winter	104.639	0.639	26.8	3563.3	O K
2880 min Winter	104.592	0.592	26.8	3276.8	O K
4320 min Winter	104.496	0.496	26.8	2713.0	O K
5760 min Winter	104.416	0.416	26.8	2244.7	O K
7200 min Winter	104.351	0.351	26.8	1878.7	O K
8640 min Winter	104.301	0.301	26.7	1597.2	O K
10080 min Winter	104.263	0.263	26.4	1388.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	2620.7	66	
120 min Winter	36.913	0.0	3190.4	124	
180 min Winter	27.268	0.0	3507.5	184	
240 min Winter	21.821	0.0	3710.8	242	
360 min Winter	15.737	0.0	3944.1	358	
480 min Winter	12.370	0.0	4058.7	474	
600 min Winter	10.223	0.0	4111.4	590	
720 min Winter	8.729	0.0	4124.2	702	
960 min Winter	6.777	0.0	4069.8	924	
1440 min Winter	4.731	0.0	3836.9	1328	
2160 min Winter	3.309	0.0	5471.6	1644	
2880 min Winter	2.578	0.0	5654.0	2108	
4320 min Winter	1.834	0.0	5941.6	2944	
5760 min Winter	1.454	0.0	6580.6	3744	
7200 min Winter	1.225	0.0	6916.9	4464	
8640 min Winter	1.071	0.0	7234.5	5112	
10080 min Winter	0.961	0.0	7522.0	5760	
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<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> </tr> <tr> <td>Site Location</td> <td>GB 483669 232428 SP 83669 32428</td> </tr> <tr> <td>Data Type</td> <td>Point</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> </tr> <tr> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 5.680 <table> <thead> <tr> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> </tr> <tr> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0 4</td> <td>2.840</td> <td>4 8</td> <td>2.840</td> </tr> </tbody> </table>			Rainfall Model	FEH	Return Period (years)	100	FEH Rainfall Version	2013	Site Location	GB 483669 232428 SP 83669 32428	Data Type	Point	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	0.750	Cv (Winter)	0.840	Shortest Storm (mins)	15	Longest Storm (mins)	10080	Climate Change %	+40	Time (mins)	Area	Time (mins)	Area	From: To:	(ha)	From: To:	(ha)	0 4	2.840	4 8	2.840
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Model Details Storage is Online Cover Level (m) 105.000 Tank or Pond Structure Invert Level (m) 104.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>5090.0</td><td>1.000</td><td>6670.0</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0229-2680-0700-2680 Design Head (m)0.700 Design Flow (l/s)26.8 Flush-Flo™Calculated ObjectiveMinimise upstream storage ApplicationSurface Sump AvailableYes Diameter (mm)229 Invert Level (m)104.000 Minimum Outlet Pipe Diameter (mm)300 Suggested Manhole Diameter (mm)1500 <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>0.700</td><td>26.8</td></tr><tr><td>Flush-Flo™</td><td>0.335</td><td>26.8</td></tr><tr><td>Kick-Flo®</td><td>0.564</td><td>24.2</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>21.1</td></tr></table> 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 <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>7.6</td><td>1.200</td><td>34.7</td><td>3.000</td><td>54.0</td><td>7.000</td><td>81.5</td></tr><tr><td>0.200</td><td>22.9</td><td>1.400</td><td>37.4</td><td>3.500</td><td>58.2</td><td>7.500</td><td>83.7</td></tr><tr><td>0.300</td><td>26.7</td><td>1.600</td><td>39.8</td><td>4.000</td><td>62.1</td><td>8.000</td><td>86.5</td></tr><tr><td>0.400</td><td>26.6</td><td>1.800</td><td>42.2</td><td>4.500</td><td>65.7</td><td>8.500</td><td>89.2</td></tr><tr><td>0.500</td><td>25.6</td><td>2.000</td><td>44.4</td><td>5.000</td><td>69.2</td><td>9.000</td><td>91.8</td></tr><tr><td>0.600</td><td>24.9</td><td>2.200</td><td>46.5</td><td>5.500</td><td>72.5</td><td>9.500</td><td>94.4</td></tr><tr><td>0.800</td><td>28.6</td><td>2.400</td><td>48.4</td><td>6.000</td><td>75.6</td><td></td><td></td></tr><tr><td>1.000</td><td>31.8</td><td>2.600</td><td>50.4</td><td>6.500</td><td>78.6</td><td></td><td></td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	5090.0	1.000	6670.0	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	0.700	26.8	Flush-Flo™	0.335	26.8	Kick-Flo®	0.564	24.2	Mean Flow over Head Range	-	21.1	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	34.7	3.000	54.0	7.000	81.5	0.200	22.9	1.400	37.4	3.500	58.2	7.500	83.7	0.300	26.7	1.600	39.8	4.000	62.1	8.000	86.5	0.400	26.6	1.800	42.2	4.500	65.7	8.500	89.2	0.500	25.6	2.000	44.4	5.000	69.2	9.000	91.8	0.600	24.9	2.200	46.5	5.500	72.5	9.500	94.4	0.800	28.6	2.400	48.4	6.000	75.6			1.000	31.8	2.600	50.4	6.500	78.6		
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XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	104.306	0.306	15.3	906.4	O K
30 min Summer	104.389	0.389	15.3	1166.2	O K
60 min Summer	104.470	0.470	15.3	1424.2	O K
120 min Summer	104.559	0.559	15.3	1716.7	O K
180 min Summer	104.606	0.606	15.3	1873.3	O K
240 min Summer	104.634	0.634	15.3	1967.9	O K
360 min Summer	104.662	0.662	15.3	2063.8	O K
480 min Summer	104.672	0.672	15.3	2096.8	O K
600 min Summer	104.673	0.673	15.3	2099.3	O K
720 min Summer	104.668	0.668	15.3	2084.5	O K
960 min Summer	104.651	0.651	15.3	2025.3	O K
1440 min Summer	104.615	0.615	15.3	1902.3	O K
2160 min Summer	104.570	0.570	15.3	1752.7	O K
2880 min Summer	104.529	0.529	15.3	1618.3	O K
4320 min Summer	104.458	0.458	15.3	1385.2	O K
5760 min Summer	104.400	0.400	15.3	1201.4	O K
7200 min Summer	104.354	0.354	15.3	1056.0	O K
8640 min Summer	104.317	0.317	15.3	938.4	O K
10080 min Summer	104.286	0.286	15.3	844.7	O K
15 min Winter	104.342	0.342	15.3	1016.3	O K
30 min Winter	104.434	0.434	15.3	1308.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	765.1	23	
30 min Summer	97.974	0.0	985.3	37	
60 min Summer	60.354	0.0	1371.0	68	
120 min Summer	36.913	0.0	1673.6	126	
180 min Summer	27.268	0.0	1846.2	186	
240 min Summer	21.821	0.0	1960.2	246	
360 min Summer	15.737	0.0	2098.6	364	
480 min Summer	12.370	0.0	2175.7	484	
600 min Summer	10.223	0.0	2221.1	602	
720 min Summer	8.729	0.0	2246.1	722	
960 min Summer	6.777	0.0	2253.2	956	
1440 min Summer	4.731	0.0	2151.4	1158	
2160 min Summer	3.309	0.0	2815.7	1540	
2880 min Summer	2.578	0.0	2917.1	1940	
4320 min Summer	1.834	0.0	3083.7	2724	
5760 min Summer	1.454	0.0	3353.7	3464	
7200 min Summer	1.225	0.0	3526.1	4248	
8640 min Summer	1.071	0.0	3690.2	4936	
10080 min Summer	0.961	0.0	3840.5	5648	
15 min Winter	151.654	0.0	858.9	23	
30 min Winter	97.974	0.0	1089.6	37	
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WSP Group Ltd				Page 2	
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	104.524	0.524	15.3	1599.4	O K
120 min Winter	104.622	0.622	15.3	1928.1	O K
180 min Winter	104.674	0.674	15.3	2105.3	O K
240 min Winter	104.706	0.706	15.4	2213.9	Flood Risk
360 min Winter	104.738	0.738	15.7	2326.7	Flood Risk
480 min Winter	104.751	0.751	15.8	2369.2	Flood Risk
600 min Winter	104.753	0.753	15.8	2377.9	Flood Risk
720 min Winter	104.750	0.750	15.8	2367.3	Flood Risk
960 min Winter	104.735	0.735	15.7	2314.1	Flood Risk
1440 min Winter	104.691	0.691	15.3	2163.4	O K
2160 min Winter	104.636	0.636	15.3	1974.6	O K
2880 min Winter	104.585	0.585	15.3	1802.1	O K
4320 min Winter	104.482	0.482	15.3	1462.8	O K
5760 min Winter	104.393	0.393	15.3	1179.1	O K
7200 min Winter	104.323	0.323	15.3	958.5	O K
8640 min Winter	104.268	0.268	15.3	790.2	O K
10080 min Winter	104.228	0.228	15.2	667.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	1535.8	66	
120 min Winter	36.913	0.0	1867.3	124	
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2880 min Winter	2.578	0.0	3262.9	2108	
4320 min Winter	1.834	0.0	3443.6	2948	
5760 min Winter	1.454	0.0	3759.1	3744	
7200 min Winter	1.225	0.0	3953.4	4464	
8640 min Winter	1.071	0.0	4139.2	5104	
10080 min Winter	0.961	0.0	4311.9	5752	
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WSP Group Ltd		Page 3																																				
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WSP Group Ltd		Page 4																																																																																															
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File Catchment N_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	100.329	0.329	5.6	336.4	O K
30 min Summer	100.414	0.414	5.6	432.8	O K
60 min Summer	100.494	0.494	5.6	528.6	O K
120 min Summer	100.580	0.580	5.6	635.6	O K
180 min Summer	100.624	0.624	5.6	692.1	O K
240 min Summer	100.650	0.650	5.6	725.9	O K
360 min Summer	100.675	0.675	5.6	759.1	O K
480 min Summer	100.682	0.682	5.6	769.0	O K
600 min Summer	100.681	0.681	5.6	767.8	O K
720 min Summer	100.676	0.676	5.6	760.2	O K
960 min Summer	100.656	0.656	5.6	734.6	O K
1440 min Summer	100.616	0.616	5.6	682.2	O K
2160 min Summer	100.568	0.568	5.6	620.2	O K
2880 min Summer	100.527	0.527	5.6	568.9	O K
4320 min Summer	100.452	0.452	5.6	477.8	O K
5760 min Summer	100.390	0.390	5.6	405.3	O K
7200 min Summer	100.340	0.340	5.6	348.4	O K
8640 min Summer	100.298	0.298	5.6	302.0	O K
10080 min Summer	100.263	0.263	5.6	264.3	O K
15 min Winter	100.365	0.365	5.6	377.3	O K
30 min Winter	100.458	0.458	5.6	485.7	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	312.0	23	
30 min Summer	97.974	0.0	395.8	37	
60 min Summer	60.354	0.0	528.0	68	
120 min Summer	36.913	0.0	643.8	126	
180 min Summer	27.268	0.0	710.4	186	
240 min Summer	21.821	0.0	754.6	246	
360 min Summer	15.737	0.0	807.9	364	
480 min Summer	12.370	0.0	836.5	484	
600 min Summer	10.223	0.0	851.3	602	
720 min Summer	8.729	0.0	856.4	722	
960 min Summer	6.777	0.0	845.9	958	
1440 min Summer	4.731	0.0	801.9	1170	
2160 min Summer	3.309	0.0	1061.4	1540	
2880 min Summer	2.578	0.0	1101.0	1960	
4320 min Summer	1.834	0.0	1169.3	2764	
5760 min Summer	1.454	0.0	1252.3	3512	
7200 min Summer	1.225	0.0	1317.7	4256	
8640 min Summer	1.071	0.0	1381.2	5008	
10080 min Summer	0.961	0.0	1441.7	5656	
15 min Winter	151.654	0.0	348.1	23	
30 min Winter	97.974	0.0	431.8	37	
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	100.547	0.547	5.6	593.5	O K
120 min Winter	100.641	0.641	5.6	714.2	O K
180 min Winter	100.690	0.690	5.6	778.9	O K
240 min Winter	100.719	0.719	5.7	818.3	Flood Risk
360 min Winter	100.748	0.748	5.8	858.2	Flood Risk
480 min Winter	100.758	0.758	5.8	872.2	Flood Risk
600 min Winter	100.759	0.759	5.8	873.7	Flood Risk
720 min Winter	100.755	0.755	5.8	868.1	Flood Risk
960 min Winter	100.739	0.739	5.7	845.2	Flood Risk
1440 min Winter	100.693	0.693	5.6	783.8	O K
2160 min Winter	100.635	0.635	5.6	706.5	O K
2880 min Winter	100.583	0.583	5.6	638.9	O K
4320 min Winter	100.482	0.482	5.6	514.3	O K
5760 min Winter	100.384	0.384	5.6	398.2	O K
7200 min Winter	100.306	0.306	5.6	310.6	O K
8640 min Winter	100.243	0.243	5.6	242.8	O K
10080 min Winter	100.196	0.196	5.6	193.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	590.7	66	
120 min Winter	36.913	0.0	718.2	124	
180 min Winter	27.268	0.0	789.4	184	
240 min Winter	21.821	0.0	834.1	242	
360 min Winter	15.737	0.0	879.4	358	
480 min Winter	12.370	0.0	890.7	474	
600 min Winter	10.223	0.0	885.8	590	
720 min Winter	8.729	0.0	877.9	702	
960 min Winter	6.777	0.0	859.7	924	
1440 min Winter	4.731	0.0	820.2	1330	
2160 min Winter	3.309	0.0	1188.4	1648	
2880 min Winter	2.578	0.0	1232.2	2108	
4320 min Winter	1.834	0.0	1305.5	3028	
5760 min Winter	1.454	0.0	1403.0	3752	
7200 min Winter	1.225	0.0	1476.5	4472	
8640 min Winter	1.071	0.0	1547.9	5184	
10080 min Winter	0.961	0.0	1616.7	5840	
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WSP Group Ltd				Page 1	
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XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	102.330	0.330	9.4	509.7	O K
30 min Summer	102.416	0.416	9.4	655.5	O K
60 min Summer	102.499	0.499	9.4	799.9	O K
120 min Summer	102.587	0.587	9.4	961.1	O K
180 min Summer	102.633	0.633	9.4	1045.4	O K
240 min Summer	102.659	0.659	9.4	1095.0	O K
360 min Summer	102.683	0.683	9.4	1142.1	O K
480 min Summer	102.689	0.689	9.4	1153.9	O K
600 min Summer	102.687	0.687	9.4	1149.0	O K
720 min Summer	102.679	0.679	9.4	1134.5	O K
960 min Summer	102.657	0.657	9.4	1091.4	O K
1440 min Summer	102.616	0.616	9.4	1014.1	O K
2160 min Summer	102.564	0.564	9.4	918.9	O K
2880 min Summer	102.519	0.519	9.4	835.9	O K
4320 min Summer	102.436	0.436	9.4	689.1	O K
5760 min Summer	102.371	0.371	9.4	577.8	O K
7200 min Summer	102.319	0.319	9.4	491.0	O K
8640 min Summer	102.277	0.277	9.4	422.6	O K
10080 min Summer	102.244	0.244	9.4	369.8	O K
15 min Winter	102.367	0.367	9.4	571.6	O K
30 min Winter	102.462	0.462	9.4	735.7	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	466.1	23	
30 min Summer	97.974	0.0	598.4	37	
60 min Summer	60.354	0.0	796.1	68	
120 min Summer	36.913	0.0	972.7	126	
180 min Summer	27.268	0.0	1075.4	186	
240 min Summer	21.821	0.0	1144.6	246	
360 min Summer	15.737	0.0	1231.7	364	
480 min Summer	12.370	0.0	1283.7	484	
600 min Summer	10.223	0.0	1317.8	602	
720 min Summer	8.729	0.0	1340.8	722	
960 min Summer	6.777	0.0	1363.7	896	
1440 min Summer	4.731	0.0	1339.5	1116	
2160 min Summer	3.309	0.0	1606.7	1512	
2880 min Summer	2.578	0.0	1667.0	1928	
4320 min Summer	1.834	0.0	1771.1	2684	
5760 min Summer	1.454	0.0	1897.3	3456	
7200 min Summer	1.225	0.0	1995.9	4176	
8640 min Summer	1.071	0.0	2091.2	4848	
10080 min Summer	0.961	0.0	2181.2	5552	
15 min Winter	151.654	0.0	522.0	23	
30 min Winter	97.974	0.0	662.2	37	
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WSP Group Ltd				Page 2	
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.		DEVELOPMENT CREEP			
Date 22/04/2020		Designed by PS			
File Catchment O_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	102.553	0.553	9.4	898.5	O K
120 min Winter	102.651	0.651	9.4	1080.0	O K
180 min Winter	102.701	0.701	9.4	1176.3	Flood Risk
240 min Winter	102.731	0.731	9.6	1234.0	Flood Risk
360 min Winter	102.759	0.759	9.8	1291.0	Flood Risk
480 min Winter	102.768	0.768	9.8	1308.5	Flood Risk
600 min Winter	102.768	0.768	9.8	1307.3	Flood Risk
720 min Winter	102.762	0.762	9.8	1295.5	Flood Risk
960 min Winter	102.741	0.741	9.7	1254.8	Flood Risk
1440 min Winter	102.690	0.690	9.4	1156.0	O K
2160 min Winter	102.628	0.628	9.4	1036.8	O K
2880 min Winter	102.569	0.569	9.4	926.6	O K
4320 min Winter	102.449	0.449	9.4	712.4	O K
5760 min Winter	102.349	0.349	9.4	541.5	O K
7200 min Winter	102.272	0.272	9.4	413.8	O K
8640 min Winter	102.215	0.215	9.4	323.0	O K
10080 min Winter	102.176	0.176	9.2	262.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	891.6	66	
120 min Winter	36.913	0.0	1087.3	124	
180 min Winter	27.268	0.0	1200.0	182	
240 min Winter	21.821	0.0	1274.7	242	
360 min Winter	15.737	0.0	1365.5	358	
480 min Winter	12.370	0.0	1415.3	474	
600 min Winter	10.223	0.0	1443.0	588	
720 min Winter	8.729	0.0	1455.4	700	
960 min Winter	6.777	0.0	1446.5	918	
1440 min Winter	4.731	0.0	1374.7	1172	
2160 min Winter	3.309	0.0	1799.5	1624	
2880 min Winter	2.578	0.0	1866.4	2080	
4320 min Winter	1.834	0.0	1982.5	2904	
5760 min Winter	1.454	0.0	2125.9	3640	
7200 min Winter	1.225	0.0	2236.8	4328	
8640 min Winter	1.071	0.0	2344.2	5008	
10080 min Winter	0.961	0.0	2446.7	5552	
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WSP Group Ltd		Page 3																																				
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<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> </tr> <tr> <td>Site Location</td> <td>GB 483669 232428 SP 83669 32428</td> </tr> <tr> <td>Data Type</td> <td>Point</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> </tr> <tr> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 1.820 <table> <thead> <tr> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> </tr> <tr> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0 4</td> <td>0.910</td> <td>4 8</td> <td>0.910</td> </tr> </tbody> </table>			Rainfall Model	FEH	Return Period (years)	100	FEH Rainfall Version	2013	Site Location	GB 483669 232428 SP 83669 32428	Data Type	Point	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	0.750	Cv (Winter)	0.840	Shortest Storm (mins)	15	Longest Storm (mins)	10080	Climate Change %	+40	Time (mins)	Area	Time (mins)	Area	From: To:	(ha)	From: To:	(ha)	0 4	0.910	4 8	0.910
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Model Details Storage is Online Cover Level (m) 103.000 Tank or Pond Structure Invert Level (m) 102.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>1430.0</td><td>1.000</td><td>2180.0</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0146-9400-0700-9400 Design Head (m) 0.700 Design Flow (l/s) 9.4 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 146 Invert Level (m) 102.000 Minimum Outlet Pipe Diameter (mm) 225 Suggested Manhole Diameter (mm) 1200 Control Points <table><tr><th></th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>0.700</td><td>9.4</td></tr><tr><td>Flush-Flo™</td><td>0.242</td><td>9.4</td></tr><tr><td>Kick-Flo®</td><td>0.510</td><td>8.1</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>7.8</td></tr></table> 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 <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>5.3</td><td>1.200</td><td>12.1</td><td>3.000</td><td>18.7</td><td>7.000</td><td>28.2</td></tr><tr><td>0.200</td><td>9.3</td><td>1.400</td><td>13.0</td><td>3.500</td><td>20.2</td><td>7.500</td><td>29.0</td></tr><tr><td>0.300</td><td>9.3</td><td>1.600</td><td>13.9</td><td>4.000</td><td>21.5</td><td>8.000</td><td>30.0</td></tr><tr><td>0.400</td><td>9.0</td><td>1.800</td><td>14.7</td><td>4.500</td><td>22.8</td><td>8.500</td><td>30.9</td></tr><tr><td>0.500</td><td>8.3</td><td>2.000</td><td>15.4</td><td>5.000</td><td>23.9</td><td>9.000</td><td>31.8</td></tr><tr><td>0.600</td><td>8.7</td><td>2.200</td><td>16.2</td><td>5.500</td><td>25.1</td><td>9.500</td><td>32.7</td></tr><tr><td>0.800</td><td>10.0</td><td>2.400</td><td>16.8</td><td>6.000</td><td>26.1</td><td></td><td></td></tr><tr><td>1.000</td><td>11.1</td><td>2.600</td><td>17.5</td><td>6.500</td><td>27.2</td><td></td><td></td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	1430.0	1.000	2180.0		Head (m)	Flow (l/s)	Design Point (Calculated)	0.700	9.4	Flush-Flo™	0.242	9.4	Kick-Flo®	0.510	8.1	Mean Flow over Head Range	-	7.8	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	5.3	1.200	12.1	3.000	18.7	7.000	28.2	0.200	9.3	1.400	13.0	3.500	20.2	7.500	29.0	0.300	9.3	1.600	13.9	4.000	21.5	8.000	30.0	0.400	9.0	1.800	14.7	4.500	22.8	8.500	30.9	0.500	8.3	2.000	15.4	5.000	23.9	9.000	31.8	0.600	8.7	2.200	16.2	5.500	25.1	9.500	32.7	0.800	10.0	2.400	16.8	6.000	26.1			1.000	11.1	2.600	17.5	6.500	27.2		
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WSP Group Ltd				Page 1	
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Date 12/05/2020		Designed by PS			
File Catchment P_001.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³) Status
15 min Summer		106.178	0.178	5.4	371.4 O K
30 min Summer		106.228	0.228	5.4	477.9 O K
60 min Summer		106.276	0.276	5.4	584.3 O K
120 min Summer		106.331	0.331	5.4	705.2 O K
180 min Summer		106.361	0.361	5.4	771.5 O K
240 min Summer		106.379	0.379	5.4	812.9 O K
360 min Summer		106.399	0.399	5.4	857.8 O K
480 min Summer		106.407	0.407	5.4	876.9 O K
600 min Summer		106.410	0.410	5.4	883.4 O K
720 min Summer		106.410	0.410	5.4	882.3 O K
960 min Summer		106.403	0.403	5.4	867.0 O K
1440 min Summer		106.382	0.382	5.4	819.6 O K
2160 min Summer		106.357	0.357	5.4	763.8 O K
2880 min Summer		106.337	0.337	5.4	718.0 O K
4320 min Summer		106.302	0.302	5.4	641.3 O K
5760 min Summer		106.273	0.273	5.4	577.4 O K
7200 min Summer		106.250	0.250	5.4	525.3 O K
8640 min Summer		106.229	0.229	5.4	481.5 O K
10080 min Summer		106.212	0.212	5.4	445.0 O K
15 min Winter		106.199	0.199	5.4	416.2 O K
30 min Winter		106.254	0.254	5.4	536.0 O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer		151.654	0.0	283.7	23
30 min Summer		97.974	0.0	364.6	38
60 min Summer		60.354	0.0	538.2	68
120 min Summer		36.913	0.0	655.5	126
180 min Summer		27.268	0.0	719.9	186
240 min Summer		21.821	0.0	760.2	246
360 min Summer		15.737	0.0	804.4	366
480 min Summer		12.370	0.0	823.7	484
600 min Summer		10.223	0.0	830.4	604
720 min Summer		8.729	0.0	829.5	722
960 min Summer		6.777	0.0	814.9	962
1440 min Summer		4.731	0.0	769.5	1242
2160 min Summer		3.309	0.0	1129.5	1580
2880 min Summer		2.578	0.0	1166.3	1964
4320 min Summer		1.834	0.0	1216.2	2768
5760 min Summer		1.454	0.0	1363.2	3568
7200 min Summer		1.225	0.0	1432.6	4328
8640 min Summer		1.071	0.0	1497.8	5096
10080 min Summer		0.961	0.0	1555.6	5848
15 min Winter		151.654	0.0	318.8	23
30 min Winter		97.974	0.0	400.9	37
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT P			
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Date 12/05/2020		Designed by PS			
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	106.309	0.309	5.4	655.7	O K
120 min Winter	106.370	0.370	5.4	792.2	O K
180 min Winter	106.403	0.403	5.4	867.7	O K
240 min Winter	106.424	0.424	5.4	915.4	O K
360 min Winter	106.447	0.447	5.4	968.6	O K
480 min Winter	106.458	0.458	5.4	992.9	O K
600 min Winter	106.462	0.462	5.4	1003.2	O K
720 min Winter	106.463	0.463	5.4	1005.1	O K
960 min Winter	106.458	0.458	5.4	994.0	O K
1440 min Winter	106.438	0.438	5.4	947.2	O K
2160 min Winter	106.403	0.403	5.4	867.9	O K
2880 min Winter	106.376	0.376	5.4	805.2	O K
4320 min Winter	106.325	0.325	5.4	692.7	O K
5760 min Winter	106.281	0.281	5.4	595.0	O K
7200 min Winter	106.244	0.244	5.4	513.7	O K
8640 min Winter	106.213	0.213	5.4	446.7	O K
10080 min Winter	106.188	0.188	5.4	392.4	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	602.7	66	
120 min Winter	36.913	0.0	728.3	124	
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240 min Winter	21.821	0.0	828.7	242	
360 min Winter	15.737	0.0	856.5	360	
480 min Winter	12.370	0.0	856.5	476	
600 min Winter	10.223	0.0	846.3	594	
720 min Winter	8.729	0.0	834.9	708	
960 min Winter	6.777	0.0	813.0	936	
1440 min Winter	4.731	0.0	771.9	1372	
2160 min Winter	3.309	0.0	1261.3	1712	
2880 min Winter	2.578	0.0	1300.2	2140	
4320 min Winter	1.834	0.0	1345.4	3028	
5760 min Winter	1.454	0.0	1528.1	3856	
7200 min Winter	1.225	0.0	1606.7	4616	
8640 min Winter	1.071	0.0	1680.9	5360	
10080 min Winter	0.961	0.0	1747.9	6056	
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WSP Group Ltd		Page 3																																				
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Site Location	GB 483669 232428 SP 83669 32428																																					
Data Type	Point																																					
Summer Storms	Yes																																					
Winter Storms	Yes																																					
Cv (Summer)	0.750																																					
Cv (Winter)	0.840																																					
Shortest Storm (mins)	15																																					
Longest Storm (mins)	10080																																					
Climate Change %	+40																																					
Time (mins)	Area	Time (mins)	Area																																			
From: To:	(ha)	From: To:	(ha)																																			
0 4	0.660	4 8	0.660																																			
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XP Solutions	Source Control 2019.1																																																																																																
Model Details Storage is Online Cover Level (m) 107.000 Tank or Pond Structure Invert Level (m) 106.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>2030.0</td><td>1.000</td><td>2670.0</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0114-5400-0700-5400 Design Head (m) 0.700 Design Flow (l/s) 5.4 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 114 Invert Level (m) 106.000 Minimum Outlet Pipe Diameter (mm) 150 Suggested Manhole Diameter (mm) 1200 <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>0.700</td><td>5.4</td></tr><tr><td>Flush-Flo™</td><td>0.216</td><td>5.4</td></tr><tr><td>Kick-Flo®</td><td>0.486</td><td>4.6</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>4.6</td></tr></table> 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 <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>4.0</td><td>1.200</td><td>6.9</td><td>3.000</td><td>10.7</td><td>7.000</td><td>16.0</td></tr><tr><td>0.200</td><td>5.4</td><td>1.400</td><td>7.5</td><td>3.500</td><td>11.5</td><td>7.500</td><td>16.5</td></tr><tr><td>0.300</td><td>5.3</td><td>1.600</td><td>7.9</td><td>4.000</td><td>12.2</td><td>8.000</td><td>17.1</td></tr><tr><td>0.400</td><td>5.1</td><td>1.800</td><td>8.4</td><td>4.500</td><td>13.0</td><td>8.500</td><td>17.6</td></tr><tr><td>0.500</td><td>4.6</td><td>2.000</td><td>8.8</td><td>5.000</td><td>13.6</td><td>9.000</td><td>18.1</td></tr><tr><td>0.600</td><td>5.0</td><td>2.200</td><td>9.2</td><td>5.500</td><td>14.3</td><td>9.500</td><td>18.6</td></tr><tr><td>0.800</td><td>5.7</td><td>2.400</td><td>9.6</td><td>6.000</td><td>14.9</td><td></td><td></td></tr><tr><td>1.000</td><td>6.4</td><td>2.600</td><td>10.0</td><td>6.500</td><td>15.4</td><td></td><td></td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	2030.0	1.000	2670.0	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	0.700	5.4	Flush-Flo™	0.216	5.4	Kick-Flo®	0.486	4.6	Mean Flow over Head Range	-	4.6	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	4.0	1.200	6.9	3.000	10.7	7.000	16.0	0.200	5.4	1.400	7.5	3.500	11.5	7.500	16.5	0.300	5.3	1.600	7.9	4.000	12.2	8.000	17.1	0.400	5.1	1.800	8.4	4.500	13.0	8.500	17.6	0.500	4.6	2.000	8.8	5.000	13.6	9.000	18.1	0.600	5.0	2.200	9.2	5.500	14.3	9.500	18.6	0.800	5.7	2.400	9.6	6.000	14.9			1.000	6.4	2.600	10.0	6.500	15.4		
Depth (m)	Area (m²)	Depth (m)	Area (m²)																																																																																														
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0.500	4.6	2.000	8.8	5.000	13.6	9.000	18.1																																																																																										
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WSP Group Ltd				Page 1		
.		SWMK				
.		CATCHMENT Q				
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Date 12/05/2020		Designed by PS				
File Catchment Q_001.srcx		Checked by AC				
XP Solutions		Source Control 2019.1				
Summary of Results for 100 year Return Period						
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer		94.152	0.152	11.4	602.3	O K
30 min Summer		94.194	0.194	13.7	772.3	O K
60 min Summer		94.235	0.235	13.9	940.4	O K
120 min Summer		94.281	0.281	13.9	1127.5	O K
180 min Summer		94.305	0.305	13.9	1225.6	O K
240 min Summer		94.318	0.318	13.9	1283.5	O K
360 min Summer		94.331	0.331	13.9	1337.4	O K
480 min Summer		94.334	0.334	13.9	1349.5	O K
600 min Summer		94.332	0.332	13.9	1340.9	O K
720 min Summer		94.328	0.328	13.9	1321.9	O K
960 min Summer		94.319	0.319	13.9	1284.6	O K
1440 min Summer		94.302	0.302	13.9	1216.7	O K
2160 min Summer		94.280	0.280	13.9	1125.2	O K
2880 min Summer		94.261	0.261	13.9	1043.8	O K
4320 min Summer		94.228	0.228	13.9	909.1	O K
5760 min Summer		94.203	0.203	13.7	806.5	O K
7200 min Summer		94.184	0.184	13.6	732.3	O K
8640 min Summer		94.172	0.172	13.1	683.9	O K
10080 min Summer		94.164	0.164	12.4	649.3	O K
15 min Winter		94.170	0.170	12.9	674.4	O K
30 min Winter		94.217	0.217	13.8	866.2	O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer		108.324	0.0	416.2	23	
30 min Summer		69.981	0.0	566.9	37	
60 min Summer		43.110	0.0	843.8	66	
120 min Summer		26.366	0.0	1045.9	126	
180 min Summer		19.477	0.0	1163.4	186	
240 min Summer		15.586	0.0	1242.6	244	
360 min Summer		11.241	0.0	1343.0	364	
480 min Summer		8.836	0.0	1403.9	482	
600 min Summer		7.302	0.0	1445.2	600	
720 min Summer		6.235	0.0	1475.0	674	
960 min Summer		4.841	0.0	1513.3	770	
1440 min Summer		3.379	0.0	1547.6	1012	
2160 min Summer		2.364	0.0	1820.4	1408	
2880 min Summer		1.842	0.0	1883.5	1816	
4320 min Summer		1.310	0.0	1974.2	2592	
5760 min Summer		1.038	0.0	2194.2	3296	
7200 min Summer		0.875	0.0	2302.4	4032	
8640 min Summer		0.765	0.0	2402.3	4752	
10080 min Summer		0.687	0.0	2487.6	5448	
15 min Winter		108.324	0.0	478.7	22	
30 min Winter		69.981	0.0	645.4	37	
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT Q			
.		DEVELOPMENT CREEP			
Date 12/05/2020		Designed by PS			
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XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	94.264	0.264	13.9	1056.0	O K
120 min Winter	94.315	0.315	13.9	1268.2	O K
180 min Winter	94.342	0.342	13.9	1381.0	O K
240 min Winter	94.358	0.358	13.9	1448.4	O K
360 min Winter	94.374	0.374	13.9	1514.5	O K
480 min Winter	94.378	0.378	13.9	1533.9	O K
600 min Winter	94.378	0.378	13.9	1530.7	O K
720 min Winter	94.374	0.374	13.9	1514.7	O K
960 min Winter	94.361	0.361	13.9	1461.6	O K
1440 min Winter	94.337	0.337	13.9	1362.3	O K
2160 min Winter	94.305	0.305	13.9	1226.5	O K
2880 min Winter	94.275	0.275	13.9	1102.1	O K
4320 min Winter	94.225	0.225	13.8	899.3	O K
5760 min Winter	94.190	0.190	13.6	755.0	O K
7200 min Winter	94.169	0.169	12.8	672.6	O K
8640 min Winter	94.156	0.156	11.8	619.2	O K
10080 min Winter	94.146	0.146	10.9	579.6	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	43.110	0.0	953.6	66	
120 min Winter	26.366	0.0	1178.2	124	
180 min Winter	19.477	0.0	1308.3	182	
240 min Winter	15.586	0.0	1395.6	240	
360 min Winter	11.241	0.0	1505.4	356	
480 min Winter	8.836	0.0	1571.4	470	
600 min Winter	7.302	0.0	1615.8	584	
720 min Winter	6.235	0.0	1647.3	692	
960 min Winter	4.841	0.0	1686.5	896	
1440 min Winter	3.379	0.0	1716.5	1098	
2160 min Winter	2.364	0.0	2044.6	1540	
2880 min Winter	1.842	0.0	2116.2	1960	
4320 min Winter	1.310	0.0	2223.2	2728	
5760 min Winter	1.038	0.0	2463.0	3456	
7200 min Winter	0.875	0.0	2585.4	4112	
8640 min Winter	0.765	0.0	2699.2	4840	
10080 min Winter	0.687	0.0	2798.6	5552	
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WSP Group Ltd		Page 3																																				
. . .	SWMK CATCHMENT Q DEVELOPMENT CREEP																																					
Date 12/05/2020 File Catchment Q_001.srcx	Designed by PS Checked by AC																																					
XP Solutions Source Control 2019.1																																						
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> </tr> <tr> <td>Site Location</td> <td>GB 483669 232428 SP 83669 32428</td> </tr> <tr> <td>Data Type</td> <td>Point</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> </tr> <tr> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Climate Change %</td> <td>+0</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 3.000 <table> <thead> <tr> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> </tr> <tr> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0 4</td> <td>1.500</td> <td>4 8</td> <td>1.500</td> </tr> </tbody> </table>			Rainfall Model	FEH	Return Period (years)	100	FEH Rainfall Version	2013	Site Location	GB 483669 232428 SP 83669 32428	Data Type	Point	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	0.750	Cv (Winter)	0.840	Shortest Storm (mins)	15	Longest Storm (mins)	10080	Climate Change %	+0	Time (mins)	Area	Time (mins)	Area	From: To:	(ha)	From: To:	(ha)	0 4	1.500	4 8	1.500
Rainfall Model	FEH																																					
Return Period (years)	100																																					
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Time (mins)	Area	Time (mins)	Area																																			
From: To:	(ha)	From: To:	(ha)																																			
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WSP Group Ltd		Page 4
. . .	SWMK CATCHMENT Q DEVELOPMENT CREEP	
Date 12/05/2020 File Catchment Q_001.srcx	Designed by PS Checked by AC	
XP Solutions Source Control 2019.1		

Model Details

Storage is Online Cover Level (m) 95.000

Tank or Pond Structure

Invert Level (m) 94.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	3900.0	1.000	4750.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0173-1400-0700-1400
Design Head (m)	0.700
Design Flow (l/s)	14.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	173
Invert Level (m)	94.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	14.0
Flush-Flo™	0.272	13.9
Kick-Flo®	0.527	12.2
Mean Flow over Head Range	-	11.4

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	6.1	1.200	18.1	3.000	28.0	7.000	42.2
0.200	13.7	1.400	19.4	3.500	30.2	7.500	43.4
0.300	13.9	1.600	20.7	4.000	32.2	8.000	44.9
0.400	13.6	1.800	21.9	4.500	34.1	8.500	46.3
0.500	12.7	2.000	23.1	5.000	35.8	9.000	47.6
0.600	13.0	2.200	24.1	5.500	37.5	9.500	48.9
0.800	14.9	2.400	25.2	6.000	39.1		
1.000	16.6	2.600	26.2	6.500	40.7		

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.			CATCHMENT R			
.			DEVELOPMENT CREEP			
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File Catchment R_002.srcx			Checked by AC			
XP Solutions			Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>						
	Storm		Max	Max	Max	Status
	Event		Level	Depth	Control	
			(m)	(m)	(l/s)	Volume
						(m³)
	15 min Summer	97.307	0.307	13.1	777.2	O K
	30 min Summer	97.390	0.390	13.1	999.9	O K
	60 min Summer	97.471	0.471	13.1	1221.2	O K
	120 min Summer	97.560	0.560	13.1	1471.7	O K
	180 min Summer	97.607	0.607	13.1	1605.5	O K
	240 min Summer	97.635	0.635	13.1	1686.2	O K
	360 min Summer	97.662	0.662	13.1	1767.7	O K
	480 min Summer	97.672	0.672	13.1	1795.2	O K
	600 min Summer	97.672	0.672	13.1	1796.7	O K
	720 min Summer	97.668	0.668	13.1	1783.4	O K
	960 min Summer	97.650	0.650	13.1	1731.6	O K
	1440 min Summer	97.613	0.613	13.1	1623.9	O K
	2160 min Summer	97.567	0.567	13.1	1493.2	O K
	2880 min Summer	97.527	0.527	13.1	1377.6	O K
	4320 min Summer	97.454	0.454	13.1	1173.8	O K
	5760 min Summer	97.395	0.395	13.1	1014.4	O K
	7200 min Summer	97.349	0.349	13.1	888.4	O K
	8640 min Summer	97.310	0.310	13.1	786.4	O K
	10080 min Summer	97.279	0.279	13.1	705.0	O K
	15 min Winter	97.342	0.342	13.1	871.4	O K
	30 min Winter	97.435	0.435	13.1	1121.9	O K
	Storm		Rain	Flooded	Discharge	Time-Peak
	Event		(mm/hr)	Volume	Volume	(mins)
				(m³)	(m³)	
	15 min Summer	151.654	0.0	666.6	23	
	30 min Summer	97.974	0.0	856.1	37	
	60 min Summer	60.354	0.0	1183.1	68	
	120 min Summer	36.913	0.0	1443.7	126	
	180 min Summer	27.268	0.0	1592.5	186	
	240 min Summer	21.821	0.0	1690.8	246	
	360 min Summer	15.737	0.0	1810.2	364	
	480 min Summer	12.370	0.0	1876.5	484	
	600 min Summer	10.223	0.0	1915.2	602	
	720 min Summer	8.729	0.0	1935.9	722	
	960 min Summer	6.777	0.0	1939.3	956	
	1440 min Summer	4.731	0.0	1846.5	1160	
	2160 min Summer	3.309	0.0	2420.9	1540	
	2880 min Summer	2.578	0.0	2508.5	1960	
	4320 min Summer	1.834	0.0	2654.1	2724	
	5760 min Summer	1.454	0.0	2878.8	3512	
	7200 min Summer	1.225	0.0	3027.1	4248	
	8640 min Summer	1.071	0.0	3168.9	4936	
	10080 min Summer	0.961	0.0	3299.4	5648	
	15 min Winter	151.654	0.0	747.4	23	
	30 min Winter	97.974	0.0	945.3	37	
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WSP Group Ltd				Page 2	
.		SWMK			
.		CATCHMENT R			
.		DEVELOPMENT CREEP			
Date 21/04/2020		Designed by PS			
File Catchment R_002.srcx		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	97.524	0.524	13.1	1371.5	O K
120 min Winter	97.623	0.623	13.1	1652.9	O K
180 min Winter	97.675	0.675	13.1	1804.5	O K
240 min Winter	97.707	0.707	13.2	1897.3	Flood Risk
360 min Winter	97.739	0.739	13.4	1993.4	Flood Risk
480 min Winter	97.751	0.751	13.5	2029.3	Flood Risk
600 min Winter	97.753	0.753	13.6	2036.2	Flood Risk
720 min Winter	97.750	0.750	13.5	2026.6	Flood Risk
960 min Winter	97.734	0.734	13.4	1980.0	Flood Risk
1440 min Winter	97.690	0.690	13.1	1849.0	O K
2160 min Winter	97.634	0.634	13.1	1684.5	O K
2880 min Winter	97.582	0.582	13.1	1535.0	O K
4320 min Winter	97.478	0.478	13.1	1241.2	O K
5760 min Winter	97.388	0.388	13.1	994.9	O K
7200 min Winter	97.317	0.317	13.1	803.2	O K
8640 min Winter	97.261	0.261	13.1	656.9	O K
10080 min Winter	97.220	0.220	13.0	550.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	1324.9	66	
120 min Winter	36.913	0.0	1610.6	124	
180 min Winter	27.268	0.0	1770.4	184	
240 min Winter	21.821	0.0	1872.3	242	
360 min Winter	15.737	0.0	1986.8	358	
480 min Winter	12.370	0.0	2037.9	474	
600 min Winter	10.223	0.0	2054.2	590	
720 min Winter	8.729	0.0	2048.0	702	
960 min Winter	6.777	0.0	2002.5	924	
1440 min Winter	4.731	0.0	1894.0	1326	
2160 min Winter	3.309	0.0	2710.6	1644	
2880 min Winter	2.578	0.0	2806.1	2108	
4320 min Winter	1.834	0.0	2963.9	2980	
5760 min Winter	1.454	0.0	3226.5	3744	
7200 min Winter	1.225	0.0	3393.6	4464	
8640 min Winter	1.071	0.0	3553.8	5104	
10080 min Winter	0.961	0.0	3703.7	5752	
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Model Details Storage is Online Cover Level (m) 98.000 Tank or Pond Structure Invert Level (m) 97.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>2420.0</td><td>1.000</td><td>3200.0</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0168-1310-0700-1310 Design Head (m) 0.700 Design Flow (l/s) 13.1 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 168 Invert Level (m) 97.000 Minimum Outlet Pipe Diameter (mm) 225 Suggested Manhole Diameter (mm) 1200 <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>0.700</td><td>13.1</td></tr><tr><td>Flush-Flo™</td><td>0.267</td><td>13.1</td></tr><tr><td>Kick-Flo®</td><td>0.526</td><td>11.4</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>10.8</td></tr></table> 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 <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>6.0</td><td>1.200</td><td>16.9</td><td>3.000</td><td>26.2</td><td>7.000</td><td>39.4</td></tr><tr><td>0.200</td><td>12.9</td><td>1.400</td><td>18.2</td><td>3.500</td><td>28.2</td><td>7.500</td><td>40.6</td></tr><tr><td>0.300</td><td>13.1</td><td>1.600</td><td>19.4</td><td>4.000</td><td>30.1</td><td>8.000</td><td>41.9</td></tr><tr><td>0.400</td><td>12.7</td><td>1.800</td><td>20.5</td><td>4.500</td><td>31.9</td><td>8.500</td><td>43.3</td></tr><tr><td>0.500</td><td>11.9</td><td>2.000</td><td>21.6</td><td>5.000</td><td>33.5</td><td>9.000</td><td>44.5</td></tr><tr><td>0.600</td><td>12.2</td><td>2.200</td><td>22.6</td><td>5.500</td><td>35.1</td><td>9.500</td><td>45.8</td></tr><tr><td>0.800</td><td>13.9</td><td>2.400</td><td>23.5</td><td>6.000</td><td>36.6</td><td></td><td></td></tr><tr><td>1.000</td><td>15.5</td><td>2.600</td><td>24.5</td><td>6.500</td><td>38.1</td><td></td><td></td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	2420.0	1.000	3200.0	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	0.700	13.1	Flush-Flo™	0.267	13.1	Kick-Flo®	0.526	11.4	Mean Flow over Head Range	-	10.8	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	16.9	3.000	26.2	7.000	39.4	0.200	12.9	1.400	18.2	3.500	28.2	7.500	40.6	0.300	13.1	1.600	19.4	4.000	30.1	8.000	41.9	0.400	12.7	1.800	20.5	4.500	31.9	8.500	43.3	0.500	11.9	2.000	21.6	5.000	33.5	9.000	44.5	0.600	12.2	2.200	22.6	5.500	35.1	9.500	45.8	0.800	13.9	2.400	23.5	6.000	36.6			1.000	15.5	2.600	24.5	6.500	38.1		
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File CATCHMENT S_001.SRCX		Checked by AC			
XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	95.259	0.259	7.5	448.9	O K
30 min Summer	95.329	0.329	7.5	577.6	O K
60 min Summer	95.397	0.397	7.5	705.2	O K
120 min Summer	95.472	0.472	7.5	849.4	O K
180 min Summer	95.512	0.512	7.5	928.0	O K
240 min Summer	95.536	0.536	7.5	975.9	O K
360 min Summer	95.560	0.560	7.5	1024.8	O K
480 min Summer	95.569	0.569	7.5	1042.4	O K
600 min Summer	95.570	0.570	7.5	1044.9	O K
720 min Summer	95.567	0.567	7.5	1038.7	O K
960 min Summer	95.553	0.553	7.5	1011.5	O K
1440 min Summer	95.520	0.520	7.5	945.2	O K
2160 min Summer	95.477	0.477	7.5	859.3	O K
2880 min Summer	95.440	0.440	7.5	788.3	O K
4320 min Summer	95.381	0.381	7.5	675.1	O K
5760 min Summer	95.333	0.333	7.5	584.7	O K
7200 min Summer	95.294	0.294	7.5	512.7	O K
8640 min Summer	95.262	0.262	7.5	453.8	O K
10080 min Summer	95.236	0.236	7.5	407.0	O K
15 min Winter	95.289	0.289	7.5	503.3	O K
30 min Winter	95.367	0.367	7.5	648.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	388.2	23	
30 min Summer	97.974	0.0	497.4	37	
60 min Summer	60.354	0.0	685.9	68	
120 min Summer	36.913	0.0	837.1	126	
180 min Summer	27.268	0.0	922.7	186	
240 min Summer	21.821	0.0	978.6	246	
360 min Summer	15.737	0.0	1045.6	364	
480 min Summer	12.370	0.0	1081.4	484	
600 min Summer	10.223	0.0	1100.7	604	
720 min Summer	8.729	0.0	1109.3	722	
960 min Summer	6.777	0.0	1103.6	960	
1440 min Summer	4.731	0.0	1045.6	1214	
2160 min Summer	3.309	0.0	1400.7	1556	
2880 min Summer	2.578	0.0	1452.0	1932	
4320 min Summer	1.834	0.0	1536.0	2724	
5760 min Summer	1.454	0.0	1663.8	3512	
7200 min Summer	1.225	0.0	1749.7	4248	
8640 min Summer	1.071	0.0	1831.9	4936	
10080 min Summer	0.961	0.0	1908.0	5656	
15 min Winter	151.654	0.0	434.9	23	
30 min Winter	97.974	0.0	548.3	37	
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.		DEVELOPMENT CREEP			
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	95.442	0.442	7.5	791.9	O K
120 min Winter	95.525	0.525	7.5	955.4	O K
180 min Winter	95.570	0.570	7.5	1044.1	O K
240 min Winter	95.596	0.596	7.5	1098.6	O K
360 min Winter	95.624	0.624	7.5	1155.9	O K
480 min Winter	95.635	0.635	7.5	1178.3	O K
600 min Winter	95.638	0.638	7.5	1183.9	O K
720 min Winter	95.636	0.636	7.5	1179.9	O K
960 min Winter	95.624	0.624	7.5	1155.5	O K
1440 min Winter	95.589	0.589	7.5	1083.2	O K
2160 min Winter	95.538	0.538	7.5	980.8	O K
2880 min Winter	95.491	0.491	7.5	886.5	O K
4320 min Winter	95.402	0.402	7.5	714.0	O K
5760 min Winter	95.328	0.328	7.5	575.5	O K
7200 min Winter	95.268	0.268	7.5	465.8	O K
8640 min Winter	95.222	0.222	7.5	381.1	O K
10080 min Winter	95.186	0.186	7.4	318.6	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	768.1	66	
120 min Winter	36.913	0.0	932.8	124	
180 min Winter	27.268	0.0	1023.3	184	
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1440 min Winter	4.731	0.0	1059.5	1354	
2160 min Winter	3.309	0.0	1567.0	1672	
2880 min Winter	2.578	0.0	1623.4	2136	
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5760 min Winter	1.454	0.0	1864.6	3744	
7200 min Winter	1.225	0.0	1961.4	4464	
8640 min Winter	1.071	0.0	2054.3	5184	
10080 min Winter	0.961	0.0	2141.5	5760	
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WSP Group Ltd		Page 4																																																																																															
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Date 12/05/2020		Designed by PS			
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XP Solutions		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	96.286	0.286	28.3	1588.9	O K
30 min Summer	96.365	0.365	28.3	2039.3	O K
60 min Summer	96.442	0.442	28.3	2481.1	O K
120 min Summer	96.524	0.524	28.3	2963.0	O K
180 min Summer	96.565	0.565	28.3	3208.1	O K
240 min Summer	96.589	0.589	28.3	3345.2	O K
360 min Summer	96.607	0.607	28.3	3455.4	O K
480 min Summer	96.607	0.607	28.3	3455.4	O K
600 min Summer	96.598	0.598	28.3	3401.6	O K
720 min Summer	96.584	0.584	28.3	3317.6	O K
960 min Summer	96.547	0.547	28.3	3099.5	O K
1440 min Summer	96.488	0.488	28.3	2751.5	O K
2160 min Summer	96.426	0.426	28.3	2388.7	O K
2880 min Summer	96.375	0.375	28.3	2098.5	O K
4320 min Summer	96.297	0.297	28.3	1648.2	O K
5760 min Summer	96.234	0.234	28.3	1291.8	O K
7200 min Summer	96.182	0.182	28.3	1004.4	O K
8640 min Summer	96.141	0.141	28.3	773.8	O K
10080 min Summer	96.108	0.108	28.3	589.2	O K
15 min Winter	96.321	0.321	28.3	1784.3	O K
30 min Winter	96.409	0.409	28.3	2293.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	151.654	0.0	1624.4	23	
30 min Summer	97.974	0.0	2097.8	37	
60 min Summer	60.354	0.0	2585.9	68	
120 min Summer	36.913	0.0	3164.5	126	
180 min Summer	27.268	0.0	3508.0	186	
240 min Summer	21.821	0.0	3740.6	246	
360 min Summer	15.737	0.0	4047.6	364	
480 min Summer	12.370	0.0	4243.3	484	
600 min Summer	10.223	0.0	4382.7	602	
720 min Summer	8.729	0.0	4491.6	722	
960 min Summer	6.777	0.0	4646.8	954	
1440 min Summer	4.731	0.0	4512.9	1166	
2160 min Summer	3.309	0.0	5105.9	1536	
2880 min Summer	2.578	0.0	5303.6	1908	
4320 min Summer	1.834	0.0	5658.6	2688	
5760 min Summer	1.454	0.0	5988.0	3464	
7200 min Summer	1.225	0.0	6297.3	4184	
8640 min Summer	1.071	0.0	6613.5	4928	
10080 min Summer	0.961	0.0	6920.3	5640	
15 min Winter	151.654	0.0	1819.3	23	
30 min Winter	97.974	0.0	2351.8	37	
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	96.495	0.495	28.3	2793.5	O K
120 min Winter	96.589	0.589	28.3	3345.9	O K
180 min Winter	96.637	0.637	28.3	3632.8	O K
240 min Winter	96.665	0.665	28.3	3799.9	O K
360 min Winter	96.690	0.690	28.3	3949.2	O K
480 min Winter	96.694	0.694	28.3	3975.3	O K
600 min Winter	96.688	0.688	28.3	3942.5	O K
720 min Winter	96.677	0.677	28.3	3876.4	O K
960 min Winter	96.646	0.646	28.3	3690.0	O K
1440 min Winter	96.573	0.573	28.3	3255.3	O K
2160 min Winter	96.498	0.498	28.3	2812.2	O K
2880 min Winter	96.431	0.431	28.3	2419.6	O K
4320 min Winter	96.310	0.310	28.3	1723.1	O K
5760 min Winter	96.213	0.213	28.3	1176.1	O K
7200 min Winter	96.137	0.137	28.3	750.5	O K
8640 min Winter	96.078	0.078	28.3	426.5	O K
10080 min Winter	96.036	0.036	28.2	195.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	60.354	0.0	2898.3	66	
120 min Winter	36.913	0.0	3543.7	124	
180 min Winter	27.268	0.0	3928.8	182	
240 min Winter	21.821	0.0	4190.4	242	
360 min Winter	15.737	0.0	4532.6	358	
480 min Winter	12.370	0.0	4664.7	474	
600 min Winter	10.223	0.0	4655.6	588	
720 min Winter	8.729	0.0	4644.6	702	
960 min Winter	6.777	0.0	4617.4	924	
1440 min Winter	4.731	0.0	4543.6	1328	
2160 min Winter	3.309	0.0	5723.5	1648	
2880 min Winter	2.578	0.0	5940.5	2108	
4320 min Winter	1.834	0.0	6338.6	2936	
5760 min Winter	1.454	0.0	6705.7	3688	
7200 min Winter	1.225	0.0	7054.2	4400	
8640 min Winter	1.071	0.0	7404.7	5024	
10080 min Winter	0.961	0.0	7754.9	5648	
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Appendix C

CORRESPONDENCE

wsp



Directorate for Communities Highways and Technical Services

Service Director: Rob Smith
Buckinghamshire Council
The Gateway
Gatehouse Road
Aylesbury
HP19 8FF

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www.buckinghamshire.gov.uk

WSP
The Mailbox
Wharfside Street
Birmingham
B1 1RQ

20th April 2020

Dear Mr Grant,

Location: Off Weasel Lane, Milton Keynes
Proposal: A mixed-use sustainable urban extension on land to the south west of Milton Keynes to provide up to 1855 mixed tenure dwellings including 60 extra care units (C3); an employment area (B1) including provision for a 6GP surgery (D1); a neighbourhood centre including retail (A1/A2/A3/A4/A5), community (D1/D2) & residential (C3) uses; a primary school; a grid road reserve; multi-functional green space; a sustainable drainage system & associated access, drainage & public transport infrastructure

Thank you for the opportunity to provide pre-application advice for the above proposed development. It is understood that the purpose of this request is to understand the local flooding records within the site and the views of the Lead Local Flood Authority (LLFA) with regards to surface water management and our requirements for reviewing surface water management strategies at outline application stage. I have reviewed the information provided below:

- Indicative Surface Water Drainage Strategy (drawing no. 1442-D-003 Rev. P12, WSP)
- Development Framework Parameters Plan (drawing no. CSA/2955/114, Rev. E, CSA Environmental)

The following advice has been subdivided into the following sections for ease of reference:

- Overview of existing flood risk and historic flooding records
- Overview of surface water drainage proposals
- Connecting to an ordinary watercourse

Overview of existing flood risk and historic records

Surface water

The Flood Map for Surface Water (FMfSW) provided by the Environment Agency shows that the site lies in an area of very low to high risk of surface water flooding. An online version of this mapping data is available to view through the Environment Agency's [Long term flood risk information](#) mapping. The areas of high risk are associated with existing watercourses within the site boundary and along the existing railway line to the south of the site. These areas of surface water flood risk extend into medium to low risk events.

There are two extensive areas of surface water flood risk, one located at the junction of A421 Buckingham Road and Whaddon Road and the other near the footpath by the railway line. These areas also have an associated hazard rating of significant, meaning that this area is dangerous for most people; flood zone with deep fast flowing water.

The LLFA would strongly advise that a sequential approach is taken to locating development. The Development Framework Parameters Plan (drawing no. CSA/2955/114) indicates that the junction of A421 Buckingham Road and Whaddon Road will not be the main point of access; instead this will be located on the B4034 Buckingham Road via a new junction, therefore avoiding the area of significant hazard associated with surface water flooding. The area adjacent to the railway line is highlighted a potential route for a grid road. I would advise avoiding this area if possible to ensure that existing flood risk is not exacerbated and in line with the principles of the NPPF. If this area is identified for development, further discussions on mitigation measures will be required.

I would advise overlaying the FMfSW on the development proposals to identify any conflicts as it is noted that on the Indicative Surface Water Drainage Strategy, an existing watercourse present in Catchment B and C has not been included, in addition, it is unclear how the existing surface water overland flow routes are to be accommodated within the proposed Development Framework. I would like to highlight that development proposals should be designed with managing flood risk from the outset and ensuring that no dwellings are located within areas of existing flood risk.

In addition, the existing surface water flood risk should be taken into consideration when designing the surface water drainage scheme for the proposed development. In particular, SuDS components should not be located within areas of existing flood risk as floodwater may ingress and displace potential storage capacity for the surface water drainage system.

In relation to surface water flood records, the Council does not hold any records from this source of flooding in this area. I would advise contacting Milton Keynes Council to request any records of highway flooding for the A421 and B4034 Buckingham Road which falls within their boundary.

Groundwater

The Infiltration SuDS Map provided by the British Geological Survey 2016, indicates that the water table in this area is variable and can range from greater than 5m below the surface to less than 3m below the surface. Further site-specific investigations should be carried out to ascertain the depth to the water table across the site. This information should be used to inform the design of any sustainable drainage feature to ensure that there is a sufficient freeboard of 1m between any device and the water table to limit the potential capacity issues in times of high groundwater levels. Groundwater monitoring should take place over the winter period (October to March) in order to understand the seasonal fluctuations in groundwater levels.

In relation to groundwater flooding, the Council does not hold any records from this source of flooding in this location.

Requirement for a Flood Risk Assessment

As the application area is 144ha, the applicant is required to provide a Flood Risk Assessment (FRA) as stated in the section 14 of the National Planning Policy Framework (Footnote 50).

Overview of surface water drainage proposals

Indicative Surface Water Drainage Strategy (drawing no. 1442-D-003 Rev. P12) shows that the site will drain to two catchments, north and south, following the local topography. Prior to discharging to watercourses, surface water runoff will, in places, be conveyed by swales and then to strategic basins across the site. These SuDS features appear to sit outside the development parcels and so it is assumed that surface water will be collected using a traditional piped network. This approach is

discouraged and the surface water drainage strategy should seek to use interception components (such as permeable paving, green roofs and rainwater harvesting) prior to conveyance to the wider network. As part of a planning application, I would expect that above ground sustainable drainage features to be prioritised. This should be supported by a water quality assessment as per the guidance in the CIRIA SuDS Manual.

The surface water drainage strategy should also include details of greenfield runoff rates, which should be calculated using FEH methods. Storage calculations should demonstrate that for the 1 in 30 year event the system does not flood and any flooding occurring between the 1 in 30 year and 1 in 100 year plus 40% allowance for climate change is safely contained in the site. These calculations must include details of critical storm durations, and demonstrate how the proposed system as a whole will function during different storm events. Details of the existing and proposed discharge volumes should be shown for critical storm events and durations as detailed above along with the adopted approach to mitigate any increases in discharge volumes.

If any flooding occurs for the 1 in 100 year plus 40% climate change event, details of where this flooding will occur and the volume of the flooding must be provided. For rainfall events over the 1 in 100 plus 40% climate change allowance event, a drawing showing the direction of exceedance flows must be provided.

An urban creep value of 10% should be applied to surface water drainage schemes to take account of any future increases in impermeable areas within the site. For example, this includes patios, conservatories and small extensions (Section 24.7.2, CIRIA SuDS Manual, 2015).

The Lead Local Flood Authority promotes the use of rainwater harvesting and considers this approach to be ahead of the drainage hierarchy. Rainwater harvesting allows rainwater to be collected and used for non-potable water purposes, helping reduce dependency on potable water usage and act as an effective way of managing surface water. The Planning Practice Guidance (Paragraph 080) outlines a drainage hierarchy from which applicants should aim to discharge surface runoff as high up the hierarchy as reasonably practicable.

An indicative maintenance schedule for the surface water drainage system should be provided at outline planning stage. It should include the maintenance tasks which are required, the persons responsible for undertaking maintenance and frequency by which these will be undertaken.

We request that the applicant visit our [website](#), where our requirements are clearly stated. Useful documents include our Developer Pack. Our website also contains our Local Flood Risk Management Strategy (LFRMS) and Preliminary Flood Risk Assessment (PFRA) which are strategically important documents that should be reviewed.

Connecting to an ordinary watercourse

Under the terms of the Land Drainage Act 1991 and the Floods and Water Management Act 2010, the prior consent of the Lead Local Flood Authority is required for any proposed works or structures in the watercourse. After planning permission has been granted by the LPA, the applicant must apply for Land Drainage Consent from the LLFA, information and the application form can be found on our website. Please be aware that this process can take up to two months.

Yours sincerely,

Vikki Keeble

Sustainable Drainage Team Leader

Email: suds@buckinghamshire.gov.uk

Ryding, Phoebe

Subject: FW: EAn/2020/167369 - Final response to your request for Product 4 for a site off Weasel Lane, Milton Keynes

Filed Location Folder: \\uk.wspgroup.com\central data\Projects\700694xx\70069442 - SWMK - 2020\01 Comms\1A Emails\Flood Risk

From: Enquiries_EastAnglia <Enquiries_EastAnglia@environment-agency.gov.uk>
Sent: 23 April 2020 09:15
To: Grant, Jack <Jack.Grant@wsp.com>
Subject: EAn/2020/167369 - Final response to your request for Product 4 for a site off Weasel Lane, Milton Keynes

Dear Jack

Thank you for your request of 25th March 2020. Unfortunately, Product 4 is not available for this site. We do not hold detailed modelling in this area. The flood map here is the best information available. The Flood Map for Planning (Rivers and Sea) can be viewed and downloaded as a PDF file on GOV.UK by following this link: <https://flood-map-for-planning.service.gov.uk>. The flood zones are the result of 1D modelling from the Environment Agency's Loughton Brook Model (2014) and 1D+2D modelling from the Upper Ouse Undefended Model.

As some watercourses in this area are Ordinary Watercourses (non main), we do not hold any relevant model data for those watercourses. Please contact the relevant Lead Local Flood Authority (LLFA). For this site, contact Buckinghamshire County Council

We have considered your request under the provisions of the Freedom of Information Act 2000 / Environmental Information Regulations 2004 (EIR). The Act requires that we respond to requests by advising you whether or not information is held, and if so by providing you with that information.

EIR Regulation 3(2) states that information is held if it is in our possession and has been produced or received by us, or it is held by another person on our behalf at the time the request is received.

Information not held

In this case, the information you have requested is not held by us. Therefore we are refusing your request on the grounds that there is no information we can provide.

Where a request is for environmental information, the Regulations allow us to refuse to disclose it if the exception at EIR Regulation 12(4)(a) applies. The regulation states that a public authority may refuse to disclose environmental information to the extent that it does not hold that information when an applicant's request is received.

It is not possible for us to conduct a public interest balancing test because the reason for non-disclosure is that the information is not held.

Rights of appeal

If you are not satisfied you can contact us within 2 calendar months to ask for our decision to be reviewed. We shall review our response to your request and give you our decision in writing within 40 working days.

If you are still not satisfied following this, you can raise a concern with the Information Commissioner, who is the statutory regulator for Freedom of Information and the Environmental Information Regulations. The contact details are:

Information Commissioner's Office
Wycliffe House
Water Lane
Wilmslow
Cheshire
SK9 5AF
Tel: 0303 123 1113
Website: <http://ico.org.uk>.

Yours sincerely

Sam

Samantha Clemens

Customers & Engagement Officer, East Anglia

Environment Agency | Icen House, Cobham Road, Ipswich IP3 9JD

Environment Agency | Bromholme Lane, Brampton, Huntingdon, Cambridgeshire, PE28 4NE

Email : enquiries_eastanglia@environment-agency.gov.uk

Telephone: 0203 0255472



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**Pre-Planning
Assessment Report**
LAND AT SOUTH WEST MILTON KEYNES
151794/903865181/1/0079570

Section 1: Proposed development

Thank you for submitting a pre-planning enquiry. This has been produced for WSP UK Ltd. Your reference number is **151794/903865181/1/0079570**. If you have any questions upon receipt of this report, please contact the Pre-Development team on 03456 066087 or email planningliaison@anglianwater.co.uk.

The response within this report has been based on the following information which was submitted as part of your application:

List of planned developments	
Type of development	No. Of units
Shops	1
Business	2
Dwellings	1972
Non-residential	2

The anticipated residential build rate is:

Year	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12
Build rate	50	50	50	50	50	50	50	50	50	50	50	1427

Site grid reference no.

SP8337732448

Development type

Greenfield

Planning application status

Unknown

The comments contained within this report relate to the public water mains and sewers indicated on our records. Your attention is drawn to the disclaimer in the useful information section of this report.

Section 2: Assets affected

Our records indicate that we have the following types of assets within or overlapping the boundary of your development site as listed in the table below.

Additionally, it is highly recommended that you carry out a thorough investigation of your proposed working area to establish whether any unmapped public or private sewers and lateral drains are in existence. We are unable to permit development either over or within the easement strip without our prior consent. The extent of the easement is provided in the table below. Please be aware that the existing water mains/public sewers should be located in highway or open space and not in private gardens. This is to ensure available access for any future maintenance and repair and this should be taken into consideration when planning your site layout.

Water and Used water easement information

Asset type	Pipe size (mm)	Total easement required (m)
Water mains	252	6.00 m either side of the centre line
Water mains	463	9.00 m either side of the centre line
Water mains	157	6.00 m either side of the centre line
Water mains	463	9.00 m either side of the centre line
Water mains	146	4.50 m either side of the centre line
Water mains	463	9.00 m either side of the centre line
Water mains	457	9.00 m either side of the centre line
Water mains	312	6.00 m either side of the centre line
Water mains	252	6.00 m either side of the centre line
Water mains	252	6.00 m either side of the centre line
Water mains	157	6.00 m either side of the centre line
Water mains	463	9.00 m either side of the centre line
Water mains	463	9.00 m either side of the centre line
Water mains	252	6.00 m either side of the centre line
Water mains	312	6.00 m either side of the centre line
Water mains	252	6.00 m either side of the centre line
Water mains	457	9.00 m either side of the centre line
Water mains	312	6.00 m either side of the centre line
Water mains	457	9.00 m either side of the centre line
Water mains	457	9.00 m either side of the centre line
Water mains	463	9.00 m either side of the centre line
Water mains	312	6.00 m either side of the centre line
Water mains	457	9.00 m either side of the centre line
Water mains	457	9.00 m either side of the centre line
Sewer mains	250	3.00 m either side of the centre line
Sewer mains	225	3.00 m either side of the centre line
Sewer mains	225	3.00 m either side of the centre line

If it is not possible to avoid our assets then these may need to be diverted in accordance with Section 185 of the Water Industry Act (1991). You will need to make a formal application if you would like a diversion to be considered.

Due to the private sewer transfer in October 2011 many newly adopted public used water assets and their history are not indicated on our records. You also need to be aware that your development site may contain private water mains, drains or other assets not shown on our records. These are private assets and not the responsibility of Anglian Water but that of the landowner.

Section 3: Water supply

In examining the available capacity for your development site we assess the capacity and costs for two categories of water main. These are:

Strategic:

These are the offsite potable water mains which deliver water within an area to a large number of development sites often across a number of towns. The strategic provision of these water mains enables us to provide of the cheapest solution across a large geographical area.

Local reinforcement:

These are localised reinforcement mains to enable us to provide water to your development site.

On most sites we also have two categories of water mains the Spine Mains and Housing Estate Mains (HEMS). To support your budgeting arrangements we have also examined the estimated cost for delivering the onsite water mains needed for a site of your size.

Water supply network

Your site will benefit from the strategic water main(s) as listed below. This strategic scheme has been designed to cater for the predicted growth in this area. In addition, there is also insufficient capacity in the localised network to supply your site and therefore offsite local reinforcements are needed. Details of the necessary upgrades can be found in the water infrastructure section of this report and the cost of these works are included in the Zonal charge. If you wish to proceed with the development then you will need to complete an application for a new supply. This is recommended to be done at the earliest opportunity as it could take a minimum of 18 months to install any offsite reinforcement works. The connection point for the site will be from the existing water main in Weasel Lane to the northeast of "The Leys". The development should be connected to the 18in ST main in Weasel Lane to the northeast of "The Leys", with a 280mm HPPE SDR21 connection and pipework. As part of the onsite pipework the connection must include a new DMA meter with telemetry.

 Connection point(s)

Connection Point
CP-2368
Address
Weasel Lane to the northeast of "The Leys"
National Grid Reference (NGR)
SP8322832366

Water Infrastructure & Costs

In order to supply your site, the following upgrades are required:

Strategic Water Mains	Based on
Storage or distribution	39.058

Estimated Local reinforcement Mains	Based on
Mursley WR reflux valve No.15	Upsize the reflux valve No.15 at Mursley WR from 200mm (size taken from model) to 400mm at grid ref SP8152229210, NB the valve is not shown on GNet.

As a result of the recent charging rules published by Ofwat, our charging regime has changed. Your development site will be required to pay a Zonal charge for each new property connecting to our water supply network that benefits from Full planning permission.

Payment of the Zonal charge must be made before premises are connected to our water supply network. More information on the Zonal charge can be found at <http://www.anglianwater.co.uk/developers/charges>

The Zonal charge consists of two elements. The first is called the 'Fixed Element' which is the same in nature to the Infrastructure charge applied prior to April 2018. The second is called the 'Variable Element' which may vary each financial year.

The elements are combined together to create the 2018/19 Zonal charge for Water:

Fixed Element	£ 370
Variable Element	£ 88.50

In most circumstances zonal charges are raised on a standard basis of one charge per new connection (one for water and one for sewerage). However, if the new connection is to non-household premises, the fixed element is calculated according to the number and type of water fittings in the premises. This is called the "relevant multiplier" method of calculating the charge. Details of the relevant multiplier for each fitting can be found at our web-page: <http://www.anglianwater.co.uk/developers/charges/>

The total Zonal charge payable for your site for Water is:

Zonal charge per new connection - Water	No. Of Units	Total amount payable
£ 458.50	1972	£ 904,162.00

The estimated* Onsite Water Mains cost for your site is:

Estimated Onsite Water Mains	
Onsite water mains costs	£ 141,984.00

*A detailed cost breakdown will be provided on receipt of a formal application for a new water main.

In addition, you also have the ability to construct the onsite water mains under a self-lay agreement. In such cases, an Asset Payment is made by Anglian Water following commissioning and adoption of the assets. The Asset Payment is calculated as required in the Water Act 2003. For more information on the self-lay of water mains please see <http://www.anglianwater.co.uk/developers/self-lay>.

You will also need to budget for connection costs. Please note that we offer alternative types of connections depending on your needs and these costs are available in our annual charges booklet, which can be downloaded from <http://www.anglianwater.co.uk/developers/charges>

Section 4: Water recycling services

In examining the used water system we assess the ability for your site to connect to the public sewerage network without causing a detriment to the operation of the system. We also assess the receiving water recycling centre and determine whether the water recycling centre can cope with the increased flow and influent quality arising from your development.

Water recycling centre

The foul drainage from the proposed development is in the catchment of Cotton Valley Water Recycling Centre, which currently has capacity to treat the flows from your development site. Anglian Water cannot reserve capacity and the available capacity at the water recycling centre can be reduced at any time due to growth, environmental and regulation driven changes.

Used water network

Our assessment has been based on development flows connecting to the nearest foul water sewer of the same size or greater pipe diameter to that required to drain the site. The infrastructure to convey foul water flows to the receiving sewerage network is assumed to be the responsibility of the developer. Conveyance to the connection point is considered as Onsite Work and includes all work carried out upstream from the point of connection, including making the connection to our existing network. This connection point has been determined in reference to the calculated discharge flow and on this basis, a 450mm internal diameter pipe is required to drain the development site. The nearest practicable connection is to the 450mm diameter sewer at manhole 5601 (adjacent to Hartland Avenue) at National Grid Reference NGR SP 83529 33644. Anglian water has assessed the impact of a pumped conveyance from the planned development to the public foul sewerage network. For this purpose we would consider a 250mm nominal bore rising main to be sufficient for the conveyance of foul water flows from this development. We would also ask that you confirm your pump rate at detailed design stage. The cover level is 94.2m and the invert level is 90.6m. We can confirm that this connection is acceptable as the foul sewerage system, at present, has available capacity for your site. As per the current version of Sewers for Adoption, Anglian Water would wish to see an intermediate manhole constructed no closer than 5 metres from manhole 5601 for pumped connections to allow your flows to gravitate. Please note that Anglian Water will request a suitably worded condition at planning application stage to ensure this strategy is implemented to mitigate the risk of flooding.

It is assumed that the developer will provide the necessary infrastructure to convey flows from the site to the network. Consequently, this report does not include any costs for the conveyance of flows.

Surface water disposal

We have examined your development site for available surface water discharge options. It is our understanding that the evidence to confirm your compliance with the surface water hierarchy is not currently available. However once the evidence has been confirmed, then a connection point may be made to manhole 7953 in Steinbeck Crescent at NGR SP 82773 32909 at a rate of 5.0 l/s. The cover level is 101.05m and the invert level is 99.3m. Our assessment has been based on development flows connecting to the nearest surface water sewer of the same size or greater pipe diameter. It is your responsibility to provide the evidence to confirm that all alternative methods of surface water disposal have been explored and these will be required before your connection can be agreed. This is subject to satisfactory evidence which shows the surface water management hierarchy as outlined in Building Regulations Part H has been explored. This would encompass the results from the site specific infiltration testing and/or confirmation that the flows cannot be discharged to a watercourse. Anglian Water's surface water policy follows the Surface Water hierarchy, outlined in Part H of the Building Regulations. Should your assumptions or evidence change then an alternative solution, connection point or flow rate may be required. You are therefore advised to update Anglian Water with the key supporting evidence at your earliest convenience.

As you may be aware, Anglian Water will consider the adoption of SuDs provided that they meet the criteria outline in our SuDs adoption manual. This can be found on our website at <http://www.anglianwater.co.uk/developers/suds.aspx>. We will adopt features located in public open space that are designed and constructed, in conjunction with the Local Authority and Lead Local Flood Authority (LLFA), to the criteria within our SuDs adoption manual. Specifically, developers must be able to demonstrate:

1. Effective upstream source control,
2. Effective exceedance design, and
3. Effective maintenance schedule demonstrating that the assets can be maintained both now and in the future with adequate access.

If you wish to look at the adoption of any SuDs then an expression of interest form can be found on our website at: <http://www.anglianwater.co.uk/developers/suds.aspx>

The proposed method of surface water disposal is not relevant to Anglian Water; we suggest that you contact the relevant Local Authority, Lead Local Flood Authority, the Environment Agency or the Internal Drainage Board, as appropriate.

Trade Effluent

We note that you do not have any trade effluent requirements. Should this be required in the future you will need our written formal consent. This is in accordance with Section 118 of the Water Industry Act (1991).

Used Water Budget Costs

As a result of the recent charging rules published by Ofwat, our charging regime has changed. Your development site will be required to pay a Zonal charge for each new property connecting to the public sewer that benefits from Full planning permission.

Payment of the Zonal charge must be made before premises are connected to the public sewer. More information on the Zonal charge can be found at <http://www.anglianwater.co.uk/developers/charges>

The Zonal charge consists of two elements. The first is called the 'Fixed Element' which is the same in nature to the Infrastructure charge applied prior to April 2018. The second is called the 'Variable Element' which may vary each financial year.

The elements are combined together to create the 2018/19 Zonal charge for Sewerage:

Fixed Element	£ 370
Variable Element	£ 101

In most circumstances zonal charges are raised on a standard basis of one charge per new connection (one for water and one for sewerage). However, if the new connection is to non-household premises, the fixed element is calculated according to the number and type of water fittings in the premises. This is called the "relevant multiplier" method of calculating the charge. Details of the relevant multiplier for each fitting can be found at our web-page: <http://www.anglianwater.co.uk/developers/charges/>

The total Zonal charge payable for your site for Sewerage is:

Zonal charge per new connection - Sewerage	No. Of Units	Total amount payable
£ 471	1972	£ 928,812.00

It has been assumed that the onsite used water network will be provided under a section 104 Water Industry Act application.

It is recommended that you also budget for connection costs. Please note that we offer alternative types of connections depending on your needs and these costs are available at our website.

Section 5: Map of Proposed Connection Points



Figure 1: Showing your water point of connection



Figure 2: Showing your used water point of connection



Figure 3: Showing your surface water point of connection

Section 6: Useful Information

Water

Water Industry Act – Key Water Sections:

Section 41:

This provides you with the right to requisition a new water main for domestic purposes to connect your site to the public water network.

Section 45:

This provides you with the right to have a connection for domestic purposes from a building or part of a building to the public water main.

Section 51A - E

This provides you with the right to provide the water main or service connection yourself and for us to vest them into our company.

Section 55:

This applies where you request a supply of water for non domestic purposes.

Section 185:

This provides you with the right to make a reasonable request to have a public water main, sewer or public lateral drain removed or altered, at your expense. Details on how to make an application and the s185 form is available on our website at <http://www.anglianwater.co.uk/developers> or via our Development Services team on 03456 066087.

Details on how you can make a formal application for a new water main, new connection or diversion are available on from our Development Services team on 03456 066087 or via our website at <http://www.anglianwater.co.uk/developers>

If you have any other queries on the rights to requisition or connect your housing to the public water and sewerage infrastructure then please contact our Development Services team at: Developer Services, Anglian Water, PO Box 495, Huntingdon, PE29 6YY or Telephone: 0345 60 66 087 or Email: developerservices@anglianwater.co.uk

Water pressure and flow rate: The water pressure and consistency that we must meet for your site is laid out in the Water Industry Act(1991). This states that we must supply a flow rate of 9 litres per minute at a pressure of 10 metres of head to the external stop tap. If your water pressure requirements exceed this then you will need to provide and maintain any booster requirements to the development site.

Self Lay of Water Mains: A list of accredited Self Lay Organisations can be found at <https://www.lr.org/en/utilities/water-industry-registration-scheme-wirs-wirsae/search/>

Used water

Water Industry Act – Key Used Water Sections:

Section 98:

This provides you with the right to requisition a new public sewer. The new public sewer can be constructed by Anglian Water on your behalf. Alternatively, you can construct the sewer yourself under section 30 of the Anglian Water Authority Act 1977.

Section 102:

This provides you with the right to have an existing sewerage asset vested by us. It is your responsibility to bring the infrastructure to an adoptable condition ahead of the asset being vested.

Section 104:

This provides you with the right to have a design technically vetted and an agreement reached that will see us adopt your assets following their satisfactory construction and connection to the public sewer.

Section 106:

This provides you with the right to have your constructed sewer connected to the public sewer.

Section 185:

This provides you with the right to have a public sewerage asset diverted.

Details on how to make a formal application for a new sewer, new connection or diversion are available on our website at <http://www.anglianwater.co.uk/developers> or via our Development Services team on 03456 066087.

Sustainable drainage systems:

Many existing urban drainage systems can cause problems of flooding, pollution or damage to the environment and are not resilient to climate change in the long term. Therefore our preferred method of surface water disposal is through the use of Sustainable Drainage Systems (SuDS). SuDS are a range of techniques that aim to mimic the way surface water drains in natural systems within urban areas. For more information on SuDS, please visit our website at <http://www.anglianwater.co.uk/developers/suds.aspx>. We also recommend that you contact the Local Authority and Lead Local Flood Authority (LLFA) for the area to discuss your application.

Private sewer transfers:

Sewers and lateral drains connected to the public sewer on the 1 July 2011 transferred into Water Company ownership on the 1 October 2011. This follows the implementation of the Floods and Water Management Act (FWMA). This included sewers and lateral drains that were subject to an existing Section 104 Adoption Agreement and those that were not. There were exemptions and the main non-transferable assets were as follows:

- Surface water sewers and lateral drains that did not discharge to the public sewer, e.g. those that discharged to a watercourse.
- Foul sewers and lateral drains that discharged to a privately owned sewage treatment/collection facility.
- Pumping stations and rising mains will transfer between 1 October 2011 and 1 October 2016.

The implementation of Section 42 of the FWMA will ensure that future private sewers will not be created. It is anticipated that all new sewer applications will need to have an approved section 104 application ahead of a section 106 connection.

Encroachment:

Anglian Water operates a risk based approach to development encroaching close to our used water infrastructure. We assess the issue of encroachment if you are planning to build within 400 metres of a water recycling centre or, within 15 metres to 100 metres of a pumping station. We have more information available on our website at <http://anglianwater.co.uk/developers/encroachment.aspx>

Locating our assets:

Maps detailing the location of our water and used water infrastructure including both underground assets and above ground assets such as pumping stations and recycling centres are available from . All requests from members of the public or non-statutory bodies for maps showing the location of our assets will be subject to an appropriate administrative charge. We have more information on our website at: <http://www.anglianwater.co.uk/developers/our-assets/>

Summary of charges:

A summary of this year's water and used water connection and infrastructure charges can be found at <http://www.anglianwater.co.uk/developers/charges>

Disclaimer:

The information provided in this report is based on data currently held by Anglian Water Services Limited ('Anglian Water') or provided by a third party. Accordingly, the information in this report is provided with no guarantee of accuracy, timeliness, completeness and is without indemnity or warranty of any kind (express or implied).

This report should not be considered in isolation and does not nullify the need for the enquirer to make additional appropriate searches, inspections and enquiries. Anglian Water supports the planned approach to sustainable development that is set out in the National Planning Policy Framework ('NPPF') and any infrastructure needs identified in this report must be considered in the context of current, adopted and/or emerging local plans. Where local plans are absent, silent or have expired these needs should be considered against the definition of sustainability holistically as set out in the NPPF.

Whilst the information in this report is based on the presumption that proposed development obtains planning permission, nothing in this report confirms that planning permission will be granted or that Anglian Water will be bound to carry out the works/proposals contained within this report.

No liability whatsoever, including liability for negligence is accepted by Anglian Water, or its partners, employees or agents, for any error or omission, or for the results obtained from the use of this report and/or its content. Furthermore in no event will any of those parties be liable to the applicant or any third party for any decision made or action taken as a result of reliance on this report.

This report is valid for the date printed and the enquirer is advised to resubmit their request for an up to date report should there be a delay in submitting any subsequent application for water supply/sewer connection(s).



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100 Wharfside Street
Birmingham
B1 1RT

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