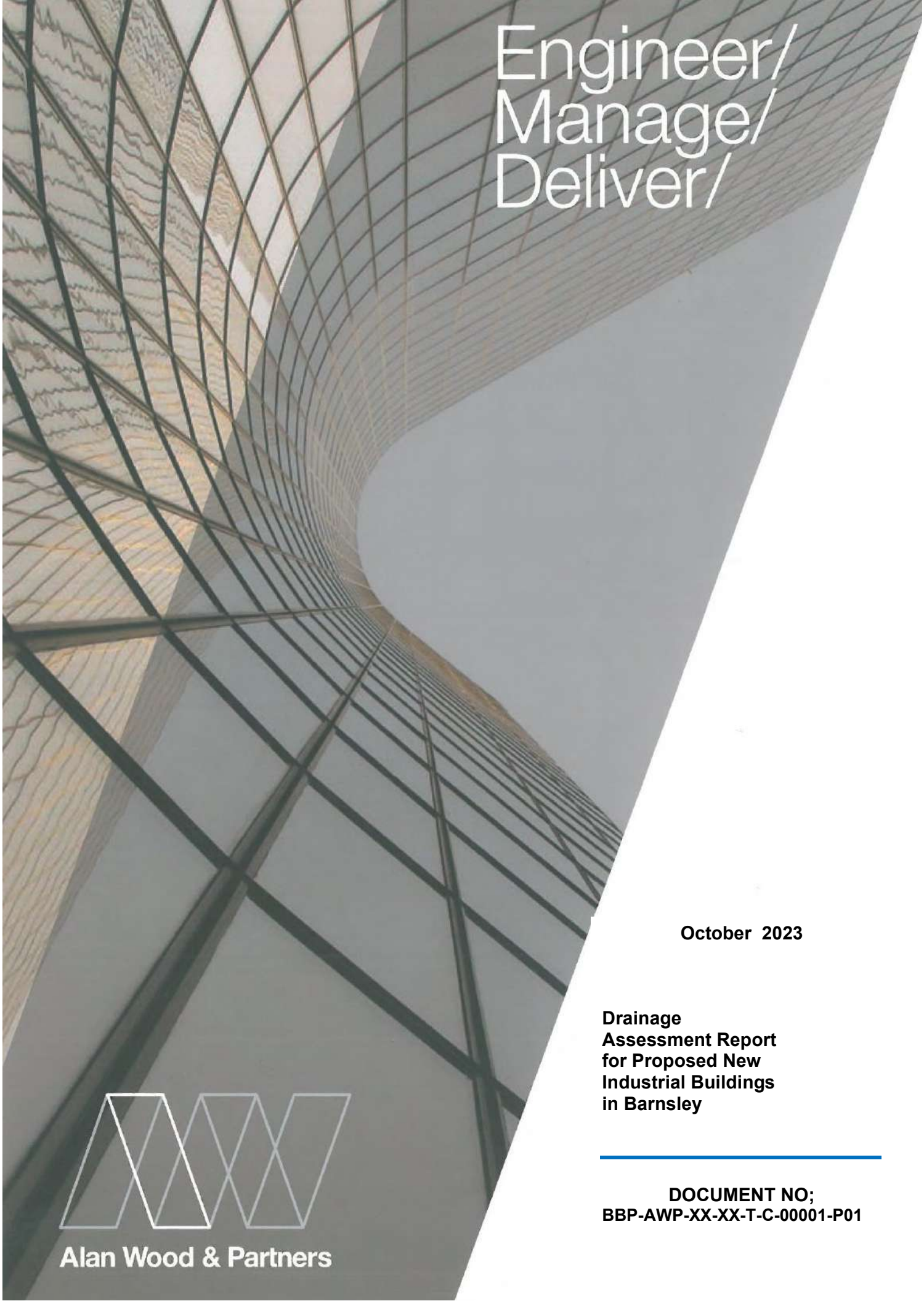

October 2023

Drainage Assessment Report for Proposed New Industrial Buildings in Barnsley

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DRAINAGE ASSESSMENT REPORT FOR PROPOSED NEW INDUSTRIAL DEVELOPMENT IN BIRTHWAITE BUSINESS PARK, BARNSLEY

Prepared by: **Mahsa Mirzaei, BEng (Hons)**

Signed: Mahsa Mirzaei ……

Date: 10th October 2023

Approved by: **Kim Han, BEng (Hons), CEng, MICE, MIStructE**

Signed: KIM HAN ……

Date: 10th October 2023

Issue	Revision	Revised by	Approved by	Revised Date
P01	First isuue	MM	KH	10/10/23

For the avoidance of doubt, the parties confirm that these conditions of engagement shall not, and the parties do not intend that these conditions of engagement shall confer on any party any rights to enforce any term of this Agreement pursuant of the Contracts (Rights of third Parties) Act 1999.

The Appointment of Alan Wood & Partners shall be governed by and construed in all respects in accordance with the laws of England & Wales and each party submits to the exclusive jurisdiction of the Courts of England & Wales.

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1.0 INTRODUCTION

1.1 Background

1.1.1 Alan Wood & Partners were commissioned by Premdor Crosby Ltd to prepare a Drainage Assessment Report for the proposed New Industrial Buildings in Birthwate Business Park, Huddersfield Road, Darton, Barnsley -S75 5JS

1.1.2 A Drainage Assessment (DAR) for the proposed development is required to assess the development's risk from flooding and determine the suitability of the site in terms of drainage.

1.2 Structure of Report

1.2.1 Section 1 introduces the DAR, explains the layout of this DAR and provides an introduction to the latest guidance on development and flood risk in England.

1.2.2 Section 2 provides an introduction to the site. The site description is based upon a desktop study and information provided by the developer. In order to obtain further information on flood risk, consultation was undertaken with the Environment Agency.

1.2.3 Section 3 of this report details the information gathered through the consultation.

1.2.4 Section 4 of this report provides details of recommendations for further work to mitigate against possible flooding.

1.2.5 Section 5 and 6 considers the conceptual drainage arrangements for the proposed development.

1.2.6 Section 7 of this report considers the operation and maintenance arrangements for the development.

1.2.7 Section 8 this report provides a summary of the report.

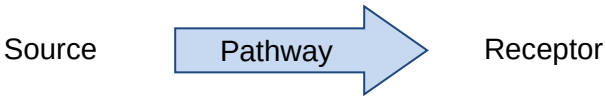
1.3 Flood Risk

1.3.1 Flood risk takes account of both the probability and the consequences of flooding.

1.3.2 Flood risk = probability of flooding x consequences of flooding

1.3.3 Probability is usually interpreted in terms of the return period, e.g., 1 in 100 and 1 in 200-year event, etc. In terms of probability, there is a 1 in 100 (1%) chance of one or more 1 in 100-year floods occurring in a given year. The consequence of flooding depends on how vulnerable a receptor is to flood.

The components of flood risk can be considered using a source-pathway-receptor model.



1.3.4 Sources constitute flood hazards, which are anything with the potential to cause harm through flooding (e.g., rainfall extreme sea levels, river flows and canals). Pathways represent the mechanism by which the flood hazard would cause harm to a receptor (e.g., overtopping and failure of embankments and flood defences, inadequate drainage, and inundation of floodplains). Receptors comprise the people, property, infrastructure, and ecosystems that could potentially be affected should a flood occur.

1.4 Climate Change

This is a planning requirement to account for climate change in the proposed design. The recommended allowances should be based on the most relevant guidance from the Environment Agency and the Lead Local Flood Authority.

1.5 Sustainable Drainage

1.5.1 The key planning objectives in the NPPF are to appraise, manage and where possible, reduce flood risk. Sustainable Drainage Systems (SuDS) provide an effective way of achieving some of these objectives, and NPPF and Part H of the Building Regulations (DTLR 2002) direct developers towards the use of SuDS wherever possible.

1.5.2 The National Standards aim to ensure the design of SuDS mimics natural drainage, managing surface run-off at or close to the surface and as close to its source as practicable, controlling the flow (volume and rate of run-off) and providing a range of additional benefits. It contrasts with traditional drainage techniques, which are based on underground pipes to convey rainwater away from properties as quickly as possible. While pipes will often be used in SuDS drainage schemes, the construction of surface water drainage systems comprising solely of pipe sewers will be the exception.

1.5.3 The most effective SuDS use a series of various drainage components (where possible vegetative units), operating as close to the source of run-off as practicable. These should work as a SuDS management train to control flow rates and reduce volumes of run-off, providing treatment to protect water quality and opportunities to encourage biodiversity and amenity.

1.5.4 Well designed, easy to maintain SuDS will deliver a range of important benefits for the local environment, the development and local communities. They can:

- contribute to the delivery of Water Framework Directive, local flood risk management, Local Biodiversity Action Plan objectives and sustainable development consistent with the Planning (Wales) Act 2015;

- add social, economic and environmental value by improving the quality of urban design, adding enhanced amenity space and providing habitats and wildlife corridors;

- contribute to health and wellbeing through access to green space, reduced urban temperatures, improved air quality and noise buffering;

- help strengthen communities, providing a focus for environmental education and public engagement in environmental protection close to home;

- help improve the adaptability of the drainage system to development pressures; and support development resilience to climate change, reducing the risk of localised surface water flooding, mitigating pollution that may arise from surface water run-off and helping to safeguard water supplies.

1.5.5 SuDS schemes should be designed in accordance with current CIRIA C753 SuDS Manual guidelines and aim to:

- manage water on or close to the surface and as close to the source of the run-off as possible;

- treat rainfall as a valuable natural resource;

- ensure pollution is prevented at source, rather than relying on the drainage system to treat or intercept it;

- manage rainfall to help protect people from increased flood risk, and the environment from morphological and associated ecological damage resulting from changes in flow rates, patterns and sediment movement caused by the development;

- take account of likely future pressures on flood risk, the environment and water resources such as climate change and urban creep;

- use the SuDS Management Train, using drainage components in series across a site to achieve a robust surface water management system (rather than using a single “end of pipe” feature, such as a pond, to serve the whole development);

- maximise the delivery of benefits for amenity and biodiversity;

- seek to make the best use of available land through multifunctional usage of public spaces and the public realm;

- perform safely, reliably and effectively over the design life of the development taking into account the need for reasonable levels of maintenance;

- avoid the need for pumping where possible; and

- be affordable, taking into account both construction and long-term maintenance costs and the additional environmental and social benefits afforded by the system.

2.0 EXISTING SITE DESCRIPTION

2.1 Location

2.1.1 The development is located The property is located off the A637 Huddersfield Road and lies immediately to the west of Junction 38 Business Park in Darton, South Yorkshire.

2.1.2 An aerial photograph and location plan are included in Figure 1 and Figure 2 below, which identify the location of the site.

Figure 1: Aerial Photograph

Figure 2: Site Location Plan

2.1.3 The Ordnance Survey grid reference for the site is as below:

development	X (Easting)	Y (Northing)	grid reference
Approx. centre point (for UNIT A)	430354m	410429m	SE303104
Approx. centre point (for UNIT B)	430470m	410330m	SE304103
Approx. centre point (for UNIT B-PARKING AREA)	430479 m	410389m	SE304103

2.2 Site Description

2.2.1 The development site consists of three main areas as follows:

2.2.1.1 **Unit A** : measures 1.457 hectares and will be constructed on top of an existing greenfield on the west side of the development. Unit A consists of a building and three parking areas.

2.2.1.2 **Unit B** : measures 0.867 hectares and will be constructed on top of an existing greenfield on the east side of the development. Unit B consists of a building and a parking area.

2.2.1.3 **Unit B-Parking Area** : measures 0.482 hectares and will be renewing the existing truck parking area on west side of the development.

2.2.2 The site can be accessed from Huddersfield Road (A637).

2.2.3 River Dearne lies approximately 300 m to the east of the site.

2.3 Topography

2.3.1 A topographic survey of the development site has been undertaken. The survey shows that:

2.3.1 Unit A: the existing ground levels vary around 70.70 m OD at the northern side, to 72.50m OD to the south.

2.3.2 Unit B: the existing ground levels vary around 70.10 m OD at the northern side, to 71.30m OD to the south.

2.3.3 Unit B-Parking Area: levels are generally level at approximately 70.20m OD.

2.3.2 The topography survey is available in Appendix A by showing the topography data for the site.

2.4 Ground Conditions

2.4.1 No previous ground investigation is available; however, due to the online investigation prepared and explained in the flood risk assessment based on British Geological Survey historical borehole records, the underlying ground conditions comprise a variable thickness of Made Ground (up to 5.2m across the central portion) that coincides with the infilled former mineral railway lines. Underlying the Made Ground (where present) is a cyclical sequence of Mudstone, Siltstone, and Sandstones that form the Lower Pennine Coal Measures in the north and Haigh Moor Rock in the south.

2.4.2 A study of the local groundwater maps shows that the site overlays a ‘Secondary A’ aquifer (comprise permeable layers that can support local water supplies, and may form an important source of base flow to rivers.)

2.4.1 The site lies within a Groundwater Vulnerability Zone (High) The site does not lie within a Groundwater Source Protection Zone (SPZ).

2.4.2 On this basis, the ground conditions are considered unsuitable for the disposal of surface water run-off from the development via infiltration and soak away drainage systems.

3.0 CONSULTATION

3.1 Design Team

3.1.1 Consultation has taken place with the design team in order to obtain relevant information pertaining to the proposed development.

3.2 Environment Agency (EA)

3.2.1 The Flood and Water Management Act 2010 gives the Environment Agency a strategic overview role for all forms of flooding and coastal erosion. They also have direct responsibility for the prevention, mitigation, and remediation of flood damage for main rivers and coastal areas. The Environment Agency is the statutory consultee with regards to flood risk and planning.

3.2.2 Consultation has taken place with the Environment Agency with regard to flood mapping, details of which are incorporated within this report. Information regarding the current flood risk at the application site and local flood defences has been obtained from the Environment Agency.

3.3 Lead Local Flood Authority (LLFA)

3.3.1 Barnsley Metropolitan Borough Council(BMBC) is the LLFA and has responsibilities for 'local flood risk', which includes surface run-off, groundwater, and ordinary watercourses. The Barnsley Metropolitan Borough Council Preliminary Flood Risk Assessment Report (PFRA) which covers the site has been reviewed.

3.4 Local Planning Authority (LPA)

3.4.1 Barnsley Metropolitan Borough Council(BMBC) is the LPA. The Barnsley Metropolitan Borough Council Strategic Flood Risk Assessment (SFRA) which covers the site has been reviewed.

3.5 Sewerage Undertakers

3.5.1 Yorkshire Water is responsible for the disposal of wastewater and supply of clean water for this area. All Water Companies have a statutory obligation to maintain a register of properties / areas which are at risk of flooding from the public sewerage system, and this is shown on the DG5 Flood Register.

4.0 FLOOD MITIGATION

4.1 Flood Zone / Finished Floor Levels

4.1.1 For this development, as the site is shown to lie in Flood Zone 1 (low probability of flooding), it is considered that the ground floor can be constructed at traditional levels of construction (normally 150mm above finished ground level).

4.2 External Ground Levels

4.2.1 The external finished ground levels should be designed generally to ensure rainfall is channeled away from buildings to ensure there is no localised risk of overland surface water flooding to the building during an extreme rainfall event. On this basis, the potential risk of overland surface water flooding to the building will be adequately addressed.

4.3 Safe Access / Egress

4.3.1 All approach roads to the development are shown to lie within Flood Zone 1 (low probability of flooding) and consequently safe access to and egress from the development should still be achievable should a flood situation arise.

4.4 Emergency Flood Measures

4.4.1 There should be no requirements for evacuation of building occupants resulting from the development during an extreme flood event.

4.5 Surface Water Drainage

4.5.1 The surface water drainage will be attenuated in accordance with Section 7 of this report in order to ensure the development does not pose a risk of flooding to other parties.

4.5.2 The volume of surface water storage required to balance excess flows between the 1 in 30 year and 1 in 100 year plus climate change storm event will be stored in a number of structures across the site, designed such that it does not pose a risk of flooding to the buildings or to other parties beyond the boundary of the development, before ultimately discharging to designed outfall.

4.6 Flood Resilience

4.6.1 As the development is not prone to fluvial flooding it is not considered necessary to incorporate any flood resilient construction methods within the design of the new building.

4.7 Flood Routing

4.7.1 The development has been designed such that the surface water run-off from new impermeable surfaces will be directed into a positive drainage system and excess volume will be attenuated on site.

4.7.2 Generally, overland flood routes will also be controlled by roughly maintaining existing site levels were possible to mitigate alterations to existing flood routing.

5.0 DRAINAGE ASSESSMENT

5.1 General

5.1.1 The surface water drainage shall be designed in accordance with current CIRIA C753 SuDS Manual guidelines.

5.2 Surface Water Drainage

Proposed drainage strategies for surface water can be found in appendixes C, D and E, and the Microdrainage Calculations can be found in Appendixes J, K and L.

5.2.1 Existing Site

5.2.1.1 From the aerial photograph included in Figure 1, it can be seen that both Unit A and Unit B will be constructed on greenfield land, with the aim of limiting the final discharge flow rate to match the existing greenfield flow rate. However in UnitB-Parking Area the goal is to renew the existing hardstanding parking area and install a proper drainage system. In this regard, it is considered that the final discharge flow rate would be limited to a 30% Betterment over the existing brownfield flow rate.

5.2.2 Run-off Destination

5.2.2.1 Requirement H3 of the Building Regulations establishes a preferred hierarchy for disposal of surface water. Consideration should firstly be given to discharge via infiltration, watercourse and sewer, in that priority order.

5.2.2.2 Ground investigations in the local vicinity are considered unsuitable for soakaways / infiltration to be used as the means of disposal of surface water run-off from the development (see Section 2.4)

5.2.2.3 According the culvert which runs through the site has been identified as a surface water drain. A drainage CCTV survey of the culvert was undertaken by UK Land and Underground Surveys Limited in July 2021. The survey identified several surface water connections from the access road and the parking areas. It is therefore considered that the surface water to be discharged into the culvert which is going to be discharged into the River Dearne.

5.2.3 Flood Risk

5.2.3.1 new developments, the current design criteria for surface water drainage will need to be based on the critical 1 in 100-year storm event, with an additional allowance to account for climate change resulting from global warming. There should be no above-ground flooding for the 1 in 30-year return period and no flooding within the development or off-site that affects other parties during the critical 1 in 100-year storm event, with an additional allowance to account for climate change.

5.2.3.2 The proposed development is to restrict discharge rates to the surface water sewer to no more than the existing greenfield run-off. Therefore, there will be no overall increase of surface water run-off.

5.2.4 Climate Change & Urban Creep

5.2.4.1 The Lead Local Flood Authority requires an allowance to be included for climate change. The lifetime of the proposed development is estimated between 2061 and 2100, therefore, the design rainfall event for the proposed development is the 1 in 100 years plus 25% climate change. See Figure 3 below.

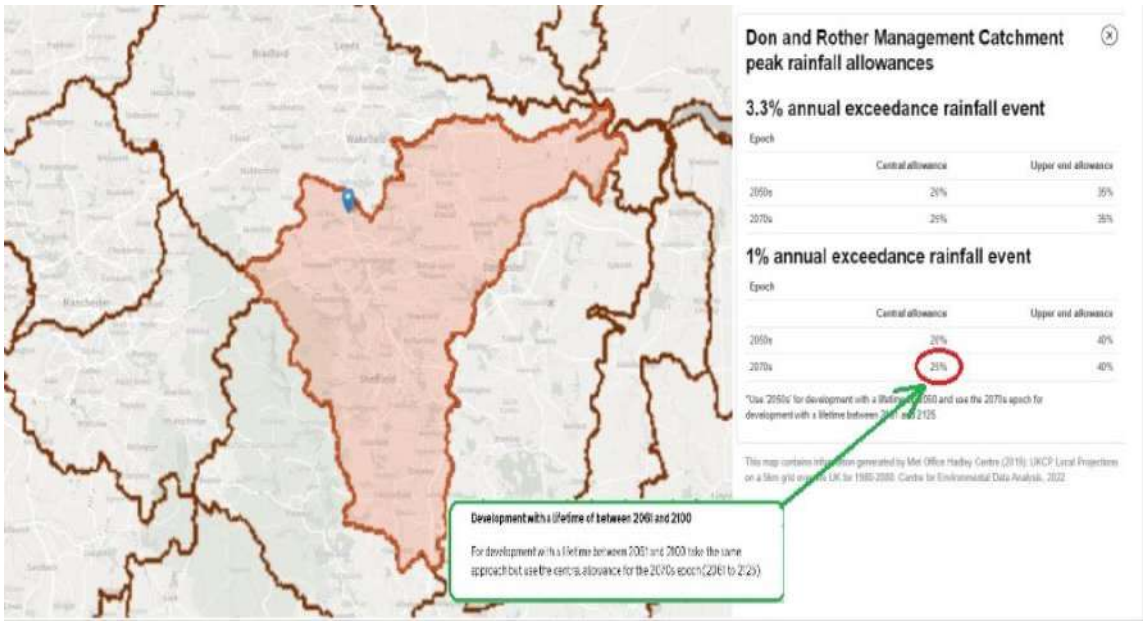


Figure 3: Environment Agency Map dated Oct. 2023 showing peak rainfall allowance

5.2.4.2 As the development is not residential and is under the control of a single body (Barnsley Metropolitan Borough Council), there should be no requirement to include an additional 10% within the surface water drainage design allowance for urban creep.

5.2.5 Peak Flow Control

5.2.5.1 As mentioned before, the new development consists of three separate areas: Unit A and Unit B, which will be constructed on greenfield land with the final flow rate limited to the existing greenfield rate, and the renewal of the parking area adjacent to Unit B, aiming for a 30% Betterment in the existing flow rate of the existing parking area. More details regarding the existing and final flow rates of these three areas are available as follow:

5.2.5.2 Unit A:

5.2.5.2.1 This area covers 1.457 hectares and includes one warehouse and three parking areas. Three drainage systems serve this unit, collecting all the surface water within the area and attenuate it after pollution removal by use of Suds approach like permeable areas and oil Separators, and discharge it to the culvert while maintaining the flow rate consistent with the existing greenfield conditions.

5.2.5.2.2 The figure 4 below shows the borders of the catchments for the three drainage systems in Unit A.

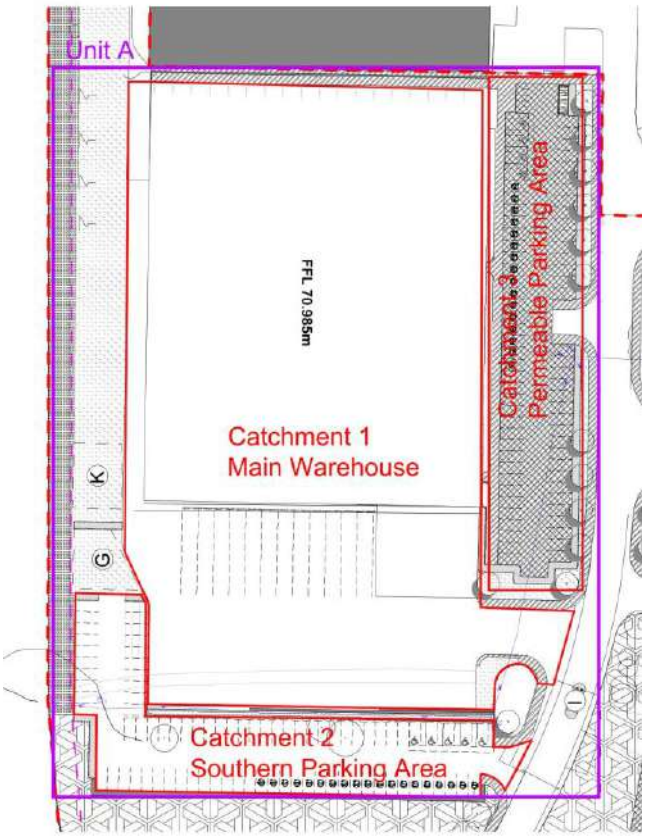


Figure 4: Unit A - drainage systems' catchments

5.2.5.2.3 On this basis, the existing rural runoff of Unit A has been calculated by ICP SUDS (FSR Method), and the following results have been obtained, which indicate the current state of the area. (appendix F)

Possibility of the storm event	Flow rate (l/s)
1-1year	2.6
1-30 year	5.4
1-100 year	6.4
QBar Rural	3.1

5.2.5.2.4 A final flow control will limit the discharge flow rate. the information about the final flow discharge rate in all three drainage systems in Unit A, is as follow:

Table 1: Final Flow Rate -Unit A

drainage system specification	Area (hectares)	final flow control setting (l/s)	Possibility of the storm event	Final discharge flow rate (l/s)
Catchment 1- Main warehouse	1.077	2.6	1-1year	2.2
			1-30 year	2.2
			1-100 year+25%CCA	2.6
Catchment 2- Southern Parking Area	0.194	0.5	1-1year	0.3
			1-30 year	0.4
			1-100 year+25%CCA	0.6
Catchment 3- Permeable Parking Area	0.186	0.2	1-1year	0.1
			1-30 year	0.2
			1-100 year+25%CCA	0.2
Overall discharge rate in Unit A			1-1year	2.6
			1-30 year	2.8
			1-100 year+25%CCA	3.4

5.2.5.2.5 In order to ensure the discharge of surface water from the development will not increase the risk of flooding to other properties, it will be necessary to attenuate the drainage by restricting the discharge to the flow rate based of the previous allowable area and providing storage as required.

5.2.5.2.6 The surface water run-off from the development will be discharged via an appropriate flow control device vortex control or similar into the existing culvert to ensure the desired flow rates are achieved. (Appendix C)

5.2.5.2.7 Based upon the above design criteria storage, a hydraulic model study has been undertaken to assess the pipe sizes and gradients and the likely storage volumes required.

5.2.5.2.8 A summary of the storage volumes required is set out in Table 6 below.

Table 2: Volumes of surface water storage required for Unit A

Storm Event	1 in 1 Year Storm	1 in 30 Year Storm	1 in 100 Year Storm +30%
Storage Volume Required for Unit A (all the systems)	275 m^3	690 m^3	1160m^3

5.2.5.2.9 A copy of the hydraulic model calculations is included in Appendix F.

5.2.5.2.10 Final storage volumes will be re-assessed at the detailed design stage.

5.2.5.2.11 The required storage volume to accommodate the full 100-year storm plus climate change will be provided within a series of below-ground attenuation storage.

5.2.5.3 Unit B:

5.2.5.3.1 This area covers 0.867 hectares and includes one warehouse and a parking area. a drainage system serves this unit, collecting all the surface water within the area, attenuate it after pollution removal by use of SUDS approach such as permeable areas in the parking area to minimise the impact of the development on the environment, and discharge it to the culvert while maintaining the flow rate consistent with the existing greenfield conditions.

5.2.5.3.2 On this basis, the existing rural runoff of the area in Unit B has been calculated by ICP SUDS (FSR Method), and the following results have been obtained, which indicate the current state of the area. (appendix G)

Possibility of the storm event	Flow rate (l/s)
1-1year	0.9
1-30 year	1.8
1-100 year	2.1
QBar Rural	1.0

5.2.5.3.3 The final flow control is limiting the discharge flow rate, the information about the final flow discharge rate in Unit B, are as follow:

Table 3: Final Flow Rate -Unit B

drainage system specification	Area (hectares)	final flow control setting (l/s)	Possibility of the storm event	Final discharge flow rate (l/s)
Unit B	0.867	2.2	1-1year	1.8
			1-30 year	2.0
			1-100 year+25%CCA	2.1

5.2.5.3.4 In order to ensure the discharge of surface water from the development will not increase the risk of flooding to other properties, it will be necessary to attenuate the drainage by restricting the discharge to the flow rate based of the previous allowable area and providing storage as required.

5.2.5.3.5 The surface water run-off from the development will be discharged via an appropriate flow control device vortex control or similar into the existing culvert to ensure the desired flow rates are achieved.

5.2.5.3.6 Based upon the above design criteria storage, a hydraulic model study has been undertaken to assess the pipe sizes and gradients and the likely storage volumes required.

5.2.5.3.7 A summary of the storage volumes required is set out in Table 7 below.

Table 4: Volumes of surface water storage required for Unit B

Storm Event	1 in 1 Year Storm	1 in 30 Year Storm	1 in 100 Year Storm +30%
Storage Volume Required for Unit B	155 m^3	390 m^3	690m^3

5.2.5.3.8 A copy of the hydraulic model calculations is included in Appendix G.

5.2.5.3.9 Final storage volumes will be re-assessed at the detailed design stage.

5.2.5.3.10 The required storage volume to accommodate the full 100-year storm plus climate change will be provided within a series of below-ground attenuation storage under the permeable areas and also a pond located in southern part of the development.

5.2.5.4 Renewal of the Unit B-Parking Area:

5.2.5.4.1 This area covers 0.482 hectares and includes renewal of the existing parking area. a drainage system will serve this area, collecting all the surface water within the area, attenuate it after pollution removal by use of oil separator to minimise the impact of the development on the environment, and discharge it to the culvert while maintaining 30% betterment of the existing brownfield flow rate.

5.2.5.4.2 On this basis, the existing flow rate has been calculated by modelling the area in microdrainage and the following flow rates have been approached. (appendix H)

Possibility of the storm event	Flow rate (l/s)	Considering 30% Betterment
1-1year	40.7	28.49
1-30 year	91.3	63.91
1-100 year+25%CCA	132.6	92.82

5.2.5.4.3 The final flow control is limiting the discharge flow rate, the information about the final flow discharge rates in Unit B-Parking Area, are as follow:

Table 5: Final Flow Rate - Parking Area-Unit B

drainage system specification	Area (hectares)	final flow control setting (l/s)	Possibility of the storm event	Final discharge flow rate (l/s)
Unit B-Parking Area	0.482	30	1-1year	23.5
			1-30 year	29.8
			1-100 year+25%CCA	29.9

5.2.5.4.4 In order to ensure the discharge of surface water from the development will not increase the risk of flooding to other properties, it will be necessary to attenuate the drainage by restricting the discharge to the flow rate based of the previous allowable area and providing storage as required.

5.2.5.4.5 The surface water run-off from the development will be discharged via an appropriate flow control device vortex control or similar into the existing culvert to ensure the desired flow rates are achieved.

5.2.5.4.6 Based upon the above design criteria storage, a hydraulic model study has been undertaken to assess the pipe sizes and gradients and the likely storage volumes required.

5.2.5.4.7 A summary of the storage volumes required is set out in Table 8 below.

Table 6: Volumes of surface water storage required for Parking Area-Unit B

Storm Event	**1 in 1 Year Storm**	**1 in 30 Year Storm**	**1 in 100 Year Storm +30%**
Storage Volume Required for Parking Area-Unit B	$8m^3$	$52m^3$	$122m^3$

5.2.5.4.8 A copy of the hydraulic model calculations is included in Appendix H.

5.2.5.4.9 Final storage volumes will be re-assessed at the detailed design stage.

5.2.5.4.10 The required storage volume to accommodate the full 100-year storm plus climate change will be provided within a series of below-ground attenuation storage.

5.2.6 Pollution Control

5.2.6.1 The water quality from the development via the surface water drainage system has been assessed in accordance with the simple index approach set out in Chapter 26 of the CIRIA SuDS Manual C753.

5.2.6.2 The risk of pollution is considered low. Clean roof water drainage will be discharged into the below ground sewers via a closed system. Parking area's drainage will be collected via trapped gullies and after passing through the oil separators will also be discharged to a sealed below ground surface water sewer system. For permeable parking areas pollution would be under control by use of SUDS approach.

5.2.6.3 In order to minimise the risk of pollutants entering the downstream watercourse, it is recommended that the final inspection chamber prior to discharge to the existing sewer off site should contain a silt trap.

5.2.6.4 On this basis it is considered that the risk of pollution to the final watercourse has been adequately addressed.

5.2.7 Designing for Exceedance

5.2.7.1 Generally, the existing overland flow routes within the development site will be maintained, ensuring that there is no increased flood risk to off-site areas. In the event of an unprecedented rainfall occurrence after development, exceeding the capacity of the drainage network, most of the site will continue to drain into the ground. Excess surface water runoff will be directed away from buildings and towards landscaped or permeable areas.

5.2.7.2 Further, overland flood risk from exceedance flows and from off-site sources will be mitigated to a large extent by the creation of the new surface water sewerage system as described above. Where possible external levels and proposed ground levels will be set to channel flows away from the proposed buildings / structures. Furthermore, the ground floor construction level for the buildings / structures will be

raised above the finished ground level in order to provide additional clearance above any likely flooding.

5.2.8 Designing for Local Drainage System Failure

5.2.8.1 When considering a residual risk, it is necessary to make predictions as to the impacts of a storm event that exceeds the design event, or the impact of a failure of the local drainage system.

5.2.8.2 The surface water drainage strategy proposed applies a safe and sustainable approach to discharging rainfall run-off from the site and this reduces the risk of flooding however, it is not possible to completely remove the risk. As part of the drainage design, it must be demonstrated that the flooding of property would not occur in the event of local drainage system failure.

5.2.8.3 In respect of local drainage system failure, the following is relevant.

a) Overland flood risk from exceedance flows and from off-site sources will be mitigated to a large extent by the creation of the new surface water sewerage system as described above. The proposed system will be simple, maintainable and it is unlikely that a catastrophic failure would therefore occur.

b) The ground floor construction level for the buildings will be raised above the finished ground level (normally 150mm above finished ground level) to provide additional clearance above any likely flooding. Furthermore, where possible, proposed ground levels will be set to channel flows away from the proposed buildings / structures to ensure there is no localised risk of overland surface water flooding to the building during an extreme rainfall event. Therefore, it is not considered that there is an increased risk to the properties on the site or located adjacent to the site.

c) The existing overland flow routes will be maintained within the final layout of the development site without increasing the flood risk to off-site parties.

d) Even when considering the impacts of a storm event that exceeds the design event, there is an additional safety factor. Consequently, if this event were to be exceeded there is additional capacity within the system to accommodate this (i.e. Fos on infiltration structures, freeboard within the infiltration structures, storage within the manholes, pipes, etc.).

5.2.8.4 Therefore, the risk of flooding associated with local drainage system failures is considered to be low and acceptable.

5.2.9 Timetable for Implementation

5.2.9.1 It is essential to consider the timetable for implementation of SuDS features during the construction phase of the works, as this phase of the project can be critical in terms of on and off-site flooding and pollution. Consideration should therefore be given to installing the SuDS features as early as possible during the construction phase of the works, after any site strip.

5.3 Highways Drainage

5.3.1 The development does not incorporate any formal highway drainage.

5.4 SuDS Features

5.4.1 SuDS features should be considered which would be subject to discussion and approval with the Lead Local Flood Authority (LLSA) at detailed design stage.

5.5 Foul Water Drainage

5.5.1 Proposed strategy for Draining Foul Water can be found in appendix M.

5.5.2 It is proposed that foul water domestic waste from the development will be discharged to the public sewer network, for which formal approval will be required from Yorkshire water.

5.5.3 Based upon a British Code of Practice ‘Flow and Loads – 4’, the average foul water flow of the development site would be approximately 2.9 l/s for Unit A and 3.5 l/s for Unit B. A peak flow rate of 6.5 l/s has been assumed for design purposes.

5.5.4 The levels of the existing public sewer are unknown. The foul drain is assumed to discharge via Pump Station.

6 PROPOSED DRAINAGE COMPONENTS

6.1 The proposed drainage design consists of silt traps, trapped gullies, pump, channels, traditional manholes and pipes, a full retention interceptor, hydro-brake® vortex flow control device, pond, and surface water attenuation storage tank consisting of cellular crates.

6.2 The drainage design is shown on Alan Wood & Partners' drawings; references

BBP - AWP - XX - XX - DR - C - 3000- P5
BBP - AWP - XX - XX - DR - C - 3001- P4
BBP - AWP - XX - XX - DR - C - 3002- P2

7 OPERATION AND MAINTENANCE

7.1 Operation and maintenance requirements of the drainage components, as listed above, should be undertaken in accordance with Chapter 32 of the CIRIA C753 SuDS Manual, along with the relevant tables as included below and any relevant manufacturer's recommendations. See also: BS 8582:2013 Code of Practice for Surface Water Management for Development Sites Section 11, and Susdrain Fact Sheet on SuDS Maintenance and Adoption Options (England) dated September 2015.

7.2 Operation and maintenance requirements for pumps should be undertaken as recommended by the pump manufacturer. Indicative required pump maintenance (not including manufacturer's requirements) outlined further in this document is based on CIRIA R182. In accordance with CIRIA C626, if the pump equipment supplier does not undertake the maintenance, it should supply full instructions to the customer, including:

- The name, address and telephone number of the system supplier and/or delegated maintenance company
- The model and serial/contract number of the system
- If appropriate, the approvals body (and certificate number) certifying compliance with standards.
- General safety advice including avoidance of hazards
- Guidance on the effective use of the system to maximise the sustainable management and use of water
- Start-up and shut-down procedures
- Periodic checks to be carried out by the operator
- Planned monitoring and maintenance requirements
- Consumable requirements

- Basic fault-finding techniques

7.3 The responsibility for the operation and maintenance of the drainage and SuDS will lie with Premdore Crosby Ltd. An initial pre-handover inspection should be undertaken once construction is complete to ensure that it has been constructed as designed.

7.4 The staff undertaking the maintenance should have appropriate experience of SuDS and drainage maintenance and should be capable of keeping sufficiently detailed records of any inspections. An example of a checklist for SuDS maintenance can be found within Appendix B of the CIRIA C753 SuDS Manual v2. If staff do not have appropriate experience, then specific inspection visits may be necessary. During the first year of operations of SuDS, inspections should usually be carried out at least monthly (and after significant storm events).

8 MAINTENANCE SCHEDULES

Table 7: Operation and Maintenance Requirements for Traditional Pipes and Manholes (Based on CIRIA C714 and CIRIA C753 Section 32)

Maintenance schedule	Required action	Typical Frequency
Remedial actions	Replace malfunctioning parts or structures	As required, based on inspections
	Remove litter and debris	As required, based on inspections
	Root cutting	As required, based on inspections
	Repair or replace pipework	As required if structural collapse / failure occurs
Monitoring	Inspect for evidence of poor operation / pollution	Monthly during first year of operation, then annually
	Inspect for sediment or debris	As required, after significant storm events or if blockage reported
	Inspect structural condition of pipework / manholes	Monthly during first year of operation, then five yearly, or as required if blockage reported
*All inspection chambers should be regularly inspected to ensure the system is free flowing. See operation and maintenance recommendations in Table 7 below.		

Table 8: Operation and Maintenance Recommendations for Silt Traps / Trapped Gullies (Based on CIRIA C753 Table 14.2)

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Remove litter and debris and inspect for sediment, oil and grease accumulation	6 monthly
	Change the filter media	As recommended by manufacturer
	Remove sediment, oil, grease and floatables	As necessary – indicated by system inspections or immediately following significant spill
Remedial actions	Replace malfunctioning parts or structures	As required
Monitoring	Inspect for evidence of poor operation	6 monthly
	Inspect filter media and establish appropriate replacement frequencies	6 monthly
	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly during first half year of operation, then every 6 months
*During the first year of operation, inspections should be carried out at least monthly (and after significant storm events) to ensure that the system is functioning as designed and that no damage is evident.		

Table 9:Operation and Maintenance Recommendations for Flow Control Device (Based on Manufacturer's recommendations)

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Remove litter and debris and inspect for sediment, oil and grease accumulation	6 monthly
	Remove sediment, oil, grease and floatables	As necessary – indicated by system inspections or immediately following significant spill
Remedial actions	Replace malfunctioning parts or structures	As required
Monitoring	Inspect for evidence of poor operation	Monthly during the first three months, then every 6 months
	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly during first half year of operation, then every 6 months

Table 10: Operation and Maintenance Requirements for Attenuation Storage Tanks

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	Remove sediment from pre-treatment structures.	Annually, or as required.
Remedial actions	Repair / rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect / check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually*
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required*
*During the first year of operation, inspections should be carried out at least monthly (and after significant storm events) to ensure that the system is functioning as designed and that no damage is evident.		

Table 11: Operation and Maintenance Requirements for Package Pumping Station (based on CIRIA R182, Section 3) – to be used in conjunction with manufacturer's recommendations

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Basic adjustment to equipment	As recommended by manufacturer
	Lubricate systems	As recommended by manufacturer
	Changeover duty pump	As recommended by manufacturer
	Recording systems (where present) – recover data	As recommended by manufacturer/as required by database
	Standby generators (where present) – run-off load	Weekly
	Standby generators (where present) – run on load	Monthly
Remedial actions	Clear blockages in pipework	As required
	Clean walls, floor, electrodes and floats	As required
	Replace malfunctioning or worn components	As required
Monitoring	Check operation of non-return valves	Six monthly
	Inspect pump and control equipment for evidence of poor operation or failure	Monthly during the first six months of operation, then every three months
	Inspect the sump for silt / grease accumulation rate and establish appropriate removal frequencies	Monthly during the first six months of operation, then six monthly
	Inspect for structural failure of pump chamber(s) and general condition of any ancillary equipment	Six monthly
	Check the pump and pipework seals for leaks	Monthly during the first six months of operation, then six monthly
Note:- Pump to be isolated from electrical supply prior to maintenance works being undertaken		

Table 12: Operation and Maintenance Requirements for Filter Drains (Based on CIRIA C753 Table 16.1)

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly (or as required)
	Remove sediment from pre-treatment devices	Six monthly, or as required
Occasional maintenance	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly, or as required
Remedial actions	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (eg NJUG, 2007 or BS 3998:2010)	As required
	Clear perforated pipework of blockages	As required
Monitoring	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Six monthly*
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate removal frequencies	Six monthly*
*During the first year of operation, inspections should be carried out at least monthly (and after significant storm events) to ensure that the system is functioning as designed and that no damage is evident.		

Table 13: Operation and Maintenance Requirements for Pervious Pavements (Based on CIRIA C753 Table 20.15)

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is the most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48h after large storms in first six months*
	Inspect silt accumulation rates and establish appropriate removal frequencies	Annually*
	Monitor inspection chambers	Annually*
*During the first year of operation, inspections should be carried out at least monthly (and after significant storm events) to ensure that the system is functioning as designed and that no damage is evident.		

Table 14: Operation and Maintenance Requirements for Attenuation Storage Tanks (Based on CIRIA C753 Table 21.3)

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	Remove sediment from pre-treatment structures.	Annually, or as required.
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually*
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required*
*During the first year of operation, inspections should be carried out at least monthly (and after significant storm events) to ensure that the system is functioning as designed and that no damage is evident.		

Table 15: Operation and Maintenance Requirements for Oil Separators/Interceptors (Based on CIRIA C753 Section 14.12.2 and Environment Agency Document PPG3. To be read in conjunction with BS EN 858-2:2003).

Note: it is also usually required that separators are filled with clean water before being put into operation and each time after emptying for maintenance. Failure to do so will cause the separator to malfunction until surface water builds up the required permanent water level in the facility. It is possible to fit an alarm to separators that will indicate when the collected oil volume is at a maximum, and this may be a regulatory requirement. The alarms should be placed in a location that is clearly visible to those responsible for maintenance of the system.

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Assess the depth of accumulated silt and oil/sludge; empty the separator if required*	Six monthly
	Check thickness of light liquid	Six monthly
	Check function of automatic closure device	Six monthly
	Check the coalescing material, and clean or change if necessary	Six monthly
	Check the function of the warning device (if fitted)	Six monthly
Remedial actions	When major fuel spill occurs, empty the separator*	As required
Monitoring	Check watertightness of system	Monthly during first half year of operation, then five yearly
	Check structural condition	Monthly during first half year of operation, then five yearly
	Check internal coatings	Monthly during first half year of operation, then five yearly
	Check in-built parts	Monthly during first half year of operation, then five yearly
	Check electrical devices and installations	Monthly during first half year of operation, then five yearly
	Check if adjustment of automatic closure devices is required	Monthly during first half year of operation, then five yearly
*If oil or silt levels exceed 90% of the storage volume, the separator should be emptied straight away. If an alarm if fitted, this is usually set to trigger just prior to this level. When the oil or silt reaches this level, or after a spillage, employ a registered waste removal company with experience in emptying separators to empty the separator. Ensure the company does not allow any of the contents to escape from the outlet during emptying.		

9 SUMMARY

9.1 This report has been prepared to assess the flood risk and drainage implications associated with the proposed New Industrial Buildings in Birthwate Business Park, Huddersfield Road, Darton, Barnsley -S75 5JS

9.2 This report has identified that:

a) Surface water run-off from the proposed development will be discharged to appropriately sized underground storage to be discharged into the existing culvert that passes through the site and discharges into River Dearne.

b) The risk of pollution to groundwater will be adequately mitigated through the implementation of appropriate measures / features in the drainage design (e.g. SuDS).

c) The risk of drainage system failure has been adequately mitigated through the implementation of appropriate measures in the design of the scheme.

d) Foul water is proposed to discharge to the public sewer.

e) Overall, the site can be suitably, safely, and sustainably drained, with the development being designed and constructed to meet the required standards.

9.3 Suitably worded conditions can be applied to the grant of planning permission to control the delivery of the development in the usual manner.

APPENDIX A

Topography Survey

ALWAYS USE SAFE DIGGING PRACTICES. ALWAYS CONSULT A TRAINED AND COMPETENT PERSON TO CHECK YOUR EXCAVATION AREA BEFORE BREAKING GROUND

ALWAYS USE SAFE DIGGING PRACTICES. ALWAYS CONSULT A TRAINED AND COMPETENT PERSON TO CHECK YOUR EXCAVATION AREA BEFORE BREAKING GROUND

APPENDIX B

Proposed Development

Key

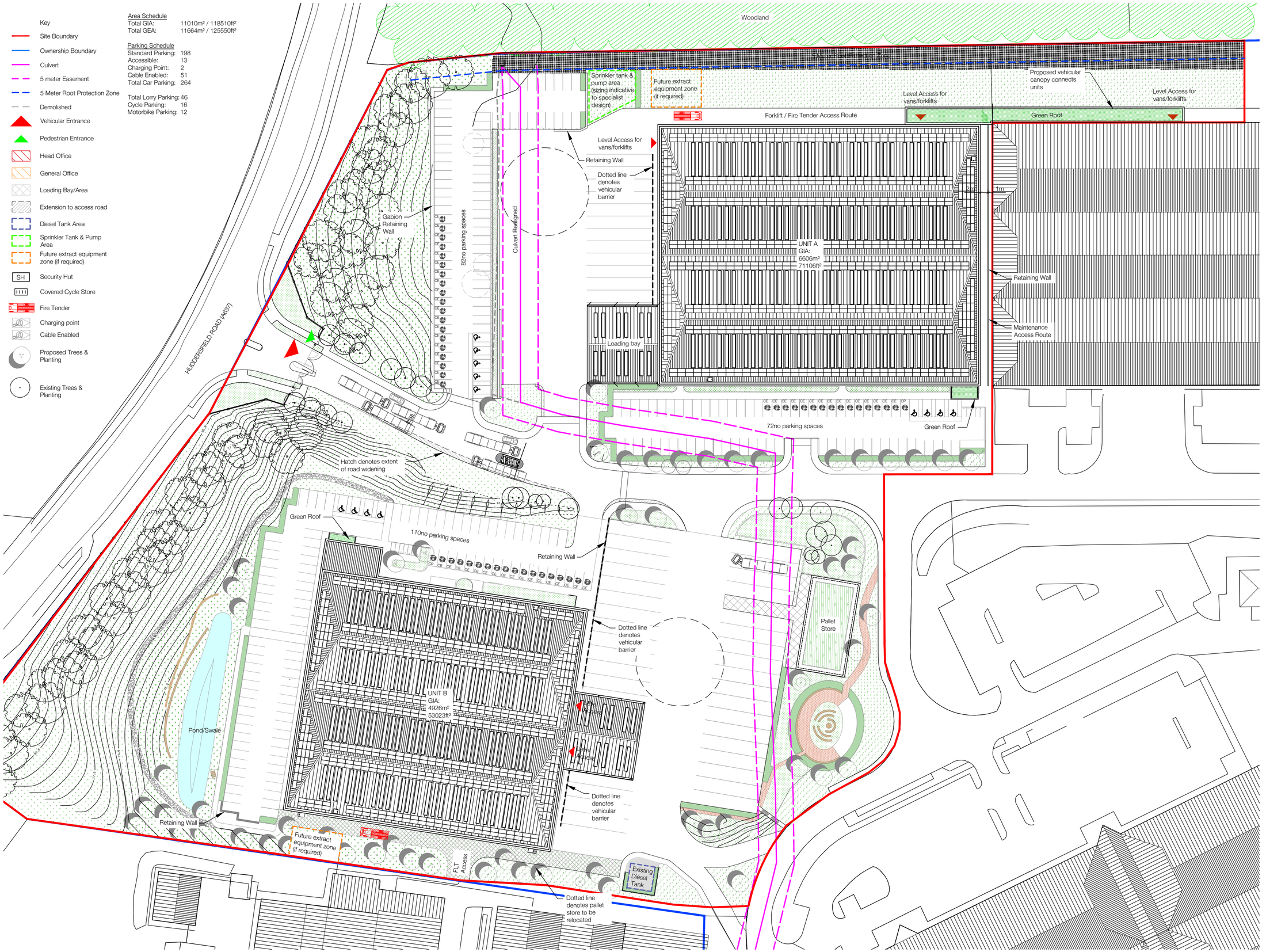
- Site Boundary
- Ownership Boundary
- Culvert
- 5 meter Easement
- 5 Meter Root Protection Zone
- Demolished
- Vehicular Entrance
- Pedestrian Entrance
- Head Office
- General Office
- Loading Bay/Area
- Extension to access road
- Diesel Tank Area
- Sprinkler Tank & Pump Area
- Future extract equipment zone (if required)
- SH Security Hut
- Covered Cycle Store
- Fire Tender
- Charging point
- Cable Enabled
- Proposed Trees & Planting
- Existing Trees & Planting

Area Schedule

Total GIA:	11010m² / 118510ft²
Total GEA:	11664m² / 125550ft²

Parking Schedule

Standard Parking:	198
Accessible:	13
Charging Point:	2
Cable Enabled:	51
Total Car Parking:	264
Total Lorry Parking:	46
Cycle Parking:	16
Motorbike Parking:	12



00-0003 Proposed Site Plan
Scale - 1:500

Notes

A1

Contractor must verify all dimensions on site before commencing any work or shop drawings.If this drawing exceeds the quantities taken in any way the Architects are to be informed before the work is initiated.
Only figured dimensions to be taken from this drawing.Do not scale off this drawing.Drawings based on Ordnance Survey and / or existing record drawings - design and drawing content subject to Site Survey, Structural Survey, Site Investigations, Planning and Statutory Requirements and Approvals. Authorised reproduction from Ordnance Survey Map with permission of the Controller of Her Majesty's Stationery Office. Crown Copyright reserved.

Location Plan

Rev.	Des.	By	Date	Ch.
P11	Levels & Retaining walls further coordinated following workshop with Civils & Landscape	JOE	12.10.23	AAH
P10	Green roofs to canopies & retaining walls indicated, stepped access to Unit B fire escapes indicated after civil's coordination	JOE	09.10.23	AAH
P09	PV's Indicated & Drawing Coordinated with landscape architect's design	EMTJ	29.09.23	JOE
P08	FLT & Fire tender access combined	JOE	11.09.23	AAH
P07	Coordinated with landscape architects plan	JOE	08.09.23	AAH
P06	Coordinated with landscape architects plan, 5 meter root protection buffer indicated at arboriculturalists request	JOE	01.09.23	AAH
P05	Unit B Roof Plan Updated	JOE	14.08.23	AAH
P04	Unit A Roof Plans Updated & position of Unit realigned following Structural workshop, Existing tree removed.	JOE	07.08.23	AAH
P03	Future Extract Equiptment zone indicated at client request	JOE	24.07.23	AAH
P02	Drawing naming amended to ISO convention formerly (00)003. Culvert realigned, entrance road amended, vehicular barriers indicated, entrance canopy indicated, 2.5 meter service access between units indicated, FLT access indicated, security hut relocated following DTM	JOE	07.07.23	AAH
P01		JOE	17.05.23	AAH

Client:
Premdor

Project:
JUGGERNAUT
Barnsley

Title:
Proposed Site Plan

Scale:	Status:	Drawn by:	Checked by:	Date:
1:500 @A1		JOE	AAH	Sep 2023

Job No: 23005 Drawing No: -A-CJCT-ZZ-XX-PL-00-0003 Rev No: P11

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PLANNING

APPENDIX C

Proposed Drainage Strategy
Unit A

NOTES:

G01. THESE NOTES ARE INTENDED TO AUGMENT DRAWINGS AND SPECIFICATIONS. WHERE CONFLICT OF REQUIREMENTS EXIST THE ORDER OF PRECEDENCE SHALL BE AS SHOWN IN THE SPECIFICATION. OTHERWISE THE STRICTEST PROVISION SHALL GOVERN.

G02. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS AND ARCHITECTS DRAWINGS.

G03. DRAWINGS NOT TO BE SCALED. ALL DIMENSIONS TO BE CHECKED ON SITE BY THE CONTRACTOR. ANY DISCREPANCIES TO BE NOTIFIED TO THE ENGINEER AND FURTHER INSTRUCTIONS OBTAINED BEFORE WORK IS COMMENCED.

G04. THE STRUCTURE IS DESIGNED TO BE SELF-SUPPORTING AND STABLE AFTER THE BUILDING IS FULLY COMPLETED. IT IS THE CONTRACTORS SOLE RESPONSIBILITY TO DETERMINE THE ERECTION PROCEDURE AND SEQUENCE AND ENSURE THAT THE BUILDING AND ITS COMPONENTS ARE SAFE DURING ERECTION. THIS INCLUDES THE ADDITION OF WHATEVER TEMPORARY BRACING, GUYS OR TIE-DOWNS WHICH MAY BE NECESSARY. SUCH MATERIAL REMAINING THE THE PROPERTY OF THE CONTRACTOR ON COMPLETION, AND FOR ENSURING THAT THE WORKS AND ANY ADJACENT PROPERTIES ARE SAFE IN THE TEMPORARY CONDITION.

EXISTING SERVICES NOTES

E01. CONTRACTOR TO PROTECT EXISTING SERVICES WITHIN THE SITE OR DIVERT AS REQUIRED.

E02. EXISTING PRESSURE PIPELINES TO BE PROTECTED DURING THE WORKS.

E03. EXISTING SEWERS AND OTHER SERVICES IN THE VICINITY OF THE PROPOSED WORKS TO BE SURVEYED AND DETAILS PROVEN AND PROTECTED AS NECESSARY FROM PROPOSED WORKS.

E04. EXISTING INFRASTRUCTURE THAT IS TO BE ABANDONED SHALL BE INFILLED WITH SUITABLE MATERIAL CAPABLE OF WITHSTANDING THE PROPOSED FUTURE LOADS. GEOTECHNICAL, CIVIL AND STRUCTURAL ENGINEER TO APPROVE.

PRIVATE DRAINAGE NOTES:

1. DRAINAGE SYSTEMS TO COMPLY WITH THE FOLLOWING STANDARDS:
   - BS EN 752:2008
   - BUILDING REGULATIONS APPROVED DOCUMENT PART H, 2015 EDITION
2. ALL COMPONENTS USED IN DRAINAGE SYSTEMS TO COMPLY WITH THE FOLLOWING: BS EN 476:2011
3. ALL DRAINAGE SYSTEMS AND COMPONENTS TO BE CONSTRUCTED AND TESTED TO THE FULL SATISFACTION OF THE BUILDING REGULATIONS INSPECTOR
4. ALL DRAINAGE TO BE CONSTRUCTED AND TESTED IN ACCORDANCE WITH BS EN 1610:2015.
5. EXACT POSITIONS OF SVPS, STUB-STACKS, W.C. OUTLETS ETC. AND RAINWATER DOWNPIPES ARE TO BE ACCURATELY LOCATED FROM THE ARCHITECT'S DESIGN DRAWINGS.
6. PIPES UPTO 225Ø TO BE VITRIFIED CLAY, VITRIFIED CLAY PIPES AND FITTINGS TO COMPLY WITH THE RELEVANT PROVISIONS OF BS EN295-1:2013,-2:2013,-3:2012 AND BS 65 RESPECTIVELY AND BE KITEMARKED. ALL PIPES SHALL BE EXTRA STRENGTH TO BS 65 OR EQUIVALENT BS EN295 PIPE CRUSHING STRENGTH.
7. ALL PRIVATE BELOW GROUND SW PIPES TO BE PLASTIC TWINWALL DRAINAGE PIPES (MAX 600Ø)
8. PRECAST CONCRETE MANHOLES TO BE IN ACCORDANCE WITH BS EN 1917:2002 AND BS 5911-3:2010,-4:2002 AND TO BE KITEMARKED. PRECAST CONCRETE RINGS AND COVER SLABS TO CONCRETE PIPES TO BE JOINTED WITH CEMENT MORTAR UNLESS NOTED OTHERWISE.
9. INSITU AND PRECAST CONCRETE UNITS SHALL HAVE SULPHATE RESISTING PORTLAND CEMENT TO BS EN 197-1:2011.
10. POLYPROPYLENE INSPECTION CHAMBERS TO COMPLY WITH BS EN 13598-1:2010,-2:2016 AND BS 7158:2001 AND TO BE KITEMARKED.
11. MANHOLE COVERS AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 124-1 TO 6:2015. MANHOLE COVERS AND FRAMES TO BE OF A NON-ROCKING DESIGN WITH CUSHION INSERTS AND KITEMARKED. LOAD CLASS D400 COVERS TO BE USED IN ALL LOCATIONS. ALL COVERS TO BE BADGED "FW" OR "SW" AS APPROPRIATE. MANHOLE COVER SLABS AND ACCESS TO BE IN ACCORDANCE WITH CONCRETE PIPE ASSOCIATION TECHNICAL BULLETIN ISSUED SEPTEMBER 2001.
12. POLYPROPYLENE INSPECTION CHAMBER COVERS AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 124-1 TO 6:2015. COVERS AND FRAMES TO BE OF A NON-ROCKING DESIGN WITH CUSHION INSERTS AND KITEMARKED. LOAD CLASS A15 COVERS TO BE USED IN AREAS INACCESSIBLE TO VEHICLES. LOAD CLASS D400 COVERS TO BE USED ELSEWHERE.
13. ROAD GULLY GRATES AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 124-1 TO 6:2015 AND BE OF A NON-ROCKING DESIGN WITH LEFT HANDED CAPTIVE HINGE ACCESS AND BE KITEMARKED. LOAD CLASS D400 GRATES TO BE USED THROUGHOUT WITH 450mm SQ. GRATE AND FRAME. MINIMUM AREA OF WATERWAY TO BE 1010cm².
14. YARD GULLY GRATES AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 124-1 TO 6:2015 AND BE OF A NON-ROCKING DESIGN AND BE KITEMARKED. LOAD CLASS A15 GRATES TO BE USED IN AREAS INACCESSIBLE TO VEHICLES. GRATES TO BE 300mm SQ. MINIMUM AREA OF WATERWAY TO BE 900cm².
15. RAINWATER DOWNPIPES CONNECTED DIRECT TO DRAIN TO BE CONNECTED USING AN APPROPRIATE ADAPTOR AND REMOVABLE SECTION OF DOWNPIPE TO PERMIT RODDING ACCESS.
16. CLASS Z BEDDING DETAIL SHALL BE PROVIDED:
    - WHERE COVER TO PIPE BARREL IS:
    - i) <1.2m IN VEHICULAR TRAFFICKED AREAS
    - ii) <0.9m IN AREAS INACCESSIBLE TO VEHICLES.
    - AT ALL ROAD GULLY, YARD GULLY, RWP, SVP AND DRAINAGE CHANNEL BRANCHES.
    - AREAS OF DEEP ROOTING VEGETATION.
    - PIPE RUNS NEAR BUILDINGS IN ACCORDANCE WITH TYPICAL SECTIONS ON AWP DRAWINGS.
    - WHERE TWO PIPES CROSS WITH A CLEAR GAP OF <300mm. CLASS Z SURROUND TO EXTEND A MINIMUM OF 1.0m FROM THE CENTRE OF THE CROSSING POINT & EXTENDED TO WITHIN 150mm OF THE NEAREST FLEXIBLE JOINT, WHERE REQUIRED.
17. CLASS Y BEDDING DETAIL TO BE PROVIDED WHERE COVER TO PIPE CROWN FROM THE UNDERSIDE OF THE SUB STRUCTURE IS LESS THAN 300mm.
18. PIPE BEDDING MATERIALS TO COMPLY GENERALLY WITH SHW - SERIES 500 - CLAUSE 503. GRANULAR BEDDING MATERIALS TO ALSO COMPLY WITH BS EN 13242 & THE GRANULAR BEDDING MATERIAL TABLE ON THIS DRAWING.
19. SELECTED BACKFILL MATERIAL TO BE PROVIDED ABOVE THE PIPE SURROUND TO A HEIGHT OF 300mm MINIMUM ABOVE THE TOP OF THE PIPE. SELECTED BACKFILL MATERIAL TO BE CLASS 8 - LOWER TRENCH FILL MATERIAL IN ACCORDANCE WITH SHW - SERIES 600 TABLE 6/1 & TO COMPRISE OF UNIFORM SOIL, FREE FROM STONES LARGER THAN 40mm, LUMPS OF CLAY OVER 100mm, TIMBER, FROZEN MATERIAL & VEGETABLE MATTER. SELECTED BACKFILL MATERIAL TO BE PLACED & COMPACTED IN LAYERS NOT EXCEEDING 150mm IN THICKNESS. SHOULD THE MATERIAL BE UNSUITABLE OR WEATHER CONDITIONS AFFECT THE MATERIALS STABILITY, THEN A SUITABLE HARD GRANULAR MATERIAL SHALL BE USED.
20. GENERAL BACKFILL TO DRAINAGE TRENCHES [OTHER THAN FILTER DRAINS] IN VEHICULAR TRAFFICKED AREAS ABOVE THE PIPE BEDDING & SELECTED BACKFILL SHALL BE CLASS 1, 2 OR 3 GENERAL FILL MATERIAL IN ACCORDANCE WITH SHW - SERIES 600.
21. GENERAL BACKFILL UNDER NON-VEHICULAR TRAFFICKED AREAS TO BE SUITABLE AS-DUG MATERIAL COMPACTED IN ACCORDANCE WITH SHW - SERIES 600 IN LAYERS NOT EXCEEDING 225mm, EACH LAYER COMPACTED TO FORM A STABLE TRENCH BACKFILL. SHOULD THE MATERIAL BE UNSUITABLE OR WEATHER CONDITIONS AFFECT THE MATERIALS STABILITY, THEN A HARD GRANULAR MATERIAL SHALL BE USED UP TO FORMATION LEVEL.
22. ALL CONCRETE TO BE DESIGNATED CONCRETE TO CONFORM TO BS 8500-2.
23. NO MECHANICAL COMPACTION OF FILL MATERIAL WITHIN 300mm OF THE CROWN OF ANY PIPE.

SIPHONIC DRAIN SYSTEM TO BE DESIGNED BY OTHERS

PROPOSED HYDRO-BRAKE FLOW CONTROL.
DESIGN HEAD: 1.100m
DESIGN DISCHARGE: 0.2 l/s
MD-SHE-0019-2000-1100-2000
CL: 70.735m
IL: 69.600m

PROPOSED BACKDROP CONNECTION TO EXISTING MANHOLE

DISCHARGE RATE 0.2 L/S
BASED ON GREENFIELD FLOW RATE

CL 70.735 (TBC)
IL 65.100 (TBC)
B.D.C 69.492 m

CAR PARK AREA
ASSUMED:
TOTAL AREA 1672 m²
CONSTRUCTION WITH 300mm TYPE 3 STONE
(30% porous material)
ATTENUATION SIZE 150 m³

SIPHONIC DRAIN SYSTEM TO BE DESIGNED BY OTHERS

FFL 70.985m

PROPOSED ATTENUATION TANK AREA TO STORE 765m³. DRAWN 36mX15mX1.5m DEPTH WITH 95% VOIDS
IL: 68.100 m

PROPOSED FULL RETENTION SEPARATOR - TO BE KLARGESTER NSFA100 OR EQUIVALENT APPROVED

SIPHONIC DRAIN SYSTEM TO BE DESIGNED BY OTHERS

PROPOSED HYDRO-BRAKE FLOW CONTROL.
DESIGN HEAD: 1.500 m
DESIGN DISCHARGE: 2.6 l/s
BASED ON GREENFIELD FLOW RATE
MD-SHE-0070-2600-1500-2600
CL: 71.06m
IL: 68.075

PROPOSED CONNECTION TO EXISTING SYSTEM BY CONSTRUCTION OF NEW MANHOLE
CL TBC
IL TBC

PROPOSED ATTENUATION TANK AREA TO STORE 127.5m³. DRAWN 22.3mX4X1.5m DEPTH WITH 95% VOIDS

PROPOSED HYDRO-BRAKE FLOW CONTROL.
DESIGN HEAD: 1.700m
DESIGN DISCHARGE: 0.5 l/s
BASED ON GREENFIELD FLOW RATE
MD-SHE-0028-5000-1700-5000
CL: 72.02m
IL: 68.62m

PROPOSED FULL RETENTION SEPARATOR - TO BE KLARGESTER NSFA040 OR EQUIVALENT APPROVED

K

G

100mm at A1

LEGEND

- DEVELOPMENT BOUNDARY
- RE — RODDING EYE
- SURFACE WATER CHAMBER
- SURFACE WATER SEWER
- PERFORATED PIPE
- SIPHONIC DRAIN-TO BE DESIGNED BY OTHER
- PROPOSED ATTENUATION TANK
- PROPOSED POND
- PROPOSED PERMEABLE AREA
- PROPOSED ACCO DRAIN CHANNEL
- RPOSED HEADWALL
- PROPOSED OIL SEPARATOR
- RWP — PROPOSED RAIN WATER PIPE
- PROPOSED EXEEDANCE FLOW PATH ROUT

Rev	Description	Date	By	Chk	App
P5	UPDATED TO MATCH WITH FINISHED LEVELS	05.10.23	MM	KH	KH
P4	UPDATED TO THE UPDATED COVER LEVELS	22.09.23	MM	KH	KH
P3	UPDATED TO REMOVE THE SWALE	13.09.23	MM	KH	KH
P2	SITE PLAN UPDATED	11.09.23	MM	KH	KH
P1	FIRST ISSUE	07.09.23	MM	KH	KH

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Sheffield T. 01142 440077
York T. 01904 611594

Project: BIRTHWAITE BUSINESS PARK

Client: PREMDOR CROSBY LTD

Drawing: PROPOSED DRAINAGE STRATEGY-UNIT A

Role: CIVIL ENGINEER

Drawing Status: FOR INFROMATION

Suitability Code: -

Job. no. 49145

Scale@ A1: 1:250

Rev. P5

Project Originator Volume Level Type Role Number
BBP - AWP - XX - XX - DR - C - 3000

APPENDIX D

Proposed Drainage Strategy
Unit B

PROPOSED HYDRO-BRAKE FLOW CONTROL.
DESIGN HEAD: 1.500m
DESIGN DISCHARGE:2.2 l/s
BASED ON THE GREENFIELD FLOW RATE
MD-SHE-0064-2200-1500-2200
CL: 68.679m
IL: 70.150

PROPOSED FULL RETENTION SEPARATOR - TO BE KLARGESTER NSFA010 OR EQUIVALENT APPROVED

PROPOSED POND
IL:67.754 m
SIDE SLOPE : 1:3
DEPTH OF PERMANENT WATER : 300 mm
MAX. DEPTH OF SURFACE WATER TO ATTENUATE: 1.000 mm
MAX. WATER LEVEL: 70.054 m
VOLUME OF WATER THAT CAN BE ATTENUATED : 305.5 m^3

SILT TRAP TO BE INSTALLED

CAR PARK AREA
ASSUMED:
TOTAL AREA 2564 m^2
CONSTRUCTION WITH 400mm TYPE 3 STONE (30% porous material)
ATTENUATION SIZE 307 m^3

SIPHONIC DRAIN SYSTEM TO BE DESIGNED BY OTHERS

FFL 71.000 m

PROPOSED CONNECTION TO EXISTING MANHOLE BACKDROP CONNECTION
CL 66.51
IL 63.4
(TBC)

PERFORATED PIPE Ø225

GREEN ROOF

PRIVATE DRAINAGE NOTES:

1. DRAINAGE SYSTEMS TO COMPLY WITH THE FOLLOWING STANDARDS:
- BS EN 752:2008
- BUILDING REGULATIONS APPROVED DOCUMENT PART H, 2015 EDITION

2. ALL COMPONENTS USED IN DRAINAGE SYSTEMS TO COMPLY WITH THE FOLLOWING: BS EN 476:2011

3. ALL DRAINAGE SYSTEMS AND COMPONENTS TO BE CONSTRUCTED AND TESTED TO THE FULL SATISFACTION OF THE BUILDING REGULATIONS INSPECTOR

4. ALL DRAINAGE TO BE CONSTRUCTED AND TESTED IN ACCORDANCE WITH BS EN 1610:2015.

5. EXACT POSITIONS OF SVP'S, STUB-STACKS, W.C. OUTLETS ETC. AND RAINWATER DOWNPIPES ARE TO BE ACCURATELY LOCATED FROM THE ARCHITECT'S DESIGN DRAWINGS.

6. PIPES UPTO 225Ø TO BE VITRIFIED CLAY, VITRIFIED CLAY PIPES AND FITTINGS TO COMPLY WITH THE RELEVANT PROVISIONS OF BS EN295-1:2013,-2:2013,-3:2012 AND BS 65 RESPECTIVELY AND BE KITEMARKED. ALL PIPES SHALL BE EXTRA STRENGTH TO BS 65 OR EQUIVALENT BS EN295 PIPE CRUSHING STRENGTH.

7. ALL PRIVATE BELOW GROUND SW PIPES TO BE PLASTIC TWINWALL DRAINAGE PIPES (MAX 600Ø)

8. PRECAST CONCRETE MANHOLES TO BE IN ACCORDANCE WITH BS EN 1917:2002 AND BS 5911-3:2010,-4:2002 AND TO BE KITEMARKED. PRECAST CONCRETE RINGS AND COVER SLABS TO CONCRETE PIPES TO BE JOINTED WITH CEMENT MORTAR UNLESS NOTED OTHERWISE.

9. INSITU AND PRECAST CONCRETE UNITS SHALL HAVE SULPHATE RESISTING PORTLAND CEMENT TO BS EN 197-1:2011.

10. POLYPROPYLENE INSPECTION CHAMBERS TO COMPLY WITH BS EN 13598-1:2010,-2:2016 AND BS 7158:2001 AND TO BE KITEMARKED.

11. MANHOLE COVERS AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 124-1 TO 6:2015. MANHOLE COVERS AND FRAMES TO BE OF A NON-ROCKING DESIGN WITH CUSHION INSERTS AND KITEMARKED. LOAD CLASS D400 COVERS TO BE USED IN ALL LOCATIONS. ALL COVERS TO BE BADGED "FW" OR "SW" AS APPROPRIATE. MANHOLE COVER SLABS AND ACCESS TO BE IN ACCORDANCE WITH CONCRETE PIPE ASSOCIATION TECHNICAL BULLETIN ISSUED SEPTEMBER 2001.

12. POLYPROPYLENE INSPECTION CHAMBER COVERS AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 124-1 TO 6:2015. COVERS AND FRAMES TO BE OF A NON-ROCKING DESIGN WITH CUSHION INSERTS AND KITEMARKED. LOAD CLASS A15 COVERS TO BE USED IN AREAS INACCESSIBLE TO VEHICLES. LOAD CLASS D400 COVERS TO BE USED ELSEWHERE.

13. ROAD GULLY GRATES AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 124-1 TO 6:2015 AND BE OF A NON-ROCKING DESIGN WITH LEFT HANDED CAPTIVE HINGE ACCESS AND BE KITEMARKED. LOAD CLASS D400 GRATES TO BE USED THROUGHOUT WITH 450mm SQ. GRATE AND FRAME. MINIMUM AREA OF WATERWAY TO BE 1010cm^2.

14. YARD GULLY GRATES AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 124-1 TO 6:2015 AND BE OF A NON-ROCKING DESIGN AND BE KITEMARKED. LOAD CLASS A15 GRATES TO BE USED IN AREAS INACCESSIBLE TO VEHICLES. GRATES TO BE 300mm SQ. MINIMUM AREA OF WATERWAY TO BE 900cm^2.

15. RAINWATER DOWNPIPES CONNECTED DIRECT TO DRAIN TO BE CONNECTED USING AN APPROPRIATE ADAPTOR AND REMOVABLE SECTION OF DOWNPIPE TO PERMIT RODDING ACCESS.

16. CLASS Z BEDDING DETAIL SHALL BE PROVIDED:
- WHERE COVER TO PIPE BARREL IS;
  i) <1.2m IN VEHICULAR TRAFFICKED AREAS
  ii) <0.9m IN AREAS INACCESSIBLE TO VEHICLES.
- AT ALL ROAD GULLY, YARD GULLY, RWP, SVP AND DRAINAGE CHANNEL BRANCHES.
- AREAS OF DEEP ROOTING VEGETATION.
- PIPE RUNS NEAR BUILDINGS IN ACCORDANCE WITH TYPICAL SECTIONS ON AWP DRAWINGS.
- WHERE TWO PIPES CROSS WITH A CLEAR GAP OF <300mm, CLASS Z SURROUND TO EXTEND A MINIMUM OF 1.0m FROM THE CENTRE OF THE CROSSING POINT & EXTENDED TO WITHIN 150mm OF THE NEAREST FLEXIBLE JOINT, WHERE REQUIRED.

17. CLASS Y BEDDING DETAIL TO BE PROVIDED WHERE COVER TO PIPE CROWN FROM THE UNDERSIDE OF THE SUB STRUCTURE IS LESS THAN 300mm.

18. PIPE BEDDING MATERIALS TO COMPLY GENERALLY WITH SHW - SERIES 500 - CLAUSE 503. GRANULAR BEDDING MATERIALS TO ALSO COMPLY WITH BS EN 13242 & THE GRANULAR BEDDING MATERIAL TABLE ON THIS DRAWING.

19. SELECTED BACKFILL MATERIAL TO BE PROVIDED ABOVE THE PIPE SURROUND TO A HEIGHT OF 300mm MINIMUM ABOVE THE TOP OF THE PIPE. SELECTED BACKFILL MATERIAL TO BE CLASS B - LOWER TRENCH FILL MATERIAL IN ACCORDANCE WITH SHW - SERIES 600 TABLE 6/1 & TO COMPRISE OF UNIFORM SOIL, FREE FROM STONES LARGER THAN 40mm, LUMPS OF CLAY OVER 100mm, TIMBER, FROZEN MATERIAL & VEGETABLE MATTER. SELECTED BACKFILL MATERIAL TO BE PLACED & COMPACTED IN LAYERS NOT EXCEEDING 150mm IN THICKNESS. SHOULD THE MATERIAL BE UNSUITABLE OR WEATHER CONDITIONS AFFECT THE MATERIALS STABILITY, THEN A SUITABLE HARD GRANULAR MATERIAL SHALL BE USED.

20. GENERAL BACKFILL TO DRAINAGE TRENCHES [OTHER THAN FILTER DRAINS] IN VEHICULAR TRAFFICKED AREAS ABOVE THE PIPE BEDDING & SELECTED BACKFILL SHALL BE CLASS 1, 2 OR 3 GENERAL FILL MATERIAL IN ACCORDANCE WITH SHW - SERIES 600.

21. GENERAL BACKFILL UNDER NON-VEHICULAR TRAFFICKED AREAS TO BE SUITABLE AS-DUG MATERIAL COMPACTED IN ACCORDANCE WITH SHW - SERIES 600 IN LAYERS NOT EXCEEDING 225mm, EACH LAYER COMPACTED TO FORM A STABLE TRENCH BACKFILL, SHOULD THE MATERIAL BE UNSUITABLE OR WEATHER CONDITIONS AFFECT THE MATERIALS STABILITY, THEN A HARD GRANULAR MATERIAL SHALL BE USED UP TO FORMATION LEVEL.

22. ALL CONCRETE TO BE DESIGNATED CONCRETE TO CONFORM TO BS 8500-2.

23. NO MECHANICAL COMPACTION OF FILL MATERIAL WITHIN 300mm OF THE CROWN OF ANY PIPE.

100mm at A1

NOTES:

G01. THESE NOTES ARE INTENDED TO AUGMENT DRAWINGS AND SPECIFICATIONS. WHERE CONFLICT OF REQUIREMENTS EXIST THE ORDER OF PRECEDENCE SHALL BE AS SHOWN IN THE SPECIFICATION. OTHERWISE THE STRICTEST PROVISION SHALL GOVERN.

G02. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS AND ARCHITECTS DRAWINGS.

G03. DRAWINGS NOT TO BE SCALED. ALL DIMENSIONS TO BE CHECKED ON SITE BY THE CONTRACTOR. ANY DISCREPANCIES TO BE NOTIFIED TO THE ENGINEER AND FURTHER INSTRUCTIONS OBTAINED BEFORE WORK IS COMMENCED.

G04. THE STRUCTURE IS DESIGNED TO BE SELF-SUPPORTING AND STABLE AFTER THE BUILDING IS FULLY COMPLETED. IT IS THE CONTRACTORS SOLE RESPONSIBILITY TO DETERMINE THE ERECTION PROCEDURE AND SEQUENCE AND ENSURE THAT THE BUILDING AND ITS COMPONENTS ARE SAFE DURING ERECTION. THIS INCLUDES THE ADDITION OF WHATEVER TEMPORARY BRACING, GUYS OR TIE-DOWNS WHICH MAY BE NECESSARY, SUCH MATERIAL REMAINING THE THE PROPERTY OF THE CONTRACTOR ON COMPLETION, AND FOR ENSURING THAT THE WORKS AND ANY ADJACENT PROPERTIES ARE SAFE IN THE TEMPORARY CONDITION.

ROADWORKS NOTES

R01. LEVELS AT TIE IN TO EXISTING ROAD CONSTRUCTION TO BE CONFIRMED, ANY DISCREPANCIES TO BE NOTIFIED TO THE ENGINEER.

R02. ALL WORKS ADJACENT OR WITHIN PUBLICLY ADOPTED ROADS TO BE IN ACCORDANCE WITH LOCAL HIGHWAY AUTHORITY REQUIREMENTS.

R03. IF ANY DISCREPANCIES EXIST BETWEEN THE SPECIFICATION AND THE DRAWINGS, THE ENGINEER SHALL BE NOTIFIED IMMEDIATELY.

R04. WHERE REQUIRED, THE CONTRACTOR SHALL NOTIFY THE APPROPRIATE AUTHORITY PRIOR TO COMMENCEMENT OF EACH STAGE OF THE WORK FOR THEIR REPRESENTATIVE TO CARRY OUT INSPECTION TO ENSURE COMPLIANCE WITH THEIR SPECIFICATION AND APPROVED DETAILS. IF ANY SUCH REQUESTS OR INSTRUCTIONS CAUSE CONFLICT WITH THE SPECIFICATION THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER.

R05. ALL BLOCKS TO BE CUT USING A STONE CUTTER NOT A BLOCK SPLITTER

R06. TYPES OF KERBING TO SUIT EACH SURFACE TYPE AND PROPOSED USE.

R07. CONCRETE AREAS TO BE:
- SUITABLE TO WITHSTAND TRAFFIC LOADING AND GROUND CONDITIONS
- JOINTS TO BE PROVIDED AS REQUIRED
- POSITIVELY DRAINED

R08. ROADS TO BE:
- SUITABLE TO WITHSTAND TRAFFIC LOADING AND GROUND CONDITIONS
- JOINTS TO BE PROVIDED AS REQUIRED
- POSITIVELY DRAINED

EXISTING SERVICES NOTES

E01. CONTRACTOR TO PROTECT EXISTING SERVICES WITHIN THE SITE OR DIVERT AS REQUIRED.

E02. EXISTING PRESSURE PIPELINES TO BE PROTECTED DURING THE WORKS.

E03. EXISTING SEWERS AND OTHER SERVICES IN THE VICINITY OF THE PROPOSED WORKS TO BE SURVEYED AND DETAILS PROVEN AND PROTECTED AS NECESSARY FROM PROPOSED WORKS.

E04. EXISTING INFRASTRUCTURE THAT IS TO BE ABANDONED SHALL BE INFILLED WITH SUITABLE MATERIAL CAPABLE OF WITHSTANDING THE PROPOSED FUTURE LOADS. GEOTECHNICAL, CIVIL AND STRUCTURAL ENGINEER TO APPROVE.

LEGEND

- DEVELOPMENT BOUNDARY
- RODDING EYE (RE)
- SURFACE WATER CHAMBER
- SURFACE WATER SEWER
- PERFORATED PIPE
- SIPHONIC DRAIN-TO BE DESIGNED BY OTHER
- PROPOSED ATTENUATION TANK
- PROPOSED POND
- PROPOSED PERMEABLE AREA
- PROPOSED ACCO DRAIN CHANNEL
- PROPOSED HEADWALL
- PROPOSED OIL SEPARATOR
- PROPOSED RAIN WATER PIPE (RWP)
- PROPOSED EXEEDANCE FLOW PATH ROUT
- PROPOSED GULLY (G)

Rev	Description	Date	By	Chk	App
P5	UPDATED TO LOCATE THE GREEN ROOF	12.10.23	MM	KH	KH
P4	UPDATED TO THE NEW LEVELS	22.09.23	MM	KH	KH
P3	UPDATED TO THE COMMENTS	13.09.23	MM	KH	KH
P2	SITE PLAN UPDATED	11.09.23	MM	KH	KH
P1	FIRST ISSUE	07.09.23	MM	KH	KH

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Project: BIRTHWAITE BUSINESS PARK

Client: PREMDOR CROSBY LTD

Drawing: PROPOSED DRAINAGE STRATEGY-UNIT B

Role: CIVIL ENGINEER

Drawing Status: FOR INFROMATION

Suitability Code: -

Job. no. 49145

Scale@ A1: 1:250

Rev. P5

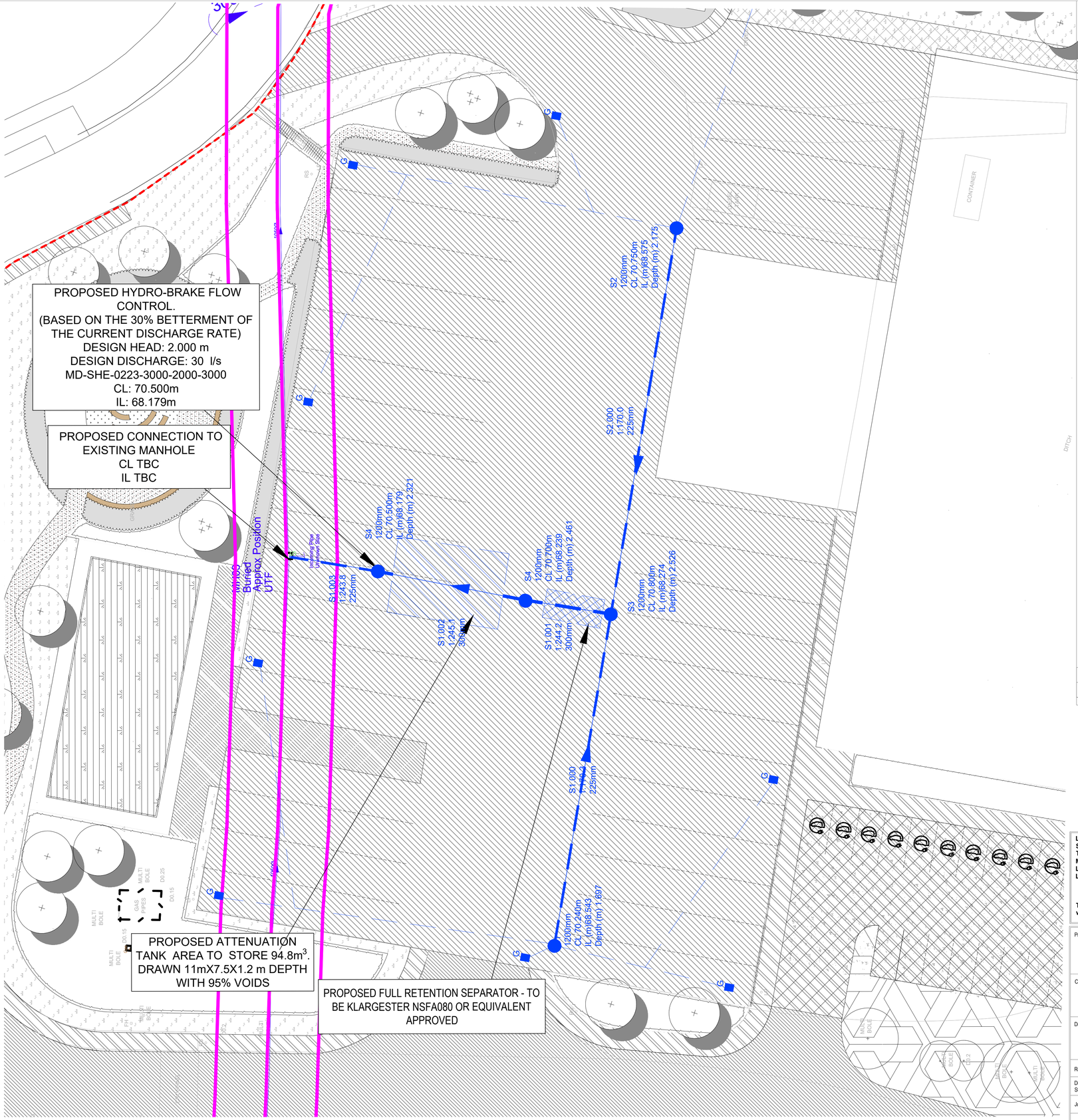
Project Originator Volume Level Type Role Number
BBP - AWP - XX - XX - DR - C - 3001

APPENDIX E

Proposed Drainage Strategy
Unit B-Parking Area

PRIVATE DRAINAGE NOTES:

1. DRAINAGE SYSTEMS TO COMPLY WITH THE FOLLOWING STANDARDS:
   - BS EN 752:2008
   - BUILDING REGULATIONS APPROVED DOCUMENT PART H, 2015 EDITION
2. ALL COMPONENTS USED IN DRAINAGE SYSTEMS TO COMPLY WITH THE FOLLOWING: BS EN 476:2011
3. ALL DRAINAGE SYSTEMS AND COMPONENTS TO BE CONSTRUCTED AND TESTED TO THE FULL SATISFACTION OF THE BUILDING REGULATIONS INSPECTOR
4. ALL DRAINAGE TO BE CONSTRUCTED AND TESTED IN ACCORDANCE WITH BS EN 1610:2015.
5. EXACT POSITIONS OF SVP'S, STUB-STACKS, W.C. OUTLETS ETC. AND RAINWATER DOWNPIPES ARE TO BE ACCURATELY LOCATED FROM THE ARCHITECT'S DESIGN DRAWINGS.
6. PIPES UPTO 225Ø TO BE VITRIFIED CLAY, VITRIFIED CLAY PIPES AND FITTINGS TO COMPLY WITH THE RELEVANT PROVISIONS OF BS EN295-1:2013,-2:2013,-3:2012 AND BS 65 RESPECTIVELY AND BE KITEMARKED. ALL PIPES SHALL BE EXTRA STRENGTH TO BS 65 OR EQUIVALENT BS EN295 PIPE CRUSHING STRENGTH.
7. ALL PRIVATE BELOW GROUND SW PIPES TO BE PLASTIC TWINWALL DRAINAGE PIPES (MAX 600Ø)
8. PRECAST CONCRETE MANHOLES TO BE IN ACCORDANCE WITH BS EN 1917:2002 AND BS 5911-3:2010,-4:2002 AND TO BE KITEMARKED. PRECAST CONCRETE RINGS AND COVER SLABS TO CONCRETE PIPES TO BE JOINTED WITH CEMENT MORTAR UNLESS NOTED OTHERWISE.
9. INSITU AND PRECAST CONCRETE UNITS SHALL HAVE SULPHATE RESISTING PORTLAND CEMENT TO BS EN 197-1:2011.
10. POLYPROPYLENE INSPECTION CHAMBERS TO COMPLY WITH BS EN 13598-1:2010,-2:2016 AND BS 7158:2001 AND TO BE KITEMARKED.
11. MANHOLE COVERS AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 124-1 TO 6:2015. MANHOLE COVERS AND FRAMES TO BE OF A NON-ROCKING DESIGN WITH CUSHION INSERTS AND KITEMARKED. LOAD CLASS D400 COVERS TO BE USED IN ALL LOCATIONS. ALL COVERS TO BE BADGED "FW" OR "SW" AS APPROPRIATE. MANHOLE COVER SLABS AND ACCESS TO BE IN ACCORDANCE WITH CONCRETE PIPE ASSOCIATION TECHNICAL BULLETIN ISSUED SEPTEMBER 2001.
12. POLYPROPYLENE INSPECTION CHAMBER COVERS AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 124-1 TO 6:2015. COVERS AND FRAMES TO BE OF A NON-ROCKING DESIGN WITH CUSHION INSERTS AND KITEMARKED. LOAD CLASS A15 COVERS TO BE USED IN AREAS INACCESSIBLE TO VEHICLES; LOAD CLASS D400 COVERS TO BE USED ELSEWHERE.
13. ROAD GULLY GRATES AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 124-1 TO 6:2015 AND BE OF A NON-ROCKING DESIGN WITH LEFT HANDED CAPTIVE HINGE ACCESS AND BE KITEMARKED. LOAD CLASS D400 GRATES TO BE USED THROUGHOUT WITH 450mm SQ. GRATE AND FRAME. MINIMUM AREA OF WATERWAY TO BE 1010cm².
14. YARD GULLY GRATES AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 124-1 TO 6:2015 AND BE OF A NON-ROCKING DESIGN AND BE KITEMARKED. LOAD CLASS A15 GRATES TO BE USED IN AREAS INACCESSIBLE TO VEHICLES. GRATES TO BE 300mm SQ. MINIMUM AREA OF WATERWAY TO BE 900cm².
15. RAINWATER DOWNPIPES CONNECTED DIRECT TO DRAIN TO BE CONNECTED USING AN APPROPRIATE ADAPTOR AND REMOVABLE SECTION OF DOWNPIPE TO PERMIT RODDING ACCESS.
16. CLASS Z BEDDING DETAIL SHALL BE PROVIDED:
   - WHERE COVER TO PIPE BARREL IS;
     i) <1.2m IN VEHICULAR TRAFFICKED AREAS
     ii) <0.9m IN AREAS INACCESSIBLE TO VEHICLES.
   - AT ALL ROAD GULLY, YARD GULLY, RWP, SVP AND DRAINAGE CHANNEL BRANCHES.
   - AREAS OF DEEP ROOTING VEGETATION.
   - PIPE RUNS NEAR BUILDINGS IN ACCORDANCE WITH TYPICAL SECTIONS ON AWP DRAWINGS.
   - WHERE TWO PIPES CROSS WITH A CLEAR GAP OF <300mm. CLASS Z SURROUND TO EXTEND A MINIMUM OF 1.0m FROM THE CENTRE OF THE CROSSING POINT & EXTENDED TO WITHIN 150mm OF THE NEAREST FLEXIBLE JOINT, WHERE REQUIRED.
17. CLASS Y BEDDING DETAIL TO BE PROVIDED WHERE COVER TO PIPE CROWN FROM THE UNDERSIDE OF THE SUB STRUCTURE IS LESS THAN 300mm.
18. PIPE BEDDING MATERIALS TO COMPLY GENERALLY WITH SHW - SERIES 500 - CLAUSE 503. GRANULAR BEDDING MATERIALS TO ALSO COMPLY WITH BS EN 13242 & THE GRANULAR BEDDING MATERIAL TABLE ON THIS DRAWING.
19. SELECTED BACKFILL MATERIAL TO BE PROVIDED ABOVE THE PIPE SURROUND TO A HEIGHT OF 300mm MINIMUM ABOVE THE TOP OF THE PIPE. SELECTED BACKFILL MATERIAL TO BE CLASS 8 - LOWER TRENCH FILL MATERIAL IN ACCORDANCE WITH SHW - SERIES 600 TABLE 6/1 & TO COMPRISE OF UNIFORM SOIL, FREE FROM STONES LARGER THAN 40mm, LUMPS OF CLAY OVER 100mm, TIMBER, FROZEN MATERIAL & VEGETABLE MATTER. SELECTED BACKFILL MATERIAL TO BE PLACED & COMPACTED IN LAYERS NOT EXCEEDING 150mm IN THICKNESS. SHOULD THE MATERIAL BE UNSUITABLE OR WEATHER CONDITIONS AFFECT THE MATERIALS STABILITY, THEN A SUITABLE HARD GRANULAR MATERIAL SHALL BE USED.
20. GENERAL BACKFILL TO DRAINAGE TRENCHES [OTHER THAN FILTER DRAINS] IN VEHICULAR TRAFFICKED AREAS ABOVE THE PIPE BEDDING & SELECTED BACKFILL SHALL BE CLASS 1, 2 OR 3 GENERAL FILL MATERIAL IN ACCORDANCE WITH SHW - SERIES 600.
21. GENERAL BACKFILL UNDER NON-VEHICULAR TRAFFICKED AREAS TO BE SUITABLE AS-DUG MATERIAL COMPACTED IN ACCORDANCE WITH SHW - SERIES 600 IN LAYERS NOT EXCEEDING 225mm, EACH LAYER COMPACTED TO FORM A STABLE TRENCH BACKFILL, SHOULD THE MATERIAL BE UNSUITABLE OR WEATHER CONDITIONS AFFECT THE MATERIALS STABILITY, THEN A HARD GRANULAR MATERIAL SHALL BE USED UP TO FORMATION LEVEL.
22. ALL CONCRETE TO BE DESIGNATED CONCRETE TO CONFORM TO BS 8500-2.
23. NO MECHANICAL COMPACTION OF FILL MATERIAL WITHIN 300mm OF THE CROWN OF ANY PIPE.



NOTES:

G01. THESE NOTES ARE INTENDED TO AUGMENT DRAWINGS AND SPECIFICATIONS. WHERE CONFLICT OF REQUIREMENTS EXIST THE ORDER OF PRECEDENCE SHALL BE AS SHOWN IN THE SPECIFICATION. OTHERWISE THE STRICTEST PROVISION SHALL GOVERN.

G02. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS AND ARCHITECTS DRAWINGS.

G03. DRAWINGS NOT TO BE SCALED. ALL DIMENSIONS TO BE CHECKED ON SITE BY THE CONTRACTOR. ANY DISCREPANCIES TO BE NOTIFIED TO THE ENGINEER AND FURTHER INSTRUCTIONS OBTAINED BEFORE WORK IS COMMENCED.

G04. THE STRUCTURE IS DESIGNED TO BE SELF-SUPPORTING AND STABLE AFTER THE BUILDING IS FULLY COMPLETED. IT IS THE CONTRACTORS SOLE RESPONSIBILITY TO DETERMINE THE ERECTION PROCEDURE AND SEQUENCE AND ENSURE THAT THE BUILDING AND ITS COMPONENTS ARE SAFE DURING ERECTION. THIS INCLUDES THE ADDITION OF WHATEVER TEMPORARY BRACING, GUYS OR TIE-DOWNS WHICH MAY BE NECESSARY, SUCH MATERIAL REMAINING THE THE PROPERTY OF THE CONTRACTOR ON COMPLETION, AND FOR ENSURING THAT THE WORKS AND ANY ADJACENT PROPERTIES ARE SAFE IN THE TEMPORARY CONDITION.

ROADWORKS NOTES

R01. LEVELS AT TIE IN TO EXISTING ROAD CONSTRUCTION TO BE CONFIRMED, ANY DISCREPANCIES TO BE NOTIFIED TO THE ENGINEER.

R02. ALL WORKS ADJACENT OR WITHIN PUBLICLY ADOPTED ROADS TO BE IN ACCORDANCE WITH LOCAL HIGHWAY AUTHORITY REQUIREMENTS.

R03. IF ANY DISCREPANCIES EXIST BETWEEN THE SPECIFICATION AND THE DRAWINGS, THE ENGINEER SHALL BE NOTIFIED IMMEDIATELY.

R04. WHERE REQUIRED, THE CONTRACTOR SHALL NOTIFY THE APPROPRIATE AUTHORITY PRIOR TO COMMENCEMENT OF EACH STAGE OF THE WORK FOR THEIR REPRESENTATIVE TO CARRY OUT INSPECTION TO ENSURE COMPLIANCE WITH THEIR SPECIFICATION AND APPROVED DETAILS. IF ANY SUCH REQUESTS OR INSTRUCTIONS CAUSE CONFLICT WITH THE SPECIFICATION THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER.

R05. ALL BLOCKS TO BE CUT USING A STONE CUTTER NOT A BLOCK SPLITTER

R06. TYPES OF KERBING TO SUIT EACH SURFACE TYPE AND PROPOSED USE.

R07. CONCRETE AREAS TO BE:
- SUITABLE TO WITHSTAND TRAFFIC LOADING AND GROUND CONDITIONS
- JOINTS TO BE PROVIDED AS REQUIRED
- POSITIVELY DRAINED

R08. ROADS TO BE:
- SUITABLE TO WITHSTAND TRAFFIC LOADING AND GROUND CONDITIONS
- JOINTS TO BE PROVIDED AS REQUIRED
- POSITIVELY DRAINED

EXISTING SERVICES NOTES

E01. CONTRACTOR TO PROTECT EXISTING SERVICES WITHIN THE SITE OR DIVERT AS REQUIRED.

E02. EXISTING PRESSURE PIPELINES TO BE PROTECTED DURING THE WORKS.

E03. EXISTING SEWERS AND OTHER SERVICES IN THE VICINITY OF THE PROPOSED WORKS TO BE SURVEYED AND DETAILS PROVEN AND PROTECTED AS NECESSARY FROM PROPOSED WORKS.

E04. EXISTING INFRASTRUCTURE THAT IS TO BE ABANDONED SHALL BE INFILLED WITH SUITABLE MATERIAL CAPABLE OF WITHSTANDING THE PROPOSED FUTURE LOADS. GEOTECHNICAL, CIVIL AND STRUCTURAL ENGINEER TO APPROVE.

LEGEND

- DEVELOPMENT BOUNDARY
- RW — INDICATIVE RETAINING WALL
- RE — RODDING EYE
- SURFACE WATER CHAMBER
- SURFACE WATER SEWER
- PERFORATED PIPE
- SIPHONIC DRAIN-TO BE DESIGNED BY OTHER
- PROPOSED ATTENUATION TANK
- PROPOSED POND
- PROPOSED PERMEABLE AREA
- PROPOSED ACCO DRAIN CHANNEL
- REPOSED HEADWALL
- PROPOSED OIL SEPARATOR
- RWP — PROPOSED RAIN WATER PIPE
- PROPOSED EXEEDANCE FLOW PATH ROUT
- G — PROPOSED GULLY

Rev	Description	Date	By	Chk	App
P2	UPDATED TO THE LEVELS	22.09.23	MM	KH	KH
P1	FIRST ISSUE	07.09.23	MM	KH	KH

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Sheffield T. 01142 440077
York T. 01904 611594

Project: BIRTHWAITE BUSINESS PARK

Client: PREMDOR CROSBY LTD

Drawing: PROPOSED DRAINAGE STRATEGY-UNIT B-PARKING AREA

Role: CIVIL ENGINEER

Drawing Status: FOR INFROMATION | Suitability Code: -

Job. no. 49145 | Scale@ A1: 1:200 | Rev. P2

Project Originator Volume Level Type Role Number
BBP - AWP - XX - XX - DR - C - 3002

100mm at A1

APPENDIX F

Hydraulic Model Calculation + ICP SuDS Calculation

Unit A

ICP SUDS Mean Annual Flood

Input

Return Period (years)	2	SAAR (mm)	789	Urban	0.000
Area (ha)	1.457	Soil	0.300	Region Number	Region 3

Results l/s

QBAR Rural	3.1
QBAR Urban	3.1
Q2 years	2.9
Q1 year	2.6
Q30 years	5.4
Q100 years	6.4

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.271	0.271	2.2	74.5	O K
30 min Summer	0.357	0.357	2.2	98.2	O K
60 min Summer	0.457	0.457	2.2	125.6	O K
120 min Summer	0.568	0.568	2.2	156.1	O K
180 min Summer	0.638	0.638	2.2	175.6	O K
240 min Summer	0.689	0.689	2.2	189.5	O K
360 min Summer	0.753	0.753	2.2	206.9	O K
480 min Summer	0.790	0.790	2.2	217.3	O K
600 min Summer	0.814	0.814	2.2	224.0	O K
720 min Summer	0.830	0.830	2.2	228.2	O K
960 min Summer	0.844	0.844	2.2	232.0	O K
1440 min Summer	0.854	0.854	2.2	234.8	O K
2160 min Summer	0.848	0.848	2.2	233.2	O K
2880 min Summer	0.832	0.832	2.2	228.7	O K
4320 min Summer	0.787	0.787	2.2	216.5	O K
5760 min Summer	0.736	0.736	2.2	202.4	O K
7200 min Summer	0.679	0.679	2.2	186.9	O K
8640 min Summer	0.606	0.606	2.2	166.6	O K
10080 min Summer	0.528	0.528	2.2	145.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	28.137	0.0	74.2	29
30 min Summer	18.655	0.0	98.6	43
60 min Summer	12.084	0.0	130.7	72
120 min Summer	7.686	0.0	166.4	132
180 min Summer	5.875	0.0	190.7	190
240 min Summer	4.852	0.0	209.9	250
360 min Summer	3.680	0.0	238.5	368
480 min Summer	3.015	0.0	260.1	486
600 min Summer	2.584	0.0	277.9	604
720 min Summer	2.278	0.0	292.8	722
960 min Summer	1.867	0.0	314.2	904
1440 min Summer	1.412	0.0	313.3	1146
2160 min Summer	1.067	0.0	418.6	1544
2880 min Summer	0.875	0.0	457.1	1968
4320 min Summer	0.661	0.0	515.7	2812
5760 min Summer	0.543	0.0	569.1	3640
7200 min Summer	0.466	0.0	610.6	4472
8640 min Summer	0.410	0.0	645.0	5280
10080 min Summer	0.368	0.0	674.5	5952

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	0.304	0.304	2.2	83.6	O K
30 min Winter	0.402	0.402	2.2	110.4	O K
60 min Winter	0.514	0.514	2.2	141.5	O K
120 min Winter	0.642	0.642	2.2	176.6	O K
180 min Winter	0.722	0.722	2.2	198.5	O K
240 min Winter	0.780	0.780	2.2	214.5	O K
360 min Winter	0.855	0.855	2.2	235.0	O K
480 min Winter	0.901	0.901	2.2	247.7	O K
600 min Winter	0.932	0.932	2.2	256.3	O K
720 min Winter	0.953	0.953	2.2	262.2	O K
960 min Winter	0.977	0.977	2.2	268.7	O K
1440 min Winter	0.984	0.984	2.2	270.6	O K
2160 min Winter	0.973	0.973	2.2	267.7	O K
2880 min Winter	0.944	0.944	2.2	259.6	O K
4320 min Winter	0.865	0.865	2.2	238.0	O K
5760 min Winter	0.777	0.777	2.2	213.6	O K
7200 min Winter	0.680	0.680	2.2	186.9	O K
8640 min Winter	0.544	0.544	2.2	149.7	O K
10080 min Winter	0.434	0.434	2.2	119.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	28.137	0.0	83.2	29
30 min Winter	18.655	0.0	110.3	43
60 min Winter	12.084	0.0	146.5	72
120 min Winter	7.686	0.0	186.3	130
180 min Winter	5.875	0.0	213.5	188
240 min Winter	4.852	0.0	234.9	244
360 min Winter	3.680	0.0	266.6	360
480 min Winter	3.015	0.0	290.2	476
600 min Winter	2.584	0.0	308.8	590
720 min Winter	2.278	0.0	322.4	702
960 min Winter	1.867	0.0	329.5	922
1440 min Winter	1.412	0.0	319.7	1216
2160 min Winter	1.067	0.0	468.8	1648
2880 min Winter	0.875	0.0	511.7	2116
4320 min Winter	0.661	0.0	572.9	3036
5760 min Winter	0.543	0.0	637.4	3936
7200 min Winter	0.466	0.0	683.9	4832
8640 min Winter	0.410	0.0	722.5	5544
10080 min Winter	0.368	0.0	755.7	6168

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.269	0.269	2.3	185.6	O K
30 min Summer	0.357	0.357	2.4	246.4	O K
60 min Summer	0.453	0.453	2.4	312.4	O K
120 min Summer	0.554	0.554	2.4	382.5	O K
180 min Summer	0.615	0.615	2.4	424.3	O K
240 min Summer	0.657	0.657	2.4	453.4	O K
360 min Summer	0.716	0.716	2.4	493.9	O K
480 min Summer	0.756	0.756	2.4	521.7	O K
600 min Summer	0.785	0.785	2.4	541.9	O K
720 min Summer	0.807	0.807	2.4	557.1	O K
960 min Summer	0.837	0.837	2.4	577.6	O K
1440 min Summer	0.863	0.863	2.4	595.7	O K
2160 min Summer	0.863	0.863	2.4	595.1	O K
2880 min Summer	0.850	0.850	2.4	586.2	O K
4320 min Summer	0.817	0.817	2.4	563.6	O K
5760 min Summer	0.781	0.781	2.4	538.9	O K
7200 min Summer	0.744	0.744	2.4	513.4	O K
8640 min Summer	0.707	0.707	2.4	487.7	O K
10080 min Summer	0.668	0.668	2.4	461.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	68.903	0.0	159.7	29
30 min Summer	45.851	0.0	190.7	44
60 min Summer	29.238	0.0	303.2	74
120 min Summer	18.103	0.0	363.3	134
180 min Summer	13.524	0.0	380.5	192
240 min Summer	10.942	0.0	378.3	252
360 min Summer	8.096	0.0	368.4	372
480 min Summer	6.535	0.0	359.7	490
600 min Summer	5.531	0.0	352.9	610
720 min Summer	4.824	0.0	347.3	728
960 min Summer	3.885	0.0	338.9	966
1440 min Summer	2.860	0.0	329.2	1444
2160 min Summer	2.103	0.0	703.2	2068
2880 min Summer	1.689	0.0	680.0	2404
4320 min Summer	1.239	0.0	626.2	3164
5760 min Summer	0.993	0.0	1035.8	3984
7200 min Summer	0.836	0.0	1088.1	4832
8640 min Summer	0.727	0.0	1129.9	5704
10080 min Summer	0.646	0.0	1153.8	6552

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	0.302	0.302	2.4	208.1	O K
30 min Winter	0.401	0.401	2.4	276.5	O K
60 min Winter	0.508	0.508	2.4	350.7	O K
120 min Winter	0.623	0.623	2.4	430.1	O K
180 min Winter	0.692	0.692	2.4	477.8	O K
240 min Winter	0.740	0.740	2.4	510.7	O K
360 min Winter	0.807	0.807	2.4	556.8	O K
480 min Winter	0.854	0.854	2.4	589.0	O K
600 min Winter	0.888	0.888	2.4	612.7	O K
720 min Winter	0.914	0.914	2.4	630.9	O K
960 min Winter	0.951	0.951	2.4	656.2	O K
1440 min Winter	0.988	0.988	2.4	681.6	O K
2160 min Winter	0.998	0.998	2.4	688.5	O K
2880 min Winter	0.983	0.983	2.4	678.1	O K
4320 min Winter	0.939	0.939	2.4	648.0	O K
5760 min Winter	0.890	0.890	2.4	613.9	O K
7200 min Winter	0.836	0.836	2.4	576.6	O K
8640 min Winter	0.781	0.781	2.4	538.7	O K
10080 min Winter	0.724	0.724	2.4	499.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	68.903	0.0	174.4	29
30 min Winter	45.851	0.0	196.1	44
60 min Winter	29.238	0.0	336.1	74
120 min Winter	18.103	0.0	381.6	132
180 min Winter	13.524	0.0	377.4	190
240 min Winter	10.942	0.0	370.9	248
360 min Winter	8.096	0.0	360.8	366
480 min Winter	6.535	0.0	354.1	482
600 min Winter	5.531	0.0	349.7	600
720 min Winter	4.824	0.0	346.8	716
960 min Winter	3.885	0.0	344.5	948
1440 min Winter	2.860	0.0	346.6	1404
2160 min Winter	2.103	0.0	711.9	2068
2880 min Winter	1.689	0.0	691.6	2688
4320 min Winter	1.239	0.0	655.1	3344
5760 min Winter	0.993	0.0	1158.9	4280
7200 min Winter	0.836	0.0	1214.9	5200
8640 min Winter	0.727	0.0	1247.1	6144
10080 min Winter	0.646	0.0	1217.4	7064

Summary of Results for 100 year Return Period (+25%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.259	0.259	3.0	301.0	O K
30 min Summer	0.348	0.348	3.0	403.8	O K
60 min Summer	0.445	0.445	3.0	515.7	O K
120 min Summer	0.546	0.546	3.0	633.4	O K
180 min Summer	0.605	0.605	3.0	701.7	O K
240 min Summer	0.645	0.645	3.0	747.7	O K
360 min Summer	0.700	0.700	3.0	812.4	O K
480 min Summer	0.740	0.740	3.0	858.8	O K
600 min Summer	0.770	0.770	3.0	893.2	O K
720 min Summer	0.793	0.793	3.0	919.6	O K
960 min Summer	0.825	0.825	3.0	956.9	O K
1440 min Summer	0.858	0.858	3.0	995.6	O K
2160 min Summer	0.870	0.870	3.0	1009.3	O K
2880 min Summer	0.860	0.860	3.0	997.4	O K
4320 min Summer	0.827	0.827	3.0	959.1	O K
5760 min Summer	0.792	0.792	3.0	918.3	O K
7200 min Summer	0.756	0.756	3.0	876.4	O K
8640 min Summer	0.718	0.718	3.0	833.3	O K
10080 min Summer	0.679	0.679	3.0	787.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	111.391	0.0	223.0	30
30 min Summer	74.850	0.0	248.9	44
60 min Summer	48.017	0.0	460.8	74
120 min Summer	29.751	0.0	500.9	134
180 min Summer	22.156	0.0	502.0	194
240 min Summer	17.848	0.0	496.9	252
360 min Summer	13.116	0.0	481.1	372
480 min Summer	10.538	0.0	463.6	492
600 min Summer	8.885	0.0	450.0	610
720 min Summer	7.725	0.0	439.5	730
960 min Summer	6.189	0.0	424.2	968
1440 min Summer	4.520	0.0	406.9	1446
2160 min Summer	3.293	0.0	878.4	2164
2880 min Summer	2.627	0.0	844.9	2812
4320 min Summer	1.908	0.0	782.8	3504
5760 min Summer	1.518	0.0	1561.9	4272
7200 min Summer	1.271	0.0	1605.6	5056
8640 min Summer	1.100	0.0	1594.0	5888
10080 min Summer	0.973	0.0	1552.8	6656

Summary of Results for 100 year Return Period (+25%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	0.291	0.291	3.0	337.4	O K
30 min Winter	0.390	0.390	3.0	452.8	O K
60 min Winter	0.499	0.499	3.0	578.5	O K
120 min Winter	0.613	0.613	3.0	711.4	O K
180 min Winter	0.680	0.680	3.0	789.1	O K
240 min Winter	0.726	0.726	3.0	842.0	O K
360 min Winter	0.790	0.790	3.0	916.1	O K
480 min Winter	0.835	0.835	3.0	968.8	O K
600 min Winter	0.869	0.869	3.0	1008.2	O K
720 min Winter	0.896	0.896	3.0	1038.9	O K
960 min Winter	0.934	0.934	3.0	1083.1	O K
1440 min Winter	0.976	0.976	3.0	1132.1	O K
2160 min Winter	0.997	0.997	3.0	1156.4	O K
2880 min Winter	0.993	0.993	3.0	1152.2	O K
4320 min Winter	0.954	0.954	3.0	1106.2	O K
5760 min Winter	0.910	0.910	3.0	1055.1	O K
7200 min Winter	0.863	0.863	3.0	1001.4	O K
8640 min Winter	0.816	0.816	3.0	946.1	O K
10080 min Winter	0.766	0.766	3.0	888.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	111.391	0.0	236.7	29
30 min Winter	74.850	0.0	254.0	44
60 min Winter	48.017	0.0	490.9	74
120 min Winter	29.751	0.0	504.5	132
180 min Winter	22.156	0.0	494.9	190
240 min Winter	17.848	0.0	480.8	250
360 min Winter	13.116	0.0	458.8	366
480 min Winter	10.538	0.0	445.1	484
600 min Winter	8.885	0.0	436.2	602
720 min Winter	7.725	0.0	430.4	718
960 min Winter	6.189	0.0	425.0	952
1440 min Winter	4.520	0.0	426.0	1416
2160 min Winter	3.293	0.0	878.2	2100
2880 min Winter	2.627	0.0	853.9	2768
4320 min Winter	1.908	0.0	819.7	3980
5760 min Winter	1.518	0.0	1715.6	4496
7200 min Winter	1.271	0.0	1688.0	5416
8640 min Winter	1.100	0.0	1619.1	6392
10080 min Winter	0.973	0.0	1550.9	7280

APPENDIX G

Hydraulic Model Calculation + ICP SuDS Calculation

Unit B

ICP SUDS Mean Annual Flood

Input

Return Period (years) 2 SAAR (mm) 789 Urban 0.000
Area (ha) 0.482 Soil 0.300 Region Number Region 3

Results l/s

QBAR Rural 1.0
QBAR Urban 1.0

Q2 years 1.0

Q1 year 0.9
Q30 years 1.8
Q100 years 2.1

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.285	0.285	1.4	44.2	O K
30 min Summer	0.376	0.376	1.4	58.3	O K
60 min Summer	0.481	0.481	1.4	74.5	O K
120 min Summer	0.597	0.597	1.4	92.5	O K
180 min Summer	0.666	0.666	1.4	103.3	O K
240 min Summer	0.715	0.715	1.4	110.9	O K
360 min Summer	0.775	0.775	1.4	120.1	O K
480 min Summer	0.807	0.807	1.4	125.2	O K
600 min Summer	0.826	0.826	1.4	128.1	O K
720 min Summer	0.836	0.836	1.4	129.6	O K
960 min Summer	0.846	0.846	1.4	131.2	O K
1440 min Summer	0.851	0.851	1.4	132.0	O K
2160 min Summer	0.840	0.840	1.4	130.1	O K
2880 min Summer	0.818	0.818	1.4	126.8	O K
4320 min Summer	0.766	0.766	1.4	118.7	O K
5760 min Summer	0.708	0.708	1.4	109.8	O K
7200 min Summer	0.650	0.650	1.4	100.7	O K
8640 min Summer	0.586	0.586	1.4	90.8	O K
10080 min Summer	0.509	0.509	1.4	78.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	28.137	0.0	44.8	29
30 min Summer	18.655	0.0	59.5	43
60 min Summer	12.084	0.0	78.1	72
120 min Summer	7.686	0.0	99.4	132
180 min Summer	5.875	0.0	114.0	190
240 min Summer	4.852	0.0	125.5	248
360 min Summer	3.680	0.0	142.7	366
480 min Summer	3.015	0.0	155.8	484
600 min Summer	2.584	0.0	166.7	602
720 min Summer	2.278	0.0	176.2	704
960 min Summer	1.867	0.0	191.7	818
1440 min Summer	1.412	0.0	205.4	1076
2160 min Summer	1.067	0.0	249.5	1492
2880 min Summer	0.875	0.0	272.5	1912
4320 min Summer	0.661	0.0	308.6	2736
5760 min Summer	0.543	0.0	338.8	3576
7200 min Summer	0.466	0.0	363.5	4400
8640 min Summer	0.410	0.0	384.0	5192
10080 min Summer	0.368	0.0	401.7	6048

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	0.320	0.320	1.4	49.6	O K
30 min Winter	0.423	0.423	1.4	65.5	O K
60 min Winter	0.542	0.542	1.4	84.0	O K
120 min Winter	0.673	0.673	1.4	104.3	O K
180 min Winter	0.753	0.753	1.4	116.8	O K
240 min Winter	0.811	0.811	1.4	125.7	O K
360 min Winter	0.883	0.883	1.4	136.8	O K
480 min Winter	0.925	0.925	1.4	143.3	O K
600 min Winter	0.951	0.951	1.5	147.4	O K
720 min Winter	0.968	0.968	1.5	150.0	O K
960 min Winter	0.981	0.981	1.5	152.1	O K
1440 min Winter	0.983	0.983	1.5	152.4	O K
2160 min Winter	0.960	0.960	1.5	148.8	O K
2880 min Winter	0.921	0.921	1.4	142.7	O K
4320 min Winter	0.828	0.828	1.4	128.3	O K
5760 min Winter	0.731	0.731	1.4	113.3	O K
7200 min Winter	0.632	0.632	1.4	98.0	O K
8640 min Winter	0.509	0.509	1.4	78.8	O K
10080 min Winter	0.373	0.373	1.4	57.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	28.137	0.0	50.2	29
30 min Winter	18.655	0.0	66.6	43
60 min Winter	12.084	0.0	87.5	72
120 min Winter	7.686	0.0	111.3	128
180 min Winter	5.875	0.0	127.6	186
240 min Winter	4.852	0.0	140.5	244
360 min Winter	3.680	0.0	159.7	358
480 min Winter	3.015	0.0	174.3	472
600 min Winter	2.584	0.0	186.4	586
720 min Winter	2.278	0.0	196.6	696
960 min Winter	1.867	0.0	211.7	904
1440 min Winter	1.412	0.0	212.4	1132
2160 min Winter	1.067	0.0	279.4	1604
2880 min Winter	0.875	0.0	305.2	2064
4320 min Winter	0.661	0.0	345.2	2980
5760 min Winter	0.543	0.0	379.4	3864
7200 min Winter	0.466	0.0	407.1	4696
8640 min Winter	0.410	0.0	430.1	5616
10080 min Winter	0.368	0.0	450.0	6144

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.282	0.282	1.6	110.2	O K
30 min Summer	0.375	0.375	1.6	146.3	O K
60 min Summer	0.475	0.475	1.6	185.4	O K
120 min Summer	0.582	0.582	1.6	226.9	O K
180 min Summer	0.644	0.644	1.6	251.2	O K
240 min Summer	0.686	0.686	1.6	267.6	O K
360 min Summer	0.743	0.743	1.6	289.9	O K
480 min Summer	0.782	0.782	1.6	304.9	O K
600 min Summer	0.809	0.809	1.6	315.4	O K
720 min Summer	0.828	0.828	1.6	322.9	O K
960 min Summer	0.852	0.852	1.6	332.2	O K
1440 min Summer	0.865	0.865	1.6	337.4	O K
2160 min Summer	0.853	0.853	1.6	332.8	O K
2880 min Summer	0.836	0.836	1.6	326.1	O K
4320 min Summer	0.796	0.796	1.6	310.5	O K
5760 min Summer	0.755	0.755	1.6	294.3	O K
7200 min Summer	0.713	0.713	1.6	278.1	O K
8640 min Summer	0.673	0.673	1.6	262.4	O K
10080 min Summer	0.633	0.633	1.6	246.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	68.903	0.0	101.6	29
30 min Summer	45.851	0.0	125.2	44
60 min Summer	29.238	0.0	184.8	74
120 min Summer	18.103	0.0	224.8	134
180 min Summer	13.524	0.0	241.7	192
240 min Summer	10.942	0.0	244.6	252
360 min Summer	8.096	0.0	242.8	370
480 min Summer	6.535	0.0	240.1	490
600 min Summer	5.531	0.0	237.8	608
720 min Summer	4.824	0.0	235.9	726
960 min Summer	3.885	0.0	233.0	964
1440 min Summer	2.860	0.0	230.9	1440
2160 min Summer	2.103	0.0	470.8	1840
2880 min Summer	1.689	0.0	464.0	2224
4320 min Summer	1.239	0.0	427.3	3028
5760 min Summer	0.993	0.0	618.3	3864
7200 min Summer	0.836	0.0	650.5	4688
8640 min Summer	0.727	0.0	677.8	5536
10080 min Summer	0.646	0.0	700.7	6360

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	0.317	0.317	1.6	123.6	O K
30 min Winter	0.421	0.421	1.6	164.2	O K
60 min Winter	0.534	0.534	1.6	208.3	O K
120 min Winter	0.654	0.654	1.6	255.0	O K
180 min Winter	0.724	0.724	1.6	282.5	O K
240 min Winter	0.773	0.773	1.6	301.3	O K
360 min Winter	0.839	0.839	1.6	327.2	O K
480 min Winter	0.884	0.884	1.6	344.9	O K
600 min Winter	0.917	0.917	1.6	357.5	O K
720 min Winter	0.941	0.941	1.6	366.9	O K
960 min Winter	0.972	0.972	1.6	379.1	O K
1440 min Winter	0.997	0.997	1.7	388.7	O K
2160 min Winter	0.989	0.989	1.7	385.8	O K
2880 min Winter	0.965	0.965	1.6	376.2	O K
4320 min Winter	0.912	0.912	1.6	355.6	O K
5760 min Winter	0.851	0.851	1.6	331.8	O K
7200 min Winter	0.788	0.788	1.6	307.2	O K
8640 min Winter	0.726	0.726	1.6	283.0	O K
10080 min Winter	0.664	0.664	1.6	258.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	68.903	0.0	112.0	29
30 min Winter	45.851	0.0	129.4	44
60 min Winter	29.238	0.0	205.8	74
120 min Winter	18.103	0.0	242.3	132
180 min Winter	13.524	0.0	246.1	190
240 min Winter	10.942	0.0	245.1	248
360 min Winter	8.096	0.0	242.6	364
480 min Winter	6.535	0.0	241.1	480
600 min Winter	5.531	0.0	240.3	598
720 min Winter	4.824	0.0	240.1	714
960 min Winter	3.885	0.0	241.7	944
1440 min Winter	2.860	0.0	244.2	1392
2160 min Winter	2.103	0.0	488.7	2032
2880 min Winter	1.689	0.0	476.5	2312
4320 min Winter	1.239	0.0	448.6	3244
5760 min Winter	0.993	0.0	692.4	4160
7200 min Winter	0.836	0.0	728.2	5056
8640 min Winter	0.727	0.0	758.1	5976
10080 min Winter	0.646	0.0	779.9	6864

Summary of Results for 100 year Return Period (+25%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.260	0.260	1.6	179.2	O K
30 min Summer	0.348	0.348	1.6	240.4	O K
60 min Summer	0.445	0.445	1.6	307.2	O K
120 min Summer	0.548	0.548	1.6	377.8	O K
180 min Summer	0.607	0.607	1.6	419.0	O K
240 min Summer	0.647	0.647	1.6	446.6	O K
360 min Summer	0.703	0.703	1.6	485.0	O K
480 min Summer	0.742	0.742	1.6	512.1	O K
600 min Summer	0.771	0.771	1.6	532.2	O K
720 min Summer	0.794	0.794	1.6	547.6	O K
960 min Summer	0.825	0.825	1.6	569.3	O K
1440 min Summer	0.858	0.858	1.6	591.8	O K
2160 min Summer	0.868	0.868	1.6	599.3	O K
2880 min Summer	0.858	0.858	1.6	591.9	O K
4320 min Summer	0.828	0.828	1.6	571.2	O K
5760 min Summer	0.796	0.796	1.6	549.2	O K
7200 min Summer	0.765	0.765	1.6	527.6	O K
8640 min Summer	0.735	0.735	1.6	507.1	O K
10080 min Summer	0.706	0.706	1.6	487.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	111.391	0.0	131.4	30
30 min Summer	74.850	0.0	139.4	44
60 min Summer	48.017	0.0	267.8	74
120 min Summer	29.751	0.0	270.0	134
180 min Summer	22.156	0.0	260.5	194
240 min Summer	17.848	0.0	254.4	252
360 min Summer	13.116	0.0	247.2	372
480 min Summer	10.538	0.0	243.5	492
600 min Summer	8.885	0.0	241.9	610
720 min Summer	7.725	0.0	241.8	730
960 min Summer	6.189	0.0	244.3	968
1440 min Summer	4.520	0.0	245.7	1446
2160 min Summer	3.293	0.0	493.5	2164
2880 min Summer	2.627	0.0	482.7	2748
4320 min Summer	1.908	0.0	465.9	3424
5760 min Summer	1.518	0.0	927.0	4208
7200 min Summer	1.271	0.0	927.3	5040
8640 min Summer	1.100	0.0	884.9	5880
10080 min Summer	0.973	0.0	834.2	6672

Summary of Results for 100 year Return Period (+25%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	0.291	0.291	1.6	200.8	O K
30 min Winter	0.391	0.391	1.6	269.6	O K
60 min Winter	0.500	0.500	1.6	344.7	O K
120 min Winter	0.615	0.615	1.6	424.3	O K
180 min Winter	0.682	0.682	1.6	470.6	O K
240 min Winter	0.727	0.727	1.6	501.9	O K
360 min Winter	0.791	0.791	1.6	545.7	O K
480 min Winter	0.836	0.836	1.6	576.9	O K
600 min Winter	0.870	0.870	1.6	600.3	O K
720 min Winter	0.896	0.896	1.7	618.5	O K
960 min Winter	0.934	0.934	1.7	644.7	O K
1440 min Winter	0.976	0.976	1.7	673.7	O K
2160 min Winter	0.997	0.997	1.7	688.1	O K
2880 min Winter	0.993	0.993	1.7	685.5	O K
4320 min Winter	0.955	0.955	1.7	658.9	O K
5760 min Winter	0.916	0.916	1.7	632.3	O K
7200 min Winter	0.874	0.874	1.6	603.4	O K
8640 min Winter	0.832	0.832	1.6	574.4	O K
10080 min Winter	0.791	0.791	1.6	545.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	111.391	0.0	136.0	30
30 min Winter	74.850	0.0	140.1	44
60 min Winter	48.017	0.0	273.7	74
120 min Winter	29.751	0.0	261.4	132
180 min Winter	22.156	0.0	253.2	190
240 min Winter	17.848	0.0	249.1	250
360 min Winter	13.116	0.0	246.3	366
480 min Winter	10.538	0.0	247.6	484
600 min Winter	8.885	0.0	251.3	602
720 min Winter	7.725	0.0	254.3	718
960 min Winter	6.189	0.0	257.8	952
1440 min Winter	4.520	0.0	258.6	1414
2160 min Winter	3.293	0.0	508.1	2096
2880 min Winter	2.627	0.0	507.6	2748
4320 min Winter	1.908	0.0	493.5	3892
5760 min Winter	1.518	0.0	994.7	4448
7200 min Winter	1.271	0.0	962.1	5400
8640 min Winter	1.100	0.0	920.4	6320
10080 min Winter	0.973	0.0	877.3	7264

APPENDIX H

Hydraulic Model Calculation + ICP SuDS Calculation

Unit B-Parking Area

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.469	0.469	23.5	3.7	O K
30 min Summer	0.702	0.702	23.5	5.6	O K
60 min Summer	0.589	0.589	23.5	4.7	O K
120 min Summer	0.294	0.294	22.7	2.4	O K
180 min Summer	0.202	0.202	20.0	1.6	O K
240 min Summer	0.177	0.177	17.3	1.4	O K
360 min Summer	0.150	0.150	13.7	1.2	O K
480 min Summer	0.134	0.134	11.5	1.1	O K
600 min Summer	0.123	0.123	10.0	1.0	O K
720 min Summer	0.114	0.114	8.9	0.9	O K
960 min Summer	0.102	0.102	7.3	0.8	O K
1440 min Summer	0.088	0.088	5.6	0.7	O K
2160 min Summer	0.075	0.075	4.2	0.6	O K
2880 min Summer	0.068	0.068	3.5	0.5	O K
4320 min Summer	0.058	0.058	2.6	0.5	O K
5760 min Summer	0.053	0.053	2.2	0.4	O K
7200 min Summer	0.048	0.048	1.8	0.4	O K
8640 min Summer	0.046	0.046	1.7	0.4	O K
10080 min Summer	0.043	0.043	1.5	0.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	28.137	0.0	25.4	20
30 min Summer	18.655	0.0	33.7	29
60 min Summer	12.084	0.0	43.7	44
120 min Summer	7.686	0.0	55.6	72
180 min Summer	5.875	0.0	63.7	98
240 min Summer	4.852	0.0	70.2	128
360 min Summer	3.680	0.0	79.8	188
480 min Summer	3.015	0.0	87.2	248
600 min Summer	2.584	0.0	93.4	308
720 min Summer	2.278	0.0	98.8	368
960 min Summer	1.867	0.0	108.0	490
1440 min Summer	1.412	0.0	122.5	728
2160 min Summer	1.067	0.0	138.9	1076
2880 min Summer	0.875	0.0	151.8	1468
4320 min Summer	0.661	0.0	172.2	2200
5760 min Summer	0.543	0.0	188.4	2880
7200 min Summer	0.466	0.0	202.2	3672
8640 min Summer	0.410	0.0	213.6	4352
10080 min Summer	0.368	0.0	223.6	5000

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	0.720	0.720	23.5	5.8	O K
30 min Winter	1.093	1.093	23.5	8.1	O K
60 min Winter	0.601	0.601	23.5	4.8	O K
120 min Winter	0.208	0.208	20.6	1.7	O K
180 min Winter	0.169	0.169	16.2	1.3	O K
240 min Winter	0.149	0.149	13.6	1.2	O K
360 min Winter	0.125	0.125	10.4	1.0	O K
480 min Winter	0.112	0.112	8.6	0.9	O K
600 min Winter	0.102	0.102	7.3	0.8	O K
720 min Winter	0.095	0.095	6.5	0.8	O K
960 min Winter	0.085	0.085	5.3	0.7	O K
1440 min Winter	0.073	0.073	4.0	0.6	O K
2160 min Winter	0.063	0.063	3.1	0.5	O K
2880 min Winter	0.057	0.057	2.5	0.5	O K
4320 min Winter	0.049	0.049	1.9	0.4	O K
5760 min Winter	0.044	0.044	1.6	0.4	O K
7200 min Winter	0.041	0.041	1.4	0.3	O K
8640 min Winter	0.039	0.039	1.2	0.3	O K
10080 min Winter	0.036	0.036	1.1	0.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	28.137	0.0	28.5	21
30 min Winter	18.655	0.0	37.8	30
60 min Winter	12.084	0.0	48.9	44
120 min Winter	7.686	0.0	62.2	68
180 min Winter	5.875	0.0	71.4	98
240 min Winter	4.852	0.0	78.6	128
360 min Winter	3.680	0.0	89.4	190
480 min Winter	3.015	0.0	97.7	244
600 min Winter	2.584	0.0	104.6	306
720 min Winter	2.278	0.0	110.7	366
960 min Winter	1.867	0.0	121.0	496
1440 min Winter	1.412	0.0	137.2	728
2160 min Winter	1.067	0.0	155.6	1104
2880 min Winter	0.875	0.0	170.0	1440
4320 min Winter	0.661	0.0	192.8	2136
5760 min Winter	0.543	0.0	211.0	2880
7200 min Winter	0.466	0.0	226.4	3680
8640 min Winter	0.410	0.0	239.3	4280
10080 min Winter	0.368	0.0	250.5	5040

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.656	0.656	29.9	34.1	O K
30 min Summer	0.843	0.843	29.9	43.8	O K
60 min Summer	0.850	0.850	29.9	44.2	O K
120 min Summer	0.696	0.696	29.9	36.2	O K
180 min Summer	0.528	0.528	29.9	27.4	O K
240 min Summer	0.394	0.394	29.8	20.5	O K
360 min Summer	0.250	0.250	28.1	13.0	O K
480 min Summer	0.208	0.208	24.1	10.8	O K
600 min Summer	0.185	0.185	20.9	9.6	O K
720 min Summer	0.170	0.170	18.5	8.8	O K
960 min Summer	0.149	0.149	15.1	7.7	O K
1440 min Summer	0.125	0.125	11.3	6.5	O K
2160 min Summer	0.105	0.105	8.3	5.4	O K
2880 min Summer	0.093	0.093	6.7	4.8	O K
4320 min Summer	0.078	0.078	4.9	4.1	O K
5760 min Summer	0.070	0.070	3.9	3.6	O K
7200 min Summer	0.064	0.064	3.3	3.3	O K
8640 min Summer	0.059	0.059	2.9	3.1	O K
10080 min Summer	0.056	0.056	2.6	2.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	68.903	0.0	62.2	23
30 min Summer	45.851	0.0	82.9	32
60 min Summer	29.238	0.0	105.7	48
120 min Summer	18.103	0.0	130.9	80
180 min Summer	13.524	0.0	146.6	110
240 min Summer	10.942	0.0	158.2	138
360 min Summer	8.096	0.0	175.6	194
480 min Summer	6.535	0.0	189.0	252
600 min Summer	5.531	0.0	199.9	312
720 min Summer	4.824	0.0	209.2	372
960 min Summer	3.885	0.0	224.7	492
1440 min Summer	2.860	0.0	248.1	734
2160 min Summer	2.103	0.0	273.6	1100
2880 min Summer	1.689	0.0	293.0	1468
4320 min Summer	1.239	0.0	322.4	2152
5760 min Summer	0.993	0.0	344.6	2912
7200 min Summer	0.836	0.0	362.8	3616
8640 min Summer	0.727	0.0	378.6	4296
10080 min Summer	0.646	0.0	392.5	5016

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	0.773	0.773	29.9	40.2	O K
30 min Winter	0.995	0.995	29.9	51.7	O K
60 min Winter	0.974	0.974	29.9	50.7	O K
120 min Winter	0.679	0.679	29.9	35.3	O K
180 min Winter	0.418	0.418	29.8	21.7	O K
240 min Winter	0.270	0.270	28.5	14.0	O K
360 min Winter	0.197	0.197	22.6	10.2	O K
480 min Winter	0.169	0.169	18.4	8.8	O K
600 min Winter	0.152	0.152	15.6	7.9	O K
720 min Winter	0.140	0.140	13.7	7.3	O K
960 min Winter	0.123	0.123	11.0	6.4	O K
1440 min Winter	0.104	0.104	8.2	5.4	O K
2160 min Winter	0.087	0.087	6.0	4.5	O K
2880 min Winter	0.078	0.078	4.8	4.0	O K
4320 min Winter	0.066	0.066	3.5	3.4	O K
5760 min Winter	0.059	0.059	2.9	3.0	O K
7200 min Winter	0.054	0.054	2.4	2.8	O K
8640 min Winter	0.050	0.050	2.1	2.6	O K
10080 min Winter	0.047	0.047	1.8	2.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	68.903	0.0	69.7	23
30 min Winter	45.851	0.0	92.8	34
60 min Winter	29.238	0.0	118.4	52
120 min Winter	18.103	0.0	146.6	84
180 min Winter	13.524	0.0	164.3	112
240 min Winter	10.942	0.0	177.2	138
360 min Winter	8.096	0.0	196.6	194
480 min Winter	6.535	0.0	211.6	252
600 min Winter	5.531	0.0	223.9	312
720 min Winter	4.824	0.0	234.4	372
960 min Winter	3.885	0.0	251.7	494
1440 min Winter	2.860	0.0	277.9	738
2160 min Winter	2.103	0.0	306.5	1104
2880 min Winter	1.689	0.0	328.2	1468
4320 min Winter	1.239	0.0	361.0	2172
5760 min Winter	0.993	0.0	386.0	2912
7200 min Winter	0.836	0.0	406.4	3656
8640 min Winter	0.727	0.0	424.0	4288
10080 min Winter	0.646	0.0	439.6	5064

Summary of Results for 100 year Return Period (+25%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.592	0.592	29.9	72.2	O K
30 min Summer	0.770	0.770	29.9	94.0	O K
60 min Summer	0.856	0.856	29.9	104.4	O K
120 min Summer	0.823	0.823	29.9	100.4	O K
180 min Summer	0.735	0.735	29.9	89.6	O K
240 min Summer	0.638	0.638	29.9	77.8	O K
360 min Summer	0.471	0.471	29.9	57.5	O K
480 min Summer	0.356	0.356	29.6	43.4	O K
600 min Summer	0.281	0.281	28.7	34.3	O K
720 min Summer	0.238	0.238	27.8	29.0	O K
960 min Summer	0.201	0.201	23.1	24.5	O K
1440 min Summer	0.163	0.163	17.4	19.9	O K
2160 min Summer	0.135	0.135	12.9	16.5	O K
2880 min Summer	0.118	0.118	10.3	14.5	O K
4320 min Summer	0.099	0.099	7.5	12.1	O K
5760 min Summer	0.087	0.087	6.0	10.6	O K
7200 min Summer	0.079	0.079	5.0	9.7	O K
8640 min Summer	0.073	0.073	4.3	8.9	O K
10080 min Summer	0.069	0.069	3.8	8.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	111.391	0.0	100.5	24
30 min Summer	74.850	0.0	135.1	34
60 min Summer	48.017	0.0	173.5	54
120 min Summer	29.751	0.0	215.0	86
180 min Summer	22.156	0.0	240.2	120
240 min Summer	17.848	0.0	258.0	152
360 min Summer	13.116	0.0	284.4	212
480 min Summer	10.538	0.0	304.7	268
600 min Summer	8.885	0.0	321.1	324
720 min Summer	7.725	0.0	335.0	378
960 min Summer	6.189	0.0	357.8	498
1440 min Summer	4.520	0.0	391.9	738
2160 min Summer	3.293	0.0	428.5	1104
2880 min Summer	2.627	0.0	455.9	1468
4320 min Summer	1.908	0.0	496.3	2204
5760 min Summer	1.518	0.0	526.8	2936
7200 min Summer	1.271	0.0	551.2	3640
8640 min Summer	1.100	0.0	572.4	4400
10080 min Summer	0.973	0.0	591.0	5080

Summary of Results for 100 year Return Period (+25%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	0.679	0.679	29.9	82.8	O K
30 min Winter	0.887	0.887	29.9	108.3	O K
60 min Winter	0.995	0.995	29.9	121.4	O K
120 min Winter	0.917	0.917	29.9	111.9	O K
180 min Winter	0.764	0.764	29.9	93.3	O K
240 min Winter	0.608	0.608	29.9	74.2	O K
360 min Winter	0.372	0.372	29.7	45.4	O K
480 min Winter	0.249	0.249	28.1	30.4	O K
600 min Winter	0.212	0.212	24.6	25.9	O K
720 min Winter	0.190	0.190	21.6	23.2	O K
960 min Winter	0.164	0.164	17.5	19.9	O K
1440 min Winter	0.135	0.135	12.8	16.4	O K
2160 min Winter	0.112	0.112	9.4	13.7	O K
2880 min Winter	0.099	0.099	7.5	12.0	O K
4320 min Winter	0.083	0.083	5.4	10.1	O K
5760 min Winter	0.073	0.073	4.3	8.9	O K
7200 min Winter	0.067	0.067	3.6	8.1	O K
8640 min Winter	0.062	0.062	3.1	7.5	O K
10080 min Winter	0.058	0.058	2.8	7.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	111.391	0.0	112.6	24
30 min Winter	74.850	0.0	151.3	35
60 min Winter	48.017	0.0	194.3	58
120 min Winter	29.751	0.0	240.8	94
180 min Winter	22.156	0.0	269.0	128
240 min Winter	17.848	0.0	289.0	160
360 min Winter	13.116	0.0	318.5	216
480 min Winter	10.538	0.0	341.2	266
600 min Winter	8.885	0.0	359.7	320
720 min Winter	7.725	0.0	375.2	380
960 min Winter	6.189	0.0	400.8	498
1440 min Winter	4.520	0.0	439.0	740
2160 min Winter	3.293	0.0	480.0	1100
2880 min Winter	2.627	0.0	510.6	1444
4320 min Winter	1.908	0.0	555.9	2204
5760 min Winter	1.518	0.0	590.0	2904
7200 min Winter	1.271	0.0	617.3	3608
8640 min Winter	1.100	0.0	641.1	4384
10080 min Winter	0.973	0.0	661.9	5064

APPENDIX I

Existing Surface Water Flow Rate Calculation / Parking Area-Unit B

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for parking unit b

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.352	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for parking unit b

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.137	4-8	0.193	8-12	0.153

Total Area Contributing (ha) = 0.482

Total Pipe Volume (m^3) = 4.834

Network Design Table for parking unit b

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	33.039	0.194	170.3	0.202	10.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	38.420	0.226	170.0	0.280	10.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	10.55	68.543	0.202	0.0	0.0	0.0	1.00	39.7	27.4
S2.000	50.00	10.64	68.575	0.280	0.0	0.0	0.0	1.00	39.8	37.9

Network Design Table for parking unit b

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.001	8.549	0.035	244.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	14.703	0.060	245.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.003	8.778	0.036	243.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.001	50.00	10.78	68.274	0.482	0.0	0.0	0.0	1.00	70.8	65.3
S1.002	50.00	11.03	68.239	0.482	0.0	0.0	0.0	1.00	70.7	65.3
S1.003	50.00	11.20	68.179	0.482	0.0	0.0	0.0	0.83	33.1«	65.3

Area Summary for parking unit b

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.202	0.202	0.202
2.000	-	-	100	0.280	0.280	0.280
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.482	0.482	0.482

Free Flowing Outfall Details for parking unit b

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.003	S	70.280	68.143	0.000	0	0

Simulation Criteria for parking unit b

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.352		

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for parking unit b

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.352	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for parking unit b

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.137	4-8	0.193	8-12	0.153

Total Area Contributing (ha) = 0.482

Total Pipe Volume (m^3) = 4.834

Network Design Table for parking unit b

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	33.039	0.194	170.3	0.202	10.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	38.420	0.226	170.0	0.280	10.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	10.55	68.543	0.202	0.0	0.0	0.0	1.00	39.7	27.4
S2.000	50.00	10.64	68.575	0.280	0.0	0.0	0.0	1.00	39.8	37.9

Network Design Table for parking unit b

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.001	8.549	0.035	244.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	14.703	0.060	245.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.003	8.778	0.036	243.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.001	50.00	10.78	68.274	0.482	0.0	0.0	0.0	1.00	70.8	65.3
S1.002	50.00	11.03	68.239	0.482	0.0	0.0	0.0	1.00	70.7	65.3
S1.003	50.00	11.20	68.179	0.482	0.0	0.0	0.0	0.83	33.1«	65.3

Area Summary for parking unit b

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.202	0.202	0.202
2.000	-	-	100	0.280	0.280	0.280
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.482	0.482	0.482

Free Flowing Outfall Details for parking unit b

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.003	S	70.280	68.143	0.000	0	0

Simulation Criteria for parking unit b

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.352		

Summary of Critical Results by Maximum Level (Rank 1) for parking unit b

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.352
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 25

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	100	+25%	30/15 Summer	100/15 Winter			70.241
S2.000	S2	15 Winter	100	+25%	30/15 Summer	100/15 Winter			70.752
S1.001	S3	30 Winter	100	+25%	30/15 Summer				69.826
S1.002	S4	30 Winter	100	+25%	30/15 Summer				69.549
S1.003	S4	15 Winter	100	+25%	1/15 Summer				69.247

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	1.473	0.971	1.51			56.3	FLOOD	2
S2.000	S2	1.952	1.706	2.08			78.5	FLOOD	3
S1.001	S3	1.252	0.000	2.49			133.4	SURCHARGED	
S1.002	S4	1.010	0.000	2.24			132.4	SURCHARGED	
S1.003	S4	0.843	0.000	4.91			132.6	SURCHARGED	

APPENDIX J

Microdrainage Calculation

Unit A

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for UNIT A

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.352	Minimum Backdrop Height (m)	10.000
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	10.100
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for UNIT A

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.716	4-8	0.361

Total Area Contributing (ha) = 1.077

Total Pipe Volume (m^3) = 29.976

Network Design Table for UNIT A

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	56.832	0.139	408.9	0.400	4.00	0.0	0.600	o	450	Pipe/Conduit	
S1.001	13.069	0.032	408.4	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S2.000	33.543	0.082	409.1	0.181	4.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	4.95	68.369	0.400	0.0	0.0	0.0	1.00	158.9	54.2
S1.001	50.00	5.17	68.230	0.400	0.0	0.0	0.0	1.00	159.0	54.2
S2.000	50.00	4.56	68.366	0.181	0.0	0.0	0.0	1.00	158.9	24.6

Network Design Table for UNIT A

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S2.001	35.118	0.086	408.4	0.303	0.00	0.0	0.600	o	450	Pipe/Conduit	
S2.002	9.602	0.023	417.5	0.192	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.002	7.726	0.016	482.9	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.003	15.742	0.032	491.9	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.004	6.151	0.036	170.9	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S2.001	50.00	5.15	68.284	0.485	0.0	0.0	0.0	1.00	159.0	65.6
S2.002	50.00	5.31	68.198	0.676	0.0	0.0	0.0	0.99	157.2	91.6
S1.002	50.00	5.43	68.123	1.077	0.0	0.0	0.0	1.01	219.2	145.8
S1.003	50.00	5.70	68.107	1.077	0.0	0.0	0.0	1.00	217.1	145.8
S1.004	50.00	5.76	68.075	1.077	0.0	0.0	0.0	1.71	370.3	145.8

Free Flowing Outfall Details for UNIT A

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.004	S	71.170	68.039	0.000	0	0

Simulation Criteria for UNIT A

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Region England and Wales
Return Period (years) 100 M5-60 (mm) 19.000

Synthetic Rainfall Details

Ratio R	0.352	Cv (Winter)	0.840
Profile Type	Summer	Storm Duration (mins)	30
Cv (Summer)	0.750		

Online Controls for UNIT A

Hydro-Brake® Optimum Manhole: S8, DS/PN: S1.003, Volume (m³): 6.6

Unit Reference	MD-SHE-0070-2600-1500-2600
Design Head (m)	1.500
Design Flow (l/s)	2.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	70
Invert Level (m)	68.107
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	2.6	Kick-Flo®	0.623	1.7
Flush-Flo™	0.305	2.2	Mean Flow over Head Range	-	2.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.8	1.200	2.3	3.000	3.6	7.000	5.3
0.200	2.1	1.400	2.5	3.500	3.8	7.500	5.5
0.300	2.2	1.600	2.7	4.000	4.1	8.000	5.7
0.400	2.1	1.800	2.8	4.500	4.3	8.500	5.8
0.500	2.0	2.000	3.0	5.000	4.5	9.000	6.0
0.600	1.8	2.200	3.1	5.500	4.7	9.500	6.1
0.800	1.9	2.400	3.2	6.000	4.9		
1.000	2.2	2.600	3.3	6.500	5.1		

Storage Structures for UNIT A

Tank or Pond Manhole: S7, DS/PN: S1.002

Invert Level (m) 68.123

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	510.0	1.500	510.0	1.501	0.0

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for UNIT A

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.352	Minimum Backdrop Height (m)	10.000
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	10.100
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for UNIT A

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.716	4-8	0.361

Total Area Contributing (ha) = 1.077

Total Pipe Volume (m^3) = 29.976

Network Design Table for UNIT A

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	56.832	0.139	408.9	0.400	4.00	0.0	0.600	o	450	Pipe/Conduit	
S1.001	13.069	0.032	408.4	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S2.000	33.543	0.082	409.1	0.181	4.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	4.95	68.369	0.400	0.0	0.0	0.0	1.00	158.9	54.2
S1.001	50.00	5.17	68.230	0.400	0.0	0.0	0.0	1.00	159.0	54.2
S2.000	50.00	4.56	68.366	0.181	0.0	0.0	0.0	1.00	158.9	24.6

Network Design Table for UNIT A

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S2.001	35.118	0.086	408.4	0.303	0.00	0.0	0.600	o	450	Pipe/Conduit	
S2.002	9.602	0.023	417.5	0.192	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.002	7.726	0.016	482.9	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.003	15.742	0.032	491.9	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.004	6.151	0.036	170.9	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S2.001	50.00	5.15	68.284	0.485	0.0	0.0	0.0	1.00	159.0	65.6
S2.002	50.00	5.31	68.198	0.676	0.0	0.0	0.0	0.99	157.2	91.6
S1.002	50.00	5.43	68.123	1.077	0.0	0.0	0.0	1.01	219.2	145.8
S1.003	50.00	5.70	68.107	1.077	0.0	0.0	0.0	1.00	217.1	145.8
S1.004	50.00	5.76	68.075	1.077	0.0	0.0	0.0	1.71	370.3	145.8

Free Flowing Outfall Details for UNIT A

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.004	S	71.170	68.039	0.000	0	0

Simulation Criteria for UNIT A

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Region England and Wales
Return Period (years) 100 M5-60 (mm) 19.000

Synthetic Rainfall Details

Ratio R	0.352	Cv (Winter)	0.840
Profile Type	Summer	Storm Duration (mins)	30
Cv (Summer)	0.750		

Online Controls for UNIT A

Hydro-Brake® Optimum Manhole: S8, DS/PN: S1.003, Volume (m³): 6.6

Unit Reference	MD-SHE-0070-2600-1500-2600
Design Head (m)	1.500
Design Flow (l/s)	2.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	70
Invert Level (m)	68.107
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	2.6	Kick-Flo®	0.623	1.7
Flush-Flo™	0.305	2.2	Mean Flow over Head Range	-	2.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.8	1.200	2.3	3.000	3.6	7.000	5.3
0.200	2.1	1.400	2.5	3.500	3.8	7.500	5.5
0.300	2.2	1.600	2.7	4.000	4.1	8.000	5.7
0.400	2.1	1.800	2.8	4.500	4.3	8.500	5.8
0.500	2.0	2.000	3.0	5.000	4.5	9.000	6.0
0.600	1.8	2.200	3.1	5.500	4.7	9.500	6.1
0.800	1.9	2.400	3.2	6.000	4.9		
1.000	2.2	2.600	3.3	6.500	5.1		

Storage Structures for UNIT A

Tank or Pond Manhole: S7, DS/PN: S1.002

Invert Level (m) 68.123

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	510.0	1.500	510.0	1.501	0.0

Summary of Critical Results by Maximum Level (Rank 1) for UNIT A

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.352
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 25

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S4	1440 Winter	100	+25%	30/360 Winter				69.596
S1.001	S5	1440 Winter	100	+25%	30/240 Summer				69.596
S2.000	S3	1440 Winter	100	+25%	30/15 Summer				69.596
S2.001	S4	1440 Winter	100	+25%	30/15 Summer				69.596
S2.002	S6	1440 Winter	100	+25%	30/15 Summer				69.596
S1.002	S7	1440 Winter	100	+25%	30/120 Winter				69.596
S1.003	S8	1440 Winter	100	+25%	30/120 Winter				69.628
S1.004	S9	1440 Winter	100	+25%					68.108

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S4	0.777	0.000	0.07			10.5	FLOOD RISK	
S1.001	S5	0.916	0.000	0.10			10.3	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for UNIT A

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S2.000	S3	0.780	0.000	0.03			4.8	FLOOD RISK	
S2.001	S4	0.862	0.000	0.09			12.4	FLOOD RISK	
S2.002	S6	0.948	0.000	0.19			17.3	SURCHARGED	
S1.002	S7	0.948	0.000	0.03			3.9	SURCHARGED	
S1.003	S8	0.996	0.000	0.02			2.6	SURCHARGED	
S1.004	S9	-0.492	0.000	0.01			2.6	OK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for car park unit A

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for car park unit A

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.174	4-8	0.020

Total Area Contributing (ha) = 0.194

Total Pipe Volume (m³) = 1.695

Network Design Table for car park unit A

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	7.250	0.131	55.3	0.194	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	19.569	0.249	78.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	15.812	0.490	32.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	4.07	69.000	0.194	0.0	0.0	0.0	1.76	70.1	26.2
S1.001	50.00	4.29	68.869	0.194	0.0	0.0	0.0	1.48	58.7	26.2
S1.002	50.00	4.40	68.620	0.194	0.0	0.0	0.0	2.31	91.9	26.2

Free Flowing Outfall Details for car park unit A

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.002	S	70.634	68.130	0.000	0	0

Simulation Criteria for car park unit A

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.350		

Online Controls for car park unit A

Hydro-Brake® Optimum Manhole: S12, DS/PN: S1.002, Volume (m³): 4.6

Unit Reference	MD-SHE-0028-5000-1700-5000
Design Head (m)	1.700
Design Flow (l/s)	0.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	28
Invert Level (m)	68.620
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.700	0.5	Kick-Flo®	0.254	0.2
Flush-Flo™	0.125	0.3	Mean Flow over Head Range	-	0.4

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	0.3	1.200	0.4	3.000	0.6	7.000	0.9
0.200	0.3	1.400	0.5	3.500	0.7	7.500	1.0
0.300	0.2	1.600	0.5	4.000	0.7	8.000	1.0
0.400	0.3	1.800	0.5	4.500	0.8	8.500	1.0
0.500	0.3	2.000	0.5	5.000	0.8	9.000	1.1
0.600	0.3	2.200	0.6	5.500	0.8	9.500	1.1
0.800	0.4	2.400	0.6	6.000	0.9		
1.000	0.4	2.600	0.6	6.500	0.9		

Storage Structures for car park unit A

Tank or Pond Manhole: S11, DS/PN: S1.001

Invert Level (m) 68.869

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	85.0	1.500	85.0	1.501	0.0

Summary of Critical Results by Maximum Level (Rank 1) for car park unit A

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model		FSR Ratio R	0.352
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 25

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S10	1440 Winter	100	+25%	1/960 Winter				71.372
S1.001	S11	1440 Winter	100	+25%	1/120 Winter				71.371
S1.002	S12	1440 Winter	100	+25%	1/15 Summer				71.370

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S10	2.147	0.000	0.10			5.0	FLOOD RISK	
S1.001	S11	2.277	0.000	0.01			0.7	SURCHARGED	
S1.002	S12	2.525	0.000	0.01			0.6	SURCHARGED	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for carpark small a

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.352	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for carpark small a

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.054	4-8	0.075	8-12	0.058

Total Area Contributing (ha) = 0.186

Total Pipe Volume (m^3) = 2.161

Network Design Table for carpark small a

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	47.138	0.400	117.8	0.084	10.00	0.0	0.600	o	150	Pipe/Conduit	
S2.000	58.089	0.400	145.2	0.102	10.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	10.85	70.000	0.084	0.0	0.0	0.0	0.92	16.3	11.4
S2.000	50.00	11.16	70.000	0.102	0.0	0.0	0.0	0.83	14.7	13.8

Network Design Table for carpark small a

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.001	7.581	0.111	68.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.001	50.00	11.24	69.600	0.186	0.0	0.0	0.0	1.58	63.0	25.2

Free Flowing Outfall Details for carpark small a

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.001	S	70.320	69.489	0.000	0	0

Simulation Criteria for carpark small a

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.352		

Online Controls for carpark small a

Hydro-Brake® Optimum Manhole: S2, DS/PN: S1.001, Volume (m³): 3.1

Unit Reference	MD-SHE-0019-2000-1100-2000
Design Head (m)	1.100
Design Flow (l/s)	0.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	19
Invert Level (m)	69.600
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.100	0.2	Kick-Flo®	0.173	0.1
Flush-Flo™	0.084	0.1	Mean Flow over Head Range	-	0.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.1	1.200	0.2	3.000	0.3	7.000	0.4
0.200	0.1	1.400	0.2	3.500	0.3	7.500	0.5
0.300	0.1	1.600	0.2	4.000	0.3	8.000	0.5
0.400	0.1	1.800	0.2	4.500	0.4	8.500	0.5
0.500	0.1	2.000	0.3	5.000	0.4	9.000	0.5
0.600	0.2	2.200	0.3	5.500	0.4	9.500	0.5
0.800	0.2	2.400	0.3	6.000	0.4		
1.000	0.2	2.600	0.3	6.500	0.4		

Storage Structures for carpark small a

Tank or Pond Manhole: S1, DS/PN: S1.000

Invert Level (m) 70.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	226.0	0.300	226.0	0.301	0.0

Tank or Pond Manhole: S2, DS/PN: S2.000

Invert Level (m) 70.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	274.0	0.300	274.0	0.301	0.0

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for carpark small a

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.352	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for carpark small a

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.054	4-8	0.075	8-12	0.058

Total Area Contributing (ha) = 0.186

Total Pipe Volume (m³) = 2.161

Network Design Table for carpark small a

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	47.138	0.400	117.8	0.084	10.00	0.0	0.600	o	150	Pipe/Conduit	
S2.000	58.089	0.400	145.2	0.102	10.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	10.85	70.000	0.084	0.0	0.0	0.0	0.92	16.3	11.4
S2.000	50.00	11.16	70.000	0.102	0.0	0.0	0.0	0.83	14.7	13.8

Network Design Table for carpark small a

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.001	7.581	0.111	68.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.001	50.00	11.24	69.600	0.186	0.0	0.0	0.0	1.58	63.0	25.2

Free Flowing Outfall Details for carpark small a

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.001	S	70.320	69.489	0.000	0	0

Simulation Criteria for carpark small a

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.352		

Online Controls for carpark small a

Hydro-Brake® Optimum Manhole: S2, DS/PN: S1.001, Volume (m³): 3.1

Unit Reference	MD-SHE-0019-2000-1100-2000
Design Head (m)	1.100
Design Flow (l/s)	0.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	19
Invert Level (m)	69.600
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.100	0.2	Kick-Flo®	0.173	0.1
Flush-Flo™	0.084	0.1	Mean Flow over Head Range	-	0.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.1	1.200	0.2	3.000	0.3	7.000	0.4
0.200	0.1	1.400	0.2	3.500	0.3	7.500	0.5
0.300	0.1	1.600	0.2	4.000	0.3	8.000	0.5
0.400	0.1	1.800	0.2	4.500	0.4	8.500	0.5
0.500	0.1	2.000	0.3	5.000	0.4	9.000	0.5
0.600	0.2	2.200	0.3	5.500	0.4	9.500	0.5
0.800	0.2	2.400	0.3	6.000	0.4		
1.000	0.2	2.600	0.3	6.500	0.4		

Storage Structures for carpark small a

Tank or Pond Manhole: S1, DS/PN: S1.000

Invert Level (m) 70.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	226.0	0.300	226.0	0.301	0.0

Tank or Pond Manhole: S2, DS/PN: S2.000

Invert Level (m) 70.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	274.0	0.300	274.0	0.301	0.0

Summary of Critical Results by Maximum Level (Rank 1) for carpark small a

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model		FSR Ratio R	0.352
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 25

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	1440 Winter	100	+25%	30/960 Summer				70.461
S2.000	S2	1440 Winter	100	+25%	30/960 Summer				70.461
S1.001	S2	1440 Winter	100	+25%	1/15 Summer				70.461

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.311	0.000	0.01			0.2	FLOOD RISK	
S2.000	S2	0.311	0.000	0.02			0.3	FLOOD RISK	
S1.001	S2	0.636	0.000	0.00			0.2	FLOOD RISK	

APPENDIX K

Microdrainage Calculation

Unit B

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for UNIT B

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.352	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for UNIT B

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.099	4-8	0.606	8-12	0.162

Total Area Contributing (ha) = 0.867

Total Pipe Volume (m^3) = 42.891

Network Design Table for UNIT B

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	72.983	0.146	499.9	0.117	4.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	86.268	0.173	498.7	0.157	4.00	0.0	0.600	o	225	Pipe/Conduit	
S2.001	15.814	0.032	494.2	0.013	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	6.10	69.625	0.117	0.0	0.0	0.0	0.58	23.0	15.8
S2.000	50.00	6.48	69.684	0.157	0.0	0.0	0.0	0.58	23.0	21.3
S2.001	50.00	6.94	69.511	0.171	0.0	0.0	0.0	0.58	23.1	23.1

Network Design Table for UNIT B

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.001	4.755	0.028	169.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.000	21.704	0.128	169.6	0.014	4.00	0.0	0.600	o	225	Pipe/Conduit	
S3.001	16.551	0.097	170.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	30.620	0.125	245.0	0.141	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.000	30.833	0.181	170.3	0.133	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	19.256	0.047	410.0	0.262	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.004	29.885	0.073	409.4	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.005	25.223	0.062	410.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.006	84.949	0.207	410.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S5.000	22.018	0.130	170.0	0.031	4.00	0.0	0.600	o	225	Pipe/Conduit	
S5.001	5.107	0.030	170.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S5.002	5.821	0.034	171.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.007	13.347	0.033	404.5	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.001	50.00	7.02	69.479	0.287	0.0	0.0	0.0	1.00	39.8	38.9
S3.000	50.00	4.36	69.676	0.014	0.0	0.0	0.0	1.00	39.8	1.8
S3.001	50.00	4.64	69.548	0.014	0.0	0.0	0.0	1.00	39.7	1.8
S1.002	50.00	7.53	69.376	0.441	0.0	0.0	0.0	1.00	70.7	59.7
S4.000	50.00	4.51	69.507	0.133	0.0	0.0	0.0	1.00	39.7	18.0
S1.003	50.00	7.85	69.101	0.836	0.0	0.0	0.0	1.00	158.7	113.2
S1.004	49.66	8.35	69.054	0.836	0.0	0.0	0.0	1.00	158.8	113.2
S1.005	48.46	8.77	68.981	0.836	0.0	0.0	0.0	1.00	158.7	113.2
S1.006	44.88	10.19	68.919	0.836	0.0	0.0	0.0	1.00	158.7	113.2
S5.000	50.00	4.37	69.026	0.031	0.0	0.0	0.0	1.00	39.8	4.2
S5.001	50.00	4.45	68.963	0.031	0.0	0.0	0.0	1.00	39.7	4.2
S5.002	50.00	4.55	68.774	0.031	0.0	0.0	0.0	1.00	39.6	4.2
S1.007	44.38	10.41	68.712	0.867	0.0	0.0	0.0	1.00	159.8	113.2

Network Design Table for UNIT B

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.008	51.791	2.700	19.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.008	43.75	10.70	68.679	0.867	0.0	0.0	0.0	3.00	119.3	113.2

Free Flowing Outfall Details for UNIT B

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.008	S	66.510	65.979	0.000	0	0

Simulation Criteria for UNIT B

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 4 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.352		

Online Controls for UNIT B

Hydro-Brake® Optimum Manhole: S14, DS/PN: S1.008, Volume (m³): 4.0

Unit Reference	MD-SHE-0064-2200-1500-2200
Design Head (m)	1.500
Design Flow (l/s)	2.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	64
Invert Level (m)	68.679
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	2.2	Kick-Flo®	0.571	1.4
Flush-Flo™	0.279	1.8	Mean Flow over Head Range	-	1.7

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	1.5	1.200	2.0	3.000	3.0	7.000	4.5
0.200	1.7	1.400	2.1	3.500	3.2	7.500	4.6
0.300	1.8	1.600	2.3	4.000	3.5	8.000	4.8
0.400	1.7	1.800	2.4	4.500	3.7	8.500	4.9
0.500	1.6	2.000	2.5	5.000	3.8	9.000	5.1
0.600	1.5	2.200	2.6	5.500	4.0	9.500	5.2
0.800	1.7	2.400	2.7	6.000	4.2		
1.000	1.8	2.600	2.8	6.500	4.3		

Storage Structures for UNIT B

Tank or Pond Manhole: S15, DS/PN: S1.000

Invert Level (m) 69.625

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	350.0	0.400	350.0	0.401	0.0

Tank or Pond Manhole: S16, DS/PN: S2.000

Invert Level (m) 69.684

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	373.8	0.400	373.8	0.401	0.0

Tank or Pond Manhole: S17, DS/PN: S2.001

Invert Level (m) 69.511

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	40.0	0.400	40.0	0.401	0.0

Tank or Pond Manhole: S6, DS/PN: S1.004

Invert Level (m) 69.054

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	137.0	1.000	474.0	1.001	0.0

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for UNIT B

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.352	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for UNIT B

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.099	4-8	0.606	8-12	0.162

Total Area Contributing (ha) = 0.867

Total Pipe Volume (m^3) = 42.891

Network Design Table for UNIT B

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	72.983	0.146	499.9	0.117	4.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	86.268	0.173	498.7	0.157	4.00	0.0	0.600	o	225	Pipe/Conduit	
S2.001	15.814	0.032	494.2	0.013	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	6.10	69.625	0.117	0.0	0.0	0.0	0.58	23.0	15.8
S2.000	50.00	6.48	69.684	0.157	0.0	0.0	0.0	0.58	23.0	21.3
S2.001	50.00	6.94	69.511	0.171	0.0	0.0	0.0	0.58	23.1	23.1

Network Design Table for UNIT B

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.001	4.755	0.028	169.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.000	21.704	0.128	169.6	0.014	4.00	0.0	0.600	o	225	Pipe/Conduit	
S3.001	16.551	0.097	170.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	30.620	0.125	245.0	0.141	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.000	30.833	0.181	170.3	0.133	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	19.256	0.047	410.0	0.262	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.004	29.885	0.073	409.4	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.005	25.223	0.062	410.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.006	84.949	0.207	410.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S5.000	22.018	0.130	170.0	0.031	4.00	0.0	0.600	o	225	Pipe/Conduit	
S5.001	5.107	0.030	170.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S5.002	5.821	0.034	171.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.007	13.347	0.033	404.5	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.001	50.00	7.02	69.479	0.287	0.0	0.0	0.0	1.00	39.8	38.9
S3.000	50.00	4.36	69.676	0.014	0.0	0.0	0.0	1.00	39.8	1.8
S3.001	50.00	4.64	69.548	0.014	0.0	0.0	0.0	1.00	39.7	1.8
S1.002	50.00	7.53	69.376	0.441	0.0	0.0	0.0	1.00	70.7	59.7
S4.000	50.00	4.51	69.507	0.133	0.0	0.0	0.0	1.00	39.7	18.0
S1.003	50.00	7.85	69.101	0.836	0.0	0.0	0.0	1.00	158.7	113.2
S1.004	49.66	8.35	69.054	0.836	0.0	0.0	0.0	1.00	158.8	113.2
S1.005	48.46	8.77	68.981	0.836	0.0	0.0	0.0	1.00	158.7	113.2
S1.006	44.88	10.19	68.919	0.836	0.0	0.0	0.0	1.00	158.7	113.2
S5.000	50.00	4.37	69.026	0.031	0.0	0.0	0.0	1.00	39.8	4.2
S5.001	50.00	4.45	68.963	0.031	0.0	0.0	0.0	1.00	39.7	4.2
S5.002	50.00	4.55	68.774	0.031	0.0	0.0	0.0	1.00	39.6	4.2
S1.007	44.38	10.41	68.712	0.867	0.0	0.0	0.0	1.00	159.8	113.2

Network Design Table for UNIT B

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.008	51.791	2.700	19.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.008	43.75	10.70	68.679	0.867	0.0	0.0	0.0	3.00	119.3	113.2

Free Flowing Outfall Details for UNIT B

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.008	S	66.510	65.979	0.000	0	0

Simulation Criteria for UNIT B

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 4 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.352		

Online Controls for UNIT B

Hydro-Brake® Optimum Manhole: S14, DS/PN: S1.008, Volume (m³): 4.0

Unit Reference	MD-SHE-0064-2200-1500-2200
Design Head (m)	1.500
Design Flow (l/s)	2.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	64
Invert Level (m)	68.679
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	2.2	Kick-Flo®	0.571	1.4
Flush-Flo™	0.279	1.8	Mean Flow over Head Range	-	1.7

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	1.5	1.200	2.0	3.000	3.0	7.000	4.5
0.200	1.7	1.400	2.1	3.500	3.2	7.500	4.6
0.300	1.8	1.600	2.3	4.000	3.5	8.000	4.8
0.400	1.7	1.800	2.4	4.500	3.7	8.500	4.9
0.500	1.6	2.000	2.5	5.000	3.8	9.000	5.1
0.600	1.5	2.200	2.6	5.500	4.0	9.500	5.2
0.800	1.7	2.400	2.7	6.000	4.2		
1.000	1.8	2.600	2.8	6.500	4.3		

Storage Structures for UNIT B

Tank or Pond Manhole: S15, DS/PN: S1.000

Invert Level (m) 69.625

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	350.0	0.400	350.0	0.401	0.0

Tank or Pond Manhole: S16, DS/PN: S2.000

Invert Level (m) 69.684

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	373.8	0.400	373.8	0.401	0.0

Tank or Pond Manhole: S17, DS/PN: S2.001

Invert Level (m) 69.511

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	40.0	0.400	40.0	0.401	0.0

Tank or Pond Manhole: S6, DS/PN: S1.004

Invert Level (m) 69.054

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	137.0	1.000	474.0	1.001	0.0

Summary of Critical Results by Maximum Level (Rank 1) for UNIT B

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 4 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.352
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 25

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S15	1440 Winter	100	+25%	100/240 Summer				70.041
S2.000	S16	1440 Winter	100	+25%	100/240 Winter				70.039
S2.001	S17	1440 Winter	100	+25%	30/240 Winter				70.041
S1.001	S18	1440 Winter	100	+25%	30/240 Summer				70.041
S3.000	S1	1440 Winter	100	+25%	100/240 Winter				70.040
S3.001	S2	1440 Winter	100	+25%	30/360 Winter				70.041
S1.002	S3	1440 Winter	100	+25%	30/120 Winter				70.041
S4.000	S4	15 Winter	100	+25%	30/15 Summer				70.288
S1.003	S5	1440 Winter	100	+25%	30/15 Summer				70.040
S1.004	S6	1440 Winter	100	+25%	30/60 Summer				70.039
S1.005	S7	1440 Winter	100	+25%	1/360 Winter				70.075
S1.006	S8	1440 Winter	100	+25%	1/240 Winter				70.094
S5.000	S10	1440 Winter	100	+25%	1/120 Summer				70.107
S5.001	S14	1440 Winter	100	+25%	1/30 Winter				70.107
S5.002	S11	1440 Winter	100	+25%	1/15 Summer				70.109
S1.007	S9	1440 Winter	100	+25%	1/30 Summer				70.113

Summary of Critical Results by Maximum Level (Rank 1) for UNIT B

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S15	0.191	0.000	0.08			1.8	SURCHARGED	
S2.000	S16	0.130	0.000	0.13			2.8	SURCHARGED	
S2.001	S17	0.305	0.000	0.14			2.3	SURCHARGED	
S1.001	S18	0.337	0.000	0.14			3.9	SURCHARGED	
S3.000	S1	0.139	0.000	0.01			0.4	SURCHARGED	
S3.001	S2	0.268	0.000	0.01			0.5	SURCHARGED	
S1.002	S3	0.365	0.000	0.11			6.9	SURCHARGED	
S4.000	S4	0.556	0.000	1.78			66.2	SURCHARGED	
S1.003	S5	0.489	0.000	0.12			15.0	SURCHARGED	
S1.004	S6	0.535	0.000	0.17			22.7	SURCHARGED	
S1.005	S7	0.644	0.000	0.15			20.1	SURCHARGED	
S1.006	S8	0.725	0.000	0.07			10.4	SURCHARGED	
S5.000	S10	0.856	0.000	0.09			3.1	FLOOD RISK	
S5.001	S14	0.919	0.000	0.16			4.6	FLOOD RISK	
S5.002	S11	1.110	0.000	0.20			5.9	FLOOD RISK	
S1.007	S9	0.951	0.000	0.05			5.1	FLOOD RISK	

Summary of Critical Results by Maximum Level (Rank 1) for UNIT B

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.008	S14	1440 Winter	100	+25%	1/15 Summer				70.113

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.008	S14	1.209	0.000	0.02			2.1	FLOOD RISK	

APPENDIX L

Microdrainage Calculation

Unit B-Parking Area

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for parking unit b

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.352	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for parking unit b

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.137	4-8	0.193	8-12	0.153

Total Area Contributing (ha) = 0.482

Total Pipe Volume (m^3) = 4.834

Network Design Table for parking unit b

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	33.039	0.194	170.3	0.202	10.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	38.420	0.226	170.0	0.280	10.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	10.55	68.543	0.202	0.0	0.0	0.0	1.00	39.7	27.4
S2.000	50.00	10.64	68.575	0.280	0.0	0.0	0.0	1.00	39.8	37.9

Network Design Table for parking unit b

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.001	8.549	0.035	244.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	14.703	0.060	245.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.003	8.778	0.036	243.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.001	50.00	10.78	68.274	0.482	0.0	0.0	0.0	1.00	70.8	65.3
S1.002	50.00	11.03	68.239	0.482	0.0	0.0	0.0	1.00	70.7	65.3
S1.003	50.00	11.20	68.179	0.482	0.0	0.0	0.0	0.83	33.1«	65.3

Area Summary for parking unit b

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.202	0.202	0.202
2.000	-	-	100	0.280	0.280	0.280
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.482	0.482	0.482

Free Flowing Outfall Details for parking unit b

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.003	S	70.280	68.143	0.000	0	0

Simulation Criteria for parking unit b

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.352		

Online Controls for parking unit b

Hydro-Brake® Optimum Manhole: S4, DS/PN: S1.003, Volume (m³): 3.6

Unit Reference	MD-SHE-0223-3000-2000-3000
Design Head (m)	2.000
Design Flow (l/s)	30.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	223
Invert Level (m)	68.179
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	30.0	Kick-Flo®	1.268	24.1
Flush-Flo™	0.586	30.0	Mean Flow over Head Range	-	26.0

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	7.5	1.200	25.7	3.000	36.4	7.000	54.9
0.200	22.0	1.400	25.3	3.500	39.2	7.500	56.7
0.300	27.8	1.600	26.9	4.000	41.8	8.000	58.5
0.400	29.2	1.800	28.5	4.500	44.3	8.500	60.3
0.500	29.8	2.000	30.0	5.000	46.6	9.000	62.0
0.600	30.0	2.200	31.4	5.500	48.8	9.500	63.6
0.800	29.5	2.400	32.7	6.000	50.9		
1.000	28.4	2.600	34.0	6.500	52.9		

Storage Structures for parking unit b

Tank or Pond Manhole: S4, DS/PN: S1.002

Invert Level (m) 68.239

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	79.0	1.200	79.0	1.201	0.0

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for parking unit b

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.352	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for parking unit b

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.137	4-8	0.193	8-12	0.153

Total Area Contributing (ha) = 0.482

Total Pipe Volume (m^3) = 4.834

Network Design Table for parking unit b

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	33.039	0.194	170.3	0.202	10.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	38.420	0.226	170.0	0.280	10.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	10.55	68.543	0.202	0.0	0.0	0.0	1.00	39.7	27.4
S2.000	50.00	10.64	68.575	0.280	0.0	0.0	0.0	1.00	39.8	37.9

Network Design Table for parking unit b

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.001	8.549	0.035	244.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	14.703	0.060	245.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.003	8.778	0.036	243.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.001	50.00	10.78	68.274	0.482	0.0	0.0	0.0	1.00	70.8	65.3
S1.002	50.00	11.03	68.239	0.482	0.0	0.0	0.0	1.00	70.7	65.3
S1.003	50.00	11.20	68.179	0.482	0.0	0.0	0.0	0.83	33.1«	65.3

Area Summary for parking unit b

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.202	0.202	0.202
2.000	-	-	100	0.280	0.280	0.280
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.482	0.482	0.482

Free Flowing Outfall Details for parking unit b

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.003	S	70.280	68.143	0.000	0	0

Simulation Criteria for parking unit b

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.352		

Online Controls for parking unit b

Hydro-Brake® Optimum Manhole: S4, DS/PN: S1.003, Volume (m³): 3.6

Unit Reference	MD-SHE-0223-3000-2000-3000
Design Head (m)	2.000
Design Flow (l/s)	30.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	223
Invert Level (m)	68.179
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	30.0	Kick-Flo®	1.268	24.1
Flush-Flo™	0.586	30.0	Mean Flow over Head Range	-	26.0

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	7.5	1.200	25.7	3.000	36.4	7.000	54.9
0.200	22.0	1.400	25.3	3.500	39.2	7.500	56.7
0.300	27.8	1.600	26.9	4.000	41.8	8.000	58.5
0.400	29.2	1.800	28.5	4.500	44.3	8.500	60.3
0.500	29.8	2.000	30.0	5.000	46.6	9.000	62.0
0.600	30.0	2.200	31.4	5.500	48.8	9.500	63.6
0.800	29.5	2.400	32.7	6.000	50.9		
1.000	28.4	2.600	34.0	6.500	52.9		

Storage Structures for parking unit b

Tank or Pond Manhole: S4, DS/PN: S1.002

Invert Level (m) 68.239

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	79.0	1.200	79.0	1.201	0.0

Summary of Critical Results by Maximum Level (Rank 1) for parking unit b

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.352
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 25

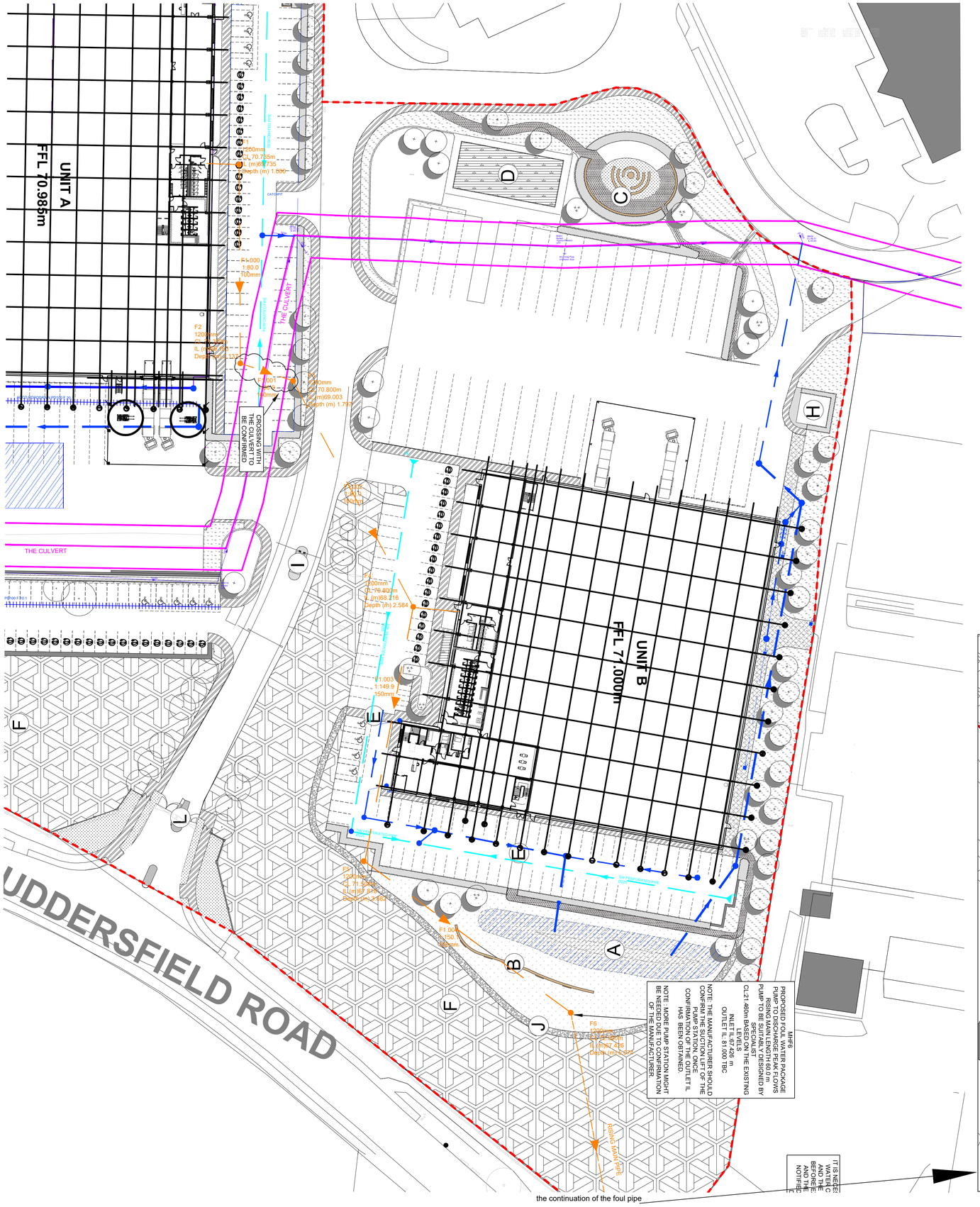
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	60 Winter	100	+25%	30/15 Summer				70.191
S2.000	S2	30 Winter	100	+25%	30/15 Summer				70.404
S1.001	S3	60 Winter	100	+25%	30/15 Summer				70.161
S1.002	S4	60 Winter	100	+25%	30/15 Summer				70.091
S1.003	S4	60 Winter	100	+25%	1/30 Winter				70.121

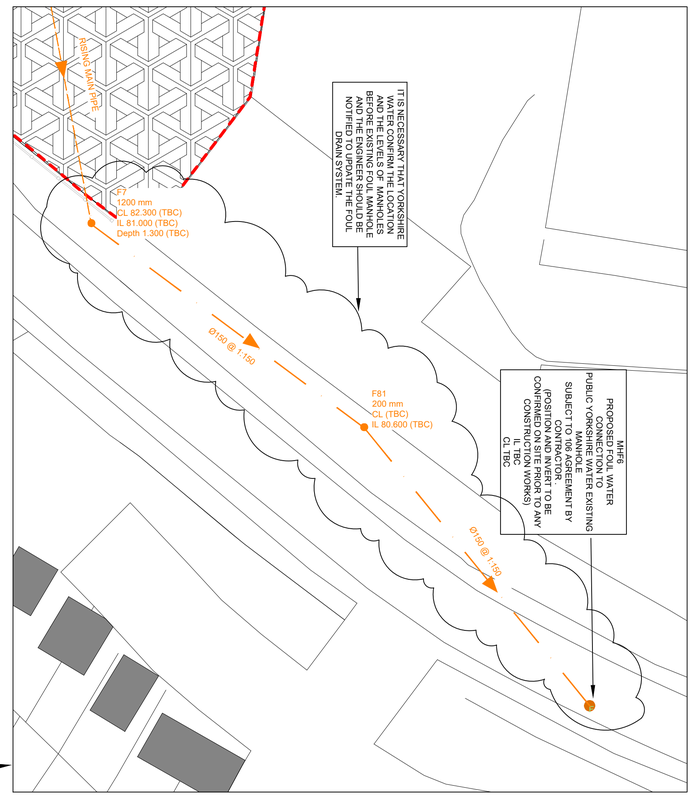
PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	1.423	0.000	1.27			47.4	FLOOD RISK	
S2.000	S2	1.604	0.000	2.23			84.1	SURCHARGED	
S1.001	S3	1.587	0.000	2.10			112.7	SURCHARGED	
S1.002	S4	1.552	0.000	0.65			38.4	SURCHARGED	
S1.003	S4	1.717	0.000	1.11			29.9	SURCHARGED	

APPENDIX M

Proposed Drainage Strategy

Foul Water





PRIVATE DRAINAGE NOTES:

1. DRAINAGE SYSTEMS TO COMPLY WITH THE FOLLOWING STANDARDS:
   - BS EN 752:2008
   - BUILDING REGULATIONS APPROVED DOCUMENT PART H, 2015 EDITION
2. ALL COMPONENTS USED IN DRAINAGE SYSTEMS TO COMPLY WITH THE FOLLOWING: BS EN 476:2011
3. ALL DRAINAGE SYSTEMS AND COMPONENTS TO BE CONSTRUCTED AND TESTED TO THE FULL SATISFACTION OF THE BUILDING REGULATIONS INSPECTOR
4. ALL DRAINAGE TO BE CONSTRUCTED AND TESTED IN ACCORDANCE WITH BS EN 1610:2015.
5. EXACT POSITIONS OF SVP'S, STUB-STACKS, W.C. OUTLETS ETC. AND RAINWATER DOWNPIPES ARE TO BE ACCURATELY LOCATED FROM THE ARCHITECT'S DESIGN DRAWINGS.
6. PIPES UPTO 225Ø TO BE VITRIFIED CLAY, VITRIFIED CLAY PIPES AND FITTINGS TO COMPLY WITH THE RELEVANT PROVISIONS OF BS EN295-1:2013,-2:2013,-3:2012 AND BS 65 RESPECTIVELY AND BE KITEMARKED. ALL PIPES SHALL BE EXTRA STRENGTH TO BS 65 OR EQUIVALENT BS EN295 PIPE CRUSHING STRENGTH.
7. ALL PRIVATE BELOW GROUND SW PIPES TO BE PLASTIC TWINWALL DRAINAGE PIPES (MAX 600Ø)
8. PRECAST CONCRETE MANHOLES TO BE IN ACCORDANCE WITH BS EN 1917:2002 AND BS 5911-3:2010,-4:2002 AND TO BE KITEMARKED. PRECAST CONCRETE RINGS AND COVER SLABS TO CONCRETE PIPES TO BE JOINTED WITH CEMENT MORTAR UNLESS NOTED OTHERWISE.
9. INSITU AND PRECAST CONCRETE UNITS SHALL HAVE SULPHATE RESISTING PORTLAND CEMENT TO BS EN 197-1:2011.
10. POLYPROPYLENE INSPECTION CHAMBERS TO COMPLY WITH BS EN 13598-1:2010,-2:2016 AND BS 7158:2001 AND TO BE KITEMARKED.
11. MANHOLE COVERS AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 124-1 TO 6:2015. MANHOLE COVERS AND FRAMES TO BE OF A NON-ROCKING DESIGN WITH CUSHION INSERTS AND KITEMARKED. LOAD CLASS D400 COVERS TO BE USED IN ALL LOCATIONS. ALL COVERS TO BE BADGED "FW" OR "SW" AS APPROPRIATE. MANHOLE COVER SLABS AND ACCESS TO BE IN ACCORDANCE WITH CONCRETE PIPE ASSOCIATION TECHNICAL BULLETIN ISSUED SEPTEMBER 2001.
12. POLYPROPYLENE INSPECTION CHAMBER COVERS AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 124-1 TO 6:2015. COVERS AND FRAMES TO BE OF A NON-ROCKING DESIGN WITH CUSHION INSERTS AND KITEMARKED. LOAD CLASS A15 COVERS TO BE USED IN AREAS INACCESSIBLE TO VEHICLES; LOAD CLASS D400 COVERS TO BE USED ELSEWHERE.
13. ROAD GULLY GRATES AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 124-1 TO 6:2015 AND BE OF A NON-ROCKING DESIGN WITH LEFT HANDED CAPTIVE HINGE ACCESS AND BE KITEMARKED. LOAD CLASS D400 GRATES TO BE USED THROUGHOUT WITH 450mm SQ. GRATE AND FRAME. MINIMUM AREA OF WATERWAY TO BE 1010cm².
14. YARD GULLY GRATES AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 124-1 TO 6:2015 AND BE OF A NON-ROCKING DESIGN AND BE KITEMARKED. LOAD CLASS A15 GRATES TO BE USED IN AREAS INACCESSIBLE TO VEHICLES GRATES TO BE 300mm SQ. MINIMUM AREA OF WATERWAY TO BE 900cm².
15. RAINWATER DOWNPIPES CONNECTED DIRECT TO DRAIN TO BE CONNECTED USING AN APPROPRIATE ADAPTOR AND REMOVABLE SECTION OF DOWNPIPE TO PERMIT RODDING ACCESS.
16. CLASS Z BEDDING DETAIL SHALL BE PROVIDED:
    - WHERE COVER TO PIPE BARREL IS;
    - i) <1.2m IN VEHICULAR TRAFFICKED AREAS
    - ii) <0.9m IN AREAS INACCESSIBLE TO VEHICLES.
    - AT ALL ROAD GULLY, YARD GULLY, RWP, SVP AND DRAINAGE CHANNEL BRANCHES.
    - AREAS OF DEEP ROOTING VEGETATION.
    - PIPE RUNS NEAR BUILDINGS IN ACCORDANCE WITH TYPICAL SECTIONS ON AWP DRAWINGS.
    - WHERE TWO PIPES CROSS WITH A CLEAR GAP OF <300mm. CLASS Z SURROUND TO EXTEND A MINIMUM OF 1.0m FROM THE CENTRE OF THE CROSSING POINT & EXTENDED TO WITHIN 150mm OF THE NEAREST FLEXIBLE JOINT, WHERE REQUIRED.
17. CLASS Y BEDDING DETAIL TO BE PROVIDED WHERE COVER TO PIPE CROWN FROM THE UNDERSIDE OF THE SUB STRUCTURE IS LESS THAN 300mm.

    PIPE BEDDING MATERIALS TO COMPLY GENERALLY WITH SHW - SERIES 500 - CLAUSE 503. GRANULAR BEDDING MATERIALS TO ALSO COMPLY WITH BS EN 13242 & THE GRANULAR BEDDING MATERIAL TABLE ON THIS DRAWING.
18. SELECTED BACKFILL MATERIAL TO BE PROVIDED ABOVE THE PIPE SURROUND TO A HEIGHT OF 300mm MINIMUM ABOVE THE TOP OF THE PIPE. SELECTED BACKFILL MATERIAL TO BE CLASS 8 - LOWER TRENCH FILL MATERIAL IN ACCORDANCE WITH SHW - SERIES 600 TABLE 6/1 & TO COMPRISE OF UNIFORM SOIL, FREE FROM STONES LARGER THAN 40mm, LUMPS OF CLAY OVER 100mm, TIMBER, FROZEN MATERIAL & VEGETABLE MATTER. SELECTED BACKFILL MATERIAL TO BE PLACED & COMPACTED IN LAYERS NOT EXCEEDING 150mm IN THICKNESS. SHOULD THE MATERIAL BE UNSUITABLE OR WEATHER CONDITIONS AFFECT THE MATERIALS STABILITY, THEN A SUITABLE HARD GRANULAR MATERIAL SHALL BE USED.
19. GENERAL BACKFILL TO DRAINAGE TRENCHES [OTHER THAN FILTER DRAINS] IN VEHICULAR TRAFFICKED AREAS ABOVE THE PIPE BEDDING & SELECTED BACKFILL SHALL BE CLASS 1, 2 OR 3 GENERAL FILL MATERIAL IN ACCORDANCE WITH SHW - SERIES 600.
20. GENERAL BACKFILL UNDER NON-VEHICULAR TRAFFICKED AREAS TO BE SUITABLE AS-DUG MATERIAL COMPACTED IN ACCORDANCE WITH SHW - SERIES 600 IN LAYERS NOT EXCEEDING 225mm, EACH LAYER COMPACTED TO FORM A STABLE TRENCH BACKFILL, SHOULD THE MATERIAL BE UNSUITABLE OR WEATHER CONDITIONS AFFECT THE MATERIALS STABILITY, THEN A HARD GRANULAR MATERIAL SHALL BE USED UP TO FORMATION LEVEL.
21. ALL CONCRETE TO BE DESIGNATED CONCRETE TO CONFORM TO BS 8500-2.
22. NO MECHANICAL COMPACTION OF FILL MATERIAL WITHIN 300mm OF THE CROWN OF ANY PIPE.
23.

NOTES:

G01. THESE NOTES ARE INTENDED TO AUGMENT DRAWINGS AND SPECIFICATIONS. WHERE CONFLICT OF REQUIREMENTS EXIST THE ORDER OF PRECEDENCE SHALL BE AS SHOWN IN THE SPECIFICATION. OTHERWISE THE STRICTEST PROVISION SHALL GOVERN.

G02. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS AND ARCHITECTS DRAWINGS.

G03. DRAWINGS NOT TO BE SCALED. ALL DIMENSIONS TO BE CHECKED ON SITE BY THE CONTRACTOR. ANY DISCREPANCIES TO BE NOTIFIED TO THE ENGINEER AND FURTHER INSTRUCTIONS OBTAINED BEFORE WORK IS COMMENCED.

G04. THE STRUCTURE IS DESIGNED TO BE SELF-SUPPORTING AND STABLE AFTER THE BUILDING IS FULLY COMPLETED. IT IS THE CONTRACTORS SOLE RESPONSIBILITY TO DETERMINE THE ERECTION PROCEDURE AND SEQUENCE AND ENSURE THAT THE BUILDING AND ITS COMPONENTS ARE SAFE DURING ERECTION. THIS INCLUDES THE ADDITION OF WHATEVER TEMPORARY BRACING, GUYS OR TIE-DOWNS WHICH MAY BE NECESSARY, SUCH MATERIAL REMAINING THE THE PROPERTY OF THE CONTRACTOR ON COMPLETION, AND FOR ENSURING THAT THE WORKS AND ANY ADJACENT PROPERTIES ARE SAFE IN THE TEMPORARY CONDITION.

EXISTING SERVICES NOTES

E01. CONTRACTOR TO PROTECT EXISTING SERVICES WITHIN THE SITE OR DIVERT AS REQUIRED.

E02. EXISTING PRESSURE PIPELINES TO BE PROTECTED DURING THE WORKS.

E03. EXISTING SEWERS AND OTHER SERVICES IN THE VICINITY OF THE PROPOSED WORKS TO BE SURVEYED AND DETAILS PROVEN AND PROTECTED AS NECESSARY FROM PROPOSED WORKS.

E04. EXISTING INFRASTRUCTURE THAT IS TO BE ABANDONED SHALL BE INFILLED WITH SUITABLE MATERIAL CAPABLE OF WITHSTANDING THE PROPOSED FUTURE LOADS. GEOTECHNICAL, CIVIL AND STRUCTURAL ENGINEER TO APPROVE.

LEGEND

- DEVELOPMENT BOUNDARY
- RODDING EYE
- SURFACE WATER CHAMBER
- FOUL WATER CHAMBER
- SURFACE WATER SEWER
- FOUL WATER SEWER
- FOUL WATER RAISING MAIN
- (SURFACE WATER) PERFORATED PIPE
- THE CULVERT
- (SURFACE WATER) PROPOSED ATTENUATION TANK
- (SURFACE WATER) PROPOSED POND
- PROPOSED PERMEABLE AREA
- (SURFACE WATER)PROPOSED ACCO DRAIN CHANNEL
- ROPOSED HEADWALL
- PROPOSED OIL SEPARATOR
- RWP PROPOSED RAIN WATER PIPE
- PROPOSED EXEEDANCE FLOW PATH ROUT

Rev	Description	Date	By	Chk	App
P1	FIRST ISSUE	12.10.23	MM	KH	KH

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Project: BIRTHWAITE BUSINESS PARK

Client: PREMDOR CROSBY LTD

Drawing: PROPOSED DRAINAGE STRATEGY-FOUL WATER-UNIT A & UNIT B

Role: CIVIL ENGINEER

Drawing Status: FOR INFROMATION | Suitability Code: -

Job. no. 49145 | Scale@ A1: 1:500 | Rev. P1

Project	Originator	Volume	Level	Type	Role	Number
BBP	AWP	XX	XX	DR	C	3002

APPENDIX N

YORKSHIRE WATER Public Sewer Map

YORKSHIRE WATER
PROTECTION OF MAINS AND SERVICES

1. The position of Yorkshire Water Services Ltd (YWS) apparatus shown on the existing mains record drawing(s) indicates the ***general*** position and nature of our apparatus and the accuracy of this information cannot be guaranteed. Any damage to YWS apparatus as a result of your works may have serious consequences and you will be held responsible for all costs incurred. Prior to commencing major works, the exact location of apparatus must be determined on site, if necessary by excavating trial holes. The actual position of such apparatus and that of service pipes which have not been indicated must be established on site by contacting the Customer Helpline on 0845 124 24 24 for both water and sewerage.

2. The public sewer and water network is lawfully retained in its existing position and the sewerage and water undertaker is entitled to have it remain so without any disturbance. The provisions of section 159 of the Water Industry Act 1991 provides that the undertaker may "inspect, maintain, adjust, repair or alter" the network. Those rights are given to enable the undertaker to perform its statutory duties. Any development of the land or any other action that unacceptably hindered the exercise of those rights would be unlawful. The provisions contained in Section 185 of the Water Industry Act 1991 state that where it is reasonable to do so, a person may require the water supply undertaker to alter or remove a pipe where it is necessary to enable that person to carry out a proposed change of use of the land. The provisions contained in Section 185 also require the person making the request to pay the full cost of carrying out the necessary works.

3. Ground levels over existing YWS apparatus are to be maintained. Sewers in highways will ***generally*** be laid to give 1200mm of cover from finished ground level working to kerb races, other permanent identification of the limits of the road or to an agreed line and level. Substantial increases or decreases to this 1200mm depth of cover will result in the sewer being re-laid at your expense. Water mains and services will ***generally*** be laid with a minimum of 750mm depth of cover however some mains and services usually those installed over 50 years ago may have less ground cover.

4. If surface levels are to be decreased / increased significantly the effects on existing water supply apparatus will be carefully considered and if any alterations are necessary, the costs of the alterations will be recharged to you in full. Outlets on fire hydrants must be no more than 300mm below the new levels and all surface boxes must be adjusted as part of the scheme.

5. To enable future repair works to be carried out without hindrance; any pipe, cable, duct, etc. installed parallel to a water main or service pipe should not be installed directly over or within 300mm of a water main or service pipe or 1000mm of a waste water asset. Where a pipe, cable, duct, etc. crosses a main or service it should preferably cross perpendicular or at an angle of no less than 45o and with a minimum clearance of 150mm. These requirements apply to activities within an existing highway and are relevant to the installation of pipes, cables, ducts, etc. up to and including 250mm in diameter *(see illustration below)*. Necessary protection measures for installations greater than 250mm in diameter and/or in private land will need to be agreed on an individual basis. Installations within a new development site must comply with the National Joint Utilities Group publication Volume 2: NJUG Guidelines On The Positioning Of Underground Utilities Apparatus For New Development Sites.

6. All excavation works near to YW apparatus should be by hand digging only.

7. Backfilling with a suitable material to a minimum 300mm above YW apparatus is required.

8. Adequate support must be provided where any works pass under YW apparatus.

9. Jointing chambers, lighting columns and other structures must be installed in such a way that future repair or maintenance works to YW apparatus will not be hindered.

10. Apparatus such as; railings, sign posts, etc. must not be placed in such a way that they prevent access to or full operation of controlling valves, hydrants or similar apparatus. YWS surface boxes must not be covered or buried. Any adjustment, alteration or replacement of manhole covers must be agreed on site prior to the commencement of the works with a YWS Inspector who may be contacted via our Call Centre on 0845 124 24 24.

11. Explosives shall not be used within 100 metres of any Yorkshire Water Services apparatus or installations.

12. Vibrating plant should not be used directly over any apparatus. Movement or operation by vehicles or heavy plant is not to be permitted in the immediate vicinity of YWS plant or apparatus unless there has been prior consultation and, if necessary, adequate protection provided without cost to YWS.

13. ***Under no circumstances*** should thrust boring or similar trenchless techniques commence until the actual position of the Company's mains/services along the proposed route have been confirmed by trial holes.

14. Any alterations to the highway should be notified following the procedures outlined in the New Road and Street Works Act 1991 Code of Practice; Measures Necessary Where Apparatus Is Affected By Major Works (Diversionary Works).

15. You will be held responsible for any damage or loss to YWS apparatus during and after completion of work, caused by yourselves, your servant or agent. Any damage caused or observed to YWS plant or apparatus should be immediately reported to YWS. Should YW incur any costs as a result of non-compliance with the above, all costs will be rechargeable in full.

16. You should ensure that nothing is done on the site to prejudice the safety or operation of YWS employees, plant or apparatus.

17. In accordance with the New Roads and Street Works Act 1991, Chapter 22, Part 3, Section 80. The location of any identified YW asset "*which is not marked, or is wrongly marked, on the records made available*" should be communicated back to Yorkshire Water. The location of the apparatus should be identified on copies of the supplied plans which should be returned to Yorkshire Water (Asset Records Team) with photographic supporting evidence where possible.

18. The Government has decided that responsibility for private sewers serving two or more properties and lateral drains (the section of pipe beyond the boundary of a single property, connecting it to the public sewer) will be transferred to the water companies on Oct 1 2011.

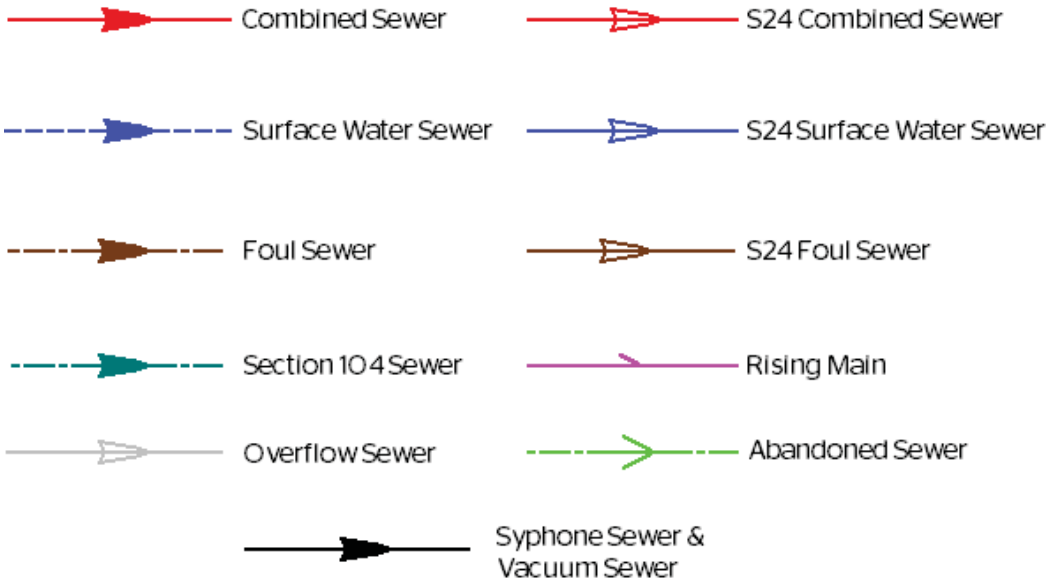
Private pumping stations will also transfer during the period 1 October 2011 – 1 Oct 2016. Records of these assets may not yet be shown on the existing mains record drawing(s). If you encounter any of these assets you must inform Yorkshire Water Services Ltd (YWS).

19. Please note that the information supplied on the enclosed plans is reproduced from Ordnance Survey material with the permission of the Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office, © Crown Copyright. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. Licence Number 1000019559.

20. This information is for guidance only and the position and depth of any YW apparatus is approximate only. Likewise, the nature and condition of any YW apparatus cannot be guaranteed. YW has no responsibility for recording the locations of privately owned apparatus. As of 1 October 2011, there may be some lateral drains and/or public sewers which are not documented on YW records but may still be present. For the avoidance of doubt, this information is not a substitute for appropriate professional and/or legal advice. YW accepts no responsibility for any inaccuracy or omissions in this information. The actual position of YW apparatus must be determined on site by excavating trail holes by hand. YW requires a minimum of two working days' written notice of the intention to excavate any trial holes before any excavation can be undertaken. If there are any queries in this respect please contact Yorkshire Water on 0845 124 24 24.

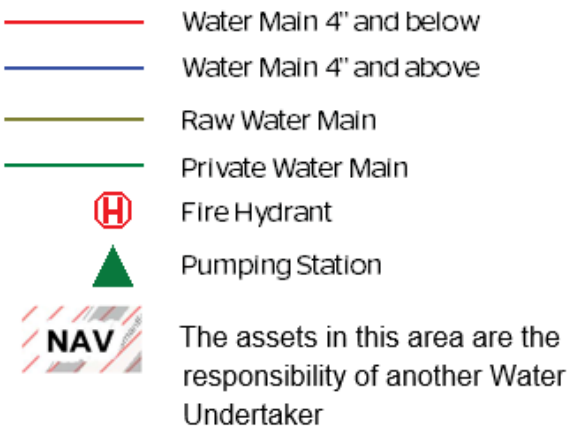
Property Identfier

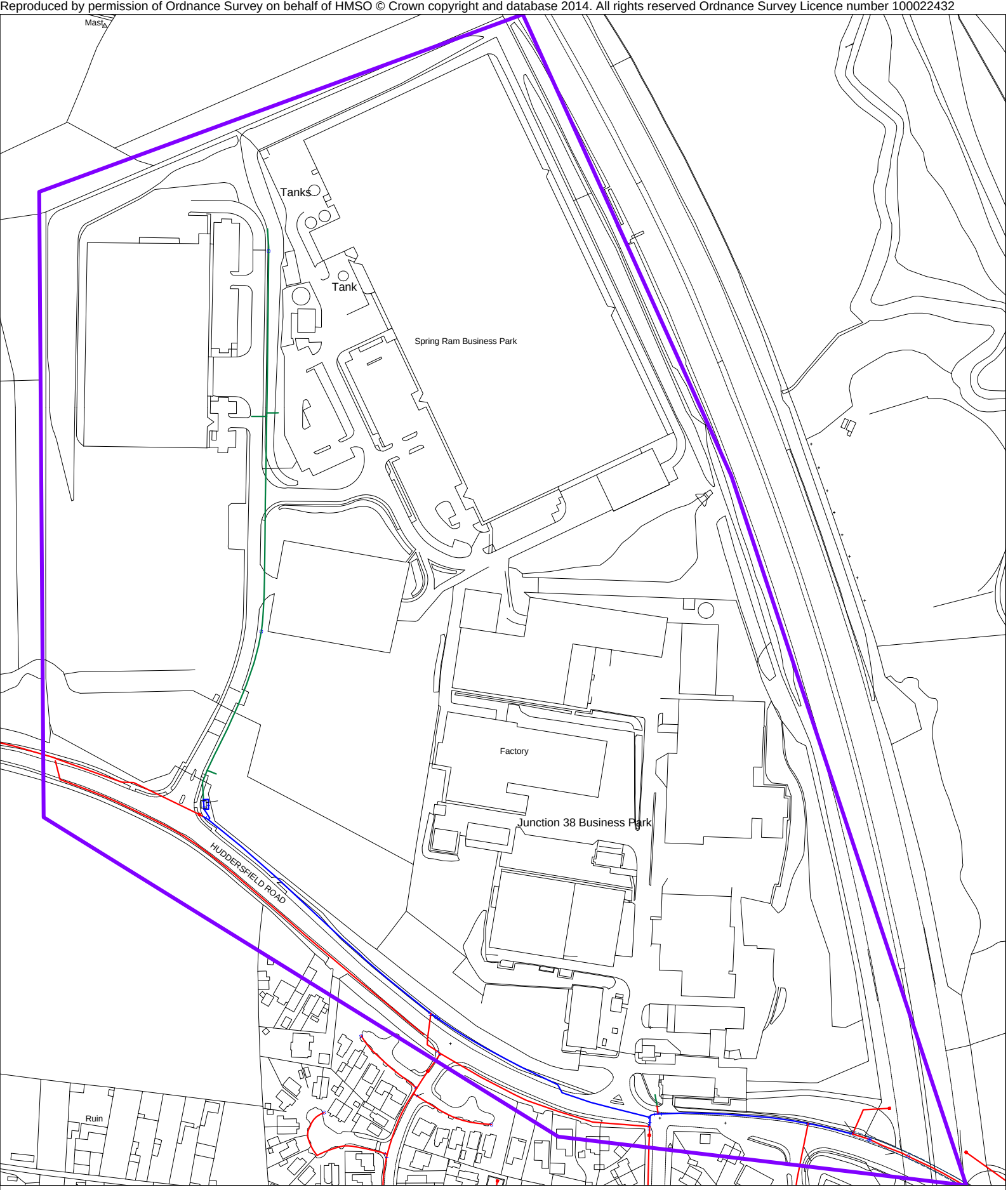
Sewer Legend



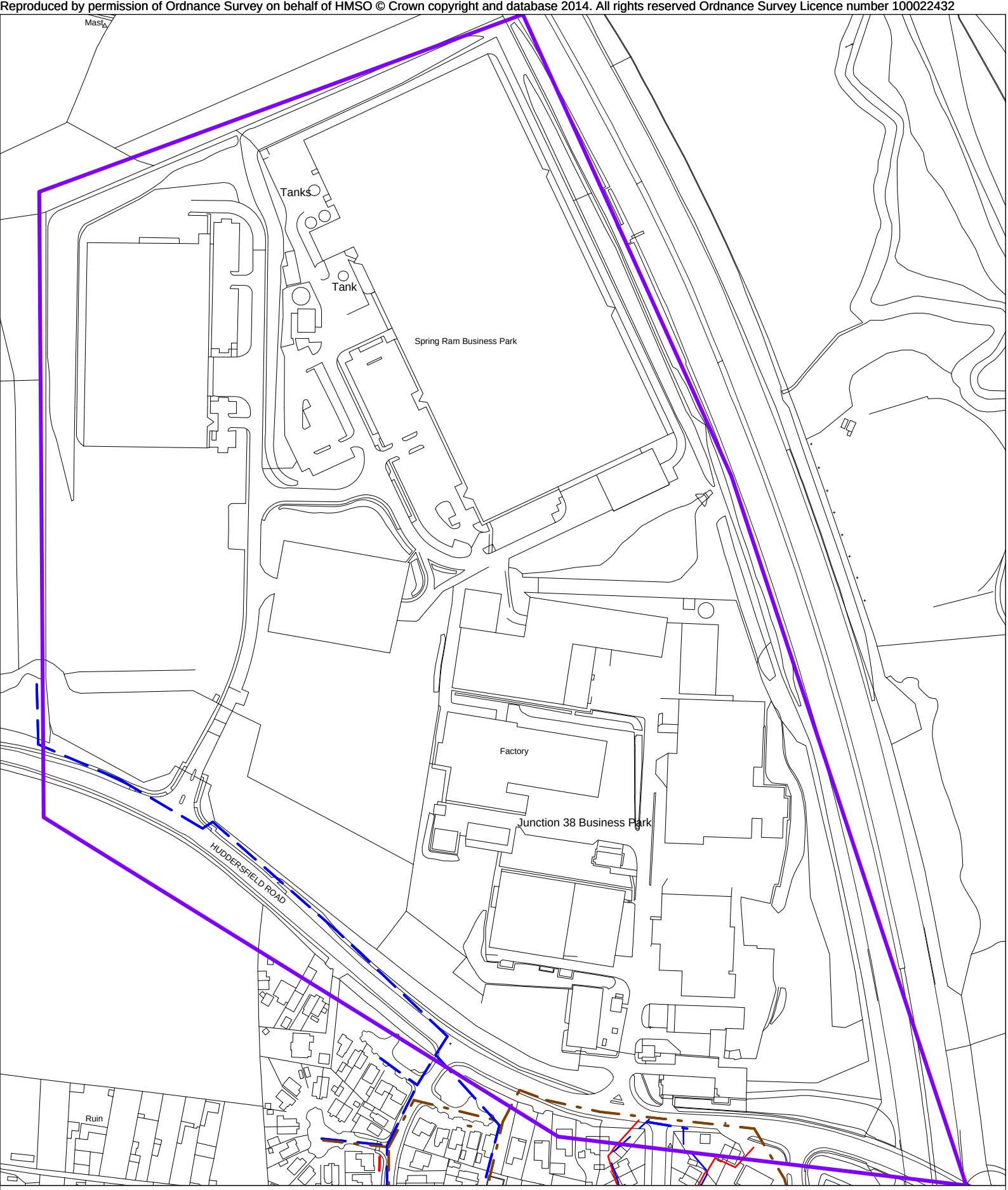
Please note that the direction of flow arrows may not always appear depending on the scale of the map.

Water Legend





Public Clean Water Network 10/10/2023 15:16:52 OS Grid Coordinates: 430279 : 410036 Map Name : SE3010SW svcGISSafeMovePD



Public Waste Water Network 10/10/2023 15:16:54 OS Grid Coordinates: 430279 : 410036 Map Name : SE3010SW svcGISSafeMovePD

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