



Princedom Street, Manchester

15th January 2024

PV2309-APP-92-XX-RP-C-1001-P02 Drainage Statement

Drainage Statement

Princedom Street, Manchester

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Document history and status

Revision	Date	Description	Originator	Checked	Approved
P01	30/06/2023	Initial Issue	LF	BD	BD
P02	15/01/2024	Drainage Layout Amendments following LLFA comments	LF	BD	BD

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1 Introduction

1.1 Terms of Reference

- 1.1.1 Align Property Partners have been commissioned by Mosscafe St Vincents to undertake a drainage design for the proposed development off Princedom Street, Manchester.
- 1.1.2 This report intends to outline the proposed drainage design philosophy for the development and maintenance requirements for SuDS components.

1.2 Site Location and Topographical Survey

- 1.2.1 The site development is located off Princedom Street, Manchester comprising two parcels of public open space.
- 1.2.2 The site is generally flat throughout both parcels with ground levels varying 77.25–77.80m AoD with a typical 1:40 fall to the western boundary for the northern parcel and 76.73–77.75m AoD with a typical 1:60 fall to the western boundary for the southern parcel.

Table 1.2 Site location

OS X	OS Y	National Grid Reference	Nearest Postcode
386431	401665	SE864016	M9 4GP

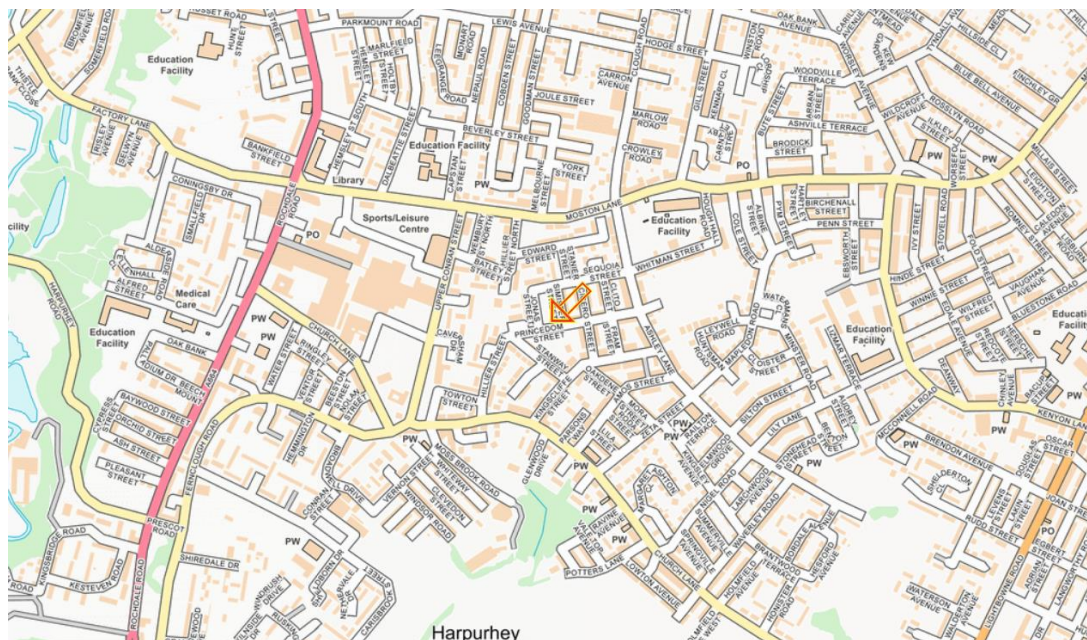


Figure 1.2 Site location plan

2 Drainage Strategy

2.1 Flood Risk Overview

- 2.1.1 The *National Planning Policy Framework* (NPPF) (July 2021) sets strict tests to protect people and property from flooding which all local planning authorities are expected to follow. Where these tests are not met, national policy is clear that new development should not be allowed.
- 2.1.2 In areas at risk of flooding or for sites of 1 hectare or more, developers must undertake a site-specific flood risk assessment to accompany applications for planning permission (or prior approval for certain types of permitted development).
- 2.1.3 In accordance with the Environment Agency's flood risk mapping data, the site is located within a Flood Zone 1 area and < 1.0ha and it is therefore not subject to a flood risk assessment, unless the LLFA have specific Flood Risk concerns. A review of the EA flood risk mapping data does not indicate any immediate flood risk issues with the site.

2.2 Existing Drainage

- 2.2.1 The site currently comprises two open greenfield areas. However, these areas previously contained housing developments that have since been demolished (est. post 2002). The two streets that crossed through the current parcels were Elsie Street and Winford Street through the northern and southern parcels, respectively.



Figure 2.2 1892 – 1914 historic mapping

- 2.2.2 From reviewing the CCTV surveys carried out by *Site Vision Survey reference: 0623-PD-0474 dated 12/06/2023*, the existing manhole to the United Utilities (UU) combined sewer within Princedom Street was surveyed.
- 2.2.3 It was noted that the sewer extending into the southern parcel coincided with the location of the previous Winford Street road (Figure 2.2). This sewer had several branches from what is suspected to be the previous houses and the CCTV footage showed no flow suggesting the sewer is not in use. It would be prudent to agree with United Utilities whether this sewer can be capped off under a Section 116 agreement or if a diversion around the site is required.
- 2.2.4 With reference to UU's asset plans, a combined sewer appears to cross through the northern parcel which coincides with the previous Elsie Street road (Figure 2.2).

- 2.2.5 Further correspondence with the surveyors confirmed that no chamber within Jonas Street nor Simister Street was found and therefore any existing apparatus within the northern parcel is unknown and cannot be verified if present.

2.3 Proposed Surface Water Drainage

- 2.3.1 The proposed surface water drainage strategy has been designed in accordance *Sewers for Adoption* and / or *Building Regulations Part H* and in compliance with the *NPPF*, local requirements and current best practices¹, to collect, convey and attenuate runoff from all impermeable areas.

- 2.3.2 Generally, the aim should be discharge surface runoff as high up the following hierarchy of drainage options as reasonably practicable:

- (a) Into the ground (infiltration)
- (b) To a surface water body
- (c) To a surface water sewer, highway drain or another drainage system;
- (d) To a combined Sewer

- 2.3.3 With reference to *Phase II Geo-Environmental Assessment Report by Brownfield Solutions* ref: PH/C4656/10673 dated February 2002 states:

“Drainage to soakaways is considered unsuitable for this site as drainage conditions are poor. Indicative soil infiltration rates range from no infiltration to $7.9 \times 10^{-7} \text{m/s}$.”

And further concludes:

“The use of sustainable drainage systems, such as traditional soakaways within the natural ground, is not likely to be feasible due to the presence of low permeability cohesive strata underlying the site, as indicated by falling head testing undertaken as part of the intrusive investigation works.”

- 2.3.4 As there are no nearby feasible watercourses to discharge into, it is therefore proposed to progress through the SuDS hierarchy to connect into a surface water sewer.
- 2.3.5 With reference to United Utilities asset maps, a 375mm diameter surface water sewer is located within the southern lane of the Princedom Street carriageway which can provide a viable discharge point for both development parcels. The surface water sewer becomes a culverted watercourse approx. 120m downstream, and hence is in line with the discharge hierarchy.
- 2.3.6 It is proposed to discharge the surface water from both parcels into UU's surface water sewer within Princedom Street.
- 2.3.7 A pre development enquiry with UU has been submitted and response outstanding.
- 2.3.8 The proposed drainage strategy has been designed to limit the surface water discharge rate as far as practicable to the Greenfield runoff rates for the site areas (0.235ha and 0.245ha). This will be achieved via. hydraulic flow control devices before connection into the surface water sewer within Princedom Street:
- 2.3.9 Greenfield runoff rates for the site as follows:
- North Parcel: 1.2l/s (100.0% AEP), 1.4l/s (Q_{BAR}), 2.4l/s (3.3% AEP) and 2.9l/s (1.0% AEP).
- South Parcel: 1.3l/s (100.0% AEP), 1.5l/s (Q_{BAR}), 2.5l/s (3.3% AEP) and 3.0l/s (1.0% AEP).

¹ e.g. *Non-Statutory Technical Standards for Sustainable Drainage Systems* (March 2015) and *The SuDS Manual* (2015).

- 2.3.10 Runoff rates have been established for the development site using the IH124 methodology with ICP SuDS correction for small catchments (Appendix B).
- 2.3.11 For both parcels, the Greenfield runoff rates result in an orifice size of <75mm diameter within the proposed flow control devices. Typically, Lead Local Flood Authorities will require a min. 75mm diameter within the flow control structure to minimise blocking which would increase flood risk to the site.
- 2.3.12 Therefore, adjusting the runoff rates to achieve the min. 75mm dia. orifice size within the flow control structure, the proposed discharge rates are as follows:
- North parcel = 3.0l/s (Q_{BAR})
- South parcel = 3.0l/s (Q_{BAR})
- Runoff rates in accordance with drainage design calculations (Appendix B) and subject to agreement with the Lead Local Flood Authority (Manchester LLFA).
- 2.3.13 Attenuation tanks could be provided to provide the necessary attenuation at 57.6m³ and 42m³ for the north and south parcels respectively, to cater for up to 100 year + 45% CC Storm Event.
- 2.3.14 The drainage system has been designed to cater for impermeable areas of 0.235ha and 0.245ha, including an allowance of 10% for Urban Creep.
- 2.3.15 The proposed drainage strategy has been designed so that:
- a) flooding does not occur on any part of the site for all events up to 3.3% AEP (1 in 30 years);
 - b) flooding does not occur in any part of a building or utility plant susceptible to water for all events up to 1.0% AEP (1 in 100 years) + 45% climate change allowance.

2.4 Water Quality Management

- 2.4.1 The suitability of the proposed drainage strategy to manage the development's pollution risk has been assessed using the simple index approach in *The SuDS Manual* (2015), as summarized in Table 2.4.

Runoff Route / Treatment Train 1				
Land Use / SuDS	Hazard Level	TSS	Metals	Hydro-Carbons
<i>Pollution Hazard Indices</i>				
Residential roofs	Very Low	0.2	0.2	0.05
Individual property driveways	Low	0.5	0.4	0.4
<i>SuDS Mitigation Indices</i>				
Permeable Paving	-	0.7	0.6	0.7
Total SuDS Mitigation Index ≥ Pollution Hazard Index (for each contaminant type)				

Table 2.4: Surface Water Quality Management (Simple Index Approach)

- 2.4.2 Alternative methods of SuDS mitigation can be explored providing the pollution hazard indices can be mitigated by the SuDS Mitigation Indices as outlined in *The SuDS Manual (2015)*.

2.5 Proposed Foul Water Drainage

- 2.5.1 Sewerage undertakers have a legal obligation under the Water Industries Act 1991 to provide developers with the right to connect to public (Foul) networks. The Water Industries Act 1991 also contains safeguards to ensure that flows resulting from developments do not cause detriment to the existing public sewerage networks by imposing a duty on sewerage undertakers to carry out works required to accommodate additional flows into their networks.
- 2.5.2 It is proposed to discharge the foul water from the northern parcel into the 300mm dia. UU combined sewer near the junction west of Simister Street.
- 2.5.3 For the southern parcel; there is an existing 300mm dia. UU combined water sewer through the site. It is proposed to discharge the foul water into this sewer once confirmed with UU if diversion is required under a S116 or if the sewer can be abandoned and the proposed foul water connection onto the remaining stub main.
- 2.5.4 The proposed foul water rates for the development are 0.55l/s and 0.46l/s for the north and south developments, respectively.

2.6 Drainage During Construction

- 2.6.1 Drainage is typically an early activity in the construction of a development, taking form during the earthworks phase. However, the connection of piped drainage system to SuDS components should not take place until the end of construction works, unless a robust strategy for silt removal prior to occupation of the site is implemented.
- 2.6.2 Silt-laden runoff from construction sites represents a common form of waterborne pollution and cannot enter SuDS components not specifically designed to manage this, as it can overwhelm the system and pollute receiving water features. Any gullies and piped systems should be capped off during construction and fully jetted and cleaned prior to connection to SuDS components.
- 2.6.3 The three principal aspects of drainage during construction are conveying runoff, controlling runoff and trapping sediments.
- 2.6.4 Conveyance of runoff can be achieved through small ditches / swales, channels and drains. Runoff control measures should be implemented to ensure that runoff does not overwhelm the temporary drainage system causing flooding on site or elsewhere.
- 2.6.5 Control of runoff can be achieved through perimeter ditches or appropriate grading to ensure that any runoff from the construction site stays on site. Runoff rates leaving the site should be managed so they do not exceed pre-development conditions.
- 2.6.6 Construction runoff should be directed to dedicated infiltration basins with adequate upstream sediment and pollution control such as sediment basins, silt fences and straw bales prior to infiltration or off-site discharge.
- 2.6.7 Additional conveyance, control and treatment measures should be installed as needed during grading. Slope stability needs to be considered when using open water features to convey, control and treat runoff across the site. Any necessary surface stabilisation measures should be applied immediately on all disturbed areas where construction work is either delayed or incomplete.
- 2.6.8 Maintenance inspections should be performed weekly, and maintenance repairs should be made immediately after periods of rainfall.
- 2.6.9 All drainage infrastructure (namely underground features) must be protected from damage by construction traffic and heavy machinery through the implementation of measures such as protective barriers and storing construction materials away from the drainage infrastructure.

3 SuDS Management and Maintenance Regime

3.1 General

- 3.1.1 There are two proposed attenuation tanks for the development. MOSSCARE ST VINCENTS Housing will be responsible for the maintenance of all drainage to both parcels and will be managed by the MOSSCARE ST VINCENTS Housing's maintenance team or an appointed private management company.
- 3.1.2 MOSSCARE ST VINCENTS Housing must fully understand their responsibilities outlined in this plan and be aware of any legally binding maintenance agreement.
- 3.1.3 MOSSCARE ST VINCENTS Housing will ensure only trained personnel will be permitted to undertake maintenance of SuDS features. This work must be carried out in accordance with the Confined Space Regulations. To facilitate this maintenance, SuDS have been located in public open space, where possible, or where they are reasonably accessible.
- 3.1.4 Tables outlining the maintenance activities that should be undertaken for each SuDS feature, outlined in the following sections, in accordance with the SuDS Manual, CIRIA, 2015. These tables must be reviewed by MOSSCARE ST VINCENTS Housing or the appointed private management company.

3.2 Hydro Brake

- 3.2.1 A hydro-brake is a flow control manhole, which restricts the velocity of water whereby the water enters through the inlet pipe with enough energy to create a vortex in the chamber. The vortex then controls the flow to the specified discharge rate. The main parameters that effect the hydro-brake specification is the design head (m) and the specified discharge rate (l/s).
- 3.2.2 There are two hydro-brakes proposed for this development:
 - One with a discharge rate of 3.0l/s and a design head of 1.50m located within the proposed northern parcel discharging into the existing sewer network within Princedom Street opposite Simister Street junction.
 - One with a discharge rate of 3.0 l/s and a design head of 1.50m located within the proposed southern parcel discharging into UU's surface water sewer within Princedom Street opposite Jonas Street junction.
- 3.2.3 Regular inspection and maintenance will be required to ensure the long-term effectiveness of the hydro-brakes
- 3.2.4 Hydro International have provided the following statement in terms of maintenance of the hydro-brake:

"Normally, little maintenance is required as there are no moving parts within the Flow Control. Experience has shown that if blockages occur, they do so at the intake, and the cause on such occasions has been due to a lack of attention to engineering detail such as approach velocities being too low, inadequate benching, or the use of units below the minimum recommended size. The Flow Control (where applicable) is fitted with a pivoting bypass door, which allows the manhole chamber to be drained down should blockage occur. The smaller conical units, below the minimum recommended size, are also supplied with rodding facilities or vortex suppressor pipes as standard."

Following installation of the Flow Control it is vitally important that any extraneous material i.e. building materials are removed from the unit and the chamber. After the system is made live, and assuming that the chamber design is satisfactory, it is recommended that each unit be inspected monthly for three months and thereafter at six monthly intervals with hose down if required. If problems are experienced, please do not hesitate to contact the company so that an investigation may be made.

3.3 Permeable Paving

- 3.3.1 Runoff is allowed to soak through structural paving. This can be paving blocks with gaps between solid blocks, or porous paving where water filters through the block itself. Water can be stored in the subbase and potentially allowed to infiltrate into the ground
- 3.3.2 This method provides attenuation and treatment from surface flows.
- 3.3.3 Regular inspection and maintenance would be required to ensure the long-term effectiveness of the paving.
- 3.3.4 A checklist for the maintenance of porous paving installed at the site and the party responsible for their maintenance, is provided in accordance with the 2015 SuDS Manual below:

Operation and maintenance requirements for Permeable Paving		
Maintenance schedule	Required action	Typical frequency
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
	Stabilise and mow contributing and adjacent areas	As required
Remedial actions	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to used, and replace lost jointing material	As required
Monitoring	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging).
	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48hr after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Table 3.3 – Permeable Paving (CIRIA, 2015)

- 3.3.5 Minor maintenance will be possible to be undertaken by the residents. However, remedial works and monitoring will be undertaken by MOSSCARE ST VINCENTS Housing's maintenance team or private management company as appointed.

3.4 Attenuation Tank

- 3.4.1 Attenuation storage tanks are used to create a below ground void space for the temporary storage of surface water before use, infiltration or controlled release. Attenuation storage tanks can help reduce flow rates from a site by providing significant attenuation storage. Storage tanks do not provide any form of treatment of surface water runoff and therefore need to be combined in a “management train” with other methods that do provide suitable treatment of all relevant pollutants (coarse sediment must always be removed upstream of a storage tank).
- 3.4.2 The inherent flexibility in size and shape of the typical attenuation storage tank systems means that they can be tailored to suit the specific characteristics and requirements of any site.
- 3.4.3 Two cellular detention tanks are proposed; one for each of the parcels and located beneath parking areas near Princedom Street.
- 3.4.4 This method provides attenuation and reduces the volume of runoff and outflow.
- 3.4.5 Regular inspection and maintenance would be required to ensure the long-term effectiveness of the attenuation tank.
- 3.4.6 A checklist for the maintenance of the attenuation tanks installed at the site and party responsible for their maintenance, is provided in accordance with the 2015 SuDS Manual below:

Operation and maintenance requirements for attenuation storage tanks		
<i>Maintenance schedule</i>	<i>Required action</i>	<i>Typical frequency</i>
<i>Regular Maintenance</i>	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary	Annually
	Remove sediment from pre-treatment structures and/or internal forebays	Annually, or as required
<i>Remedial actions</i>	Repair/rehabilitate inlets, outlet, overflows and vents	As required
<i>Monitoring</i>	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

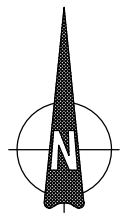
Table 3.4 – Attenuation Tanks (CIRIA, 2015)

- 3.4.7 The surface water attenuation tank will be maintained by MOSSCARE ST VINCENTS Housing's maintenance team or private management company as appointed.

Appendices

Appendix A

Engineering Plan



Historic Existing 300mm Sewer Shown from Sewer Records. Sewer could not be located via drainage survey. Further investigation required to be carried to determine extents of this existing sewer. Discussion with UU for potential abandonment under S116

Existing 375mm dia. United Utilities Surface Water Sewer UU STORM SEWER TO BE RETRACTED. ACCURATE INVERT LEVEL TO BE CONFIRMED

Existing 300mm United Utilities Combined Sewer to be abandoned under section 116. May need to be diverted subject to further discussion with UU. Diversion route can be accommodated if required.

DRAINAGE

- ALL DRAINAGE WORKS TO BE CONSTRUCTED FROM THE OUTFALL TOWARDS THE HEAD OF RUN TO ENSURE THE OUTFALL CAN BE ACHIEVED.
- ALL EXISTING DRAINS & SERVICES (LINE & LEVELS) TO BE CHECKED & CONFIRMED BY THE CONTRACTOR PRIOR COMMENCEMENT OF ANY ON SITE DRAINAGE WORKS. ANY DISCREPANCY IN LEVELS IS TO BE REPORTED IMMEDIATELY TO APP.
- ALL DRAINAGE WORK TO BE IN ACCORDANCE WITH THE BUILDING REGULATIONS, BS EN 752 & TO THE SATISFACTION OF THE BUILDING INSPECTOR.
- ALL PROPRIETARY ITEMS TO BE INSTALLED STRICTLY IN ACCORDANCE WITH MANUFACTURER'S DETAILS, INSTRUCTIONS & SPECIFICATIONS.
- ALL COVER LEVELS ARE APPROXIMATE. EXACT LEVELS TO BE DETERMINED FROM THE EXTERNAL WORKS LAYOUT.
- INVERT LEVELS QUOTED AT MANHOLES & INSPECTION CHAMBERS ARE THOSE OF THE LARGEST CONNECTED PIPE DIAMETER. PIPES AT CHAMBERS TO BE LAID WITH SOFFITS LEVEL UNLESS NOTED OTHERWISE.
- PIPE GRADIENTS WHERE STATED ARE APPROXIMATE - LEVELS AT THE CHAMBERS TAKE PRECEDENT.
- REFER TO ARCHITECT'S DRAWINGS FOR PRECISE LOCATION OF ALL RAINWATER PIPES, INTERNAL CONNECTIONS ETC.
- ALL INTERNAL CONNECTIONS TO HAVE AN ABOVE-FLOOR ACCESS POINT TO ENABLE FUTURE ACCESS FOR MAINTENANCE.
- PIPES & FITTINGS TO BE:
 - CONCRETE PIPES & ANCILLARY PRODUCTS TO BS 5911:2022 & BS EN 1916:2002.
 - VITRIFIED CLAY PIPES & FITTINGS TO BS EN 295:2013
 - DUCTILE IRON TO BS EN 598:2007 & BS ISO 4179:2005.
 - PERFORATED VITRIFIED CLAY PIPES FOR LAND DRAINAGE TO BS 1196.
 - PLASTIC PIPES FOR LAND DRAINAGE TO BS 4962:1982.
 - PLASTIC PIPING SYSTEMS FOR NON-PRESSURE UNDERGROUND DRAINAGE & SEWAGE TO BS EN 1401 & BS 4680 - SOLID WALL, STRUCTURED WALL PIPES TO BS EN 13476.
 - PRECAST CONCRETE MANHOLE UNITS TO BS EN 1917:2002.
 - PLASTIC INSPECTION CHAMBERS FOR DRAINS & SEWERS TO BS EN 13598-1:2010.
 - GULLY & MANHOLE TOPS FOR VEHICULAR & PEDESTRIAN AREAS TO BS EN 124:1994.
 - DRAINAGE CHANNELS FOR VEHICULAR & PEDESTRIAN AREAS TO BS EN 1433:2002.
- ALL MANHOLE COVERS, ROAD GULLY COVERS & FRAMES TO COMPLY WITH BS EN 124 NON ROCKING TYPE. UNLESS NOTED OTHERWISE USE CLASS:
 - A15 FOR USE IN PEDESTRIAN AREAS WHERE VEHICLES HAVE NO ACCESS.
 - B125 FOR USE IN CAR PARKS & PEDESTRIAN AREAS WHERE INFREQUENT LIGHT VEHICLE ACCESS IS LIKELY (INCLUDING DRIVEWAYS).
 - C250 FOR ACCESS COVERS & GULLY GRATINGS IN AREAS OF SLOW MOVING, HEAVY TRAFFIC; ALSO FOR GULLY GRATINGS IN CARRIAGEWAY WITHIN 500mm OF KERB & UP TO 200mm INTO THE FOOTWAY.
 - D400 FOR USE IN CARRIAGEWAYS OF ROADS & PARKING AREAS ACCESSED BY ALL TYPES OF VEHICLES.
 - E600 FOR USE IN AREAS WHERE HIGH WHEEL LOADS ARE PRESENT.
 - F900 FOR USE IN AREAS WHERE EXTREMELY HIGH WHEEL LOADS ARE PRESENT SUCH AS AIRCRAFT PAVEMENTS, DOCKS, HEAVY INDUSTRIAL SITES.
- MANHOLES IN INTERNAL AREAS REQUIRE DOUBLE SEALED COVERS WITH LOCKING SCREWS. RECESSED WHERE REQUIRED TO ACCOMMODATE FLOOR FINISHES TO ARCHITECT'S SPECIFICATION.
- PIPE BEDDING
 - USE CLASS 3 BEDDING UNLESS NOTED OTHERWISE. NB PROTECT AGAINST CONSTRUCTION TRAFFIC AS NECESSARY
 - USE CLASS 2 CONCRETE BED & SURROUND OR CONCRETE SLAB PROTECTION AS FOLLOWS:
 - CLASS 120 CLAYWARE OR CLASS M CONCRETE (100 - 6000 PIPES)
 - LANDSCAPING - LESS THAN 600mm COVER TO CROWN. HARDSTANDING - LESS THAN 1200mm COVER TO CROWN
 - PLASTIC (100 - 3000 PIPES)
 - LANDSCAPING - LESS THAN 600mm COVER TO CROWN. HARDSTANDING - LESS THAN 900mm COVER TO CROWN
- PIPES BELOW CONCRETE GROUND FLOOR SLABS:
 - WHERE THE CROWN OF THE PIPE IS WITHIN 300mm OF THE UNDERSIDE OF SLAB, SPECIAL PROTECTION TO BE PROVIDED IN ACCORDANCE WITH BUILDING REGULATIONS H1 2.44 OR 150mm GEND CONCRETE BED & SURROUND CAST INTEGRALLY WITH SLAB.
 - OTHERWISE USE CLASS 3 BEDDING.
- MAIN BACKFILL TO BE WELL COMPACTED IN 150mm LAYERS OF:
 - SELECTED BACKFILL MATERIAL IN ALL SOFT LANDSCAPED AREAS
 - TYPE 1 GRANULAR MATERIAL IN ALL HARDSTANDING AREAS & PUBLIC HIGHWAYS
- BACKFILL TO DRAINS NEAR FOUNDATIONS TO BE IN ACCORDANCE WITH BUILDING REGULATIONS H1 DIAGRAMS 8 & 12.
- CCTV TO BE CARRIED OUT TO VERIFY CONDITION OF ANY DRAINAGE TO BE RE-USED.

DRAINAGE KEY:

- PROPOSED FOUL DRAINAGE PIPE
- PROPOSED FOUL WATER PVC INSPECTION CHAMBER (SIZE VARIES)
- PROPOSED STORM DRAINAGE PIPE
- PROPOSED STORM INSPECTION CHAMBER (SIZE VARIES)
- PROPOSED DIVERTED DRAINAGE PIPE
- PROPOSED DIVERTED WATER INSPECTION CHAMBER (SIZE VARIES)
- PROPOSED ATTENUATION TANK
- PROPOSED PERMEABLE PAVING (LINED)
- PROPOSED ACCO CHANNEL
- EXISTING UNITED UTILITIES COMBINED WATER SEWER
- ABANDONED EXISTING UNITED UTILITIES COMBINED WATER SEWER
- EXISTING UNITED UTILITIES STORM WATER SEWER
- SEWER EASEMENT
- FLOW EXCEEDANCE ROUTE
- INDICATIVE FFL

Notes

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GENERAL NOTES

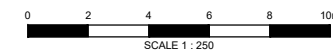
- THE STRUCTURAL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH ALL RELEVANT CLIENT, ARCHITECT, SERVICES ENGINEER, AND SPECIALIST CONTRACTOR DRAWINGS, REPORTS AND SPECIFICATIONS.
- FOR SETTING OUT AND LEVELS REFER TO ARCHITECTS DRAWINGS.
- FOR THE PURPOSE OF CONSTRUCTION ALL DRAWINGS MUST NOT BE SCALED AND ONLY WRITTEN OR CALCULATED DIMENSIONS USED. LEVEL DATUMS TO BE CONFIRMED BY THE ARCHITECT.
- ANY REVISIONS TO THE LAYOUT DETAILS REQUIRED BY THE CONTRACTOR TO BE AGREED AND APPROVED BY THE ALIGN PROPERTY PARTNERS ENGINEER.
- FINISHED FLOOR LEVELS TO BE DETERMINED.
- ALL PROPRIETARY PRODUCTS ARE TO BE USED STRICTLY IN ACCORDANCE WITH THE MANUFACTURER'S DETAILS AND REQUIREMENTS.
- GENERALLY, ONLY KNOWN PENETRATIONS, HOLES, POCKETS AND RECESSES ETC. WITH ANY DIMENSIONS GREATER THAN 150 ARE SHOWN ON THE DRAWINGS. FOR CONFIRMATION OF THESE AND FOR DETAILS OF SMALLER HOLES PLUS INSERTS, FIXINGS ETC. REFERENCE SHALL BE MADE TO THE ARCHITECT'S SERVICES ENGINEERS OR THE RELEVANT SUBCONTRACTOR'S BUILDERS WORK DRAWINGS.
- THE CONTRACTOR SHALL ENSURE THAT TEMPORARY LOADS ONTO THE NEW STRUCTURES/DRAINAGE SHALL BE LESS THAN THOSE FOR WHICH IT HAS BEEN DESIGNED.
- THE CONTRACTOR IS RESPONSIBLE FOR ESTABLISHING AND CHECKING THE SETTING OUT OF GRIDLINES, LEVELS AND DATUMS.
- ANY DISCREPANCIES BETWEEN THE STRUCTURAL AND ARCHITECTURAL DRAWINGS SHOULD IMMEDIATELY BE BROUGHT TO THE ATTENTION OF THE CONTRACT ADMINISTRATOR.
- THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO ENSURE THAT NOISE, VIBRATION AND DUST RESULTING FROM THE WORKS ARE KEPT WITHIN REASONABLE LIMITS.
- THE CONTRACTOR IS TO ALLOW A MINIMUM OF 10 WORKING DAYS IN THEIR PROGRAMME FOR THE REVIEW OF ANY CONTRACTOR'S DESIGN PORTIONS OF WORK FOR REVIEW BY THE ALIGN PROPERTY PARTNERS ENGINEER.
- IRRESPECTIVE OF ANY NAMED MANUFACTURERS OF ANY PRODUCT/MATERIAL NOTED ON DRAWINGS, THE CONTRACTOR IS FREE TO PROPOSE AN EQUAL OR APPROVED PRODUCT/MATERIAL PROVIDED THAT ANY SUCH CHANGE TO THE SPECIFICATION MEETS A SIMILAR LEVEL OF PERFORMANCE AND IS NOTED ON ALL M TENDER RETURNS AND DOCUMENTATION FOR ALIGN PROPERTY PARTNERS.

IMPORTANT:

DRAWING PROVIDED FOR INFORMATION ONLY AND IS SUBJECT TO THE FOLLOWING STATUTORY APPROVALS:

- UNITED UTILITIES APPROVAL
- PLANNING APPROVAL
- BUILDING CONTROL

ALL CONSTRUCTION WORKS PRIOR TO APPROVALS ABOVE WILL BE UNDERTAKEN AT CLIENTS/CONTRACTORS RISK



P02	Amendments following LLFA discussion. Attenuation tank width reduced and chamber numbering.	MD 12/12/23	LF 14/12/23	BD 01/10/24
P01	Initial Issue.	ZS 29/06/23	BD 29/06/23	BD 29/06/23
Rev	Details	Author & Date	Checked & Date	Approved & Date
align PROPERTY PARTNERS Westmorland & Furness Office, Riverside Business Park, Natland Road, Kendal LA9 7SX				
Client Mosscaire St Vincents				
Project Name Princes Street, Manchester				
Drawing Title Drainage Strategy				
Purpose Planning				
Scale	Drawn	Checked	Approved	
1:250	ZS	BD	BD	
Original Size	Date	Date	Date	
A1	29/06/23	29/06/23	29/06/23	
Drawing Number	Rev.			
PV2309-APP-92-XX-DR-C-2001	P02			

Appendix B

Drainage Calculations

Align Property Partners		Page 1																								
Morgan House, Mount View Standard Way Northallerton DL6 2YD	Princedom Northern Section																									
Date 28/06/2023 File	Designed by BID Checked by BD																									
Innovyze		Source Control 2020.1																								
<u>ICP SUDS Mean Annual Flood</u> Input <table><tr><td>Return Period (years)</td><td>1</td><td>Soil</td><td>0.450</td></tr><tr><td>Area (ha)</td><td>0.235</td><td>Urban</td><td>0.000</td></tr><tr><td>SAAR (mm)</td><td>911</td><td>Region Number</td><td>Region 10</td></tr></table> Results 1/s <table><tr><td>QBAR Rural</td><td>1.4</td></tr><tr><td>QBAR Urban</td><td>1.4</td></tr><tr><td>Q1 year</td><td>1.2</td></tr><tr><td>Q1 year</td><td>1.2</td></tr><tr><td>Q30 years</td><td>2.4</td></tr><tr><td>Q100 years</td><td>2.9</td></tr></table>			Return Period (years)	1	Soil	0.450	Area (ha)	0.235	Urban	0.000	SAAR (mm)	911	Region Number	Region 10	QBAR Rural	1.4	QBAR Urban	1.4	Q1 year	1.2	Q1 year	1.2	Q30 years	2.4	Q100 years	2.9
Return Period (years)	1	Soil	0.450																							
Area (ha)	0.235	Urban	0.000																							
SAAR (mm)	911	Region Number	Region 10																							
QBAR Rural	1.4																									
QBAR Urban	1.4																									
Q1 year	1.2																									
Q1 year	1.2																									
Q30 years	2.4																									
Q100 years	2.9																									
©1982-2020 Innovyze																										

Align Property Partners		Page 1																								
Morgan House, Mount View Standard Way Northallerton DL6 2YD	Princedom Southern Section																									
Date 28/06/2023 File	Designed by BID Checked by																									
Innovyze	Source Control 2020.1																									
<u>ICP SUDS Mean Annual Flood</u> Input <table><tr><td>Return Period (years)</td><td>1</td><td>Soil</td><td>0.450</td></tr><tr><td>Area (ha)</td><td>0.245</td><td>Urban</td><td>0.000</td></tr><tr><td>SAAR (mm)</td><td>911</td><td>Region Number</td><td>Region 10</td></tr></table> Results 1/s <table><tr><td>QBAR Rural</td><td>1.5</td></tr><tr><td>QBAR Urban</td><td>1.5</td></tr><tr><td>Q1 year</td><td>1.3</td></tr><tr><td>Q1 year</td><td>1.3</td></tr><tr><td>Q30 years</td><td>2.5</td></tr><tr><td>Q100 years</td><td>3.0</td></tr></table>			Return Period (years)	1	Soil	0.450	Area (ha)	0.245	Urban	0.000	SAAR (mm)	911	Region Number	Region 10	QBAR Rural	1.5	QBAR Urban	1.5	Q1 year	1.3	Q1 year	1.3	Q30 years	2.5	Q100 years	3.0
Return Period (years)	1	Soil	0.450																							
Area (ha)	0.245	Urban	0.000																							
SAAR (mm)	911	Region Number	Region 10																							
QBAR Rural	1.5																									
QBAR Urban	1.5																									
Q1 year	1.3																									
Q1 year	1.3																									
Q30 years	2.5																									
Q100 years	3.0																									
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Align Property Partners		Page 1																								
Morgan House, Mount View Standard Way Northallerton DL6 2YD	Princedom Greenfield Runoff Combined																									
Date 28/06/2023	Designed by BID																									
File	Checked by BD																									
Innovyze	Source Control 2020.1																									
<u>ICP SUDS Mean Annual Flood</u> Input <table><tr><td>Return Period (years)</td><td>1</td><td>Soil</td><td>0.450</td></tr><tr><td>Area (ha)</td><td>0.480</td><td>Urban</td><td>0.000</td></tr><tr><td>SAAR (mm)</td><td>911</td><td>Region Number</td><td>Region 10</td></tr></table> Results 1/s <table><tr><td>QBAR Rural</td><td>2.9</td></tr><tr><td>QBAR Urban</td><td>2.9</td></tr><tr><td>Q1 year</td><td>2.5</td></tr><tr><td>Q1 year</td><td>2.5</td></tr><tr><td>Q30 years</td><td>4.9</td></tr><tr><td>Q100 years</td><td>6.0</td></tr></table>			Return Period (years)	1	Soil	0.450	Area (ha)	0.480	Urban	0.000	SAAR (mm)	911	Region Number	Region 10	QBAR Rural	2.9	QBAR Urban	2.9	Q1 year	2.5	Q1 year	2.5	Q30 years	4.9	Q100 years	6.0
Return Period (years)	1	Soil	0.450																							
Area (ha)	0.480	Urban	0.000																							
SAAR (mm)	911	Region Number	Region 10																							
QBAR Rural	2.9																									
QBAR Urban	2.9																									
Q1 year	2.5																									
Q1 year	2.5																									
Q30 years	4.9																									
Q100 years	6.0																									
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Align Property Partners		Page 1
Morgan House, Mount View Standard Way Northallerton, DL6 2YD	Princedom South SW Drainage	
Date 29/06/2023	Designed by LF	
File PV2309-APP-92-XX-CA-C-1000 SW	Checked by BD	
Innovyze	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm North

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	18.300	Add Flow / Climate Change (%)	0
Ratio R	0.348	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm North

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S2.000	33.462	0.439	76.2	0.037	4.00	0.0	0.600	o	225	Pipe/Conduit	
S2.001	56.034	0.374	149.8	0.019	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.002	4.856	0.094	51.7	0.018	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.003	28.338	0.189	149.9	0.034	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.004	3.188	0.026	122.6	0.001	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.005	8.468	0.085	99.6	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S2.000	50.00	4.37	76.350	0.037	0.0	0.0	0.0	1.50	59.6	5.0
S2.001	50.00	5.25	75.911	0.056	0.0	0.0	0.0	1.07	42.4	7.6
S2.002	50.00	5.29	75.537	0.074	0.0	0.0	0.0	1.82	72.5	10.0
S2.003	50.00	5.74	75.443	0.108	0.0	0.0	0.0	1.07	42.4	14.6
S2.004	50.00	5.78	75.254	0.109	0.0	0.0	0.0	1.18	46.9	14.8
S2.005	50.00	5.92	75.228	0.109	0.0	0.0	0.0	1.01	17.8	14.8

Align Property Partners		Page 2
Morgan House, Mount View Standard Way Northallerton, DL6 2YD	Princedom South SW Drainage	
Date 29/06/2023	Designed by LF	
File PV2309-APP-92-XX-CA-C-1000 SW	Checked by BD	
Innovyze	Network 2020.1.3	

Manhole Schedules for Storm North

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S5	77.260	0.910	Open Manhole	600	S2.000	76.350	225				
S6	77.600	1.689	Open Manhole	600	S2.001	75.911	225	S2.000	75.911	225	
S7	77.620	2.083	Open Manhole	600	S2.002	75.537	225	S2.001	75.537	225	
S8 - CP MH	77.450	2.007	Open Manhole	600	S2.003	75.443	225	S2.002	75.443	225	
S9 - HB	77.250	1.996	Open Manhole	1500	S2.004	75.254	225	S2.003	75.254	225	
S10	77.250	2.022	Open Manhole	450	S2.005	75.228	150	S2.004	75.228	225	
SS11 - New MH	77.120	1.977	Open Manhole	1200		OUTFALL		S2.005	75.143	150	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S5	386406.918	401717.822	386406.918	401717.822	Required	
S6	386439.817	401723.933	386439.817	401723.933	Required	
S7	386450.051	401668.841	386450.051	401668.841	Required	
S8 - CP MH	386445.283	401667.922	386445.283	401667.922	Required	
S9 - HB	386417.454	401662.577	386417.454	401662.577	Required	
S10	386417.835	401659.512	386417.835	401659.512	Required	
SS11 - New MH	386419.291	401651.170			No Entry	

Align Property Partners		Page 3
Morgan House, Mount View Standard Way Northallerton, DL6 2YD	Princedom South SW Drainage	
Date 29/06/2023	Designed by LF	
File PV2309-APP-92-XX-CA-C-1000 SW	Checked by BD	
Innovyze	Network 2020.1.3	

PIPELINE SCHEDULES for Storm North

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S2.000	o	225	S5	77.260	76.350	0.685	Open Manhole	600
S2.001	o	225	S6	77.600	75.911	1.464	Open Manhole	600
S2.002	o	225	S7	77.620	75.537	1.858	Open Manhole	600
S2.003	o	225	S8 - CP MH	77.450	75.443	1.782	Open Manhole	600
S2.004	o	225	S9 - HB	77.250	75.254	1.771	Open Manhole	1500
S2.005	o	150	S10	77.250	75.228	1.872	Open Manhole	450

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S2.000	33.462	76.2	S6	77.600	75.911	1.464	Open Manhole	600
S2.001	56.034	149.8	S7	77.620	75.537	1.858	Open Manhole	600
S2.002	4.856	51.7	S8 - CP MH	77.450	75.443	1.782	Open Manhole	600
S2.003	28.338	149.9	S9 - HB	77.250	75.254	1.771	Open Manhole	1500
S2.004	3.188	122.6	S10	77.250	75.228	1.797	Open Manhole	450
S2.005	8.468	99.6	SS11 - New MH	77.120	75.143	1.827	Open Manhole	1200

Setting Out Information - True Coordinates (Storm North)

PN	USMH Name	Dia/Len (mm)	Width (mm)	US Easting (m)	US Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Layout (North)
S2.000	S5	600		386406.918	401717.822	386406.918	401717.822	
S2.001	S6	600		386439.817	401723.933	386439.817	401723.933	
S2.002	S7	600		386450.051	401668.841	386450.051	401668.841	
S2.003	S8 - CP MH	600		386445.283	401667.922	386445.283	401667.922	
S2.004	S9 - HB	1500		386417.454	401662.577	386417.454	401662.577	
S2.005	S10	450		386417.835	401659.512	386417.835	401659.512	

PN	DSMH Name	Dia/Len (mm)	Width (mm)	DS Easting (m)	DS Northing (m)	Layout (North)
S2.005	SS11 - New MH	1200		386419.291	401651.170	

Align Property Partners		Page 5
Morgan House, Mount View Standard Way Northallerton, DL6 2YD	Princedom South SW Drainage	
Date 29/06/2023	Designed by LF	
File PV2309-APP-92-XX-CA-C-1000 SW	Checked by BD	
Innovyze	Network 2020.1.3	

Area Summary for Storm North

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
2.000	-	-	100	0.037	0.037	0.037
2.001	-	-	100	0.019	0.019	0.019
2.002	-	-	100	0.018	0.018	0.018
2.003	-	-	100	0.034	0.034	0.034
2.004	-	-	100	0.001	0.001	0.001
2.005	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.109	0.109	0.109

Free Flowing Outfall Details for Storm North

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
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S2.005	SS11 - New MH	77.120	75.143	0.000	1200	0
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Simulation Criteria for Storm North

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.300	Storm Duration (mins)	30
Ratio R	0.348		

Align Property Partners		Page 6
Morgan House, Mount View Standard Way Northallerton, DL6 2YD	Princedom South SW Drainage	
Date 29/06/2023	Designed by LF	
File PV2309-APP-92-XX-CA-C-1000 SW	Checked by BD	
Innovyze	Network 2020.1.3	

Online Controls for Storm North

Hydro-Brake® Optimum Manhole: S9 - HB, DS/PN: S2.004, Volume (m³): 4.6

Unit Reference	MD-SHE-0075-3000-1500-3000
Design Head (m)	1.500
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	75.254
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	3.0	Kick-Flo®	0.671	2.1
Flush-Flo™	0.329	2.6	Mean Flow over Head Range	-	2.4

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)	Depth (m)	Flow (l/s)
0.100	2.1	0.800	2.2	2.000	3.4	4.000	4.7	7.000	6.1
0.200	2.5	1.000	2.5	2.200	3.6	4.500	5.0	7.500	6.3
0.300	2.6	1.200	2.7	2.400	3.7	5.000	5.2	8.000	6.5
0.400	2.6	1.400	2.9	2.600	3.9	5.500	5.5	8.500	6.7
0.500	2.5	1.600	3.1	3.000	4.1	6.000	5.7	9.000	6.9
0.600	2.3	1.800	3.3	3.500	4.4	6.500	5.9	9.500	7.1

Align Property Partners		Page 7
Morgan House, Mount View Standard Way Northallerton, DL6 2YD	Princedom South SW Drainage	
Date 29/06/2023	Designed by LF	
File PV2309-APP-92-XX-CA-C-1000 SW	Checked by BD	
Innovyze	Network 2020.1.3	

Storage Structures for Storm North

Cellular Storage Manhole: S9 - HB, DS/PN: S2.004

Invert Level (m) 75.443 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)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	48.0	48.0	1.200	48.0	86.4	1.210	0.0	86.4

Align Property Partners		Page 8
Morgan House, Mount View Standard Way Northallerton, DL6 2YD	Princedom South SW Drainage	
Date 29/06/2023	Designed by LF	
File PV2309-APP-92-XX-CA-C-1000 SW	Checked by BD	
Innovyze	Network 2020.1.3	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm North

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.300 Cv (Summer) 1.000
 Region England and Wales Ratio R 0.350 Cv (Winter) 1.000

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

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water	Surcharged
									Level (m)	Depth (m)
S2.000	S5	15 Summer	1	+0%	100/15 Summer				76.400	-0.175
S2.001	S6	15 Summer	1	+0%	100/15 Summer				75.982	-0.154
S2.002	S7	15 Summer	1	+0%	30/15 Summer				75.613	-0.149
S2.003	S8 - CP MH	60 Summer	1	+0%	30/15 Summer				75.553	-0.115
S2.004	S9 - HB	60 Summer	1	+0%	1/15 Summer				75.546	0.067
S2.005	S10	60 Summer	1	+0%					75.268	-0.110

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level
								Exceeded
S2.000	S5	0.000	0.11			6.4	OK	
S2.001	S6	0.000	0.21			8.4	OK	
S2.002	S7	0.000	0.25			10.7	OK	
S2.003	S8 - CP MH	0.000	0.28			11.1	OK	
S2.004	S9 - HB	0.000	0.09		33	2.5	SURCHARGED	
S2.005	S10	0.000	0.16			2.5	OK	

Align Property Partners		Page 9
Morgan House, Mount View Standard Way Northallerton, DL6 2YD	Princedom South SW Drainage	
Date 29/06/2023	Designed by LF	
File PV2309-APP-92-XX-CA-C-1000 SW	Checked by BD	
Innovyze	Network 2020.1.3	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm North

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.300 Cv (Summer) 1.000
 Region England and Wales Ratio R 0.350 Cv (Winter) 1.000

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

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water	Surcharged
									Level (m)	Depth (m)
S2.000	S5	15 Summer	30	+0%	100/15 Summer				76.431	-0.144
S2.001	S6	15 Summer	30	+0%	100/15 Summer				76.034	-0.102
S2.002	S7	60 Winter	30	+0%	30/15 Summer				75.859	0.097
S2.003	S8 - CP MH	60 Winter	30	+0%	30/15 Summer				75.857	0.189
S2.004	S9 - HB	60 Winter	30	+0%	1/15 Summer				75.851	0.372
S2.005	S10	30 Summer	30	+0%					75.269	-0.109

PN	US/MH Name	Flooded		Half Drain		Pipe	Status	Level Exceeded
		Volume (m ³)	Flow / Cap.	Flow / (l/s)	Time (mins)	Flow (l/s)		
S2.000	S5	0.000	0.28			15.7	OK	
S2.001	S6	0.000	0.55			22.3	OK	
S2.002	S7	0.000	0.29			12.7	SURCHARGED	
S2.003	S8 - CP MH	0.000	0.48			18.8	SURCHARGED	
S2.004	S9 - HB	0.000	0.09		80	2.6	SURCHARGED	
S2.005	S10	0.000	0.17			2.6	OK	

Align Property Partners		Page 10
Morgan House, Mount View Standard Way Northallerton, DL6 2YD	Princedom South SW Drainage	
Date 29/06/2023	Designed by LF	
File PV2309-APP-92-XX-CA-C-1000 SW	Checked by BD	
Innovyze	Network 2020.1.3	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm North

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.300 Cv (Summer) 1.000
 Region England and Wales Ratio R 0.350 Cv (Winter) 1.000

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

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level	Surcharged Depth
									(m)	(m)
S2.000	S5	15 Summer	100	+45%	100/15 Summer				76.856	0.281
S2.001	S6	15 Summer	100	+45%	100/15 Summer				76.720	0.584
S2.002	S7	120 Winter	100	+45%	30/15 Summer				76.490	0.728
S2.003	S8 - CP MH	120 Winter	100	+45%	30/15 Summer				76.489	0.821
S2.004	S9 - HB	120 Winter	100	+45%	1/15 Summer				76.481	1.002
S2.005	S10	120 Winter	100	+45%					75.270	-0.108

PN	US/MH Name	Flooded		Half Drain	Pipe	Status	Level Exceeded
		Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)		
S2.000	S5	0.000	0.50			27.9	SURCHARGED
S2.001	S6	0.000	0.85			34.6	SURCHARGED
S2.002	S7	0.000	0.35			15.2	SURCHARGED
S2.003	S8 - CP MH	0.000	0.58			22.7	SURCHARGED
S2.004	S9 - HB	0.000	0.09		190	2.7	SURCHARGED
S2.005	S10	0.000	0.17			2.7	OK

Align Property Partners		Page 1
Morgan House, Mount View Standard Way Northallerton, DL6 2YD	Princedom South SW Drainage	
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Innovyze	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm South

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	18.300	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm South

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	31.491	0.912	34.5	0.045	4.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	20.875	0.139	150.2	0.042	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	1.685	0.020	84.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	4.269	0.061	70.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	4.31	76.350	0.045	0.0	0.0	0.0	1.72	30.4	6.1
S1.001	50.00	4.63	75.363	0.087	0.0	0.0	0.0	1.06	42.3	11.8
S1.002	50.00	4.66	75.224	0.087	0.0	0.0	0.0	1.10	19.4	11.8
S1.003	50.00	4.72	75.204	0.087	0.0	0.0	0.0	1.20	21.3	11.8

Manhole Schedules for Storm South											
MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backfall
S1	77.700	1.350	Open Manhole	450	S1.000	76.350	150				
S2	77.310	1.947	Open Manhole	600	S1.001	75.363	225	S1.000	75.438	150	
S3 - HB	77.250	2.026	Open Manhole	1500	S1.002	75.224	150	S1.001	75.224	225	
S4	77.200	1.996	Open Manhole	450	S1.003	75.204	150	S1.002	75.204	150	
SS11 - New Outfall MH	77.120	1.977	Open Manhole	0		OUTFALL		S1.003	75.143	150	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1	386471.919	401654.815	386471.919	401654.815	Required	
S2	386440.945	401649.133	386440.945	401649.133	Required	
S3 - HB	386420.420	401645.324	386420.420	401645.324	Required	
S4	386420.099	401646.978	386420.099	401646.978	Required	
SS11 - New Outfall MH	386419.291	401651.170			No Entry	

Align Property Partners		Page 3
Morgan House, Mount View Standard Way Northallerton, DL6 2YD	Princedom South SW Drainage	
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PIPELINE SCHEDULES for Storm South

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	150	S1	77.700	76.350	1.200	Open Manhole	450
S1.001	o	225	S2	77.310	75.363	1.722	Open Manhole	600
S1.002	o	150	S3 - HB	77.250	75.224	1.876	Open Manhole	1500
S1.003	o	150	S4	77.200	75.204	1.846	Open Manhole	450

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	31.491	34.5		S2	77.310	75.438	1.722 Open Manhole	600
S1.001	20.875	150.2		S3 - HB	77.250	75.224	1.801 Open Manhole	1500
S1.002	1.685	84.2		S4	77.200	75.204	1.846 Open Manhole	450
S1.003	4.269	70.0	SS11 - New Outfall	MH	77.120	75.143	1.827 Open Manhole	0

Align Property Partners		Page 4
Morgan House, Mount View Standard Way Northallerton, DL6 2YD	Princedom South SW Drainage	
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Innovyze	Network 2020.1.3	

Setting Out Information - True Coordinates (Storm South)

PN	USMH Name	Dia/Len (mm)	Width (mm)	US Easting (m)	US Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Layout (North)
S1.000	S1	450		386471.919	401654.815	386471.919	401654.815	
S1.001	S2	600		386440.945	401649.133	386440.945	401649.133	
S1.002	S3 - HB	1500		386420.420	401645.324	386420.420	401645.324	
S1.003	S4	450		386420.099	401646.978	386420.099	401646.978	

PN	DSMH Name	Dia/Len (mm)	Width (mm)	DS Easting (m)	DS Northing (m)	Layout (North)
S1.003	SS11 - New Outfall MH		0	386419.291	401651.170	

Align Property Partners		Page 5
Morgan House, Mount View Standard Way Northallerton, DL6 2YD	Princedom South SW Drainage	
Date 29/06/2023	Designed by LF	
File PV2309-APP-92-XX-CA-C-1000 SW	Checked by BD	
Innovyze	Network 2020.1.3	

Area Summary for Storm South

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.045	0.045	0.045
1.001	-	-	100	0.042	0.042	0.042
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.087	0.087	0.087

Free Flowing Outfall Details for Storm South

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.003	SS11 - New Outfall MH	77.120	75.143	0.000	0	0

Simulation Criteria for Storm South

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	0.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Offline Controls	0
Number of Online Controls	1	Number of Storage Structures	1
		Number of Time/Area Diagrams	0
		Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.300	Storm Duration (mins)	30
Ratio R	0.348		

Align Property Partners		Page 6
Morgan House, Mount View Standard Way Northallerton, DL6 2YD	Princedom South SW Drainage	
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Innovyze	Network 2020.1.3	

Online Controls for Storm South

Hydro-Brake® Optimum Manhole: S3 - HB, DS/PN: S1.002, Volume (m³): 4.4

Unit Reference	MD-SHE-0075-3000-1500-3000
Design Head (m)	1.500
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	75.224
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	3.0	Kick-Flo®	0.671	2.1
Flush-Flo™	0.329	2.6	Mean Flow over Head Range	-	2.4

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)	Depth (m)	Flow (l/s)
0.100	2.1	0.800	2.2	2.000	3.4	4.000	4.7	7.000	6.1
0.200	2.5	1.000	2.5	2.200	3.6	4.500	5.0	7.500	6.3
0.300	2.6	1.200	2.7	2.400	3.7	5.000	5.2	8.000	6.5
0.400	2.6	1.400	2.9	2.600	3.9	5.500	5.5	8.500	6.7
0.500	2.5	1.600	3.1	3.000	4.1	6.000	5.7	9.000	6.9
0.600	2.3	1.800	3.3	3.500	4.4	6.500	5.9	9.500	7.1

Align Property Partners		Page 7
Morgan House, Mount View Standard Way Northallerton, DL6 2YD	Princedom South SW Drainage	
Date 29/06/2023	Designed by LF	
File PV2309-APP-92-XX-CA-C-1000 SW	Checked by BD	
Innovyze	Network 2020.1.3	

Storage Structures for Storm South

Cellular Storage Manhole: S3 - HB, DS/PN: S1.002

Invert Level (m) 75.363 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)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	35.0	35.0	1.200	35.0	67.4	1.210	0.0	67.4

Align Property Partners		Page 8
Morgan House, Mount View Standard Way Northallerton, DL6 2YD	Princedom South SW Drainage	
Date 29/06/2023	Designed by LF	
File PV2309-APP-92-XX-CA-C-1000 SW	Checked by BD	
Innovyze	Network 2020.1.3	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm South

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.300 Cv (Summer) 1.000
 Region England and Wales Ratio R 0.350 Cv (Winter) 1.000

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

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water	Surcharged
									Level (m)	Depth (m)
S1.000	S1	15 Summer	1	+0%	100/15 Summer				76.402	-0.098
S1.001	S2	60 Summer	1	+0%	30/15 Summer				75.471	-0.117
S1.002	S3 - HB	60 Summer	1	+0%	1/15 Summer				75.466	0.092
S1.003	S4	60 Summer	1	+0%					75.244	-0.110

PN	US/MH Name	Flooded		Half Drain		Pipe	Status	Level Exceeded
		Volume (m ³)	Flow / Cap. (l/s)	Time (mins)	Flow (l/s)	Flow		
S1.000	S1	0.000	0.27			7.8	OK	
S1.001	S2	0.000	0.24			9.3	OK	
S1.002	S3 - HB	0.000	0.23		27	2.5	SURCHARGED	
S1.003	S4	0.000	0.16			2.5	OK	

Align Property Partners		Page 9
Morgan House, Mount View Standard Way Northallerton, DL6 2YD	Princedom South SW Drainage	
Date 29/06/2023	Designed by LF	
File PV2309-APP-92-XX-CA-C-1000 SW	Checked by BD	
Innovyze	Network 2020.1.3	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm South

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.300 Cv (Summer) 1.000
 Region England and Wales Ratio R 0.350 Cv (Winter) 1.000

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

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water	Surcharged
									Level (m)	Depth (m)
S1.000	S1	15 Summer	30	+0%	100/15 Summer				76.439	-0.061
S1.001	S2	60 Winter	30	+0%	30/15 Summer				75.799	0.211
S1.002	S3 - HB	60 Winter	30	+0%	1/15 Summer				75.793	0.419
S1.003	S4	480 Summer	30	+0%					75.245	-0.109

PN	US/MH Name	Flooded		Half Drain		Pipe	Status	Level Exceeded
		Volume (m ³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)		
S1.000	S1	0.000	0.65			19.1	OK	
S1.001	S2	0.000	0.43			16.4	SURCHARGED	
S1.002	S3 - HB	0.000	0.24		58	2.6	SURCHARGED	
S1.003	S4	0.000	0.17			2.6	OK	

Align Property Partners		Page 10
Morgan House, Mount View Standard Way Northallerton, DL6 2YD	Princedom South SW Drainage	
Date 29/06/2023	Designed by LF	
File PV2309-APP-92-XX-CA-C-1000 SW	Checked by BD	
Innovyze	Network 2020.1.3	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm South

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.300 Cv (Summer) 1.000
 Region England and Wales Ratio R 0.350 Cv (Winter) 1.000

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

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water	Surcharged
									Level (m)	Depth (m)
S1.000	S1	15 Summer	100	+45%	100/15 Summer				77.447	0.947
S1.001	S2	120 Winter	100	+45%	30/15 Summer				76.480	0.892
S1.002	S3 - HB	120 Winter	100	+45%	1/15 Summer				76.474	1.100
S1.003	S4	120 Winter	100	+45%					75.246	-0.108

PN	US/MH Name	Flooded		Half Drain		Pipe	Level Exceeded
		Volume (m ³)	Flow / Cap. (l/s)	Time (mins)	Flow (l/s)	Status	
S1.000	S1	0.000	1.18		34.4	FLOOD RISK	
S1.001	S2	0.000	0.51		19.7	SURCHARGED	
S1.002	S3 - HB	0.000	0.25	143	2.7	SURCHARGED	
S1.003	S4	0.000	0.18		2.7	OK	

Appendix C

Hydro-Brake Technical Information

Technical Specification

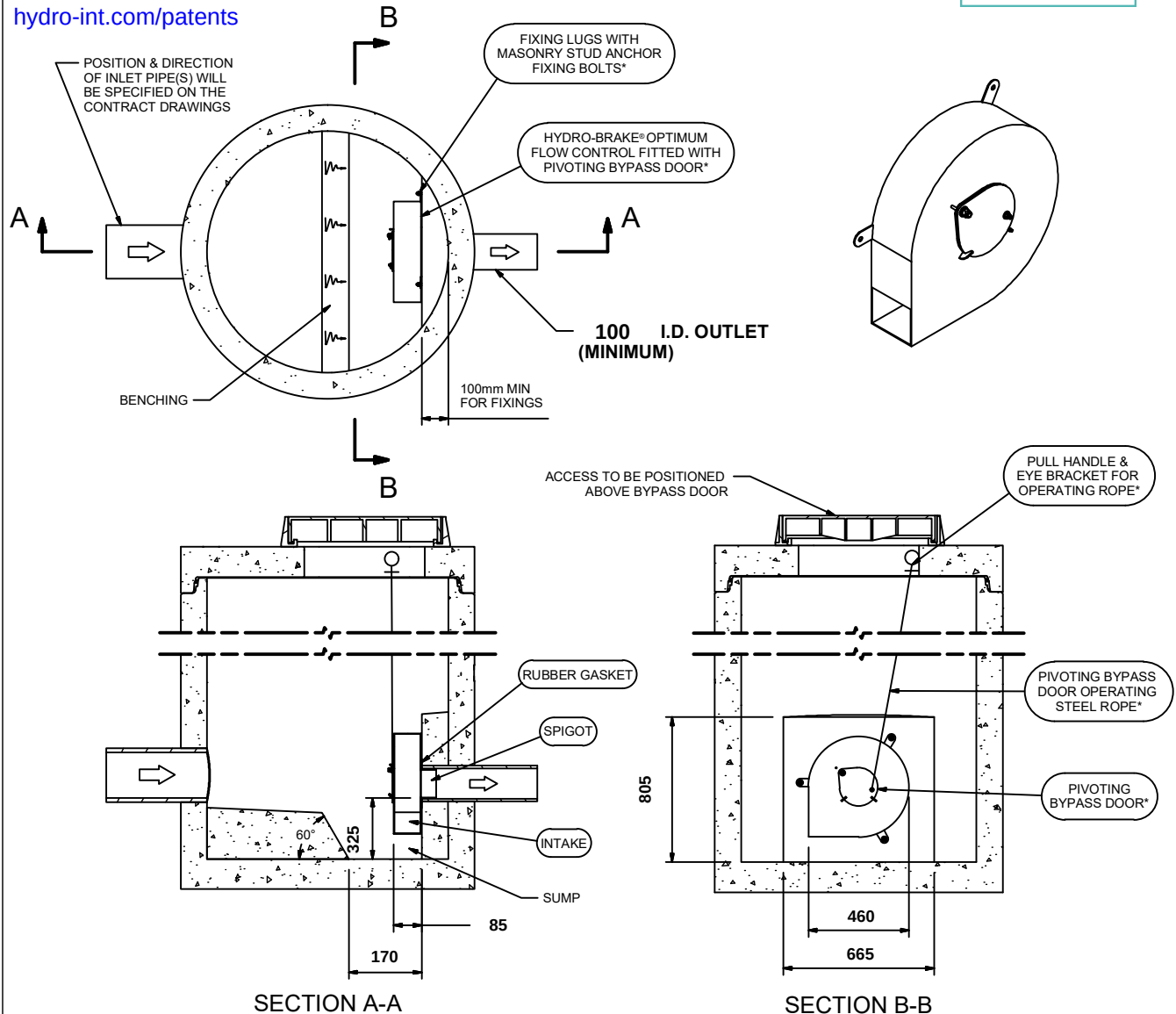
Control Point	Head (m)	Flow (l/s)
Primary Design	1.500	3.000
Flush-Flo™	0.329	2.578
Kick-Flo®	0.671	2.076
Mean Flow		2.415

Hydro-Brake® Optimum Flow Control including:

- 3 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet
- Indicative Weight: 10 kg



hydro-int.com/patents



IMPORTANT:

○ LIMIT OF HYDRO INTERNATIONAL SUPPLY

THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS

* WHERE SUPPLIED

HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

**DESIGN
ADVICE**



The head/flow characteristics of this SHE-0075-3000-1500-3000 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro
International®

DATE	29/06/2023 14:21
SITE	Princedom Street
DESIGNER	Louis Ford
REF	PV2309

SHE-0075-3000-1500-3000
Hydro-Brake® Optimum

Appendix D

Maintenance Data Sheets



Sustainable Drainage Systems Limited

SDS GEOLight Maintenance Datasheet

Once received, stormwater reaches the storage reservoir through one or more distribution pipes laid out between the GEOLight units.

The distribution pipes generally consist of 150mm to 600mm fully perforated twinwall pipe installed within a trench filled with draining material (washed rolled pebbles, free from fines, and 15/25 grading) requiring little compaction.

A high flow, non-woven GEOTextile is laid between the distribution pipe and the GEOLight units preventing the horizontal GEOLight units from being clogged by the draining materials.

The permeability of the supply and distribution pipe located within the reservoir is designed to prevent any clogging of the system upstream of the stormwater drain. The ends of the distribution pipes are generally connected to inspection chambers (manholes) acting as settling tanks, enabling inspection and maintenance of the whole distribution pipe.

For small discharges, stormwater does not penetrate the GEOLight blocks, but circulates either in an appropriate bypass, or in the distribution pipe drain itself. This allows draining of the first water which will be handled downstream if required.

When the reservoir is drained, water is drained through the distribution pipe, possibly the same as the one located at the input which operates in the opposite direction. Drainage discharge is controlled downstream either by the system piping or a flow control device. A drainage geocomposite is installed in the upper part of the reservoir allowing air to ventilate into the inspection chamber.

SDS generally recommend that the stormwater tank inspection chambers are checked periodically in conjunction with general maintenance of the underground pipe network



MARSHALLS PRIORA: MAINTENANCE

Maintaining your Marshalls Priora Permeable Paving System is easy: simply ensure that the voids between the blocks don't get blocked and prevent water from flowing through the surface and into the sub-base.

However, it's important to remember that even if the voids do appear to be blocked, it's unlikely to stop the system working. This is because the voids on a Marshalls Priora surface have been specially engineered to be far wider than they need to be – so blocked voids are likely to only slow the flow of water, not stop it completely.

A Marshalls Priora surface made of 200mmx100mm blocks provides infiltration rates in excess of 18,000 litres per second per hectare (l/s/h). The average rainfall event in the UK provides flow at approximately 180 l/s/h. Independent research in 2006 by Soenke Borgwardt concluded that after 10 years, in a worst case scenario with absolutely zero maintenance, a permeable pavement might be reduced to 10% of its original permeability. In Priora's case, this would be 1,800 l/s/h – still TEN TIMES more permeable than it needs to be!



See for yourself!

Visit YouTube and search for "Marshalls Priora Maintenance Test" to see a real time infiltration test on an unmaintained Priora system!



Marshall's
Creating Better Spaces

5 SIMPLE STEPS TO MAINTAIN A MARSHALLS PRIORA SURFACE IN OPTIMUM CONDITION:

- **NEVER** dump sand, cement, soil or other loose material directly onto a Marshall's Priora surface. This could block the joints or even fall into the sub-base. If you do need to store any loose material on a Marshall's Priora surface, make sure you put down a tarpaulin or impenetrable sheet first.
- Every twelve months or so, undertake a visual inspection to check that the voids aren't blocked with dirt or other debris. This is usually best undertaken after a period of heavy rainfall. If any voids are blocked, ponding on the surface will be apparent.
- If you notice ponding, the joints in that area are blocked. To clear them, either sweep the joints with a stiff brush or vacuum the contaminated aggregate out and replace it. If using an automatic suction brush, angle the brushes at 30° to avoid aggregate migration.
- Any vegetation growing in the joints can be removed manually, or treated with a Glyphosate-based weedkiller. Glyphosate will be neutralised upon contact with the ground, so it will be safe to plant in the area soon after treatment
- For winter maintenance, pure (white) rock salt is an effective and readily available de-icer. However, avoid using salts which contain an additional abrasive such as sand or grit. For heavy ice, should an abrasive be required, mix pure (white) rock salt with 6mm Priora jointing aggregate. This can be brushed safely back into the joints once thawed. (nb – Use of chlorides is highly unlikely to increase chloride levels in the local ground).

Appendix E

Typical Construction Details

