DRAINAGE IMPACT ASSESSMENT

Rockingham, Plot 2
Birdwell
Barnsley

Reference	**5419-JPG-XX-XX-RP-D-0622-S2-P02**
Date	**March 2021**
Revision	**P02**
Author	**IB**

5 John Charles Way
LEEDS
LS12 6QA

Tel: 0113 263 1155
admin@jpg.group
www.jpg.group

CONTENTS

APPENDICES

CONFIDENTIALITY STATEMENT

This report is addressed to and may be relied upon by the following:

Gregory Property Group
12 Cardale Court
Cardale Park
Beckwith Head Road
HARROGATE
HG3 1RY

This report has been prepared for the sole use and reliance of the above named party. This report shall not be relied upon or transferred to any other parties without the express written authorisation of JPG (Leeds) Limited. No responsibility will be accepted where this report is used, either in its entirety or in part, by any other party.

DOCUMENT HISTORY

Rev	Date	Revision Details	Status	Author(s)	Approved
P01	19.03.2021	First Issue	Information	IB	JDM
P02	26.03.2021	Second Issue - Report amended to suit revised architect's layout	Information	IB	JDM

1.0 INTRODUCTION

JPG (Leeds) Limited has been instructed by Gregory Property Group to prepare a Drainage Impact Assessment for a proposed commercial development on land immediately to the south of Dearne Valley Parkway.

The Drainage Impact Assessment (DIA) for the proposed development considers the drainage implications of the proposed development.

This report should be read in conjunction with the Flood Risk Assessment (FRA) which has been prepared for the development and covers the flood risk issues.

Report reference 5419-JPG-XX-XX-RP-D-0621-S2.

Documents we have reviewed and referred to in compiling this Drainage Impact Assessment report area detailed below.

These include both technical, non-technical, legislation, codes, and guidance document at both national and local level.

- National Planning Policy Guidance.
- Defra's Non-Statutory Technical Standards for SuDS.
- CIRIA C753 SUDS Manual and various other CIRIA guidance.
- Building Regulations: Approved Document H - Drainage and Waste Disposal (2015 edition).
- BS 8582:2013 Code of Practice for Surface Water Management for Development Sites.
- BS EN 752:2017 Drain and sewer systems outside buildings - sewer system management.
- Yorkshire Water Foul and Surface Water Drainage Policy.
- Barnsley Authorities Local Standards for Sustainable Drainage.
- Design and Construction Guidance (DCG) version 2.0, March 2020.

2.0 THE SITE

The site is located to the north east of Junction 36 of the M1 motorway, on the south side of the Dearne Valley Parkway, approximately 2.05km north west of Hoyland town centre. The approximate centre of the site is located at NGR E435283, N400720.

The site is located to the south of Dearne Valley Parkway and is an irregular shape covering an area of approximately 4.03ha.

The site is bounded by Dearne Valley Parkway to the north, Sheffield Road to the west, Hoyland Dismantling and Riverside Truck Rental to the south and beyond this is a residential estate.

Adjacent to the eastern boundary there is a watercourse/ditch running from south to north including a small pond in the north east corner. Further over to the east is future development land.

The site comprises of restored former opencast working and currently is an open field.

The site generally falls from south west to north east in the order of 6.6m.

A Site Location Plan is included in Appendix A and a topographic survey of the site in Appendix B.

3.0 EXISTING DRAINAGE AND SEWER NETWORK

A Yorkshire Water public sewer plan is provided in Appendix C, this indicates the following public sewers near the site.

- Adjacent to the eastern site boundary there is an existing surface water sewer and outfall structure into the existing pond.

Along the northern site boundary there are existing foul and surface water drains running in an approximate south west to north east direction. These were designed and installed by Waddington's who developed a drive thru coffee shop on a site to the west of the proposed development.

These drainages are currently privately owned and maintained. With only the coffee shop connected they are unlikely to meet with Yorkshire Water adoption requirements.

However, once the proposed development is connected the adoption criteria may be met and as such could be adopted at some point in the future via a Section 102 agreement.

There are several existing ditches located within the proposed development land across the north eastern and central parts of the site.

An open watercourse and pond exist running adjacent to the east of the site outside of the development boundary which flows in a south to north direction.

This passes beneath Dearne Valley Parkway in a culvert and becomes open watercourse again with a further pond located to the east of the Car Supermarket depot.

This watercourse is understood to be a tributary of the downstream watercourse known as Short Wood Dike which is located further north east.

4.0 DEVELOPMENT PROPOSALS

It is proposed to redevelop the site for a commercial end use.

The Harris Partnership drawing 15315 – (P)111 shows the proposed development masterplan and is provided in Appendix D.

Total development area is approximately 4.03 Ha.

Total impermeable area for the proposed development is approximately 2.997 Ha.

5.0 PROPOSED SURFACE AND FOUL WATER DRAINAGE

The proposed site drainage will comprise of a separate surface and foul water drainage system.

The proposed drainage will be designed in accordance with current Building Regulations, DCG and industry best practice as required.

The following details the proposals for the discharge of surface and foul water from the site.

5.1 Sustainable Urban Drainage Systems (SUDS)

Initial investigations indicate the site is underlain by significant depths of made ground/fill due to former mine workings in the area, as such the disposal of surface water by infiltration methods is not deemed feasible.

Given the underlying ground strata the use of infiltration methods for the discharge of surface water is deemed unsuitable due to potential settlement issues associated with the made ground becoming inundated with surface water.

Sustainable Urban Drainage System (SUDS) may be used in conjunction with conventional drainage systems to improve water quality as well as manage surface water discharge.

The following audit has been carried out relating to suitability of SUD's systems.

Drainage Method	Description/Suitability	Proposal/Feasibility
1. Infiltration.	Methods not deemed suitable due to underlying ground strata	Not applicable.
2. Ponds and wetlands.	May be suitable if land is allocated	Applicable.
3. Infiltration Basins.	Methods not deemed suitable due to underlying ground strata	Not applicable.
4. Detention Basins.	May be suitable if land is allocated.	Applicable.
5. Swale.	May be utilised convey water.	Applicable.
6. French/Filter drain.	May be utilised convey water.	Applicable.
7. Pervious/Permeable Pavement.	Methods not deemed suitable due to underlying ground strata	Not applicable.
8. Geocellular Systems/Tank systems.	May be used as surface water attenuation.	Applicable.
9. Oversized pipes.	May be used as surface water attenuation.	Applicable.
10. Box culverts.	May be used as surface water attenuation.	Applicable.
11. Purpose designed tanks.	May be used as surface water attenuation.	Applicable.

5.2 Surface Water Drainage

The disposal of surface water shall be in accordance with the Requirement H3 of Building Regulations 2000. This establishes a preferred hierarchy for surface water disposal. Consideration should firstly be given to discharge via soakaway/infiltration system, then watercourse and finally public sewer in that priority order.

As noted in Section 5.1 the discharge of surface water drainage via infiltration methods will not be feasible, therefore the second consideration should be discharge to watercourse.

The nearest watercourse is a tributary of the downstream watercourse known as Short Wood Dike. Short Wood Dike is located approximately 1.2km to the north east from the proposed development.

The tributary which passes adjacent to the proposed development is located to the east and runs in a south to north direction passing beneath Dearne Valley Parkway.

While there is no direct connection available into this watercourse without having to pass-through third-party land, an existing private surface water drain is located along the northern boundary which ultimately connects into the culverted section of the watercourse where it passes beneath Dearne Valley Parkway.

It is proposed that surface water will discharge from the site into this existing surface water private drain via one or more of the existing stubs left for this development plot. Refer to Section 3 for details of the existing drain.

Discharge Rates
Surface water discharge from the site would be restricted to agreed rates with the LLFA (Barnsley MBC).

In previous consultation with Barnsley MDC land drainage department as part of the Hoyland Master Plan Strategy which this site falls within. BMDC confirmed that a greenfield discharge rate of 4.4 litres/second/hectare would be applicable for this site.

Therefore, it is proposed that this greenfield run off rate of 4.4 litres/second/hectare is applied to the proposed site. Further consultation with the LLFA (Barnsley MBC) will be undertaken to confirm that this is appropriate.

The proposed surface drainage would be split into three broad catchment areas as shown on the proposed impermeable area drawing in Appendix E.

Based on the above figure the greenfield run off for the three catchments would be as follows:

- Unit 1 impermeable area approximately 0.639Ha x 4.4l/s/ha = 2.8 l/s.
- Unit 2 impermeable area approximately 1.164Ha x 4.4l/s/ha = 5.1 l/s.
- Unit 3 and Access Road impermeable area approximately 1.194Ha x 4.4l/s/ha= 5.3 l/s
- Thus, total discharge rate for the whole site would be 13.2 l/s.

Greenfield run-off calculations have been prepared using Windes Micro Drainage software and results are in Appendix H. These calculations were based on the total impermeable area for the whole site and align with the above discharge rates.

Allowance for Climate Change
Proposed allowance for climate change for this development has been taken as 30% in line with previously approved Hoyland Master Plan for the commercial development's elements.

Unit 1 Attenuation Volumes
Given the restricted surface water discharge rate on-plot surface water attenuation will be required, it is proposed this will be provided in a cellular storage tank beneath the service yard.

High level attenuation calculations using the 'Source Control' element of Windes Micro Drainage have been produced. The results are presented in Appendix F.

Storage Design Parameters:

- Restricted discharge rate = 2.8 litres/second.
- Proposed Impermeable area = 0.639 Ha.
- M5-60 = 18.800.
- Ratio R = 0.360.
- 1:2 Year Return Period = 105.1 m^3.
- 1:30 Year Return Period = 218.9 m^3.
- 1:100 Year Return Period (+30% cc) = 415.0 m^3.

The proposed onsite drainage system shall be designed in accordance with the requirements of Building Regulations and Sewers for Adoption and shall demonstrate that:

- No surcharge of pipes occurs in the 1 in 2-year rainfall event.
- No surface flooding occurs in 1 in 30-year rainfall event.
- No flooding to buildings and adjacent properties occurs in 1 in 100-year rainfall event (including an allowance of 30% for the effects of future climate change), as defined in NPPF Technical Guidance.

To minimise the risk of pollution to the final discharge point, clean roof water drainage should discharge directly into the sealed drainage network (i.e., not via gullies) and will then be stored below ground prior to discharge to the off-site drainage network.

Drainage from areas of parking and service yards will be routed through appropriately designed and sized full retention oil interceptors prior to discharge into the attenuation tank and ultimately the off-site drainage network.

Unit 2 Attenuation Volumes
Given the restricted surface water discharge rate on-plot surface water attenuation will be required, it is proposed this will be provided in a cellular storage tank beneath the service yard.

High level attenuation calculations using the 'Source Control' element of Windes Micro Drainage have been produced. The results are presented in Appendix F.

Storage Design Parameters:

- Restricted discharge rate = 5.1 litres/second.
- Proposed Impermeable area = 1.164 Ha.
- M5-60 = 18.800.
- Ratio R = 0.360.
- 1:2 Year Return Period = 195.2 m^3.
- 1:30 Year Return Period = 402.1 m^3.
- 1:100 Year Return Period (+30% cc) = 760.7 m^3.

The proposed onsite drainage system shall be designed in accordance with the requirements of Building Regulations and Sewers for Adoption and shall demonstrate that:

- No surcharge of pipes occurs in the 1 in 2-year rainfall event.
- No surface flooding occurs in 1 in 30-year rainfall event.
- No flooding to buildings and adjacent properties occurs in 1 in 100-year rainfall event (including an allowance of 30% for the effects of future climate change), as defined in NPPF Technical Guidance.

To minimise the risk of pollution to the final discharge point, clean roof water drainage should discharge directly into the sealed drainage network (i.e., not via gullies) and will then be stored below ground prior to discharge to the off-site drainage network.

Drainage from areas of parking and service yards will be routed through appropriately designed and sized full retention oil interceptors prior to discharge into the attenuation tank and ultimately the off-site drainage network.

Unit 3 and Access Road Attenuation Volumes
Given the restricted surface water discharge rate on-plot surface water attenuation will be required, it is proposed this will be provided in a detention basin in the south western corner of the site.

Surface water from the proposed dock levellers on unit 3 would need to be pumped to the proposed detention basin due to levels.

High level attenuation calculations using the 'Source Control' element of Windes Micro Drainage have been produced. The results are presented in Appendix F.

Storage Design Parameters:

- Restricted discharge rate = 5.3 litres/second.
- Proposed Impermeable area = 1.194 Ha.
- M5-60 = 18.800.

- Ratio R = 0.360.
- 1:2 Year Return Period = 191.9 m^3.
- 1:30 Year Return Period = 411.3 m^3.
- 1:100 Year Return Period (+30% cc) = 765.8 m^3.

The proposed onsite drainage system shall be designed in accordance with the requirements of Building Regulations and Sewers for Adoption and shall demonstrate that:

- No surcharge of pipes occurs in the 1 in 2-year rainfall event.
- No surface flooding occurs in 1 in 30-year rainfall event.
- No flooding to buildings and adjacent properties occurs in 1 in 100-year rainfall event (including an allowance of 30% for the effects of future climate change), as defined in NPPF Technical Guidance.

To minimise the risk of pollution to the final discharge point, clean roof water drainage should discharge directly into the sealed drainage network (i.e., not via gullies) and will then be stored in a detention basin prior to discharge to the off-site sewer network.

Drainage from areas of parking and service yards will be routed through appropriately designed and sized full retention oil interceptors prior to discharge into the attenuation tank and ultimately the off-site drainage network.

Flood Exceedance
A flood exceedance plan for storm events above the 1 in 100-year storm event plus climate change allowance has been produced and is in Appendix G.

Flood Risk
For details of flood risk refer to the separate Flood Risk Assessment Report 5419-JPG-XX-XX-RP-D-0621.

Foul Water Drainage
The proposed foul water discharge has been calculated for each unit and is detailed below:

- Unit 1 foul water discharge – 0.40 /s (design flow 6xDWF+10%).
- Unit 2 foul water discharge – 0.67 l/s (design flow 6xDWF+10%).
- Unit 3 foul water discharge – 0.45 l/s (design flow 6xDWF+10%).

Thus, design foul water flows from the proposed development would be 1.507 l/s which is 6xDWF+10%. For design purposes and to allow for any variation to the proposed development layout the design flow is assumed to be 2.000 l/s.

Calculations have been carried out using the method as detailed in SFA and calculations are presented in Appendix I.

Discharge from the site is proposed to drain into the existing 150mm diameter private foul water drain running along the northern boundary.

Detail about this drain can be found in Section 3.0 of this report.

At the time of writing the Drainage Impact Assessment correspondence from Yorkshire Water had not been received. The report will be reviewed and updated as necessary once correspondence has been received from Yorkshire Water the local Sewerage/Water Company.

6.0 DRAINAGE MAINTENANCE AND MANAGEMENT

The proposed foul and surface water drainage systems including the detention basin will remain private in the short term.

The following maintenance and management guidance is provided.

6.1 Introduction

Pipe sizes and gradients are designed to be self-cleansing albeit regular maintenance and inspections are required to ensure the long-term efficiency of the systems.

All works should be undertaken by suitably qualified personnel and waste should be treated and removed by an appropriately registered company.

6.2 Drains/Sewers

The main objective of maintenance guidance is to establish procedures to ensure the sewer system functions appropriately in the long term within an environment of fiscal control.

Maintenance includes:

- Local repair or local replacement of damaged pipes or other structures to maintain the functioning of the sewer.
- Cleaning and removal of sediments, obstructions etc. to restore hydraulic capacity.
- Jetting/vacuum of sewers to be undertaken as often as necessary to remove silts and/or ordinary debris.
- In the event that any extraordinary issues are encountered during an inspection, further information may be required such as a CCTV survey report.
- Maintenance to be undertaken on a six-monthly schedule.

To avoid damaging the pipe, PSI pressures need to be verified before jetting of plastic twin wall sewers. Cleaning of drainage systems may require the temporary sealing of the system and careful collection of the effluent for disposal off site.

6.3 Detention Basin

Regular inspection and maintenance are important for the effective operation of the detention basin. CIRIA's SUDS manual C753 Table 23.1 recommends the following maintenance regime for detention basins:

Maintenance schedule	Required action	Typical Frequency
Regular Maintenance	Remove litter and debris.	Monthly (or as required).
	Cut the grass – public areas.	Monthly (during growing season).
	Cut the meadow grass.	Half yearly (spring, before nesting season, and autumn).
	Inspect marginal and bankside vegetation and remove nuisance plants (first 3 years).	Monthly (at start, then as required).
	Inspect inlets, outlets, bankside, structures, pipework, etc. for evidence of blockage and/or physical damage.	Monthly.
	Inspect water body for signs of poor water quality.	Monthly (May – October).
	Inspect silt accumulation rates in any dry weather channel and in main body of the basin and establish appropriate removal frequencies; undertake contamination testing once some build-up has occurred, to inform management and disposal options.	Half yearly.
	Check any mechanical devices, e.g., flow controls.	Half yearly.
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1m above basin base; include 25% of basin surface).	Annually.
	Remove 25% of bank vegetation from water's edge to a minimum of 1m above water level.	Annually.
	Tidy all dead growth (scrub clearance) before start of growing season (Note: tree maintenance is usually part of overall landscape management contract)	Annually.
	Remove sediment from any dry weather channel.	Every 1-5 years, or as required.
	Remove sediment and planting from one quadrant of the main body of basins.	Every 5 years, or as required.
Occasional maintenance	Remove sediment from the main body of big basins when pool volume is reduced by 20%.	With effective pre- treatment this will only be required rarely, e.g., every 25-50 years.
Remedial actions	Repair erosion or other damage.	As required.
	Replant, where necessary.	As required.
	Repair/rehabilitation of inlets, outlets, and overflows.	As required.

This regime can be tailored to suit the detention basin dependant on final landscaping details and many of the maintenance activities may be undertaken as landscaping maintenance.

The maintenance regime will also depend upon who will be responsible of the basin.

Where this is likely to be the local authority or local Water Company (YW) internal maintenance policy at these bodies would take precedence over any recommendations in this report.

6.4 Flow Control Chamber

The surface water drainage network has a discharge restriction imposed by Barnsley MBC; this is controlled by a flow control device.

Regular inspections of the flow control chamber should be carried out to ensure that debris that may obstruct the inlet to the flow control is not present. The frequency of inspection will depend on the location of the unit, it is recommended initial inspections should be on a three-month basis for the first year of operation followed by a six-monthly basis thereafter.

In the event that the inlet to the control unit becomes blocked, the pivoting bypass door may be operated by pulling the wire rope attached upwards to drain down the chamber and provide access for maintenance.

6.5 Attenuation Tanks

There are several different types of attenuation tanks from large diameter pipe system to precast concrete tanks, box culverts and geo-cellular storage units and all have variations depending upon the manufacturer.

Inspection and maintenance of the attenuation tank shall be in accordance with the manufacturer's recommendations for the installed system.

Attenuation tanks shall be inspected at least twice a year (every six months) or if the tank and drainage system does not appear to be fully draining down as there may be a problem.

Inspections shall be carried out visually from ground level and only as a last resort should a person enter the tank using appropriate safety equipment (where man access to a tank is possible).

Sumps shall be checked and cleaned on a six-monthly basis and silt removed to a licenced facility.

Where a vortex flow control and/or pumps are located in the attenuation tank these shall be maintained in accordance the relevant sections in this document.

6.6 Manholes/Access Chambers

All manhole covers should be lifted, and the manholes visually inspected for silt, debris damage to benching and signs of blockages within the drainage system.

Debris shall be removed from the benching and chamber. This shall not be removed by washing down the outgoing pipe.

Any loose benching shall be removed from the chamber and not allowed to be washed down the pipe system where it could cause a blockage. Areas of damaged benching shall be noted and procedure for repair instigated.

Should any debris or blockages be detected, the manholes should be cleaned along with associated pipe runs which should be high pressure jetted and CCTV surveyed to verify/identify that no further remedial works are required.

The manhole covers and frames shall be checked for damage and ensure correctly bolted together. This should be undertaken on a six-monthly basis.

Missing bolts and broken items shall be replaced in accordance with the manufacturer's details. Damaged cover/frames that cannot be repaired shall be completely replaced.

Before replacing the cover, suitable grease or other sealing material shall be applied to the frame as required to form an airtight seal. Bolts shall be replaced and fully tightened.

6.7 Silt Trap Manholes

These chambers are designed with sumps to accumulate silt and debris at specific locations, in particular upstream of the attenuation structures, basins, and ponds. These should be checked and cleaned out on a six-monthly basis.

6.8 Drainage Chanels and Kerb Drains

All drainage channels and kerb drains systems should be inspected regularly to ensure that the system continues to operate effectively and is free from damage and blockage by debris or solid objects.

The systems should be cleaned at least once a year and incorporated into a planned maintenance schedule. The frequency of inspection and maintenance depends on the local environment and conditions.

Channel units/kerb drains can be cleaned using a high-pressure hose. This can be fed into the system through access units.

The throat section of channel units and aperture of the kerb drains should be kept clear at all times to ensure uninterrupted flow of surface runoff into the drainage channel. Any debris should be removed.

The seating areas for covers and grates should be cleaned before they are replaced. The covers and grates should be locked into position to prevent these being removed, stolen, or dislodged by traffic. Locking bolts should be replaced and sufficiently tightened, taking care that the bolt heads do not stand above the top surface of the cover or grate. If grates/covers can move within their frame, this may cause damage to the frame or seating or surrounding paving.

During prolonged periods of dry weather, traps shall be checked and replenished as necessary to maintain the seal and preventing the escape of odours.

6.9 Road Gullies

Road gullies should be inspected regularly to ensure that the system continues to operate effectively and is free from damage and blockage by debris or solid objects.

The gullies should be cleaned at least once a year and incorporated into a planned maintenance schedule. The frequency of inspection and maintenance depends on the local environment and conditions.

The gully grating should be kept clear at all times to ensure uninterrupted flow of surface runoff into the gully. Any debris should be removed.

The seating areas for the grate should be cleaned before they are replaced. The covers and grates should be locked into position to prevent these being removed, stolen, or dislodged by traffic.

During prolonged periods of dry weather, traps shall be checked and replenished as necessary to maintain the seal and preventing the escape of odours.

6.10 Pumping Stations

Where private pumping stations or pumps in tanks form part of the drainage system the developer and/or end user shall enter into a maintenance agreement with a pump maintenance company.

The pumping station should be serviced as a minimum annually (once every 12 months).

Maintenance shall involve removing the pumps and carrying out any routine maintenance or repairs to the pumps.

Control system including any alarms shall be checked to ensure they are in fully working order.

The wet wells shall be visually inspected from ground level to assess if any repairs are necessary. If repairs to benching or the chamber are required, this should be carried out as soon as possible.

All pumping stations should be connected to a monitoring/telemetry system which activates an alarm upon failure. The location of the alarm will vary to suit the development and how this is maintained overall. Ideally the alarm would be located on site in a facilities manager's office or in a staffed office (this could be a gate house for example that is staffed 24 hours a day). If there is to be no on-site facilities management then a remote type of alarm should be installed and connected to the landlord offices/premises, or to the facilities management company, or appointed pump maintenance company.

For surface water pumping stations, the sump shall be emptied of any silt that may have accumulated in the sump. The sump shall be inspected every 6 months. Any silt removed shall be disposed of offsite at a licenced facility.

6.11 Oil Separators

In order to prevent pollution, the separators need to be regularly maintained. This should be carried out on a six-monthly basis by suitably qualified personnel and in accordance with details in EN858-2:2003 section 6.

Maintenance should be as follows:

- Determine sludge/silt volume in upstream catchpits and remove.
- Assess the depth of accumulated oil and silt in the separator.
- Check the condition of any coalescing device and replace, as necessary.
- Service any electrical equipment, i.e. alarms or management systems.
- Physically inspect the integrity of the separator and any mechanical parts.

The separator should be emptied when oil/silt levels have significantly built up. All retained waste, including silt must be removed and the separator refilled with clean water. In the event of a spillage, the separator should be emptied. Emptying should be undertaken by a registered waste removal company, experienced in separator emptying.

Every five years, the separator should be emptied and given a general inspection to test its integrity and performance, after which the separator must be refilled with clean water.

A detailed log should be kept up when the separator has been inspected, maintained, emptied and serviced, along with records of any specific events relating to the system such as cleaning, spillages. Failure to carry out the maintenance may result in pollution of the environment.

6.12 Health and Safety

Employers shall, so far as is reasonably practical, provide and maintain systems of work that are safe and without risks to health. The systems of work shall cover all aspects of the works including above-ground operations (for example manhole location and traffic control), access to the sewer system and all operations in the confined space of the sewer system.

6.13 Record History

The site manager shall be responsible for recording and updating details of prior maintenance and operations, which can be made available for future reference.

The site manager shall also be responsible for scheduling future maintenance in accordance with the necessary requirements of each component, create a fixed timetable of routine checks and ensure that the maintenance is undertaken appropriately.

7.0 CONCLUSIONS

This report has been prepared to assess the drainage impact for a proposed commercial development on land adjacent to Dearne Valley Parkway.

This report should be rad in conjunction with the accompanying Flood Risk Assessment (ref. 5419-JPG-XX-XX-RD-D-0621).

The site lies within Flood Zone 1 and is considered to be at a low and acceptable flood risk from all sources.

Discharge from the site will be restricted to a greenfield run off rate as detailed in the report.

Surface water shall discharge at the agreed restricted discharge into the existing private surface water drain running along the northern site boundary.

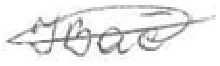
Surface water attenuation will be provided for each unit. Units 1 and 2 will drain to their own below ground attenuation tanks while Unit 3 and the Access Road will drain to the detention basin.

Proposed allowance for climate change for this development is 30% which is in line with Hoyland Master Plan Strategy previously approved by Barnsley MDC.

Foul water drainage will discharge to the existing 150mm diameter foul water drain running along the northern site boundary at unrestricted discharge.

Both existing foul and surface water drains located along the northern site boundary were designed and installed by a third party. It is understood that these drains were designed to Sewers for Adoption and Yorkshire Water requirements and have sufficient capacity to drain the proposed site.

The existing drains could be put forward for retrospective adoption by Yorkshire Water should the necessary criteria be met.



Ieva Baciulyte
For and behalf of JPG (Leeds) Limited

March 2021

Appendix A Site Location Plan

DO NOT SCALE (A1)

NOTES

GENERAL NOTES

1. ALL MATERIALS AND WORKMANSHIP IS TO COMPLY WITH JPG CONSULTANTS STANDARD SPECIFICATION & ALL RELEVANT BRITISH & EUROPEAN STANDARDS.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, M & E CONSULTANTS AND JPG CONSULTANTS DRAWINGS.
3. ANY DISCREPANCIES SHOULD BE REPORTED TO THE ENGINEER IMMEDIATELY SO THAT CLARIFICATION CAN BE SOUGHT PRIOR TO COMMENCEMENT OF WORKS.

SITE INFORMATION

SITE ADDRESS	SHEFFIELD ROAD, BARNSLEY, SOUTH YORKSHIRE
NEAREST POSTCODE	S74 0QA
OS SHEET/TILE	SE351010
OS COORDINATES	E:435283, N: 400720

SITE LOCATION

0m 62.5m 125m

SCALE 1:2500

SITE LOCATION PLAN

SCALE 1:2500

REV	DESCRIPTION	DATE	CHK	BY
P01	FIRST ISSUE	15/03/21	JDM	IB

Project
ROCKINGHAM
PLOT 2
BIRDWELL
BARNSLEY

Drawing Title
LOCATION PLAN

INFORMATION ISSUE

JPG
www.jpg.group
Leeds - 0113 263 1155 | London - 0207 947 4148

5419-JPG-SW-XX-DR-D-1451	S2	P01

Appendix B Topographic Survey

N

Station Information:

Station	Easting (m)	Northing (m)	Level (m)
J3	435882.1325	401329.6624	137.5958
J9	435461.1431	401030.8561	133.7290
J10	435379.0995	400966.2000	133.1627
J11	435297.9100	400902.7972	132.5586
J101	435584.3756	401567.5944	115.8042
J102	435740.2869	401523.5149	125.2937
J103	435810.8799	401448.4666	131.4481
R1	435197.5609	400844.8155	132.8223
GH1	435043.1610	400723.1770	134.9460
GH2	435031.6440	400619.6290	137.2870
GH3	435120.3913	400749.6597	134.5070

OS Note:

Some services may have been omitted due to parked vehicles. The Ordnance Survey tile is to be used as a guide only.

OS Buildings *Surveyed Buildings*

This survey has been orientated to the Ordnance Survey (O.S) National Grid (OSGB36) via Global Navigational Satellite Systems (GNSS) and the O.S. Active Network (OS Net).

A true OSGB36 coordinate has been established near to the site centre via a transformation using the OSTN02 & OSGM02 transformation models.
The survey has been correlated to this point and a further one or more OSGB36 points established to create a true O.S. bearing for angle orientation.

No scale factor has been applied to the survey therefore the coordinates shown are arbitrary & not true O.S. Coordinates which have a scale factor applied.

Please refer to Survey Station Table to enable establishment of the on-site grid and datum.

Legend:

Buildings, Wall, Kerb line, Line marking, Hedge, Drop kerb, Centre line, Station and Name, Station Level, Tree / Bush / Sapling, Area of Undergrowth, Woodland, R: Ridge Level, E: Eaves Level, F: Flat Roof Level, Gate

Fence types: IW, IR, WM, PW, CL, WCF, CIF, SP

Overhead Cable, Concrete edge, Tarmac edge, Grass verge, Canopy/Overhang, Verge

IC Inspection chamber, Piw Pipe invert, Dy Gully, Bg Back gully, Dp Down pipe, Pipe Pipe above ground, MH Manhole, WL Water level, Fl Flood light, Lp Lamp post, Tg Telegraph post, Ep Electricity post, Tl Traffic light, Bus Bus stop, Sv Stop valve, St Stop tap, Er Earth rod, Wm Water meter, Gas Gas valve, Av Air valve, ICU Unidentified inspection, Rb Wash out, Re Rodding eye, BB Bellsha beacon, CTV Cable tv, Mkr Marker post, Gmkr Gas marker post, So Soffit

Bollard, Illuminated bollard, Rubbish bin, Vent pipe, Ground light, Letter box, Ladder, Stile, Internal floor level, Threshold level, Sign post, Trialhole, Borehole, Electric, British Telecom, Control box, Tactile, Brick paved, Concrete paving slabs, Cover, Inspection chamber, Retaining wall, Unable to lift, Tree canopy level, Girth, Multi girth, Tree Stump, Cover level, Invert level

Rev.	Date	Description	Drawn	Q. Ref.
4	11.01.19	Survey extension Plot 2	JT	GH4278
3	20.07.17	Survey extension	JC	C1489
2	Sept 14	All phases surveyed. Site grid updated	BG	C1191
1	12.06.14	Drainage info added	CS	A1042

greenhatch group

- Topographical Surveys
- Site Engineering
- Utility / CCTV Surveys
- Measured Building Surveys
- 3D Laser Scanning
- Revit & BIM Models

Rowan House
Duffield Road
Little Eaton
Derby
DE21 5DR
Tel (01332) 830044 Fax (01332) 830055
admin@greenhatch-group.co.uk
www.greenhatch-group.co.uk

St Albans: Unit B, The Courtyard, Alban Park, St Albans, Hertfordshire, AL4 0LA, t. (01727) 854481

Newcastle: 24 Riverside Studios, Amethyst Road, Newcastle Bus. Park, Newcastle-U-Tyne, NE4 7YL, t. (01912) 738391

Poland: ul. Pagowicka 91, 40-761 Katowice, Poland, t. 0048 32 202 2292, www.greenhatch.pl

CLIENT
Harworth Estates Ltd

PROJECT
Rockingham Dearne Valley Parkway Birdwell

TITLE
Topographical Survey

SCALE	DATE
A1@ 1: 2000	05-06.06.14
DRAWN	QUALITY REF
LP	A1042

Level datum	See OS Note
Grid orientation	See OS Note
Job number	20379
Drawing No.	Rev.
20379_OGL	4

Comments
This plan should only be used for its original purpose. Greenhatch Group accepts no responsibility for this plan if supplied to any party other than the original client.

All dimensions should be checked on site prior to design and construction.

Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only.

Notes:

N

Station Information:

Station	Easting (m)	Northing (m)	Level (m)
JC1	435004.5070	401532.2286	117.0630
JC2	434906.5536	401494.6448	121.4947
JC3	434803.9817	401438.6245	128.7390
JC4	434709.7214	401393.8639	131.6309
JC5	434795.7565	401252.9290	131.2561
JC6	434873.1119	401061.9135	128.0374
JC7	435101.1215	401098.9856	126.6099
JC8	435032.4588	401195.4740	124.2577
JC9	434951.9381	401357.6965	120.4226
BB1	434586.1723	401377.1065	131.2154
BB2	434591.4801	401345.7262	131.5619

OS Note:

Some services may have been omitted due to parked vehicles. The Ordnance Survey tile is to be used as a guide only.

OS Buildings *Surveyed Buildings*

This survey has been orientated to the Ordnance Survey (O.S) National Grid (OSGB36) via Global Navigational Satellite Systems (GNSS) and the O.S. Active Network (OS Net).

A true OSGB36 coordinate has been established near to the site centre via a transformation using the OSTN02 & OSGM02 transformation models.
The survey has been correlated to this point and a further one or more OSGB36 points established to create a true O.S. bearing for angle orientation.

No scale factor has been applied to the survey therefore the coordinates shown are arbitrary & not true O.S. Coordinates which have a scale factor applied.

Please refer to Survey Station Table to enable establishment of the on-site grid and datum.

Legend:

Buildings, Wall, Kerb line, Line marking, Drop kerb, Centre line, 100.000, Ridge Level, Eaves Level, Flat Roof Level, Gate, Fence types: HW, HR, WM, PW, PWI, CL, WCF, CAP, SCP, Overhead Cable, Concrete edge, Tarmac edge, Grass verge, Canopy/Overhang, Verge, Station and Name, Station Level, Tree / Bush / Sapling, Area of Undergrowth, Woodland, Intervewen, Iron Railings, Wire Mesh, Post & Rail, Post & Wire, Chain Link, Wooden Panels, Concrete Panels, Steel Palisade

IC Inspection chamber, PInv Pipe invert, Gy Gully, Bg Back gully, Dp Down pipe, Pipe Pipe above ground, MH Manhole, WL Water level, Fl Flood light, Lp Lamp post, Tp Telegraph post, Ep Electricity post, Tl Traffic light, Bus Bus stop, Sv Stop valve, St Stop tap, Er Earth rod, Wm Water meter, Gas Gas valve, Av Air valve, ICU Unidentified inspection, Rb Wash out, Re Rodding eye, BB Bellsha beacon, CTV Cable tv, Mkr Marker post, Gmkr Gas marker post, Sv Soffit

Bollard, Illuminated bollard, Rubbish bin, Vent pipe, Ground light, Letter box, Ladder, Stile, Internal floor level, Threshold level, Sign post, Trialhole, Borehole, Electric, British Telecom, Control box, Tactile, Brick paved, Concrete paving slabs, Cover, Inspection chamber, Retaining wall, Unable to lift, Tree canopy level, Girth, Multi girth, Tree Stump, Cover level, Invert level

Rev.	Date	Description	Drawn	Q. Ref.
4	11.01.19	Survey extension Plot 2	JT	GH4278
3	20.07.17	Survey extension	JC	C1489
2	Sept 14	All phases surveyed. Site grid updated	BG	C1191
1	12.06.14	Drainage info added	CS	A1042

greenhatch group

- Topographical Surveys
- Site Engineering
- Utility / CCTV Surveys
- Measured Building Surveys
- 3D Laser Scanning
- Revit & BIM Models

Rowan House
Duffield Road
Little Eaton
Derby
DE21 5DR
Tel (01332) 830044 Fax (01332) 830055
admin@greenhatch-group.co.uk
www.greenhatch-group.co.uk

St Albans: Unit B, The Courtyard, Alban Park, St Albans, Hertfordshire, AL4 0LA, t. (01727) 854481
Newcastle: 24 Riverside Studios, Amethyst Road, Newcastle Bus. Park, Newcastle-U-Tyne, NE4 7YL, t. (01912) 738391
Poland: ul. Panewnicka 91, 40-761 Katowice, Poland, t. 0048 32 202 2292, www.greenhatch.pl

CLIENT
Harworth Estates Ltd

PROJECT
Rockingham Dearne Valley Parkway Birdwell

TITLE
Topographical Survey

SCALE	DATE
A1@ 1: 2000	05-06.06.14
DRAWN	QUALITY REF
LP	A1042

Level datum	See OS Note
Grid orientation	See OS Note
Job number	20379
Drawing No.	Rev.
20379_OGL	4

Comments
This plan should only be used for its original purpose. Greenhatch Group accepts no responsibility for this plan if supplied to any party other than the original client.

All dimensions should be checked on site prior to design and construction.

Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only.

Notes:

N

NOTES;

In all cases please call the BT Dial before you dig service to mark their own plant before any site works commence 0800 917 3993

Always consult utility plans

1. Drainage Information provided has been determined without man entry into the chambers. Whilst every effort has been made to correctly identify the duty/pipes/chamber detail, it is recommended that this information should be checked in areas that are critical to the future proposal/development.
2. All sewer runs are presumed to be straight line connections between chambers unless proven otherwise by the use of a sonde or CCTV survey.
3. Some information has been added to the drawing using the statutory records where needed.
4. Some areas of site were unable to be surveyed due to the dense nature of the vegetation.

UTILITY KEY

Symbol	Meaning
LV	ELECTRICITY CABLE
EARTH	EARTH
HV	HIGH VOLTAGE ELECTRICITY CABLE
TLS	TRAFFIC LIGHT SIGNAL CABLE
OH	OVERHEAD ELECTRIC LINES
OH	OVERHEAD TELECOM LINES
BT	BT CABLE
FO	FIBRE OPTICS
CATV	CABLE TELEVISION
T	TELECOM CABLE
GAS	GAS
W	WATER SUPPLY PIPE
F	FOUL WATER DRAINAGE
S	SURFACE WATER DRAINAGE
C	COMBINED DRAINAGE
GPR	GROUND PENETRATING RADAR
	UNIDENTIFIED - SEE NOTES
OIL	OIL PIPE
HEAT	HEATING MAIN
ED	EMPTY DUCT
P	FUEL LINE - PETROL
D	FUEL LINE - DIESEL, KERO OR PARAFFIN
G	TANK GAUGE LINE OR COMMS CABLE
OF	OFF-SET FILL
V	VENT PIPE
	EDGE OF SURVEY
	CHAMBER EXTENTS
	TRENCH SCAR

Symbol	Meaning
	UNABLE TO SURVEY AREA
	MULTIPLE SERVICES
	BUILDING
	CANOPY OUTLINE
MH	MANHOLE
IC	INSPECTION COVER
	CHANGE OF SURFACE
SCAR	SCAR OUTLINE
	STATION LOCATION
	GULLY
	CHANGE OF GROUND LEVEL
	APPROXIMATE LOCATION
EOT	END OF TRACE
	PUMPING MAIN

ABBREVIATIONS

AB	Abandoned	NVE	No visible Exit
A/C	Air Conditioner	NVP	No visible Pipes
ACP	Assumed Connection Point	NB	Notice Board
AG	Above Ground	O/H	Overhead
AR	Assumed Route	OF	Offset Fill
B	Bollard	OSBM	Ordnance Survey Benchmark
BH	Borehole	OSA	Off Survey Area
BL	Base Level	PC	Pilot Cable
BTB	British Telecom Box	PE	Polyethylene
BT	British Telecom Cover	PR	Pipe Riser
CI	Cast Iron	PM	Phone Mast
CR	Cable Riser	RWP	Rain Water Pipe
CTV	Cable TV	RS	Road Sign
CP	Catch Pit	RE	Rodding Eye
Co	Concrete	S/A	Soakaway
CL	Cover Level	SP	Sign Post
CWS	Combined Water Sewer	ST	Steel
DI	Ductile Iron	SV	Sluice Valve
DP	Down Pipe	SVP	Soil Vent Pipe
DCB	Drivers Control Box	SVS	Soil Vapour Sample
ER	Earth Rod	TFR	Taken From Records
EIC	Electricity IC	TK	Tank
EOT	End of Trace	TL	Traffic Light
EP	Electricity Pole	TP	Telegraph Pole
FH	Fire Hydrant	U/I	Unidentified
FP	Fence Post	UTL	Unable to Locate
GV	Gas Valve	UTR	Unable to Raise
GU	Gully	UTS	Unable to Survey
HV	High Voltage	UTT	Unable to Trace
IC	Inspection Cover	VR	Vapour Recovery
INT	Interceptor	VP	Vent Pipe
IL	Invert Level	WL	Water Level
LC	Lighting Column	WM	Water Meter
LP	Lamp Post	WO	Wash Out
LV	Low Voltage	L/P	Low Pressure
MH	Manhole Cover	M/P	Medium Pressure
MW	Monitoring Well	H/P	High Pressure

PAS 128 : 2014

SURVEY CATEGORY	QUALITY LEVEL	CRITERIA USED IN THE DETERMINATION OF QUALITY LEVEL
TYPE B - DETECTION	QL-B4	A UTILITY SEGMENT WHICH IS SUSPECTED TO EXIST BUT HAS NOT BEEN DETECTED AND THEREFORE SHOWN AS AN ASSUMED ROUTE. **(NO DETECTION POSSIBLE)**
	QL-B3	POSITION OF THE UTILITY DETECTED BY ONE OF THE GEOPHYSICAL TECHNIQUES. **(EML OR GPR DETECTION WITH LIMITED CONFIDENCE IN DEPTH)**
	QL-B2	POSITION AND DEPTH OF THE UTILITY DETECTED BY ONE OF THE GEOPHYSICAL TECHNIQUES. **(EML OR GPR DETECTION WITH CONFIDENCE IN DEPTH)**
	QL-B1	POSITION AND DEPTH OF THE UTILITY DETECTED BY MULTIPLE GEOPHYSICAL TECHNIQUES. **(EML + GPR DETECTION)**

DISCLAIMER

Whilst every effort has been taken in the preparation of this drawing, the original land marks/apparatus configuration may have been altered since the survey/drawing was produced. The user shall make further enquiries and investigations to satisfy himself as to the accuracy of this drawing and position of the apparatus. The exact positions of the apparatus should be verified by the use of suitable detection devices and safe digging practices in accordance with HSG47, further advice on the location of apparatus should be recommended by the owner. No representation is made by Greenhatch Group, its agents or servants as to the accuracy, completeness, and sufficiency or otherwise of this drawing and the position of the apparatus.

All apparatus shall be treated as live unless proved otherwise by the owner. It is the users responsibility to ensure that the information on the location of apparatus is provided to all persons (either direct labour or contractors) working in proximity to the apparatus.

Rev	Date	Description	Drawn	Q. Ref
4	11.01.19	Survey extension Plot 2	JT	GH4278
3	20.07.17	Survey extension	JC	C1489
2	Sept 14		BG	C1191
1	12.06.14	Drainage info added	CS	A1042

greenhatch group

Topographical Surveys
Site Engineering
Utility / CCTV Surveys
Measured Building Surveys
3D Laser Scanning
Revit & BIM Models

Rowan House
Duffield Road
Little Eaton
Derby
DE21 5DR
Tel (01332) 830044 Fax (01332) 830055
admin@greenhatch-group.co.uk
www.greenhatch-group.co.uk

St Albans
Unit B, The Courtyard
Alban Park
St Albans
Hertfordshire
AL4 0LA
t. (01727) 854481

Newcastle
24 Riverside Studios
Amethyst Road
Newcastle Bus. Park
Newcastle-U-Tyne
NE4 7YL
t. (01912) 736391

Poland
ul. Panewnicka 91
40-761 Katowice
Poland
t. 0048 32 202 2292
www.greenhatch.pl

CLIENT

Harworth Estates Ltd

PROJECT

Rockingham
Dearne Valley Parkway
Birdwell

TITLE

Utility Survey

SCALE	DATE
A1@ 1: 1000	11.01.19
DRAWN	**QUALITY REF**
SM	A1042

Level datum	See OS Note
Grid orientation	See OS Note
Job number	20379

Drawing No.	Rev.
20379_OGL	4

Comments

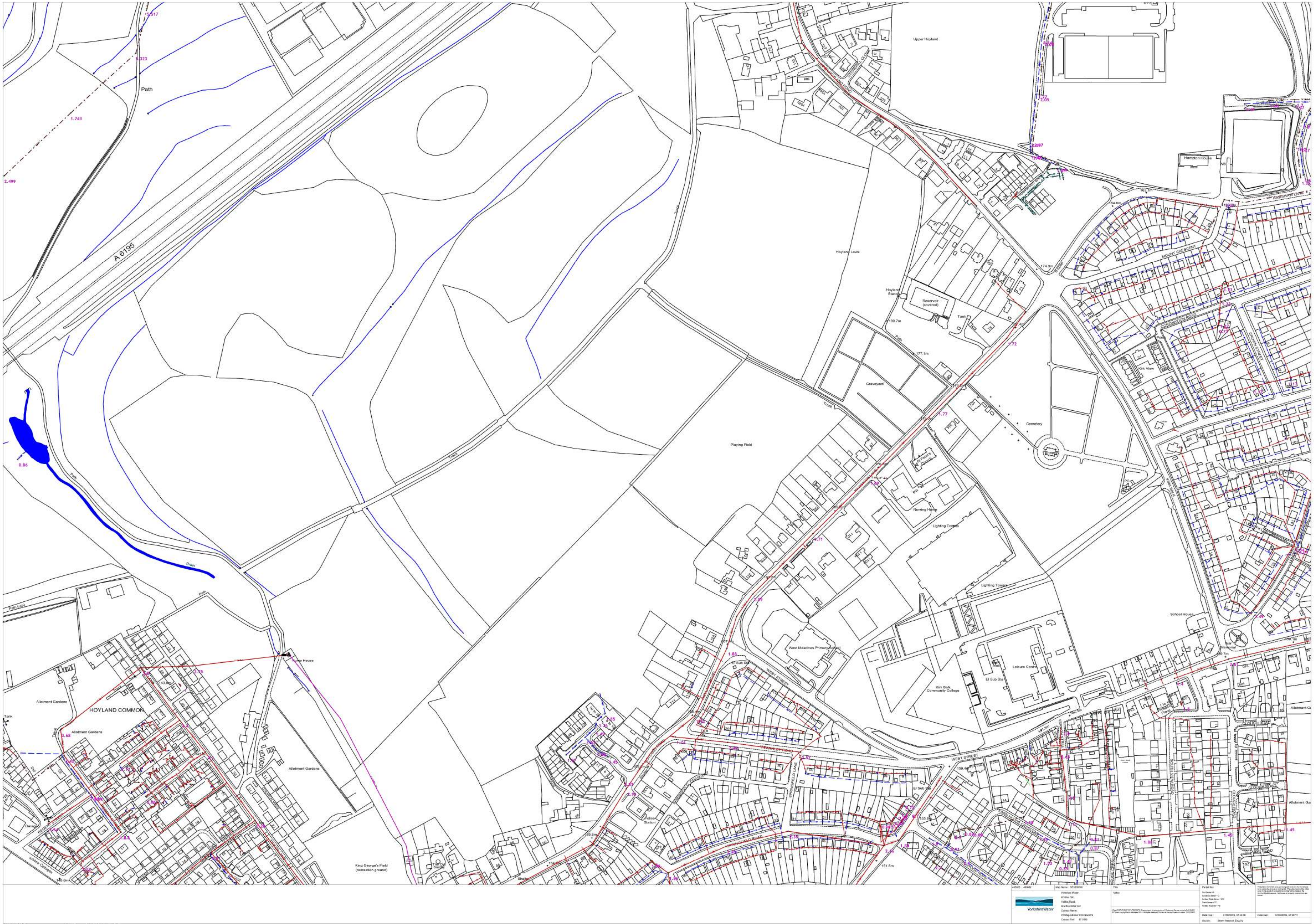
This plan should only be used for its original purpose. Greenhatch Group accepts no responsibility for this plan if supplied to any party other than the original client.

All dimensions should be checked on site prior to design and construction.

Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only.

Notes:

Appendix C Yorkshire Water Sewer Records



A 6195
Path
Track
Drain
Path (um)
Upper Hoyland
Hampton House
Hoyland Lowe
Hoyland Stand
Reservoir (covered)
Tank
Graveyard
Cemetery
Chapel
St Peter's Church
Playing Field
Nursing Home
Lighting Towers
West Meadows Primary School
Leisure Centre
El Sub Sta
Kirk Balk Community College
School House
War Memorial
Kirk View
HOYLAND COMMON
Allotment Gardens
Pump House
King George's Field (recreation ground)
The Old Smithy
Police Station
Garage
Jubilee Cottages
MOUNT CRESCENT
CORONATION ROAD
CROWN STREET
KIRK BALK
WEST STREET
SPRINGFIELD LANE
SPRINGFIELD ROAD
SPRINGFIELD CRESCENT
STONEHILL CLOSE
UPPER HOYLAND ROAD
HAWSHAW LANE
REGENT STREET
SOUTH VIEW ROAD
CLOUGH ROAD
174.3m
180.7m
177.1m
163.1m
164.8m
143.8m
148.8m
151.8m
154.9m
159.4m
161.8m
162.5m
169.7m

Map Name : SE3500SW
Yorkshire Water,
PO Box 360,
Halifax Road,
Bradford BD6 2LZ
YorkshireWater
Title
Notes
Partial Key
Date Req : 07/03/2016, 07:33:38
Date Gen : 07/03/2016, 07:58:11
Source : Sewer Network Enquiry

Appendix D Proposed Development Plan

NORTH

DESIGN SECTION B

DESIGN SECTION A

DEARNE VALLEY PARKWAY

Existing Pub

Existing Rockingham Roundabout

Existing Roundabout

Existing Roundabout

SHEFFIELD ROAD

CROSS KEYS LANE

Existing Dwellings

Drainage Easement

Retaining Wall

FE

FFL - 135.5

FFL - 135.850

FFL - 136.400

FFL - 137.00

Service

Service Yard

25m service spin

40m

Gates

Ent.

Office

Pond

Existing Brook

Existing Breakers Yard

Unit 1

Total GIA - 37,750 sqft 3,507.1 sqm
Footprint - 35,000 sqft 3,251.6 sqm
Offices @ 1st 2,750 sqft 255.5 sqm

Unit 2

Total GIA - 64,500 sqft 5,992.3 sqm
Footprint - 60,000 sqft 5,574.2 sqm
Offices @ 1st 4,500 sqft 418.1 sqm

Unit 3

Total GIA - 43,000 sqft 3,994.8 sqm
Footprint - 40,000 sqft 3,716.1 sqm
Offices @ 1st 3,000 sqft 278.7 sqm

Car Parking
67 no. spaces
(inc 3no. Disabled / 2 no. Charging)

Car Parking
46 no. spaces
(inc 2no. Disabled / 2 no. Charging)

Car Parking
54 no. spaces
(inc 2no. Disabled / 4 no. Charging)

Proposed Sub Station

Footpath

Turning Head

Access Road

Footpath / Cycle Route

Existing Access Retained

Existing Access

Existing Egress

3m Easement strip for future services

Attenuation pond

Public Rights of Way
Taken from Barnsley MBC Definitive Map

Note:
Information is based on OS map and received information and is subject to full topographical and building survey.
Assumed site boundary and site constraints subject to confirmation.
All Legal easements and extent of existing underground services locations are subject to confirmation.

0 5 10 15 20 25m
SCALE 1:500

Rev	Date	Description	Rev By	Ch'k'd By
L	25.03.21	Units office content amended	NBB	PSM
K	19.03.21	Cut and fill & Landscape Updated	NBB	PSM
J	12.03.21	Cut and fill Updated	NBB	PSM
H	04.03.21	Sub Station Added	NBB	PSM
G	25.02.21	Updated for planning submission	NBB	PSM
F	19.02.21	Updated inline with discussions	NBB	PSM
E	20.01.21	Redline adjusted & public footpaths added	NBB	PSM
D	16.11.20	Updated	NBB	PSM
C	02.11.20	Updated	NBB	PSM
B	20.10.20	Added side Road	AL	PSM
A	21.07.20	Updated	NBB	PSM

Project Title	PROPOSED INDUSTRIAL DEVELOPMENT Dearne Valley Parkway Barnsley
Client	Gregory Properties
Status	FOR PLANNING
Scale	1:500
Drawing Size	A1
Date	07.2020
Drawn By	NBB
Checked	PSM
Drawing Title	PROPOSED SITE PLAN
Job-Dwg No	15315 - (P)111
Rev	L

2 St. Johns North, Wakefield, WF1 3QA t. 01924 291800
Carvers Warehouse, 77 Dale Street, Manchester, M1 2HG t. 0161 2388555
The Old Rectory, 79 High Street, Newport Pagnell, MK16 8AB t. 01908 211577
101 London Road, Reading, RG1 5BY t. 0118 9507700
10 Gees Court, St Christophers Place, London, W1U 1JJ t. 0207 4091215

THE HARRIS PARTNERSHIP
ARCHITECTS
www.harrispartnership.com

CAD file reference

Appendix E Proposed Drainage Area Plan

DO NOT SCALE (A1)

NOTES

GENERAL NOTES

1. ALL MATERIALS AND WORKMANSHIP IS TO COMPLY WITH JPG CONSULTANTS STANDARD SPECIFICATION & ALL RELEVANT BRITISH & EUROPEAN STANDARDS.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, M & E CONSULTANTS AND JPG CONSULTANTS DRAWINGS.
3. ANY DISCREPANCIES SHOULD BE REPORTED TO THE ENGINEER IMMEDIATELY SO THAT CLARIFICATION CAN BE SOUGHT PRIOR TO COMMENCEMENT OF WORKS.

TOTAL SITE SURFACE WATER RUN OFF

VOLUME RUN OFF (Cv)	0.750
ROUTING COEFFICIENT (Cr)	1.300
AVERAGE RAINFALL (I) IN mm/hr	50.000
AREA IN HECTARES (A)	2.997
FLOW RATE (Q) = 2.78 x Cv x Cr x I x A	406.168l/s

Rough Flow Rate Calc = Area in Hectares x (140 for 50mm/hr) / (210 for 75mm/hr)

LEGEND

- DENOTES PROPOSED BUILDINGS
- DENOTES PROPOSED EXTERNALS
- DENOTES PROPOSED HIGHWAY
- UNIT 1 CATCHMENT
- UNIT 2 CATCHMENT
- UNIT 3 CATCHMENT
- PROPOSED SITE BOUNDARY

IMPERMEABLE AREAS

UNIT 1 CATCHMENT = 6388m²/0.639Ha
UNIT 2 CATCHMENT = 11643m²/1.164Ha
UNIT 3 CATCHMENT = 11940m²/1.194Ha

TOTAL = 29972m²/2.997Ha

0m 12.5m 25m

SCALE 1:500

5812.188m² 0.581Ha 78.770l/s
456.170m² 0.046Ha 6.182l/s
3356.240m² 0.336Ha 45.485l/s
3451.162m² 0.345Ha 46.772l/s
1347.285m² 0.135Ha 18.259l/s
285.289m² 0.029Ha 3.866l/s
121.749m² 0.012Ha 1.650l/s
124.734m² 0.012Ha 1.690l/s
1443.998m² 0.144Ha 19.570l/s
139.476m² 0.014Ha 1.890l/s
3888.540m² 0.389Ha 52.699l/s
903.032m² 0.090Ha 12.238l/s
192.672m² 0.019Ha 2.611l/s
240.000m² 0.024Ha 3.253l/s
64.464m² 0.006Ha 0.874l/s
246.254m² 0.025Ha 3.337l/s
141.128m² 0.014Ha 1.913l/s
326.169m² 0.033Ha 4.420l/s
353.349m² 0.035Ha 4.789l/s
92.498m² 0.009Ha 1.254l/s
421.188m² 0.042Ha 5.708l/s
225.889m² 0.023Ha 3.061l/s
1685.140m² 0.169Ha 22.838l/s
157.860m² 0.016Ha 2.139l/s
155.534m² 0.016Ha 2.108l/s
166.417m² 0.017Ha 2.255l/s
1428.783m² 0.143Ha 19.364l/s
156.981m² 0.016Ha 2.127l/s
153.325m² 0.015Ha 2.078l/s
2050.833m² 0.205Ha 27.794l/s
148.576m² 0.015Ha 2.014l/s
238.647m² 0.024Ha 3.234l/s

IMPERMEABLE AREA PLAN

SCALE 1:500

REV	DESCRIPTION	DATE	CHK	BY
P04	DRAWING UPDATED IN LINE WITH REVISED ARCHITECTS LAYOUT	26/03/21	JDM	IB
P03	DRAWING UPDATED IN LINE WITH REVISED ARCHITECTS LAYOUT	16/03/21	JDM	IB
P02	AREA PLAN UPDATED WITH BASIN AREA	09/02/21	RMR	JDM
P01	INITIAL ISSUE	11/12/20	JDM	HPW

Project
ROCKINGHAM, PLOT 2, BIRDWELL, BARNSLEY

Drawing Title
IMPERMEABLE AREA PLAN

INFORMATION ISSUE

JPG
www.jpg.group
Leeds - 0113 263 1155 | London - 0207 947 4148

5419-JPG-SW-XX-DR-D-1450 | S2 | P04

Appendix F Preliminary Surface Water Attenuation Calculations

Summary of Results for 2 year Return Period

Half Drain Time : 334 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	132.949	0.099	0.0	2.3	2.3	42.3	O K
30 min Summer	132.978	0.128	0.0	2.5	2.5	54.7	O K
60 min Summer	133.008	0.158	0.0	2.6	2.6	67.3	O K
120 min Summer	133.035	0.185	0.0	2.7	2.7	79.2	O K
180 min Summer	133.049	0.199	0.0	2.7	2.7	84.9	O K
240 min Summer	133.056	0.206	0.0	2.7	2.7	87.9	O K
360 min Summer	133.064	0.214	0.0	2.7	2.7	91.4	O K
480 min Summer	133.068	0.218	0.0	2.7	2.7	93.1	O K
600 min Summer	133.069	0.219	0.0	2.8	2.8	93.8	O K
720 min Summer	133.069	0.219	0.0	2.8	2.8	93.8	O K
960 min Summer	133.066	0.216	0.0	2.7	2.7	92.5	O K
1440 min Summer	133.055	0.205	0.0	2.7	2.7	87.5	O K
2160 min Summer	133.034	0.184	0.0	2.7	2.7	78.5	O K
2880 min Summer	133.014	0.164	0.0	2.6	2.6	70.0	O K
4320 min Summer	132.982	0.132	0.0	2.5	2.5	56.4	O K
5760 min Summer	132.960	0.110	0.0	2.4	2.4	47.0	O K
7200 min Summer	132.947	0.097	0.0	2.2	2.2	41.3	O K
8640 min Summer	132.938	0.088	0.0	2.0	2.0	37.5	O K
10080 min Summer	132.931	0.081	0.0	1.9	1.9	34.5	O K
15 min Winter	132.961	0.111	0.0	2.4	2.4	47.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	36.306	0.0	39.2	18
30 min Summer	23.908	0.0	52.7	33
60 min Summer	15.183	0.0	70.5	62
120 min Summer	9.451	0.0	88.2	122
180 min Summer	7.126	0.0	100.0	180
240 min Summer	5.825	0.0	109.1	226
360 min Summer	4.372	0.0	123.0	286
480 min Summer	3.559	0.0	133.6	350
600 min Summer	3.033	0.0	142.4	418
720 min Summer	2.662	0.0	149.9	490
960 min Summer	2.166	0.0	162.6	626
1440 min Summer	1.620	0.0	182.1	896
2160 min Summer	1.211	0.0	207.4	1296
2880 min Summer	0.985	0.0	224.8	1672
4320 min Summer	0.736	0.0	251.0	2380
5760 min Summer	0.599	0.0	274.8	3104
7200 min Summer	0.511	0.0	292.6	3816
8640 min Summer	0.448	0.0	307.8	4496
10080 min Summer	0.401	0.0	320.3	5240
15 min Winter	36.306	0.0	44.3	18

Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	132.994	0.144	0.0	2.6	2.6	61.5	O K
60 min Winter	133.027	0.177	0.0	2.7	2.7	75.8	O K
120 min Winter	133.060	0.210	0.0	2.7	2.7	89.6	O K
180 min Winter	133.076	0.226	0.0	2.8	2.8	96.6	O K
240 min Winter	133.085	0.235	0.0	2.8	2.8	100.6	O K
360 min Winter	133.093	0.243	0.0	2.8	2.8	103.7	O K
480 min Winter	133.095	0.245	0.0	2.8	2.8	104.9	O K
600 min Winter	133.096	0.246	0.0	2.8	2.8	105.1	O K
720 min Winter	133.094	0.244	0.0	2.8	2.8	104.3	O K
960 min Winter	133.087	0.237	0.0	2.8	2.8	101.1	O K
1440 min Winter	133.065	0.215	0.0	2.7	2.7	92.1	O K
2160 min Winter	133.031	0.181	0.0	2.7	2.7	77.4	O K
2880 min Winter	133.001	0.151	0.0	2.6	2.6	64.7	O K
4320 min Winter	132.960	0.110	0.0	2.4	2.4	46.8	O K
5760 min Winter	132.940	0.090	0.0	2.1	2.1	38.6	O K
7200 min Winter	132.929	0.079	0.0	1.8	1.8	33.7	O K
8640 min Winter	132.921	0.071	0.0	1.6	1.6	30.3	O K
10080 min Winter	132.915	0.065	0.0	1.5	1.5	27.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	23.908	0.0	59.4	33
60 min Winter	15.183	0.0	79.2	62
120 min Winter	9.451	0.0	99.0	120
180 min Winter	7.126	0.0	112.2	176
240 min Winter	5.825	0.0	122.4	232
360 min Winter	4.372	0.0	138.0	332
480 min Winter	3.559	0.0	149.8	376
600 min Winter	3.033	0.0	159.7	454
720 min Winter	2.662	0.0	168.2	530
960 min Winter	2.166	0.0	182.4	684
1440 min Winter	1.620	0.0	204.3	968
2160 min Winter	1.211	0.0	232.5	1368
2880 min Winter	0.985	0.0	252.0	1756
4320 min Winter	0.736	0.0	281.5	2424
5760 min Winter	0.599	0.0	307.9	3120
7200 min Winter	0.511	0.0	327.9	3824
8640 min Winter	0.448	0.0	345.0	4576
10080 min Winter	0.401	0.0	359.2	5240

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.800	Shortest Storm (mins)	15
Ratio R	0.360	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.639

Time (mins) From:	To:	Area (ha)
0	4	0.639

Model Details

Storage is Online Cover Level (m) 135.550

Cellular Storage Structure

Invert Level (m) 132.850 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	450.0	450.0	1.100	0.0	539.1
1.000	450.0	534.9			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0080-2800-1000-2800
Design Head (m)	1.000
Design Flow (l/s)	2.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	80
Invert Level (m)	132.850
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.8
Flush-Flo™	0.299	2.8
Kick-Flo®	0.623	2.3
Mean Flow over Head Range	-	2.5

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.3	1.200	3.0	3.000	4.7	7.000	6.9
0.200	2.7	1.400	3.3	3.500	5.0	7.500	7.2
0.300	2.8	1.600	3.5	4.000	5.3	8.000	7.4
0.400	2.8	1.800	3.7	4.500	5.6	8.500	7.6
0.500	2.6	2.000	3.9	5.000	5.9	9.000	7.8
0.600	2.4	2.200	4.0	5.500	6.2	9.500	8.0
0.800	2.5	2.400	4.2	6.000	6.4		
1.000	2.8	2.600	4.4	6.500	6.7		

Summary of Results for 30 year Return Period

Half Drain Time : 665 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	133.039	0.189	0.0	2.7	2.7	80.6	O K
30 min Summer	133.097	0.247	0.0	2.8	2.8	105.8	O K
60 min Summer	133.158	0.308	0.0	2.8	2.8	131.8	O K
120 min Summer	133.218	0.368	0.0	2.8	2.8	157.2	O K
180 min Summer	133.249	0.399	0.0	2.8	2.8	170.4	O K
240 min Summer	133.267	0.417	0.0	2.8	2.8	178.1	O K
360 min Summer	133.284	0.434	0.0	2.8	2.8	185.7	O K
480 min Summer	133.290	0.440	0.0	2.8	2.8	188.3	O K
600 min Summer	133.291	0.441	0.0	2.8	2.8	188.6	O K
720 min Summer	133.290	0.440	0.0	2.8	2.8	188.2	O K
960 min Summer	133.285	0.435	0.0	2.8	2.8	186.1	O K
1440 min Summer	133.268	0.418	0.0	2.8	2.8	178.6	O K
2160 min Summer	133.234	0.384	0.0	2.8	2.8	164.2	O K
2880 min Summer	133.199	0.349	0.0	2.8	2.8	149.4	O K
4320 min Summer	133.136	0.286	0.0	2.8	2.8	122.2	O K
5760 min Summer	133.084	0.234	0.0	2.8	2.8	99.8	O K
7200 min Summer	133.043	0.193	0.0	2.7	2.7	82.3	O K
8640 min Summer	133.011	0.161	0.0	2.6	2.6	69.0	O K
10080 min Summer	132.988	0.138	0.0	2.5	2.5	58.9	O K
15 min Winter	133.061	0.211	0.0	2.7	2.7	90.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	68.720	0.0	77.2	19
30 min Summer	45.545	0.0	103.1	33
60 min Summer	28.921	0.0	135.9	64
120 min Summer	17.839	0.0	168.0	122
180 min Summer	13.302	0.0	188.1	182
240 min Summer	10.751	0.0	202.7	242
360 min Summer	7.934	0.0	224.4	360
480 min Summer	6.394	0.0	241.1	480
600 min Summer	5.405	0.0	254.6	534
720 min Summer	4.710	0.0	266.1	592
960 min Summer	3.787	0.0	284.9	716
1440 min Summer	2.782	0.0	312.4	982
2160 min Summer	2.041	0.0	350.3	1388
2880 min Summer	1.637	0.0	374.5	1788
4320 min Summer	1.198	0.0	410.1	2552
5760 min Summer	0.960	0.0	440.6	3288
7200 min Summer	0.807	0.0	463.1	3968
8640 min Summer	0.701	0.0	482.0	4672
10080 min Summer	0.622	0.0	498.0	5352
15 min Winter	68.720	0.0	86.8	19

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	133.128	0.278	0.0	2.8	2.8	118.8	O K
60 min Winter	133.197	0.347	0.0	2.8	2.8	148.3	O K
120 min Winter	133.265	0.415	0.0	2.8	2.8	177.4	O K
180 min Winter	133.301	0.451	0.0	2.8	2.8	192.9	O K
240 min Winter	133.323	0.473	0.0	2.8	2.8	202.4	O K
360 min Winter	133.348	0.498	0.0	2.8	2.8	212.7	O K
480 min Winter	133.359	0.509	0.0	2.8	2.8	217.5	O K
600 min Winter	133.362	0.512	0.0	2.8	2.8	218.9	O K
720 min Winter	133.360	0.510	0.0	2.8	2.8	218.1	O K
960 min Winter	133.349	0.499	0.0	2.8	2.8	213.5	O K
1440 min Winter	133.323	0.473	0.0	2.8	2.8	202.4	O K
2160 min Winter	133.271	0.421	0.0	2.8	2.8	180.1	O K
2880 min Winter	133.217	0.367	0.0	2.8	2.8	156.7	O K
4320 min Winter	133.120	0.270	0.0	2.8	2.8	115.3	O K
5760 min Winter	133.047	0.197	0.0	2.7	2.7	84.4	O K
7200 min Winter	132.998	0.148	0.0	2.6	2.6	63.2	O K
8640 min Winter	132.965	0.115	0.0	2.4	2.4	49.3	O K
10080 min Winter	132.948	0.098	0.0	2.3	2.3	42.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	45.545	0.0	115.7	33
60 min Winter	28.921	0.0	152.4	62
120 min Winter	17.839	0.0	188.4	120
180 min Winter	13.302	0.0	210.8	180
240 min Winter	10.751	0.0	227.2	238
360 min Winter	7.934	0.0	251.4	352
480 min Winter	6.394	0.0	270.0	464
600 min Winter	5.405	0.0	285.1	574
720 min Winter	4.710	0.0	297.8	680
960 min Winter	3.787	0.0	318.6	778
1440 min Winter	2.782	0.0	348.5	1080
2160 min Winter	2.041	0.0	392.5	1516
2880 min Winter	1.637	0.0	419.6	1932
4320 min Winter	1.198	0.0	459.8	2720
5760 min Winter	0.960	0.0	493.6	3408
7200 min Winter	0.807	0.0	518.9	4104
8640 min Winter	0.701	0.0	540.1	4752
10080 min Winter	0.622	0.0	558.4	5344

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.800	Shortest Storm (mins)	15
Ratio R	0.360	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.639

Time (mins) From:	To:	Area (ha)
0	4	0.639

Model Details

Storage is Online Cover Level (m) 135.550

Cellular Storage Structure

Invert Level (m) 132.850 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	450.0	450.0	1.100	0.0	539.1
1.000	450.0	534.9			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0080-2800-1000-2800
Design Head (m)	1.000
Design Flow (l/s)	2.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	80
Invert Level (m)	132.850
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.8
Flush-Flo™	0.299	2.8
Kick-Flo®	0.623	2.3
Mean Flow over Head Range	-	2.5

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.3	1.200	3.0	3.000	4.7	7.000	6.9
0.200	2.7	1.400	3.3	3.500	5.0	7.500	7.2
0.300	2.8	1.600	3.5	4.000	5.3	8.000	7.4
0.400	2.8	1.800	3.7	4.500	5.6	8.500	7.6
0.500	2.6	2.000	3.9	5.000	5.9	9.000	7.8
0.600	2.4	2.200	4.0	5.500	6.2	9.500	8.0
0.800	2.5	2.400	4.2	6.000	6.4		
1.000	2.8	2.600	4.4	6.500	6.7		

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 1277 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	133.169	0.319	0.0	2.8	2.8	136.4	O K
30 min Summer	133.274	0.424	0.0	2.8	2.8	181.4	O K
60 min Summer	133.386	0.536	0.0	2.8	2.8	229.3	O K
120 min Summer	133.500	0.650	0.0	2.8	2.8	278.0	O K
180 min Summer	133.562	0.712	0.0	2.8	2.8	304.5	O K
240 min Summer	133.601	0.751	0.0	2.8	2.8	321.0	O K
360 min Summer	133.646	0.796	0.0	2.8	2.8	340.5	O K
480 min Summer	133.673	0.823	0.0	2.8	2.8	351.8	O K
600 min Summer	133.687	0.837	0.0	2.8	2.8	358.0	O K
720 min Summer	133.694	0.844	0.0	2.8	2.8	360.8	O K
960 min Summer	133.693	0.843	0.0	2.8	2.8	360.4	O K
1440 min Summer	133.671	0.821	0.0	2.8	2.8	350.9	O K
2160 min Summer	133.632	0.782	0.0	2.8	2.8	334.3	O K
2880 min Summer	133.592	0.742	0.0	2.8	2.8	317.1	O K
4320 min Summer	133.509	0.659	0.0	2.8	2.8	281.9	O K
5760 min Summer	133.416	0.566	0.0	2.8	2.8	241.9	O K
7200 min Summer	133.333	0.483	0.0	2.8	2.8	206.6	O K
8640 min Summer	133.262	0.412	0.0	2.8	2.8	176.1	O K
10080 min Summer	133.202	0.352	0.0	2.8	2.8	150.5	O K
15 min Winter	133.208	0.358	0.0	2.8	2.8	153.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	115.528	0.0	131.3	19
30 min Summer	77.308	0.0	174.7	34
60 min Summer	49.388	0.0	233.0	64
120 min Summer	30.495	0.0	287.5	124
180 min Summer	22.679	0.0	320.1	184
240 min Summer	18.260	0.0	342.9	242
360 min Summer	13.384	0.0	375.0	362
480 min Summer	10.738	0.0	397.8	482
600 min Summer	9.045	0.0	413.2	602
720 min Summer	7.857	0.0	421.0	720
960 min Summer	6.287	0.0	419.2	960
1440 min Summer	4.583	0.0	401.0	1210
2160 min Summer	3.334	0.0	572.0	1580
2880 min Summer	2.657	0.0	607.0	1992
4320 min Summer	1.927	0.0	655.8	2848
5760 min Summer	1.532	0.0	703.7	3624
7200 min Summer	1.281	0.0	735.5	4328
8640 min Summer	1.107	0.0	762.0	5096
10080 min Summer	0.979	0.0	784.8	5752
15 min Winter	115.528	0.0	147.0	19

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	133.326	0.476	0.0	2.8	2.8	203.6	O K
60 min Winter	133.453	0.603	0.0	2.8	2.8	257.6	O K
120 min Winter	133.582	0.732	0.0	2.8	2.8	312.8	O K
180 min Winter	133.652	0.802	0.0	2.8	2.8	343.0	O K
240 min Winter	133.697	0.847	0.0	2.8	2.8	362.1	O K
360 min Winter	133.751	0.901	0.0	2.8	2.8	385.2	O K
480 min Winter	133.784	0.934	0.0	2.8	2.8	399.3	O K
600 min Winter	133.804	0.954	0.0	2.8	2.8	407.7	O K
720 min Winter	133.815	0.965	0.0	2.8	2.8	412.5	O K
960 min Winter	133.821	0.971	0.0	2.8	2.8	415.0	O K
1440 min Winter	133.799	0.949	0.0	2.8	2.8	405.5	O K
2160 min Winter	133.748	0.898	0.0	2.8	2.8	383.9	O K
2880 min Winter	133.694	0.844	0.0	2.8	2.8	360.7	O K
4320 min Winter	133.576	0.726	0.0	2.8	2.8	310.5	O K
5760 min Winter	133.439	0.589	0.0	2.8	2.8	252.0	O K
7200 min Winter	133.308	0.458	0.0	2.8	2.8	195.9	O K
8640 min Winter	133.205	0.355	0.0	2.8	2.8	151.9	O K
10080 min Winter	133.126	0.276	0.0	2.8	2.8	117.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	77.308	0.0	194.0	33
60 min Winter	49.388	0.0	261.0	64
120 min Winter	30.495	0.0	321.4	122
180 min Winter	22.679	0.0	357.3	180
240 min Winter	18.260	0.0	381.9	240
360 min Winter	13.384	0.0	414.1	356
480 min Winter	10.738	0.0	430.6	472
600 min Winter	9.045	0.0	433.4	588
720 min Winter	7.857	0.0	431.5	700
960 min Winter	6.287	0.0	424.5	924
1440 min Winter	4.583	0.0	408.1	1342
2160 min Winter	3.334	0.0	640.3	1668
2880 min Winter	2.657	0.0	679.1	2136
4320 min Winter	1.927	0.0	726.3	3068
5760 min Winter	1.532	0.0	788.2	3928
7200 min Winter	1.281	0.0	824.0	4616
8640 min Winter	1.107	0.0	853.7	5280
10080 min Winter	0.979	0.0	879.6	5952

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.800	Shortest Storm (mins)	15
Ratio R	0.360	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.639

Time (mins) From:	To:	Area (ha)
0	4	0.639

Model Details

Storage is Online Cover Level (m) 135.550

Cellular Storage Structure

Invert Level (m) 132.850 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	450.0	450.0	1.100	0.0	539.1
1.000	450.0	534.9			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0080-2800-1000-2800
Design Head (m)	1.000
Design Flow (l/s)	2.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	80
Invert Level (m)	132.850
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.8
Flush-Flo™	0.299	2.8
Kick-Flo®	0.623	2.3
Mean Flow over Head Range	-	2.5

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.3	1.200	3.0	3.000	4.7	7.000	6.9
0.200	2.7	1.400	3.3	3.500	5.0	7.500	7.2
0.300	2.8	1.600	3.5	4.000	5.3	8.000	7.4
0.400	2.8	1.800	3.7	4.500	5.6	8.500	7.6
0.500	2.6	2.000	3.9	5.000	5.9	9.000	7.8
0.600	2.4	2.200	4.0	5.500	6.2	9.500	8.0
0.800	2.5	2.400	4.2	6.000	6.4		
1.000	2.8	2.600	4.4	6.500	6.7		

Summary of Results for 2 year Return Period

Half Drain Time : 347 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	131.898	0.098	0.0	3.6	3.6	77.1	O K
30 min Summer	131.927	0.127	0.0	4.5	4.5	99.6	O K
60 min Summer	131.957	0.157	0.0	4.8	4.8	122.8	O K
120 min Summer	131.985	0.185	0.0	4.9	4.9	145.0	O K
180 min Summer	131.999	0.199	0.0	5.0	5.0	155.9	O K
240 min Summer	132.007	0.207	0.0	5.0	5.0	161.9	O K
360 min Summer	132.016	0.216	0.0	5.0	5.0	169.0	O K
480 min Summer	132.020	0.220	0.0	5.0	5.0	172.8	O K
600 min Summer	132.023	0.223	0.0	5.0	5.0	174.7	O K
720 min Summer	132.024	0.224	0.0	5.0	5.0	175.3	O K
960 min Summer	132.022	0.222	0.0	5.0	5.0	174.0	O K
1440 min Summer	132.012	0.212	0.0	5.0	5.0	166.3	O K
2160 min Summer	131.993	0.193	0.0	4.9	4.9	151.0	O K
2880 min Summer	131.973	0.173	0.0	4.9	4.9	135.9	O K
4320 min Summer	131.943	0.143	0.0	4.7	4.7	111.8	O K
5760 min Summer	131.923	0.123	0.0	4.4	4.4	96.3	O K
7200 min Summer	131.911	0.111	0.0	4.0	4.0	86.7	O K
8640 min Summer	131.902	0.102	0.0	3.7	3.7	79.6	O K
10080 min Summer	131.895	0.095	0.0	3.4	3.4	74.1	O K
15 min Winter	131.910	0.110	0.0	4.0	4.0	86.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	36.306	0.0	67.8	22
30 min Summer	23.908	0.0	92.1	36
60 min Summer	15.183	0.0	126.2	64
120 min Summer	9.451	0.0	158.3	122
180 min Summer	7.126	0.0	179.7	180
240 min Summer	5.825	0.0	196.2	228
360 min Summer	4.372	0.0	221.4	288
480 min Summer	3.559	0.0	240.6	352
600 min Summer	3.033	0.0	256.5	420
720 min Summer	2.662	0.0	270.2	490
960 min Summer	2.166	0.0	293.0	628
1440 min Summer	1.620	0.0	328.0	898
2160 min Summer	1.211	0.0	376.3	1296
2880 min Summer	0.985	0.0	407.6	1672
4320 min Summer	0.736	0.0	454.3	2380
5760 min Summer	0.599	0.0	499.6	3064
7200 min Summer	0.511	0.0	531.8	3816
8640 min Summer	0.448	0.0	559.1	4496
10080 min Summer	0.401	0.0	581.0	5240
15 min Winter	36.306	0.0	77.0	22

Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	131.943	0.143	0.0	4.7	4.7	111.8	O K
60 min Winter	131.977	0.177	0.0	4.9	4.9	138.3	O K
120 min Winter	132.009	0.209	0.0	5.0	5.0	164.1	O K
180 min Winter	132.026	0.226	0.0	5.0	5.0	177.2	O K
240 min Winter	132.036	0.236	0.0	5.0	5.0	184.9	O K
360 min Winter	132.044	0.244	0.0	5.1	5.1	191.4	O K
480 min Winter	132.048	0.248	0.0	5.1	5.1	194.3	O K
600 min Winter	132.049	0.249	0.0	5.1	5.1	195.2	O K
720 min Winter	132.048	0.248	0.0	5.1	5.1	194.3	O K
960 min Winter	132.042	0.242	0.0	5.1	5.1	189.6	O K
1440 min Winter	132.023	0.223	0.0	5.0	5.0	174.4	O K
2160 min Winter	131.990	0.190	0.0	4.9	4.9	148.9	O K
2880 min Winter	131.961	0.161	0.0	4.8	4.8	126.1	O K
4320 min Winter	131.923	0.123	0.0	4.4	4.4	96.2	O K
5760 min Winter	131.905	0.105	0.0	3.8	3.8	82.0	O K
7200 min Winter	131.893	0.093	0.0	3.3	3.3	72.8	O K
8640 min Winter	131.885	0.085	0.0	3.0	3.0	66.5	O K
10080 min Winter	131.879	0.079	0.0	2.7	2.7	61.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	23.908	0.0	104.2	36
60 min Winter	15.183	0.0	142.0	64
120 min Winter	9.451	0.0	178.0	120
180 min Winter	7.126	0.0	201.9	178
240 min Winter	5.825	0.0	220.4	232
360 min Winter	4.372	0.0	248.6	334
480 min Winter	3.559	0.0	270.1	378
600 min Winter	3.033	0.0	287.9	456
720 min Winter	2.662	0.0	303.2	532
960 min Winter	2.166	0.0	328.9	684
1440 min Winter	1.620	0.0	368.1	970
2160 min Winter	1.211	0.0	421.9	1368
2880 min Winter	0.985	0.0	457.1	1736
4320 min Winter	0.736	0.0	509.9	2420
5760 min Winter	0.599	0.0	559.9	3120
7200 min Winter	0.511	0.0	596.0	3824
8640 min Winter	0.448	0.0	626.8	4576
10080 min Winter	0.401	0.0	652.0	5248

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.800	Shortest Storm (mins)	15
Ratio R	0.360	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.164

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.664	4	8	0.500

Model Details

Storage is Online Cover Level (m) 134.870

Cellular Storage Structure

Invert Level (m) 131.800 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	825.0	825.0	1.100	0.0	945.6
1.000	825.0	939.9			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0107-5100-1000-5100
Design Head (m)	1.000
Design Flow (l/s)	5.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	107
Invert Level (m)	131.800
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	5.1
Flush-Flo™	0.297	5.1
Kick-Flo®	0.640	4.2
Mean Flow over Head Range	-	4.4

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	3.6	1.200	5.6	3.000	8.5	7.000	12.8
0.200	5.0	1.400	6.0	3.500	9.2	7.500	13.2
0.300	5.1	1.600	6.3	4.000	9.8	8.000	13.6
0.400	5.0	1.800	6.7	4.500	10.3	8.500	14.0
0.500	4.9	2.000	7.0	5.000	10.9	9.000	14.4
0.600	4.5	2.200	7.4	5.500	11.4	9.500	14.8
0.800	4.6	2.400	7.7	6.000	11.9		
1.000	5.1	2.600	8.0	6.500	12.3		

Summary of Results for 30 year Return Period

Half Drain Time : 662 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	131.987	0.187	0.0	4.9	4.9	146.3	O K
30 min Summer	132.045	0.245	0.0	5.1	5.1	192.3	O K
60 min Summer	132.106	0.306	0.0	5.1	5.1	240.1	O K
120 min Summer	132.166	0.366	0.0	5.1	5.1	287.0	O K
180 min Summer	132.197	0.397	0.0	5.1	5.1	311.5	O K
240 min Summer	132.216	0.416	0.0	5.1	5.1	326.0	O K
360 min Summer	132.235	0.435	0.0	5.1	5.1	341.0	O K
480 min Summer	132.242	0.442	0.0	5.1	5.1	346.5	O K
600 min Summer	132.244	0.444	0.0	5.1	5.1	347.8	O K
720 min Summer	132.244	0.444	0.0	5.1	5.1	347.8	O K
960 min Summer	132.240	0.440	0.0	5.1	5.1	345.0	O K
1440 min Summer	132.225	0.425	0.0	5.1	5.1	333.1	O K
2160 min Summer	132.193	0.393	0.0	5.1	5.1	308.2	O K
2880 min Summer	132.159	0.359	0.0	5.1	5.1	281.5	O K
4320 min Summer	132.096	0.296	0.0	5.1	5.1	231.8	O K
5760 min Summer	132.044	0.244	0.0	5.1	5.1	190.8	O K
7200 min Summer	132.003	0.203	0.0	5.0	5.0	158.8	O K
8640 min Summer	131.972	0.172	0.0	4.8	4.8	134.5	O K
10080 min Summer	131.948	0.148	0.0	4.7	4.7	116.4	O K
15 min Winter	132.009	0.209	0.0	5.0	5.0	164.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	68.720	0.0	136.3	22
30 min Summer	45.545	0.0	183.0	37
60 min Summer	28.921	0.0	245.1	66
120 min Summer	17.839	0.0	303.3	124
180 min Summer	13.302	0.0	339.6	184
240 min Summer	10.751	0.0	366.2	242
360 min Summer	7.934	0.0	405.4	362
480 min Summer	6.394	0.0	435.5	480
600 min Summer	5.405	0.0	459.9	536
720 min Summer	4.710	0.0	480.6	594
960 min Summer	3.787	0.0	514.2	718
1440 min Summer	2.782	0.0	562.9	984
2160 min Summer	2.041	0.0	636.3	1388
2880 min Summer	1.637	0.0	680.1	1792
4320 min Summer	1.198	0.0	743.9	2556
5760 min Summer	0.960	0.0	801.6	3288
7200 min Summer	0.807	0.0	842.4	3968
8640 min Summer	0.701	0.0	876.3	4672
10080 min Summer	0.622	0.0	904.6	5344
15 min Winter	68.720	0.0	153.6	22

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	132.076	0.276	0.0	5.1	5.1	215.9	O K
60 min Winter	132.144	0.344	0.0	5.1	5.1	270.0	O K
120 min Winter	132.213	0.413	0.0	5.1	5.1	323.8	O K
180 min Winter	132.250	0.450	0.0	5.1	5.1	352.5	O K
240 min Winter	132.272	0.472	0.0	5.1	5.1	370.1	O K
360 min Winter	132.297	0.497	0.0	5.1	5.1	389.7	O K
480 min Winter	132.309	0.509	0.0	5.1	5.1	399.0	O K
600 min Winter	132.313	0.513	0.0	5.1	5.1	402.1	O K
720 min Winter	132.312	0.512	0.0	5.1	5.1	401.3	O K
960 min Winter	132.303	0.503	0.0	5.1	5.1	394.2	O K
1440 min Winter	132.279	0.479	0.0	5.1	5.1	375.7	O K
2160 min Winter	132.229	0.429	0.0	5.1	5.1	336.5	O K
2880 min Winter	132.176	0.376	0.0	5.1	5.1	294.5	O K
4320 min Winter	132.079	0.279	0.0	5.1	5.1	218.6	O K
5760 min Winter	132.006	0.206	0.0	5.0	5.0	161.6	O K
7200 min Winter	131.956	0.156	0.0	4.8	4.8	122.6	O K
8640 min Winter	131.926	0.126	0.0	4.5	4.5	99.1	O K
10080 min Winter	131.913	0.113	0.0	4.1	4.1	88.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	45.545	0.0	205.8	36
60 min Winter	28.921	0.0	275.0	66
120 min Winter	17.839	0.0	340.2	122
180 min Winter	13.302	0.0	380.8	180
240 min Winter	10.751	0.0	410.5	238
360 min Winter	7.934	0.0	454.3	354
480 min Winter	6.394	0.0	487.8	466
600 min Winter	5.405	0.0	514.9	576
720 min Winter	4.710	0.0	537.8	680
960 min Winter	3.787	0.0	575.0	778
1440 min Winter	2.782	0.0	627.6	1080
2160 min Winter	2.041	0.0	713.0	1516
2880 min Winter	1.637	0.0	762.1	1936
4320 min Winter	1.198	0.0	834.2	2724
5760 min Winter	0.960	0.0	898.1	3408
7200 min Winter	0.807	0.0	944.0	4040
8640 min Winter	0.701	0.0	982.2	4664
10080 min Winter	0.622	0.0	1014.5	5344

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.800	Shortest Storm (mins)	15
Ratio R	0.360	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.164

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.664	4	8	0.500

Model Details

Storage is Online Cover Level (m) 134.870

Cellular Storage Structure

Invert Level (m) 131.800 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	825.0	825.0	1.100	0.0	945.6
1.000	825.0	939.9			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0107-5100-1000-5100
Design Head (m)	1.000
Design Flow (l/s)	5.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	107
Invert Level (m)	131.800
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	5.1
Flush-Flo™	0.297	5.1
Kick-Flo®	0.640	4.2
Mean Flow over Head Range	-	4.4

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	3.6	1.200	5.6	3.000	8.5	7.000	12.8
0.200	5.0	1.400	6.0	3.500	9.2	7.500	13.2
0.300	5.1	1.600	6.3	4.000	9.8	8.000	13.6
0.400	5.0	1.800	6.7	4.500	10.3	8.500	14.0
0.500	4.9	2.000	7.0	5.000	10.9	9.000	14.4
0.600	4.5	2.200	7.4	5.500	11.4	9.500	14.8
0.800	4.6	2.400	7.7	6.000	11.9		
1.000	5.1	2.600	8.0	6.500	12.3		

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 1272 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	132.116	0.316	0.0	5.1	5.1	247.7	O K
30 min Summer	132.221	0.421	0.0	5.1	5.1	330.1	O K
60 min Summer	132.333	0.533	0.0	5.1	5.1	417.4	O K
120 min Summer	132.446	0.646	0.0	5.1	5.1	506.6	O K
180 min Summer	132.509	0.709	0.0	5.1	5.1	555.6	O K
240 min Summer	132.548	0.748	0.0	5.1	5.1	586.0	O K
360 min Summer	132.594	0.794	0.0	5.1	5.1	622.4	O K
480 min Summer	132.621	0.821	0.0	5.1	5.1	643.8	O K
600 min Summer	132.637	0.837	0.0	5.1	5.1	655.8	O K
720 min Summer	132.644	0.844	0.0	5.1	5.1	661.6	O K
960 min Summer	132.645	0.845	0.0	5.1	5.1	661.9	O K
1440 min Summer	132.624	0.824	0.0	5.1	5.1	646.2	O K
2160 min Summer	132.588	0.788	0.0	5.1	5.1	617.5	O K
2880 min Summer	132.549	0.749	0.0	5.1	5.1	586.7	O K
4320 min Summer	132.466	0.666	0.0	5.1	5.1	522.1	O K
5760 min Summer	132.373	0.573	0.0	5.1	5.1	449.1	O K
7200 min Summer	132.292	0.492	0.0	5.1	5.1	385.7	O K
8640 min Summer	132.221	0.421	0.0	5.1	5.1	330.3	O K
10080 min Summer	132.161	0.361	0.0	5.1	5.1	283.3	O K
15 min Winter	132.155	0.355	0.0	5.1	5.1	277.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	115.528	0.0	233.7	22
30 min Summer	77.308	0.0	311.6	37
60 min Summer	49.388	0.0	421.2	66
120 min Summer	30.495	0.0	519.7	126
180 min Summer	22.679	0.0	578.4	186
240 min Summer	18.260	0.0	619.4	246
360 min Summer	13.384	0.0	676.6	364
480 min Summer	10.738	0.0	717.3	484
600 min Summer	9.045	0.0	745.3	602
720 min Summer	7.857	0.0	761.4	722
960 min Summer	6.287	0.0	760.3	960
1440 min Summer	4.583	0.0	725.0	1210
2160 min Summer	3.334	0.0	1038.9	1584
2880 min Summer	2.657	0.0	1101.8	1992
4320 min Summer	1.927	0.0	1188.1	2852
5760 min Summer	1.532	0.0	1280.7	3584
7200 min Summer	1.281	0.0	1338.5	4328
8640 min Summer	1.107	0.0	1386.2	5096
10080 min Summer	0.979	0.0	1426.6	5752
15 min Winter	115.528	0.0	261.9	22

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	132.273	0.473	0.0	5.1	5.1	370.4	O K
60 min Winter	132.399	0.599	0.0	5.1	5.1	469.2	O K
120 min Winter	132.528	0.728	0.0	5.1	5.1	570.2	O K
180 min Winter	132.598	0.798	0.0	5.1	5.1	625.7	O K
240 min Winter	132.643	0.843	0.0	5.1	5.1	660.8	O K
360 min Winter	132.698	0.898	0.0	5.1	5.1	703.7	O K
480 min Winter	132.732	0.932	0.0	5.1	5.1	730.1	O K
600 min Winter	132.752	0.952	0.0	5.1	5.1	746.0	O K
720 min Winter	132.763	0.963	0.0	5.1	5.1	755.1	O K
960 min Winter	132.771	0.971	0.0	5.1	5.1	760.7	O K
1440 min Winter	132.750	0.950	0.0	5.1	5.1	744.9	O K
2160 min Winter	132.702	0.902	0.0	5.1	5.1	706.9	O K
2880 min Winter	132.649	0.849	0.0	5.1	5.1	665.4	O K
4320 min Winter	132.532	0.732	0.0	5.1	5.1	574.0	O K
5760 min Winter	132.394	0.594	0.0	5.1	5.1	465.7	O K
7200 min Winter	132.267	0.467	0.0	5.1	5.1	365.7	O K
8640 min Winter	132.164	0.364	0.0	5.1	5.1	285.0	O K
10080 min Winter	132.083	0.283	0.0	5.1	5.1	222.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	77.308	0.0	346.3	37
60 min Winter	49.388	0.0	471.8	66
120 min Winter	30.495	0.0	580.9	124
180 min Winter	22.679	0.0	645.3	182
240 min Winter	18.260	0.0	689.3	242
360 min Winter	13.384	0.0	747.1	358
480 min Winter	10.738	0.0	779.7	474
600 min Winter	9.045	0.0	788.2	590
720 min Winter	7.857	0.0	784.1	702
960 min Winter	6.287	0.0	770.3	926
1440 min Winter	4.583	0.0	739.1	1344
2160 min Winter	3.334	0.0	1162.7	1672
2880 min Winter	2.657	0.0	1232.2	2140
4320 min Winter	1.927	0.0	1314.6	3072
5760 min Winter	1.532	0.0	1434.6	3920
7200 min Winter	1.281	0.0	1499.6	4616
8640 min Winter	1.107	0.0	1553.3	5280
10080 min Winter	0.979	0.0	1599.4	5952

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.800	Shortest Storm (mins)	15
Ratio R	0.360	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 1.164

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.664	4	8	0.500

Model Details

Storage is Online Cover Level (m) 134.870

Cellular Storage Structure

Invert Level (m) 131.800 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	825.0	825.0	1.100	0.0	945.6
1.000	825.0	939.9			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0107-5100-1000-5100
Design Head (m)	1.000
Design Flow (l/s)	5.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	107
Invert Level (m)	131.800
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	5.1
Flush-Flo™	0.297	5.1
Kick-Flo®	0.640	4.2
Mean Flow over Head Range	-	4.4

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	3.6	1.200	5.6	3.000	8.5	7.000	12.8
0.200	5.0	1.400	6.0	3.500	9.2	7.500	13.2
0.300	5.1	1.600	6.3	4.000	9.8	8.000	13.6
0.400	5.0	1.800	6.7	4.500	10.3	8.500	14.0
0.500	4.9	2.000	7.0	5.000	10.9	9.000	14.4
0.600	4.5	2.200	7.4	5.500	11.4	9.500	14.8
0.800	4.6	2.400	7.7	6.000	11.9		
1.000	5.1	2.600	8.0	6.500	12.3		

Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	134.846	0.346	4.4	77.5	O K
30 min Summer	134.935	0.435	4.4	100.6	O K
60 min Summer	135.019	0.519	4.4	123.7	O K
120 min Summer	135.093	0.593	4.4	145.1	O K
180 min Summer	135.128	0.628	4.4	155.3	O K
240 min Summer	135.145	0.645	4.4	160.5	O K
360 min Summer	135.155	0.655	4.4	163.8	O K
480 min Summer	135.156	0.656	4.4	164.0	O K
600 min Summer	135.152	0.652	4.4	162.9	O K
720 min Summer	135.146	0.646	4.4	161.0	O K
960 min Summer	135.129	0.629	4.4	155.9	O K
1440 min Summer	135.088	0.588	4.4	143.6	O K
2160 min Summer	135.021	0.521	4.4	124.2	O K
2880 min Summer	134.954	0.454	4.4	105.8	O K
4320 min Summer	134.840	0.340	4.4	76.0	O K
5760 min Summer	134.757	0.257	4.3	55.6	O K
7200 min Summer	134.699	0.199	4.1	42.2	O K
8640 min Summer	134.659	0.159	3.8	33.3	O K
10080 min Summer	134.632	0.132	3.6	27.4	O K
15 min Winter	134.884	0.384	4.4	87.2	O K
30 min Winter	134.982	0.482	4.4	113.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	36.306	0.0	80.3	22
30 min Summer	23.908	0.0	106.0	36
60 min Summer	15.183	0.0	135.5	64
120 min Summer	9.451	0.0	168.8	124
180 min Summer	7.126	0.0	190.9	182
240 min Summer	5.825	0.0	208.1	240
360 min Summer	4.372	0.0	234.3	316
480 min Summer	3.559	0.0	254.4	380
600 min Summer	3.033	0.0	271.0	444
720 min Summer	2.662	0.0	285.4	512
960 min Summer	2.166	0.0	309.6	648
1440 min Summer	1.620	0.0	347.2	924
2160 min Summer	1.211	0.0	390.2	1320
2880 min Summer	0.985	0.0	423.1	1700
4320 min Summer	0.736	0.0	474.1	2424
5760 min Summer	0.599	0.0	515.1	3112
7200 min Summer	0.511	0.0	548.8	3816
8640 min Summer	0.448	0.0	577.9	4496
10080 min Summer	0.401	0.0	603.0	5152
15 min Winter	36.306	0.0	90.0	22
30 min Winter	23.908	0.0	118.8	36

Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	135.076	0.576	4.4	139.9	O K
120 min Winter	135.160	0.660	4.4	165.4	O K
180 min Winter	135.202	0.702	4.4	178.4	O K
240 min Winter	135.226	0.726	4.4	185.8	O K
360 min Winter	135.244	0.744	4.4	191.9	O K
480 min Winter	135.243	0.743	4.4	191.5	O K
600 min Winter	135.235	0.735	4.4	188.9	O K
720 min Winter	135.226	0.726	4.4	186.0	O K
960 min Winter	135.200	0.700	4.4	177.6	O K
1440 min Winter	135.132	0.632	4.4	156.8	O K
2160 min Winter	135.022	0.522	4.4	124.5	O K
2880 min Winter	134.917	0.417	4.4	95.8	O K
4320 min Winter	134.758	0.258	4.3	55.9	O K
5760 min Winter	134.667	0.167	3.9	34.9	O K
7200 min Winter	134.620	0.120	3.5	24.7	O K
8640 min Winter	134.604	0.104	3.1	21.3	O K
10080 min Winter	134.593	0.093	2.8	19.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	15.183	0.0	151.8	64
120 min Winter	9.451	0.0	189.1	122
180 min Winter	7.126	0.0	213.9	178
240 min Winter	5.825	0.0	233.1	236
360 min Winter	4.372	0.0	262.5	346
480 min Winter	3.559	0.0	284.9	450
600 min Winter	3.033	0.0	303.6	484
720 min Winter	2.662	0.0	319.6	558
960 min Winter	2.166	0.0	346.8	712
1440 min Winter	1.620	0.0	388.9	1008
2160 min Winter	1.211	0.0	437.1	1412
2880 min Winter	0.985	0.0	473.9	1792
4320 min Winter	0.736	0.0	531.2	2468
5760 min Winter	0.599	0.0	576.9	3120
7200 min Winter	0.511	0.0	614.7	3744
8640 min Winter	0.448	0.0	647.3	4408
10080 min Winter	0.401	0.0	675.5	5144

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.800	Shortest Storm (mins)	15
Ratio R	0.360	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.194

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.694	4	8	0.500

Model Details

Storage is Online Cover Level (m) 136.750

Tank or Pond Structure

Invert Level (m) 134.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	197.0	0.700	315.3	1.400	461.4	2.100	635.1
0.100	212.2	0.800	334.5	1.500	484.5	2.200	662.2
0.200	228.0	0.900	354.2	1.600	508.2	2.300	689.9
0.300	244.3	1.000	374.5	1.700	532.5	2.400	718.1
0.400	261.2	1.100	395.4	1.800	557.3	2.500	746.9
0.500	278.7	1.200	416.8	1.900	582.7		
0.600	296.7	1.300	438.8	2.000	608.6		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0094-5300-2000-5300
Design Head (m)	2.000
Design Flow (l/s)	5.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	94
Invert Level (m)	134.500
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	5.3
Flush-Flo™	0.413	4.4
Kick-Flo®	0.844	3.6
Mean Flow over Head Range	-	4.2

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.0	1.200	4.2	3.000	6.4	7.000	9.6
0.200	4.1	1.400	4.5	3.500	6.9	7.500	9.9
0.300	4.4	1.600	4.8	4.000	7.3	8.000	10.2
0.400	4.4	1.800	5.0	4.500	7.7	8.500	10.5
0.500	4.4	2.000	5.3	5.000	8.1	9.000	10.8
0.600	4.3	2.200	5.5	5.500	8.5	9.500	11.0
0.800	3.8	2.400	5.8	6.000	8.9		
1.000	3.8	2.600	6.0	6.500	9.2		

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	135.108	0.608	4.4	149.6	O K
30 min Summer	135.260	0.760	4.4	196.9	O K
60 min Summer	135.405	0.905	4.4	246.3	O K
120 min Summer	135.535	1.035	4.4	294.2	O K
180 min Summer	135.599	1.099	4.4	319.1	O K
240 min Summer	135.635	1.135	4.4	333.7	O K
360 min Summer	135.672	1.172	4.4	348.6	O K
480 min Summer	135.686	1.186	4.4	354.2	O K
600 min Summer	135.686	1.186	4.4	354.4	O K
720 min Summer	135.679	1.179	4.4	351.6	O K
960 min Summer	135.663	1.163	4.4	344.8	O K
1440 min Summer	135.625	1.125	4.4	329.7	O K
2160 min Summer	135.567	1.067	4.4	306.7	O K
2880 min Summer	135.507	1.007	4.4	283.6	O K
4320 min Summer	135.375	0.875	4.4	235.8	O K
5760 min Summer	135.210	0.710	4.4	180.9	O K
7200 min Summer	135.072	0.572	4.4	138.8	O K
8640 min Summer	134.957	0.457	4.4	106.4	O K
10080 min Summer	134.866	0.366	4.4	82.6	O K
15 min Winter	135.169	0.669	4.4	168.1	O K
30 min Winter	135.333	0.833	4.4	221.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	68.720	0.0	152.6	22
30 min Summer	45.545	0.0	202.3	37
60 min Summer	28.921	0.0	258.4	66
120 min Summer	17.839	0.0	318.8	126
180 min Summer	13.302	0.0	356.6	184
240 min Summer	10.751	0.0	384.3	244
360 min Summer	7.934	0.0	425.3	362
480 min Summer	6.394	0.0	456.9	482
600 min Summer	5.405	0.0	482.7	600
720 min Summer	4.710	0.0	504.6	674
960 min Summer	3.787	0.0	540.7	790
1440 min Summer	2.782	0.0	593.8	1044
2160 min Summer	2.041	0.0	657.7	1468
2880 min Summer	1.637	0.0	703.3	1876
4320 min Summer	1.198	0.0	771.9	2720
5760 min Summer	0.960	0.0	825.0	3408
7200 min Summer	0.807	0.0	867.5	4112
8640 min Summer	0.701	0.0	903.6	4760
10080 min Summer	0.622	0.0	935.6	5448
15 min Winter	68.720	0.0	170.9	22
30 min Winter	45.545	0.0	226.4	37

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	135.490	0.990	4.4	277.2	O K
120 min Winter	135.632	1.132	4.4	332.3	O K
180 min Winter	135.704	1.204	4.4	361.6	O K
240 min Winter	135.746	1.246	4.4	379.5	O K
360 min Winter	135.791	1.291	4.4	399.1	O K
480 min Winter	135.812	1.312	4.4	408.3	O K
600 min Winter	135.819	1.319	4.4	411.3	O K
720 min Winter	135.817	1.317	4.4	410.5	O K
960 min Winter	135.798	1.298	4.4	402.3	O K
1440 min Winter	135.751	1.251	4.4	381.9	O K
2160 min Winter	135.672	1.172	4.4	348.4	O K
2880 min Winter	135.583	1.083	4.4	313.0	O K
4320 min Winter	135.382	0.882	4.4	238.3	O K
5760 min Winter	135.119	0.619	4.4	152.9	O K
7200 min Winter	134.923	0.423	4.4	97.5	O K
8640 min Winter	134.789	0.289	4.3	63.4	O K
10080 min Winter	134.706	0.206	4.1	43.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	28.921	0.0	289.4	66
120 min Winter	17.839	0.0	357.1	124
180 min Winter	13.302	0.0	399.4	182
240 min Winter	10.751	0.0	430.3	240
360 min Winter	7.934	0.0	476.2	356
480 min Winter	6.394	0.0	511.6	468
600 min Winter	5.405	0.0	540.4	580
720 min Winter	4.710	0.0	564.8	690
960 min Winter	3.787	0.0	604.7	894
1440 min Winter	2.782	0.0	655.6	1112
2160 min Winter	2.041	0.0	736.6	1580
2880 min Winter	1.637	0.0	787.6	2044
4320 min Winter	1.198	0.0	864.6	2940
5760 min Winter	0.960	0.0	924.0	3576
7200 min Winter	0.807	0.0	971.7	4184
8640 min Winter	0.701	0.0	1012.1	4840
10080 min Winter	0.622	0.0	1048.0	5448

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.800	Shortest Storm (mins)	15
Ratio R	0.360	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.194

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.694	4	8	0.500

Model Details

Storage is Online Cover Level (m) 136.750

Tank or Pond Structure

Invert Level (m) 134.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	197.0	0.700	315.3	1.400	461.4	2.100	635.1
0.100	212.2	0.800	334.5	1.500	484.5	2.200	662.2
0.200	228.0	0.900	354.2	1.600	508.2	2.300	689.9
0.300	244.3	1.000	374.5	1.700	532.5	2.400	718.1
0.400	261.2	1.100	395.4	1.800	557.3	2.500	746.9
0.500	278.7	1.200	416.8	1.900	582.7		
0.600	296.7	1.300	438.8	2.000	608.6		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0094-5300-2000-5300
Design Head (m)	2.000
Design Flow (l/s)	5.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	94
Invert Level (m)	134.500
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	5.3
Flush-Flo™	0.413	4.4
Kick-Flo®	0.844	3.6
Mean Flow over Head Range	-	4.2

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.0	1.200	4.2	3.000	6.4	7.000	9.6
0.200	4.1	1.400	4.5	3.500	6.9	7.500	9.9
0.300	4.4	1.600	4.8	4.000	7.3	8.000	10.2
0.400	4.4	1.800	5.0	4.500	7.7	8.500	10.5
0.500	4.4	2.000	5.3	5.000	8.1	9.000	10.8
0.600	4.3	2.200	5.5	5.500	8.5	9.500	11.0
0.800	3.8	2.400	5.8	6.000	8.9		
1.000	3.8	2.600	6.0	6.500	9.2		

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	135.427	0.927	4.4	254.4	O K
30 min Summer	135.648	1.148	4.4	338.7	O K
60 min Summer	135.855	1.355	4.4	427.6	O K
120 min Summer	136.044	1.544	4.7	516.6	O K
180 min Summer	136.138	1.638	4.8	564.5	O K
240 min Summer	136.194	1.694	4.9	593.9	O K
360 min Summer	136.258	1.758	5.0	628.1	O K
480 min Summer	136.293	1.793	5.0	647.3	O K
600 min Summer	136.310	1.810	5.1	657.0	O K
720 min Summer	136.317	1.817	5.1	660.6	O K
960 min Summer	136.309	1.809	5.1	656.2	O K
1440 min Summer	136.271	1.771	5.0	635.2	O K
2160 min Summer	136.211	1.711	4.9	602.5	O K
2880 min Summer	136.154	1.654	4.8	572.5	O K
4320 min Summer	136.044	1.544	4.7	516.7	O K
5760 min Summer	135.936	1.436	4.5	464.8	O K
7200 min Summer	135.830	1.330	4.4	416.2	O K
8640 min Summer	135.726	1.226	4.4	371.2	O K
10080 min Summer	135.626	1.126	4.4	330.0	O K
15 min Winter	135.511	1.011	4.4	285.4	O K
30 min Winter	135.747	1.247	4.4	380.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	115.528	0.0	256.1	23
30 min Summer	77.308	0.0	336.1	37
60 min Summer	49.388	0.0	441.3	66
120 min Summer	30.495	0.0	544.6	126
180 min Summer	22.679	0.0	607.1	186
240 min Summer	18.260	0.0	651.0	244
360 min Summer	13.384	0.0	711.9	364
480 min Summer	10.738	0.0	740.2	482
600 min Summer	9.045	0.0	743.3	602
720 min Summer	7.857	0.0	742.8	722
960 min Summer	6.287	0.0	740.3	956
1440 min Summer	4.583	0.0	738.8	1182
2160 min Summer	3.334	0.0	1074.1	1560
2880 min Summer	2.657	0.0	1141.1	1964
4320 min Summer	1.927	0.0	1236.2	2808
5760 min Summer	1.532	0.0	1316.6	3632
7200 min Summer	1.281	0.0	1376.6	4400
8640 min Summer	1.107	0.0	1426.8	5192
10080 min Summer	0.979	0.0	1471.7	6048
15 min Winter	115.528	0.0	286.1	23
30 min Winter	77.308	0.0	350.1	37

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	135.970	1.470	4.6	480.6	O K
120 min Winter	136.172	1.672	4.9	582.3	O K
180 min Winter	136.276	1.776	5.0	637.9	O K
240 min Winter	136.338	1.838	5.1	672.8	O K
360 min Winter	136.411	1.911	5.2	714.9	O K
480 min Winter	136.454	1.954	5.2	740.2	Flood Risk
600 min Winter	136.479	1.979	5.3	755.0	Flood Risk
720 min Winter	136.492	1.992	5.3	762.9	Flood Risk
960 min Winter	136.496	1.996	5.3	765.8	Flood Risk
1440 min Winter	136.461	1.961	5.2	744.6	Flood Risk
2160 min Winter	136.390	1.890	5.2	702.8	O K
2880 min Winter	136.317	1.817	5.1	660.7	O K
4320 min Winter	136.166	1.666	4.9	578.7	O K
5760 min Winter	136.012	1.512	4.6	500.9	O K
7200 min Winter	135.858	1.358	4.4	428.9	O K
8640 min Winter	135.705	1.205	4.4	362.2	O K
10080 min Winter	135.548	1.048	4.4	299.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	49.388	0.0	494.1	66
120 min Winter	30.495	0.0	609.5	124
180 min Winter	22.679	0.0	678.5	182
240 min Winter	18.260	0.0	724.2	240
360 min Winter	13.384	0.0	753.0	358
480 min Winter	10.738	0.0	756.8	474
600 min Winter	9.045	0.0	759.1	588
720 min Winter	7.857	0.0	761.7	702
960 min Winter	6.287	0.0	770.1	924
1440 min Winter	4.583	0.0	774.5	1340
2160 min Winter	3.334	0.0	1202.8	1664
2880 min Winter	2.657	0.0	1277.5	2132
4320 min Winter	1.927	0.0	1333.2	3028
5760 min Winter	1.532	0.0	1474.6	3920
7200 min Winter	1.281	0.0	1541.7	4760
8640 min Winter	1.107	0.0	1598.1	5616
10080 min Winter	0.979	0.0	1648.5	6456

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.800	Shortest Storm (mins)	15
Ratio R	0.360	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 1.194

Time From: (mins)	To: (mins)	Area (ha)	Time From: (mins)	To: (mins)	Area (ha)
0	4	0.694	4	8	0.500

Model Details

Storage is Online Cover Level (m) 136.750

Tank or Pond Structure

Invert Level (m) 134.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	197.0	0.700	315.3	1.400	461.4	2.100	635.1
0.100	212.2	0.800	334.5	1.500	484.5	2.200	662.2
0.200	228.0	0.900	354.2	1.600	508.2	2.300	689.9
0.300	244.3	1.000	374.5	1.700	532.5	2.400	718.1
0.400	261.2	1.100	395.4	1.800	557.3	2.500	746.9
0.500	278.7	1.200	416.8	1.900	582.7		
0.600	296.7	1.300	438.8	2.000	608.6		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0094-5300-2000-5300
Design Head (m)	2.000
Design Flow (l/s)	5.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	94
Invert Level (m)	134.500
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	5.3
Flush-Flo™	0.413	4.4
Kick-Flo®	0.844	3.6
Mean Flow over Head Range	-	4.2

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.0	1.200	4.2	3.000	6.4	7.000	9.6
0.200	4.1	1.400	4.5	3.500	6.9	7.500	9.9
0.300	4.4	1.600	4.8	4.000	7.3	8.000	10.2
0.400	4.4	1.800	5.0	4.500	7.7	8.500	10.5
0.500	4.4	2.000	5.3	5.000	8.1	9.000	10.8
0.600	4.3	2.200	5.5	5.500	8.5	9.500	11.0
0.800	3.8	2.400	5.8	6.000	8.9		
1.000	3.8	2.600	6.0	6.500	9.2		

Appendix G Flood Exceedance Plan

0m 12.5m 25m

SCALE 1:500

DO NOT SCALE (A1)

NOTES

GENERAL NOTES

1. ALL MATERIALS AND WORKMANSHIP IS TO COMPLY WITH JPG CONSULTANTS STANDARD SPECIFICATION & ALL RELEVANT BRITISH & EUROPEAN STANDARDS.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, M & E CONSULTANTS AND JPG CONSULTANTS DRAWINGS.
3. ANY DISCREPANCIES SHOULD BE REPORTED TO THE ENGINEER IMMEDIATELY SO THAT CLARIFICATION CAN BE SOUGHT PRIOR TO COMMENCEMENT OF WORKS.

KEY:

FLOOD ROUTING IN EXCEEDANCE EVENT IN EXCESS OF 1:100 YEAR + 30% cc STORM.

REV	DESCRIPTION	DATE	CHK	BY
P02	REVISED ARCHITECTS SITE PLAN ADDED	26/03/21	JDM	IB
P01	PREMILINARY ISSUE	19/03/21	RMR	BT

Project
ROCKINGHAM
PLOT 2
BARNSLEY

Drawing Title
EXCEEDANCE ROUTE PLAN

INFORMATION ISSUE

JPG
www.jpg.group
Leeds - 0113 263 1155 | London - 0207 947 4148

5419-JPG-XX-00-DR-D-1405 | S2 | P02

Appendix H Greenfield Runoff Calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years)	1	Soil	0.450
Area (ha)	2.997	Urban	0.000
SAAR (mm)	700	Region Number	Region 3

Results l/s

QBAR Rural	13.2
QBAR Urban	13.2
Q1 year	11.3
Q1 year	11.3
Q30 years	23.1
Q100 years	27.4

Appendix I Preliminary Foul Water Drainage Calculations

DO NOT SCALE (A1)

NOTES

GENERAL NOTES

1. ALL MATERIALS AND WORKMANSHIP IS TO COMPLY WITH JPG CONSULTANTS STANDARD SPECIFICATION & ALL RELEVANT BRITISH & EUROPEAN STANDARDS.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, M & E CONSULTANTS AND JPG CONSULTANTS DRAWINGS.
3. ANY DISCREPANCIES SHOULD BE REPORTED TO THE ENGINEER IMMEDIATELY SO THAT CLARIFICATION CAN BE SOUGHT PRIOR TO COMMENCEMENT OF WORKS.

FOUL WATER DESIGN FLOW CALCULATION

USE	L/DAY	AREA m²	TOTAL L/DAY
WAREHOUSING	150 PER 100m²	3451.2	5176.800
DESIGN FLOW= (6xDWF+10%)		34166.880l/Day	
DESIGN FW FLOW=		0.395l/s	

FOUL WATER DESIGN FLOW CALCULATION

USE	L/DAY	AREA m²	TOTAL L/DAY
WAREHOUSING	150 PER 100m²	5812.2	8718.300
DESIGN FLOW= (6xDWF+10%)		57540.780l/Day	
DESIGN FW FLOW=		0.666l/s	

FOUL WATER DESIGN FLOW CALCULATION

USE	L/DAY	AREA m²	TOTAL L/DAY
WAREHOUSING	150 PER 100m²	3888.5	5832.750
DESIGN FLOW= (6xDWF+10%)		38496.150l/Day	
DESIGN FW FLOW=		0.446l/s	

TOTAL DESIGN FLOW = 1.507l/s. FOR DESIGN PURPOSES ASSUME 2.000l/s

0m 12.5m 25m

SCALE 1:500

UNIT 1
3451.2m²

UNIT 2
5812.2m²

UNIT 3
3888.5m²

DEARNE VALLEY PARKWAY

PRELIMINARY FOUL WATER DRAINAGE CALCULATIONS

SCALE 1:500

REV	DESCRIPTION	DATE	CHK	BY
P02	REVISED ARCHITECTS SITE PLAN ADDED	26/03/21	JDM	IB
P01	FIRST ISSUE	19/03/21	JDM	IB

Project
ROCKINGHAM
PLOT 2
BIRDWELL
BARNSLEY

Drawing Title
PRELIMINARY FOUL WATER DRAINAGE CALCULATIONS

INFORMATION ISSUE

JPG
www.jpg.group
Leeds - 0113 263 1155 | London - 0207 947 4148

5419-JPG-SW-XX-DR-D-1452	S2	P02

5 John Charles Way
LEEDS
LS12 6QA

Tel: 0113 263 1155
admin@jpg.group
www.jpg.group