FIRST STREET SOUTH, MANCHESTER

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FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY REPORT

The Alan Johnston Partnership LLP

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1.0 INTRODUCTION

This Flood Risk Assessment (FRA) and Drainage Strategy Report has been prepared on behalf of Downing in connection with a planning application for the construction of a proposed mixed-use development. The proposed site is located to the south of Hulme Street, Manchester. This FRA is required as even though the site is located within Flood Zone 1, the total area of the proposed development site is over 1.0ha in area.

This FRA has been prepared in accordance with the general requirements of the National Planning Policy Framework and the Technical Guidance to the National Planning Policy Framework, both published by the Department for Communities and Local Government. This involves the identification of flood risk to new development(s) on the site, the possible effect of this development on flood risk elsewhere and the investigation of the impact on the development as a result of increased sea levels, fluvial flows and larger pluvial events due to increased impermeable areas and climate change.

The purpose of this report is to present a site-specific assessment of flood risk based on available information, to identify relevant flood levels affecting the site with respect to a particular probability of flooding. The flood levels identified are dependent on the correctness of the current conditions, as stated in this report and the prediction of future climatic conditions implicit in the National Planning Policy Framework.

For any size of storm event, the procedure will always yield a probability that the event will occur in any year, albeit the probability is smaller for larger events. The predicted storm event has a probability of occurrence in any year and the derived flood level has an associated probability of exceedance. This means that there is always a risk that property flooding could occur one or more times in any year.

Therefore, this report should not be interpreted or relied upon as providing a guarantee against flooding. There is always a residual risk that flooding will occur and it is not possible to predict a zero risk of flooding.

In accordance with National Planning Policy Framework (NPPF) and the associated Technical Guidance document, flood risk must be assessed for all sources including tidal (from the sea), fluvial (from rivers), pluvial (from land), groundwater, sewer and artificial water bodies (e.g. reservoirs, canals, major water supply infrastructure etc.).

More specifically, the development of any site must be carried out in such a way as to mitigate any potential flood risk, both on and off site from all sources of flooding.

The other purpose of this report is to present the surface water and foul water outline drainage strategies for the site which have been developed by the Alan Johnston Partnership. To demonstrate how the specific drainage requirements are to be met, the report should be read in conjunction with the relevant drawings and supporting information, included within the appendices.

The drainage strategies outlined within this report, have been prepared in accordance with BS EN 752:2008 (Drain and sewer systems outside buildings), Sewers for Adoption, Building Regulations Approved Document H (Drainage and waste disposal) and the Technical Guidance to the National Planning Policy Framework document (Department for Communities and Local Government, March 2012).

2.0 SITE DESCRIPTION

The existing site is situated to the south of Hulme Street and north of Chester Street, Manchester and is located at National Grid reference SJ 83814 97172. The location of the existing site is illustrated in Appendix A and the extent of the area to which the application relates is shown on the enclosed aerial photo, attached in Appendix B.

The existing site covers a total area of 1.22ha and is a brownfield site. The site currently consists of an existing highway, Newcastle Street through the centre of the site and two areas on either side of the highway, both of which consist of areas of hardstanding associated with the demolition of previous developments.

The site is bounded on all four sides by existing highways, with Hulme Street to the north, Wilmott Street to the east, Medlock Street to the west and Chester Street to the south. The site slopes from south-west to north-east with levels

sloping from approximately 35.00mAOD in the south-west corner to approximately 33.00mAOD in the north-east corner. A topographical and utility survey of the existing site is attached in Appendix C and an aerial photo is included in Appendix B to illustrate the site at the present day.

2.1 Geology

An intrusive site investigation was completed in June 2016 by Cundall and is contained within the Cundall Geotechnical and Geoenvironmental Assessment Report, 1011906.RPT.GL.004. The site investigation report indicates that the underlying strata consists of made ground to a maximum recorded depth of 3.75mbgl, which is underlain by Glaciofluvial and Glacial Till deposits comprising mainly of clayey sands and gravels and firm to stiff clays with a maximum recorded stratum thickness of 7.80m. This is then underlain by bedrock, comprising mainly of sandstone, to a maximum recorded depth of 30.00mbgl.

This is supported by the information taken from the British Geological Survey (BGS) 1:50,000 Bedrock geology maps. These show that the site has superficial deposits comprising of both Glaciofluvial Sheet Deposits and Till, Devensian deposits, with the bedrock reported to be of the Chester Formation comprising of sandstone.

The intrusive site investigation report is also supported by the Cundall Supplementary Ground Investigation Report, 1011906.RPT.GL.007, dated October 2016. This supplementary report outlines the likely extents of the buried obstructions across the site, which include numerous basements and an air raid shelter.

2.2 Hydrogeology

The Environment Agency groundwater maps show that the superficial deposits are classified as both Secondary A and Secondary undifferentiated strata. These are defined as areas with permeable layers capable of supporting water supplies at a local rather than strategic scale and areas where it has not been possible to attribute either category A or B to a rock type, respectively. In most cases this is due to the variable characteristics of the rock type.

The bedrock is classified as a Principal Aquifer, defined as an area that exhibits high permeability and/or provides a high level of water storage. These areas may also support water supply and/or river base flow on a strategic scale.

The Environment Agency groundwater maps also indicate that the majority of the development site is not situated within a groundwater Source Protection Zone (SPZ) with only the eastern edge of the site located within a Source Protection Zone III.

The Cundall Supplementary Ground Investigation Report includes groundwater strikes were recorded as shallow as 2.60mbgl but monitoring has indicated that the groundwater level is actually at around 3.92mbgl.

2.3 Hydrology

The development site is situated in the direct catchment of the River Medlock, which is located approximately 145m north of the site. The site is located is located within Flood Zone 1 which is categorized by the Environment Agency as land assessed as having less than a 1 in 1,000 annual probability of river flooding (1% – 0.1%). Therefore, the site is an area identified by the Environment Agency as at low risk of flooding from rivers and streams.

3.0 PROPOSED DEVELOPMENT

The proposed development will occupy the entire 1.22ha site and will consist of 4no. mixed-use development buildings (Blocks A – D) and associated landscaped/pedestrian courtyard areas. The buildings will consist of mainly residential units with numerous commercial and leisure units and also associated car parking.

To enable a viable scheme, the proposed site levels are constrained by the existing highways surrounding the site, therefore the site levels are likely to remain similar to the existing. The proposed site plan is attached in Appendix D.

4.0 PLANNING POLICY

The National Planning Policy Framework (NPPF) sets out the Government's policy on meeting the challenges of climate change, flooding and coastal change. The NPPF states that:

"Planning plays a key role in helping shape places to secure radical reductions in greenhouse gas emissions, minimising vulnerability and providing resilience to the impact of climate change, and supporting the delivery of renewable and low carbon energy and associated infrastructure. This is central to the economic, social and environmental dimensions of sustainable development. Local planning authorities should adopt proactive strategies to mitigate and adapt to climate change taking full account of flood risk, coastal change and water supply and demand consideration."

This Flood Risk Assessment proposes recommendations to facilitate the proposed development so that it takes into account flood risk at all stages of the development.

4.1 Sequential Test

Based on the sites location, within Flood Zone 1, the Sequential Test is not required. Therefore, the development is deemed appropriate, in Flood Zone 1 and a sequential test is not required.

4.2 Exception Test

NPPF classifies the development (Residential) as a 'More vulnerable development' but as the site is located within Flood Zone 1, the development is deemed appropriate according to NPPF and therefore the Exception Test is not required.

5.0 FORMS OF FLOODING

The Technical Guidance to the National Planning Policy Framework requires all forms of flooding to be considered.

5.1 Flooding from Rivers

The Flood Risk map is included as Appendix E.
As can be seen from the Flood Risk map, the entire site is located within Flood Zone 1 and therefore, the site is located in Flood Zone 1 with a chance of flooding of less than 0.1% (or 1 in 1000).

The nearest river is the River Medlock, which is located approximately 145m north of the site. Despite this, the risk of flooding to the new development from rivers is considered to be low.

5.2 Flooding from the Sea

The site is not at risk of flooding from the sea. The lowest level of the site is approximately 33.00mAOD, i.e. well above tidal flood levels.

5.3 Flooding from Land

Intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems can run quickly off land and result in local flooding.

The Surface Water Flooding map is included in Appendix E. It can be seen from the map that the entire site is classified as having a very low risk of surface water flooding. As such, the risk of flooding from overland flows due to surface water flooding is considered to be low.

Therefore, the risk of flooding from overland flows due to surface water flooding is considered to be low and as such the overall site is considered to be at low risk of flooding from surface water/surrounding land.

5.4 Flooding from Groundwater

The Groundwater Flooding Map contained within the Manchester City, Salford City and Trafford Councils Level 2 Hybrid Strategic Flood Risk Assessment (SFRA) Report indicates that the site is in an area which is at risk of groundwater flooding.

As outlined in Section 2.2, the Cundall Supplementary Ground Investigation Report has indicated that groundwater strikes as shallow as 2.60mbgl were encountered during the site investigation. However, subsequent groundwater monitoring has indicated that the shallowest groundwater level is 3.92mbgl, with the majority of groundwater levels being reported as between 4.00mbgl – 5.00mbgl.

As such, due to the depths of the groundwater encountered by the site investigation it is envisaged that the site has a negligible risk of groundwater flooding. Therefore, due to the depths of the groundwater encountered by the site investigation, the site is considered to be at low risk of flooding from groundwater.

5.5 Flooding from Sewers

A record of Public Sewers surrounding and serving the development site has been obtained from United Utilities and this is included in Appendix F. As can be seen from the United Utilities map, there is an existing combined water public sewer which runs south to north along Newcastle Street, through the centre of the site. There are also a number of other public combined water sewers located within the surrounding highways.

The intention for the proposed development is to 'stop up' Newcastle Street and as such it is envisaged that the existing combined water public sewer which runs along Newcastle Street will also be abandoned. However, as per the correspondence from United Utilities, also attached in Appendix F, the sewer along Newcastle Street is already abandoned. As such, the only sewers within the proposed site boundary will likely be private sewers used to drain the proposed development, which will have been suitably designed.

Therefore, due to the lack of public sewers within the proposed site, the proposed drainage networks for the site being suitably designed and the fact that the surrounding public sewers are maintained by United Utilities, leads to the conclusion that the site itself is considered to have a low risk of flooding from sewers.

5.6 Flooding from Reservoirs, Canals and Other Artificial Sources

The Reservoir Flood Risk map is included in Appendix E and the closest artificial waterbody or reservoir is Audenshaw Reservoir which is located approximately 7.5km east of the site. As such, it can be seen from the map that the site is not at risk of flooding from reservoirs, canals or other artificial sources.

Therefore, the proposed development has a low risk of flooding from reservoirs, canals and other artificial sources.

6.0 DEVELOPMENT AND DRAINAGE STRATEGY

6.1 Effect of Development on Flood Risk

As previously outlined in Section 2.0, the existing site covers an area of 1.22ha and currently consists of an existing highway, Newcastle Street through the centre of the site and two areas on either side of the highway, both of which consist of areas of hardstanding associated with the demolition of previous developments.

As the buildings on either side of the highway have been demolished for a number of years it is envisaged that any existing drainage within these areas will now be redundant. Also, as United utilities have indicated that the sewer within the existing highway, Newcastle Street is abandoned it is anticipated that the highway drainage will also be redundant.

As such, it is envisaged that only the footpath and hardstanding areas (which drain to the highways) currently have an active drainage system. This has been confirmed via the existing levels within the Topo and Utility survey which is attached in Appendix C. Therefore, only the footpath and hardstanding areas have been considered during the pre-development impermeable areas calculation.

The pre and post development impermeable areas have been assessed and are indicated on the attached drawing in Appendix G. The comparison between the pre and post development impermeable areas is also summarised below;

Total Development Site Area (ha)	Existing Impermeable Area (ha)	Proposed Impermeable Area (ha)
1.220	0.171	1.058

As can be seen from the summary table above, the introduction of the proposed buildings and associated hard-standing areas will increase the impermeable area across the site. This increase in the impervious area within the proposed site will lead to an increase in the;

- Volume of surface water ponding on the site.
- Volume of surface water runoff leaving the site or discharging into surrounding areas.
- Peak discharge rate from the site.

Accordingly, drainage systems are needed to drain the foul and surface water flows arising from the proposed development. Where possible, any existing drainage networks should be utilised. Appropriate design and construction of these systems as set out in Section 6.3 should ensure that there is no increase in offsite flood risk that would otherwise impact downstream areas.

6.2 Existing Drainage Systems

As can be seen from the United Utilities map, attached in Appendix F, there is an existing public combined water sewer which runs south to north along Newcastle Street, through the centre of the site, however subsequent correspondence from United Utilities, also attached in Appendix F, indicates that this sewer is now abandoned.

There is also an existing 660mm x 460mm public combined water sewer which runs in an easterly direction from within the site and discharges into the 560mm x 760mm public combined water sewer on Wilmott Street. There are also a number of other public combined water sewers located within the surrounding highways.

To the north of the site on Hulme Street, there is an existing manhole located at the junction of Hulme Street and Newcastle Street, UU MH 7201, into which three existing public combined sewers discharge. The first is a 600mm x 500mm combined water sewer which runs from the western end of Hulme Street into UU MH 7201. The second is also a 600mm x 500mm combined water sewer but this sewer runs from the eastern end of Hulme Street, starting just east of the junction of Hulme Street and Wilmott Street before discharging into UU MH 7201.

The third is a 610mm x 660mm public combined water sewer running north along Newcastle Street, through the centre of the site itself and this public sewer also discharges into UU MH 7201 at the junction of Hulme Street and Newcastle Street, to the north of the site.

There are also two combined water sewers on Wilmott Street, to the east of the site. The first is an existing 560mm x 760mm public combined water sewer, which runs south to north along Wilmott Street and the second is a 300mm diameter public combined water sewer, which runs north to south along Wilmott Street. There is also an existing public combined water sewer which runs in an easterly direction from within the site and discharges into the 560mm x 760mm brick public combined water sewer on Wilmott Street.

Also, there is an existing 600mm x 900mm public combined water sewer, which runs east to west along Chester Street to the south of the site and finally there are two public combined water sewers on Newcastle Street to the south of the site. The first of these sewers is a 920mm x 590mm public combined water sewer which runs north to south, away from the site along Newcastle Street and the second is a 550mm x 560mm public combined water sewer which runs south to north along Newcastle Street prior to discharging into UU MH 8102 at the southern boundary of the site.

To enable the construction of the proposed development it is envisaged that the existing 610mm x 660mm public combined water sewer which runs along Newcastle Street, through the centre of the site will need to be grouted up or grubbed up. It is also envisaged that the existing 660mm x 460mm public combined water sewer which runs in an easterly direction from within the site and discharges into the 560mm x 760mm public combined water sewer on Wilmott Street, will be abandoned. As such, a Section 116 agreement with United Utilities will be required to abandon this public sewer.

A CCTV survey of the existing public and private sewers should be undertaken to confirm the location, details, levels and condition of the public and private sewers both within and surrounding the proposed site. This will help identify if there are any existing private connections to the surrounding public sewers which can be re-used and also identify if invert levels are such to avoid the need for pumping the proposed drainage.

The surveys should also identify if the previous surveys are correct and that the existing public combined water sewer which runs through the centre of the site has been intentionally blocked up, immediately downstream of UU MH 8102 and the flow from the south diverted back into the public combined water sewer which flows in a southerly direction along Newcastle Street, away from the site.

6.3 Proposed Drainage Strategy

As outlined above in section 6.1, where required drainage systems are needed to drain the foul and surface water flows arising from the proposed development. The proposed drainage systems must ensure that there is no increase in offsite flood risk that would otherwise impact downstream areas.

6.3.1 Surface Water Drainage

The Building Regulations - Approved Document H (2002) details a hierarchy of potential methods for disposing of surface water as shown below in order of preference:

- Discharge via infiltration
- Discharge to watercourse
- Discharge to sewer

Considering the hierarchy above, the surface water network for the proposed development should infiltrate where possible. The Cundall Geotechnical and Geoenvironmental Assessment Report, 1011906.RPT.GL.004, did not undertake any BRE365 complaint infiltration tests but it has indicated that the site is underlain by large depths of made ground, up to 3.75mbgl and also a number of buried obstructions. The made ground and glaciofluvial deposits are then underlain by a substrate of firm to stiff clays.

Even though no BRE 365 compliant soakaway tests were completed as part of the intrusive site investigation, it is envisaged that infiltration is not suitable across the proposed site. This is due to the potential for inundation settlement resulting from infiltration through the large depths of made ground and buried obstructions and also due to the low permeability of firm to stiff clays.

As such, it is envisaged that infiltration is not viable across the site and therefore soakaway tests are not required. This has been confirmed via detailed discussions with United Utilities, with the correspondence attached in Appendix F.

As the large depths of made ground and underlying impermeable clay strata has ruled out the use of infiltration, the intention for the development would be to discharge to watercourse. The nearest watercourse is the River Medlock, which is located approximately 145m north of the site. However, due to the distance through developed third-party land, discharging to watercourse has been deemed impractical.

As such, the only practical solution for discharge of the surface water is discharge to public sewer. As indicated within Section 6.2, the only nearby public sewers are the combined water sewers located within the highways surrounding the proposed site. As such, it is envisaged that the surface water runoff from the proposed development will discharge to the surrounding public combined water sewers.

While every effort to utilise any suitable existing systems should be made, the drainage systems should be designed to suit the proposed site layout and topography which aims to provide an efficient design.

In line with Sewers for Adoption (6th Edition), the requirements for the design of a new surface water drainage systems are as follows:

- Below ground piped drainage to be sized to accommodate the 1 in 2 year (50% AEP) design storm without surcharge.
- System to be designed not to flood any part of the site in a 1 in 30 year (3% AEP) design storm.
- For events in exceedance of the 1 in 30 year design storm and up to and including the 1 in 100 year event, site drainage and topography should be designed where practicable to route surface water run-off away from buildings to safe above-ground storage areas on site, thereby preventing this run-off from leaving the site and increasing flood risk elsewhere.

For each design case described above, the design storm is the critical storm duration for the site conditions. In the case of the 1 in 100 year design storm, a 40% increase in the peak rainfall intensity is applied to allow for the estimated worst case impacts of climate change. This is in accordance with new advice, issued by the Environment Agency, which updates previous climate change allowances outlined in the National Planning Policy Framework.

Therefore, suitable systems of below ground drainage will be required to contain as a minimum requirement, the 1 in 30 year event. Additionally, any surface water run-off from events that exceed the design capacity of the new drainage system, up to and including the 1 in 100 year (+40%) event, will be retained on-site in safe storage areas.

As the site area consists mainly of pedestrianised areas and roof areas and there is only one car park, which is less than 800m^2 in area and has less than 50no. spaces, the risk of pollution has been deemed to be minimal and therefore in line with the requirements of Pollution Prevention Guidelines 3 (PPG3), no measures to prevent oil and other contaminants being passed forward to the existing combined water sewer are required.

In line with common practice, it is proposed the surface water discharge from the proposed development should mimic that from the existing site.

It is envisaged that a minimum 50% betterment on the existing surface water brownfield runoff rate is to be applied, in line with Section 3.4.1 of the Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA User Guide.

Therefore, an assessment of the existing surface water run-off from the brownfield site has been completed using a simple three pipe network modelled in Micro Drainage. For the existing 1.22ha site, using an existing impermeable area of 0.171ha, an existing 2-year return period brownfield discharge rate of 26.7 L/s was generated. The brownfield runoff assessment is attached in Appendix H.

As such, applying a 50% reduction to comply with the Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA User Guide, the maximum surface water discharge rate for the entire site is **13.4 L/s**.

Manchester City Council (Lead Local Flood Authority) and United Utilities have been contacted regarding the maximum surface water discharge rate from the proposed development and the proposed discharge locations. To date no response has been received from the LLFA but United Utilities have indicated their acceptance of the proposed discharge rate via the correspondence attached in Appendix F. Detailed discussions must be undertaken with the LLFA to confirm their acceptance of the proposed drainage strategy.

Due to the size of the proposed development and the separate blocks, it is envisaged that the proposed development will have separate surface water networks. Blocks A and B will be served by one surface water network and Blocks C and D will be served by another separate network. As such, the total proposed discharge rate of 13.4 L/s will be split between the two networks, with Blocks A & B having a maximum discharge rate of 8.4 L/s and Blocks C & D a maximum discharge rate of 5.0 L/s. This is summarised in the below table.

Site Area	Post-Development Impermeable Area (ha)	Proposed Maximum Discharge Rate (L/s)
Blocks A & B	0.565	8.4
Blocks C & D	0.493	5.0

As can be seen from the Drainage Strategy Drawing, attached in Appendix I, the surface water runoff from the proposed Blocks A and B area, will be collected and conveyed to the east of the proposed Block A & B buildings. Here it will be restricted to the maximum discharge rate of 8.4 L/s via a vortex flow control device, prior to it combining with the proposed foul water runoff from Blocks A and B.

The combined discharge will then discharge into a new combined water manhole which is to be constructed on the line of the existing 660mm x 460mm public combined water sewer which runs from within the site and discharges into the 560mm x 760mm public combined water sewer on Wilmott Street. The existing 660mm x 460mm public combined water sewer which runs from within the site is to be abandoned upstream of the new combined manhole.

As the surface water discharge is to be restricted, the surface water runoff will surcharge the proposed drainage network. Therefore, attenuation storage will be provided in the form of a 300mm deep granular drainage blanket below the proposed areas of permeable paving and also below ground cellular attenuation tanks to supplement the required storage.

The depth of the granular drainage blanket cannot be increased to accommodate all of the attenuation storage due the potential impact or potential clashes with the existing gas main running through the centre of the site. Due to the lack of available open space in the Blocks A and B area, below ground cellular attenuation tanks are the best option to supplement the required storage. Due to the construction sequencing of Blocks A & B, two separate cellular attenuation tanks are required.

The surface water runoff from the proposed Block C & D areas, will be collected and conveyed to the east of the proposed Block C building. Here it will be restricted to the maximum discharge rate of 5.0 L/s via a vortex flow control device, prior to it combining with the proposed foul water runoff from Blocks C & D.

The combined runoff from the Blocks C & D areas will then discharge into the existing United Utilities Manhole UU MH 8102 which discharges along the existing 920mm x 590mm public combined water sewer running north to south along Newcastle Street, away from the site.

Again, as the surface water discharge is to be restricted, the surface water runoff will surcharge the proposed drainage network. Therefore, attenuation storage will be provided in the form of below ground cellular attenuation tanks. Due to the depth of the surface water drainage from the undercroft area in Block D and the lack of available public open space, the below ground cellular attenuation tanks are to be located under public open space between the two buildings and these will be used to store the surcharged runoff. Due to the construction sequencing of Blocks C & D, two separate cellular attenuation tanks are required.

The proposed attenuation storage should prevent any flooding for all rainfall events up to and including the 1 in 100 year + 40% climate change event.

The proposed maximum discharge rates and discharge locations should be confirmed via more detailed discussions with United Utilities and the Lead Local Flood Authority (Manchester City Council) prior to the commencement of any works.

As outlined below, all SuDS techniques have been considered and comments made on their suitability for this proposed development;

SuDS Technique	Suitable?	Reasoning
Green Roof	✓	Suitable and incorporated, where possible.
Rainwater Harvesting	×	Impractical due to minimal roof area available and high-rise buildings.
Basins, Ponds or Swales	×	Suitable and incorporated, where possible.
Filter Strips	×	Unsuitable due to impermeable strata.
Infiltration Techniques	×	Unsuitable due to impermeable strata.
Permeable Surfaces	✓	Suitable and incorporated where possible but non-infiltration techniques to be used.
Tank / Oversized Pipe Systems	✓	Suitable and incorporated.

As can be seen from the Drainage Strategy Drawing, attached in Appendix I, where possible SuDS solutions have been incorporated throughout the site. Where feasible these will include; green roofs, non-infiltration permeable paving and also below ground cellular attenuation tanks.

The surface water drainage calculations have also been included within Appendix I and as can be seen the proposed surface water drainage and attenuation storage prevents any flooding for all rainfall events up to and including the 1 in 100 year + 40% climate change event and also meets the maximum discharge restrictions of 8.4 L/s and 5.0 L/s.

As can be seen from the surface water drainage calculations attached in Appendix I, the green roof areas and permeable paving have been modelled within the system.

The surface water drainage strategy and SuDS solutions outlined above are all subject to detailed drainage design and LLFA and United Utilities approvals. It is also subject to change, dependent upon the final site layout and levels. The surface water drainage proposals and discharge rates should be confirmed via detailed discussions with the Lead Local Flood Authority and United Utilities prior to the commencement of any works.

6.3.2 Foul Water Drainage

Foul water drainage disposal is set out in Part H of the Building Regulations in order of priority the preferred methods are;

1. Public sewer
2. Septic tank
3. Cesspool.

The foul water system shall be designed in accordance with;

- BS EN 752:2008 (Drain and sewer systems outside buildings)
- Sewers for Adoption (6th Edition)
- Technical Guidance to the National Planning Policy Framework document (Department for Communities and Local Government, March 2012).
- BS EN 12056-2:2000 (Drainage systems inside buildings)
- Building Regulations Approved Document H, Drainage and waste disposal. (Office of the Deputy Prime Minister, December 2010).

As seen in the Drainage Strategy Drawing, attached in Appendix I, it is anticipated that the proposed foul water drainage will mimic the proposed surface water drainage and will therefore also have separate foul water networks. It is anticipated that Blocks A and B will be served by the same foul water network, while Blocks C and D will be served by their own separate networks.

It is anticipated that the foul water runoff from Blocks A and B, will be collected and conveyed to the east of the proposed Block A & B buildings. Here it will combine with the restricted surface water runoff from the Blocks A and B area. The combined discharge will then discharge into a new combined water manhole which is to be constructed on the line of the existing 660mm x 460mm public combined water sewer which runs from within the site and discharges into the 560mm x 760mm public combined water sewer on Wilmott Street.

The foul water runoff from the proposed Blocks C & D, will be collected and conveyed to the east of the proposed Block C building. Here it will combine with the restricted surface water runoff from the Blocks C & D areas, prior to discharging into the existing United Utilities Manhole UU MH 8102 which discharges along the existing 920mm x 590mm public combined water sewer, running north to south along Newcastle Street, away from the site.

It is anticipated that the foul water from all areas will discharge at an unrestricted rate into the surrounding public combined water sewers.

As with the surface water drainage strategy, the foul water drainage strategy outlined above is subject to change and is dependent upon detailed drainage design and LLFA and United Utilities approvals, in addition to the finalised site layout and levels.

The foul water drainage strategy and unrestricted discharge rates should also be confirmed via detailed discussions with the Lead Local Flood Authority and United Utilities prior to the commencement of any works.

7.0 FUTURE MANAGEMENT & MAINTENANCE

The proposed drainage solution uses SUDS techniques in accordance with the CIRIA SUDS Manual C753. The surface water run-off from the proposed development is restricted using a vortex flow control device and the attenuated run-off is stored using a granular drainage blanket below the area of permeable paving and also cellular attenuation tanks.

It is envisaged that the following components have been or will be included within the drainage strategy for the proposed development:

- Inspection chambers, manholes and catchpits.
- Pipes.
- Drainage channels and gullies.
- Vortex flow control device.
- Cellular attenuation tanks.
- Green roofs.
- Permeable paving.

A suitable maintenance strategy should be adopted to ensure the drainage network is cleaned regularly and the routine maintenance and cleansing regime should be documented. It is assumed that the proposed drainage will remain private and therefore maintenance of the surface and foul water drainage systems will be the responsibility of an on-site facilities management team or the end user.

As such, the maintenance of the specified SuDS should be included within the developments Operation and Maintenance Manual and should be detailed in accordance with the CIRIA SuDS Manual C753, as per the operation and maintenance guidance outlined below.

7.1 General Maintenance & Inspection Requirements

- No work shall be carried out on the drainage system without permission from a nominated person, who has access to information/a working knowledge of the system.
- Maintenance/inspection work shall be carried out in a safe/planned manner.
- All work is to be carried out by competent persons suitably trained and equipped in accordance with current statutory safe working policies.
- Entry into confined spaces shall be kept to a minimum and be restricted to suitably qualified/equipped persons working in accordance with current statutory safe working policies.
- Drainage systems shall be inspected on a regular basis or should any problems be suspected. Any debris/defects discovered shall be recorded and a programme of cleaning/ repair initiated. Urgent repairs/cleaning shall be actioned as soon as practicable.
- It is recommended that the drainage system is inspected as a minimum twice a year, with the system also being inspected after any major storm event.
- Clearing of the drainage system can be achieved by a number of methods depending on the nature of the work;
    - Rodding – Manual/Mechanical with flexible rods.
    - Jetting – High pressure water jetting.
    - Plunging.

7.2 Inspection Chambers, Manholes and Catchpits

The appropriate health and safety equipment must be used when accessing manholes/catchpits. Confined space certificates must be held by any personnel entering a manhole and the appropriate permits should be obtained from the Maintenance Manager prior to any access. The following operations should be carried out annually.

- Covers of inspection chambers and manholes shall be removed and the sides, benchings and channels cleared.
- Accumulated deposits of silt in inspection chambers, catchpits and manholes shall be removed. Any traps shall then be plunged and thoroughly flushed out with clean water. This should be completed in Autumn, after leaf fall.
- Main and branch drains shall be cleared as required and afterwards be flushed with clean water. Any obstructions found shall be removed and not flushed down the system.
- Covers of inspection chambers, manholes and catchpits shall be replaced, bedded in suitable grease or other sealing material as required and bolted/locked down as appropriate. Missing bolts and broken items shall be replaced in accordance with the manufacturer's details.

7.3 Pipes

Regular inspection and maintenance is important to identify areas which may have become obstructed/clogged and may not be draining correctly, as failure to do so would expose the development to a greater level of flood risk.

Pipes are proprietary products and therefore the materials used can vary across the site. As such, where used the manufacturer's recommendations should be followed. Access for maintenance of the pipes is provided through inspection chambers and manholes. The below table sets out the maintenace schedule for the pipe components of the proposed drianage systems.

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect for evidence of poor operation via water levels. If required take remedial action.	Monthly for 3 months, then six-monthly intervals. Also, 48 hours after large storms.
	Check and remove large debris and/or vegetation growth near pipe runs.	Monthly or as required.
Remedial Actions	Rod through poorly performing runs as initial remediation.	As required.
	If continued poor performance jet and CCTV survey poorly performing runs.	As required.
	Seek advice as to remediation techniques suitable for the type of performance issue.	As required, if above actions do not improve performance.
Monitoring	Initial Inspection should be provided as post construction CCTV survey.	N/A
	Inspect/check all inlets, outlets and overflows to ensure they are in good condition and operating as designed.	Monthly for 3 months, then six-monthly intervals. Also, 48 hours after large storms.

7.4 Drainage Channels and Gullies

Channels and gullies should be inspected and cleaned in accordance with the manufacturer's details. Channel units can be cleaned through the use of a high-pressure hose; this can be fed into the channel system through access units strategically placed along the channel run. The throat section of channel units should be kept clear at all times to ensure uninterrupted flow of surface water into the drainage channel and any debris within the throat should be removed.

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 covers are allowed to move within their frame, this may cause damage to the frame or seating. The below stable sets out the maintenace schedule for the drainage channel and gullies components of the proposed drianage systems.

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Litter and debris removal.	Monthly or as required.
	Check and remove large debris and/or vegetation growth near pipe runs.	Monthly or as required.
	Inspect for evidence of poor operation and/or weed growth. If required take remedial action. Inspect silt accumulation rates and establish appropriate brushing frequencies.	Monthly for 3 months, then six-monthly intervals. Also, 48 hours after large storms.
Remedial Actions	Inspect access/outlet boxes and rod through poorly performing channels and outlets as initial remediation.	As required.
	Seek advice as to remediation techniques suitable for the type of performance issue.	As required, if above actions do not improve performance.
Monitoring	Initial Inspection including channel outlet boxes and gully sumps.	Monthly for 3 months, then six-monthly intervals. Also, 48 hours after large storms.

7.5 Vortex Flow Control Devices

Regular inspection and maintenance is important to identify if the vortex flow control device has become obstructed/clogged and may not be functioning correctly, as failure to do so would expose the development to a greater level of flood risk.

Vortex flow control devices are proprietary products and therefore can vary from manufacturer to manufacturer. As such, where used the manufacturer's recommendations should be followed.

- Normally, little maintenance is required as there are generally a vortex flow control device has no moving parts.
- If blockages occur they tend to do so at the intake of the vortex flow control device.
- Vortex flow control devices are generally fitted with a pivoting by-pass door, which allows the manhole chamber to be drained down should blockages occur.
- The smaller type conical units, below the minimum recommended size, are also supplied with roding facilities or vortex suppressor pipes as standard.
- Following installation of the vortex flow control device 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, it is recommended that each unit be inspected monthly for three months and thereafter at six monthly intervals with hose down if required. Units should also be inspected within 48 hours after large storms.

7.6 Cellular Attenuation Tanks

Regular inspection and maintenance is important to identify if the inlets/outlets have become obstructed/clogged and may not be functioning correctly, as failure to do so would expose the development to a greater level of flood risk. The maintenance requirements for cellular attenuation tanks are outlined within Table 21.3 of the CIRIA SUDS Manual C753. An extract of that table is given below to set out the maintenace schedule for the cellular attenuation tank component of the proposed drianage systems.

TABLE 21.3 Operation and maintenance requirements for attenuation storage tanks

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	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
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

7.7 Green Roofs

Regular inspection and maintenance is important to identify if the inlets/outlets have become obstructed/clogged and may not be functioning correctly, as failure to do so would expose the development to a greater level of flood risk. The maintenance requirements for green roofs are outlined within Table 12.5 of the CIRIA SUDS Manual C753. An extract of that table is given below to set out the maintenace schedule for the green roof components of the proposed drianage systems.

TABLE 12.5 Operation and maintenance requirements for green roofs

Maintenance schedule	Required action	Typical frequency
Regular inspections	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes and roof structure for proper operation, integrity of waterproofing and structural stability	Annually and after severe storms
	Inspect soil substrate for evidence of erosion channels and identify any sediment sources	Annually and after severe storms
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Annually and after severe storms
	Inspect underside of roof for evidence of leakage	Annually and after severe storms
Regular maintenance	Remove debris and litter to prevent clogging of inlet drains and interference with plant growth	Six monthly and annually or as required
	During establishment (ie year one), replace dead plants as required	Monthly (but usually responsibility of manufacturer)
	Post establishment, replace dead plants as required (where > 5% of coverage)	Annually (in autumn)
	Remove fallen leaves and debris from deciduous plant foliage	Six monthly or as required
	Remove nuisance and invasive vegetation, including weeds	Six monthly or as required
	Mow grasses, prune shrubs and manage other planting (if appropriate) as required – clippings should be removed and not allowed to accumulate	Six monthly or as required
Remedial actions	If erosion channels are evident, these should be stabilised with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled	As required
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required

7.8 Permeable Paving

Regular inspection and maintenance is important to identify areas which may have become obstructed/clogged and may not be draining correctly, as failure to do so would expose the development to a greater level of flood risk.

Permeable paving is aproprietary product and therefore the materials used can vary. As such, where used the manufacturer's recommendations should be followed. The maintenance requirements for permebale paving are outlined within Table 20.15 of the CIRIA SUDS Manual C753. An extract of that table is given below to set out the maintenace schedule for the permebale paving component of the proposed drianage systems.

TABLE 20.15 Operation and maintenance requirements for pervious pavements

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
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

It should be noted that the Main Contractor should provide a Verification Report, including photographic evidence, to demonstrate that the drainage has been constructed as per the design drawings. As-built drawings should as be supplied by the Main Contractor, where the construction of the drainage varies from the design construction status drawings.

8.0 CONCLUSIONS

- The site is located within Flood Zone 1 and therefore is classified as having a low probability of flooding from rivers or sea. The site is also at a low risk of flooding from surface water flows and all other sources.

- An intrusive site investigation has been completed but this does not include BRE365 compliant infiltration tests. However, the site investigation has indicated that the site is underlain by large depths of made ground and buried obstructions and also firm to stiff clays. Therefore, due to the potential for inundations settlement of the made ground and buried obstructions and also the likely low permeability of the clay stratum, infiltration is not considered to be viable across the site and therefore these tests are not required. United Utilities have confirmed their acceptance of this but it should be confirmed via discussions with the LLFA.

- The nearest watercourse is the River Medlock, which is located approximately 145m north of the site. However, due to the distance through developed third-party land, discharging to watercourse has been deemed impractical. Therefore, the only practical solution for the discharge of the surface water is discharge to public sewer.

- There are no public surface water sewers within close vicinity of the site and as such the only viable option for the disposal of the surface water runoff from the proposed development is to the surrounding public combined water sewers.

- It is envisaged that a minimum 50% betterment on the existing surface water brownfield runoff rate is to be applied, in line with Section 3.4.1 of the Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA User Guide.

- Therefore, an assessment of the existing surface water run-off from the brownfield site has been completed using a simple three pipe network modelled in Micro Drainage. For the existing 1.22ha site, using an existing impermeable area of 0.171ha, an existing 2-year return period brownfield discharge rate of 26.7 L/s was generated.

- As such, applying a 50% reduction to offer improvement and comply with the Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA User Guide, the maximum surface water discharge rate for the site as a whole is 13.4 L/s.

- Blocks A and B will be served by the same surface water network, while Blocks C and D will be served by another separate network. As such, the total proposed discharge rate of 13.4 L/s will be split between the two networks, with Blocks A & B having a maximum discharge rate of 8.4 L/s and Blocks C & D a maximum discharge rate of 5.0 L/s, for all rainfall events up to and including the 1 in 100 year +40% climate change event.

- The surface water runoff from the Blocks A and B area, will be collected and conveyed to the east of the proposed Block A & B buildings. Here it will be restricted to the maximum discharge rate of 8.4 L/s via a vortex flow control device, prior to it combining with the proposed foul water runoff from Blocks A and B. This will then discharge into a new combined water manhole which is to be constructed on the line of the existing 660mm x 460mm public combined water sewer which runs from within the site and discharges into the 560mm x 760mm public combined water sewer on Wilmott Street.

- As the surface water discharge is to be restricted, the surface water runoff will surcharge the proposed drainage network. Therefore, attenuation storage will be provided in the form of a granular drainage blanket below the areas of permeable paving and also below ground cellular attenuation tanks. Due to the lack of available open space in the Blocks A and B area, below ground cellular attenuation tanks are the best option to supplement the required storage. Due to the construction sequencing of Blocks A & B, two separate cellular attenuation tanks are required..

- The surface water runoff from the proposed Block C & D areas, will be collected and conveyed to the east of the proposed Block C building. Here it will be restricted to the maximum discharge rate of 5.0 L/s via a vortex flow control device, prior to it combining with the proposed foul water runoff from Blocks C & D. This will then discharge into the existing United Utilities Manhole UU MH 8102 which discharges along the existing 920mm x 590mm public combined water sewer running north to south along Newcastle Street, away from the site.

- Again, as the surface water discharge is to be restricted, the surface water runoff will surcharge the proposed drainage network. Therefore, attenuation storage will be provided in the form of below ground cellular attenuation tanks, located under public open space between the two buildings. Due to the construction sequencing of Blocks C & D, two separate cellular attenuation tanks are required.

- The surface water calculations indicate that with the proposed green roof areas, areas of permeable paving and the below ground cellular attenuation tanks, the proposed surface water drainage network prevents any flooding for all rainfall events up to and including the 1 in 100 year + 40% climate change event.

- The proposed surface water drainage strategy, where possible, has incorporated SuDS solutions throughout the site. The proposed surface water drainage strategy for the site currently includes; green roofs, non-infiltration permeable paving and also below ground cellular attenuation tanks.

- It is anticipated that the foul water from all areas will combine with the restricted surface water runoff from each Block and discharge at an unrestricted rate into the surrounding public combined water sewers.

- Manchester City Council (Lead Local Flood Authority) and United Utilities have been contacted regarding the maximum surface water discharge rates from the proposed development and also the overall drainage strategies. To date no response has been received from the LLFA but United Utilities have indicated their acceptance of the proposed discharge rate. Detailed discussions must be undertaken with the LLFA to confirm their acceptance of the proposed drainage strategy.

- The surface water drainage strategy is subject to detailed drainage design and LLFA and United Utilities approvals. It is also subject to change, dependent upon the finalised site layout and levels. The surface water drainage proposals and discharge rates should be confirmed via detailed discussions with the Lead Local Flood Authority and United Utilities prior to the commencement of any works.

- The foul water drainage strategy is also subject to detailed drainage design and LLFA and United Utilities approvals. It is also subject to change, dependent upon the finalised site layout and levels. The foul water drainage proposals and unrestricted discharge rates should be confirmed via detailed discussions with the Lead Local Flood Authority and United Utilities prior to the commencement of any works.

9.0 RECOMMENDATIONS

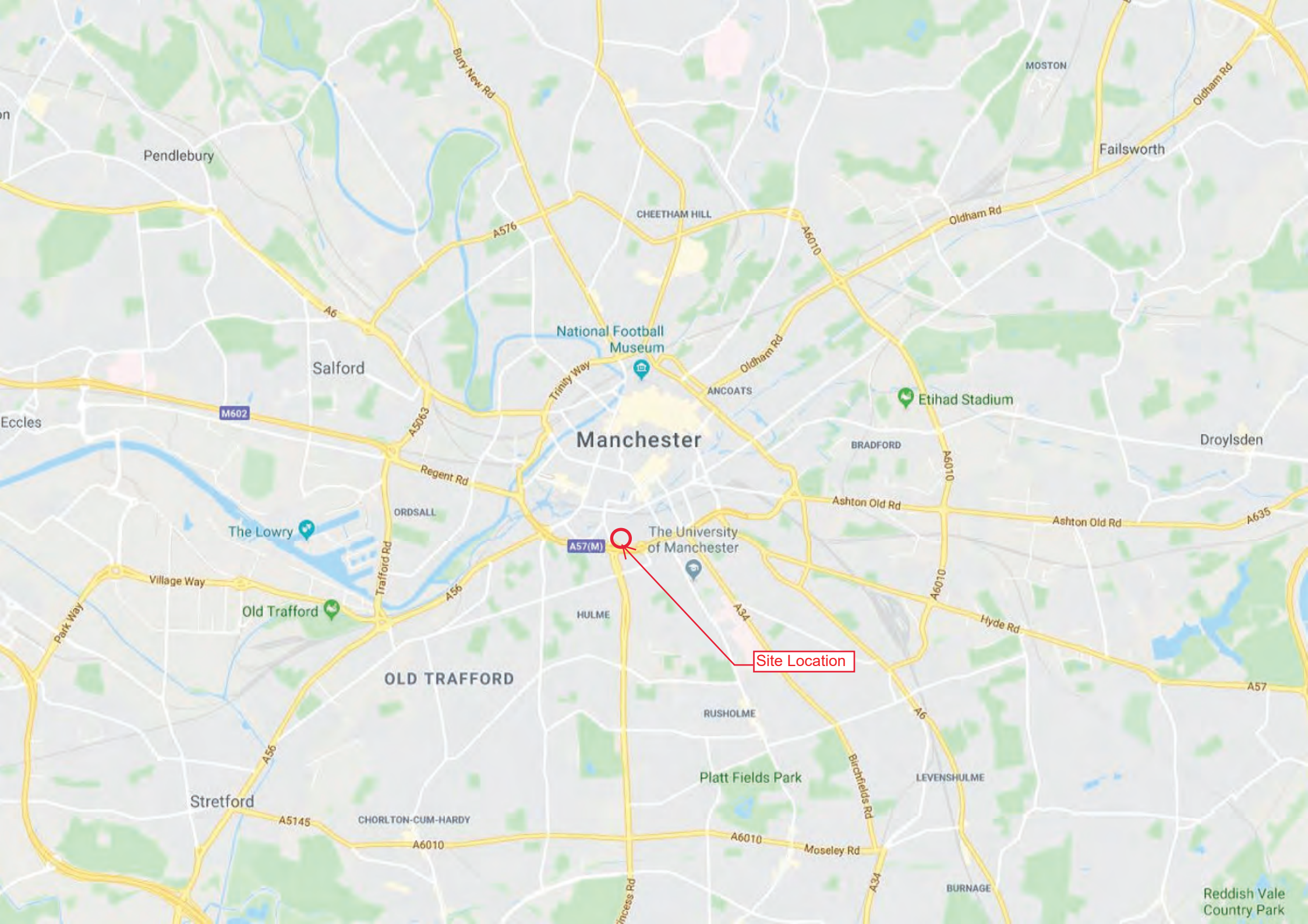
- A CCTV survey of the existing public and private sewers should be undertaken to confirm the location, details, levels and condition of the public and private sewers both within and surrounding the proposed site. This will help identify if there are any existing private connections to the surrounding public sewers which can be re-used and also identify if invert levels are such to avoid the need for pumping the proposed drainage.

- The surveys should also identify if the previous surveys are correct and that the existing public combined water sewer which runs through the centre of the site has been intentionally blocked up, immediately downstream of UU MH 8102 and the flow from the south diverted back into the public combined water sewer which flows in a southerly direction along Newcastle Street, away from the site.

- It is envisaged that the existing public combined water sewer which runs in an easterly direction from within the site and discharges into the 560mm x 760mm brick public combined water sewer on Wilmott Street will need to be abandoned/partially abandoned. As such, a Section 116 agreement with United Utilities will be required to abandon these public sewers.

- Detailed discussions with Lead Local Flood Authority and United Utilities should be completed to ensure agreement of the surface water and foul water drainage strategies, the proposed discharge rates and the overall approach.

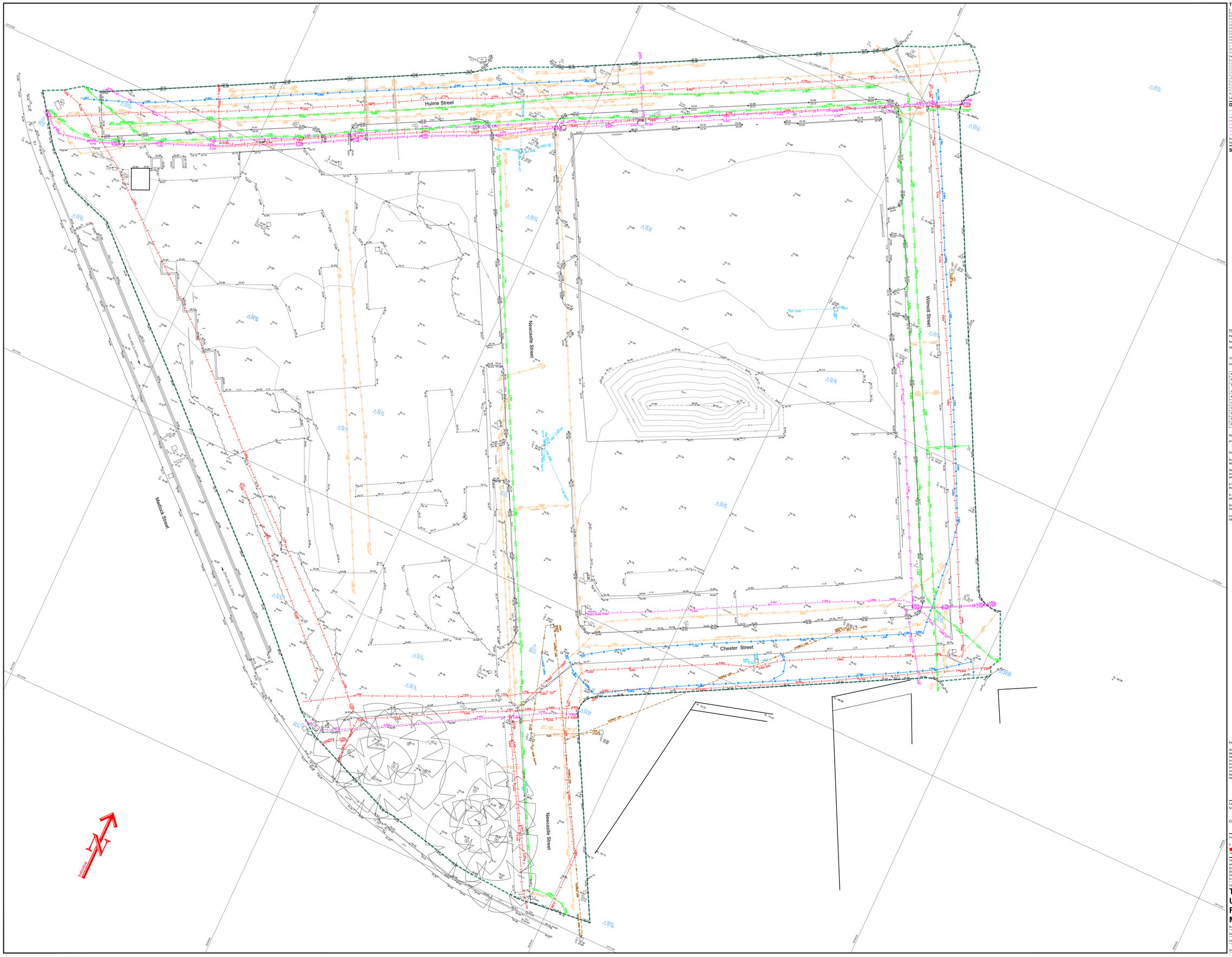
Appendix A Site Location Plan



Site Location
Manchester
Pendlebury
Salford
Eccles
Failsworth
MOSTON
CHEETHAM HILL
National Football Museum
ANCOATS
Etihad Stadium
BRADFORD
Droylsden
ORDSALL
The Lowry
The University of Manchester
Old Trafford
HULME
OLD TRAFFORD
RUSHOLME
Platt Fields Park
LEVENSHULME
Stretford
CHORLTON-CUM-HARDY
BURNAGE
Reddish Vale Country Park
Bury New Rd
Oldham Rd
A576
A6010
A6
Trinity Way
M602
A5063
Regent Rd
Ashton Old Rd
A635
A57(M)
Trafford Rd
Village Way
Park Way
A56
A34
Hyde Rd
A57
Birchfields Rd
A5145
Moseley Rd

Appendix B Aerial Photo

Appendix C Topographic & Utility Survey



Topographical Survey Legend

B Bollard
BS Bus stop
BT British telecom u
CPS Car parking stalls
CTV Cable television cover
DP Downpipe
DR Drain
Elec Electrical u
EM Elec meter
ER Earth rod
FP Flagpole
FT Floodlight
G Gully
GP Guard post
GV Gas valve
H Height
Hyd Hydrant
IC Inspection cover
KO Kerb outlet
KO Kerb outlet
LB Letter box
LP Lamp post
Utr Utility marker
M Manhole
NP Name plate
P Post
PM Parking meter
RS Rodding eye
RS Road sign
rwp Rain water pipe
SP Soil pipe
ST Stop tap
Stay Cable stay
TC Telephone cabinet
TCB Telephone call box
TL Traffic light
TP Telegraph pole
TPS Tactile paving slabs
VM Vent meter
WM Water meter
WO Water outlet
UTL Unable to lift

Level prefix descriptions
AL Arch level
BL Bed level
CL Cill level
EL Eaves level
FL Floor level
IL Invert level
PL Parapet level
SL Soffit level
SpL Soffit level
Spr Arch springing level
TF Top of fence level
TW Top of wall level
WL Water level
WL Water level

Fence annotation
B/B Barbed wire
C/B Closed boarded
C/I Corrugated iron
C/L Chain link
M/P Metal panel
H/R Hand rail
I/R Iron railings
O/B Open boarded
P/C Post & chain
P/R Post & rail
P/W Post & wire
W/M Wire mesh

Fence
Safety barrier
Gate
Stile
Hedge
Limit of foliage & tree canopy

Spot level
SSL1 50.00
Survey control station (Coordinated point)
Tree
MT Multi trunk

Levels defining edge of carriageway are observed at channel (bottom of kerb). Unless otherwise stated.

Drainage/Services Legend

Foul
Surface
Combined
Drainage (unspecified)
BT British telecom
T Telecom
FO Fibre optics
CATV
CCTV CCTV
E Electric
SL Street lighting
TM Traffic management
GAS Gas
W Water
F Fuel
Unknown / misc
Ducting
d Service depth (m)
ø Pipe diameter (mm)
EOT End of trace
UTT Unable to trace
Utility Survey Boundary

Drainage pipe size data has been determined from the surface, in order to comply with confined spaces health and safety legislation. Please regard this data as approximate.

Survey Station Coordinates

STN	EASTING	NORTHING	LEVEL
JS01	383798.78	397112.93	34.52
JS02	383727.05	397175.47	34.53
JS03	383715.43	397188.33	34.31
JS04	383784.81	397229.75	33.15
JS05	383884.74	397272.28	32.64
JS4A	383726.55	397196.24	33.54
JS4B	383844.46	397255.74	32.84
JS4C	383868.11	397218.38	33.70
RL01	383811.19	397131.64	34.70
S2A1	383761.34	397172.35	34.36
SE01	383829.11	397141.66	34.67
SE02	383812.75	397164.06	34.60
SE03	383797.47	397207.70	33.74
SE1A	383812.20	397126.52	34.75
SE1B	383889.58	397175.49	34.44
SE2A	383787.62	397166.65	34.14
SE3A	383815.96	397214.32	33.81
SSL01	383903.21	397171.06	34.51
SE3B	383855.42	397203.90	34.77
SSL2	383859.54	397253.33	32.96
RL02	383783.22	397161.58	34.13
NB01	383859.72	397103.81	34.88
S1A1	383785.11	397130.94	34.81
SE2B	383847.26	397176.81	34.74
S21A	383761.34	397172.36	34.36
RC04	383841.03	397135.01	34.81
SSL1	383903.21	397171.06	34.53

PAS128 Quality Levels

Please refer to PAS128:2014 Table 1 - "Quality level of survey outputs (normative)"

for in anticipated accuracy of quality levels.

All utilities are located to PAS128 QL-B2 unless otherwise stated.

The following table identifies the PAS128 quality level based on the text notes shown on the drawing:

Annotation found on drawing	PAS128 Quality Level
Added from records	PAS128 QL-D
Trench scar, street furniture, visual note/reference to utility	PAS128 QL-C
Assumed route	PAS128 QL-B4
Unable to obtain depth	PAS128 QL-B3
QL-B1	PAS128 QL-B1
QL-B3P	PAS128 QL-B3P
QL-B2P	PAS128 QL-B2P
QL-B1P	PAS128 QL-B1P

Quality levels ending with a "P" refer to a utility that has been located with post processed Ground Penetrating Radar (GPR).

Drawing caveats, please note:

Survey Systems Ltd carry out surveys in accordance with site procedures using approved detectors.

Depth data is limited by the accuracy of the detection equipment. Average accuracy is +/- 10% of depth with GPR and +/- 5% of the depth with electromagnetic technologies.

It is SSL's procedure to use statutory undertakers plans prior to and during the survey as a guide for the survey team.

In accordance with British Telecom's national policy survey companies are not permitted to raise BT inspection chamber covers.

Drainage routes between manholes, if not able to be traced by Locate's survey methodologies, are assumed to be direct lines between manholes.

Locate advise that excavations in the vicinity of services are carried out with due diligence, please refer to HSG47.

Please note:

Any discrepancy found between an Ordnance Survey benchmark and an OSGB15 computed orthometric height is likely to be due to bench mark displacement. If an OS benchmark where a GPS survey has been carefully carried out, the orthometric height given by OSGB15 should be considered correct in preference to archive benchmark heights. OSGB15 converts GPS ellipsoid heights to orthometric heights above mean sea level.

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Levels are related to **OSGB15**
Value **n/a**

Coordinates are related to **National Grid** (GPS)

Scale **1:200**
0 2 4 6 8 10 12 14 16 18
metres

The accuracy of this survey is commensurate with the drawing scale specified within the title block.
Copyright in this drawing remains with Survey Systems Ltd.
Do not scale from this drawing, work to figured dimensions.
Check all dimensions on-site.
In the event of any discrepancy, please refer query to Survey Systems Ltd.

Title
Topographical & Utility Survey
First Street South
Manchester M15 6HF

Surveyed SE JS AD DB RL NB CM Drawn AG
Date October 2019 Checked MT
File name 19700 Revision No. Sheet size A0
Drawing No. **SSL:19700:200:1:1**

SURVEYsystems

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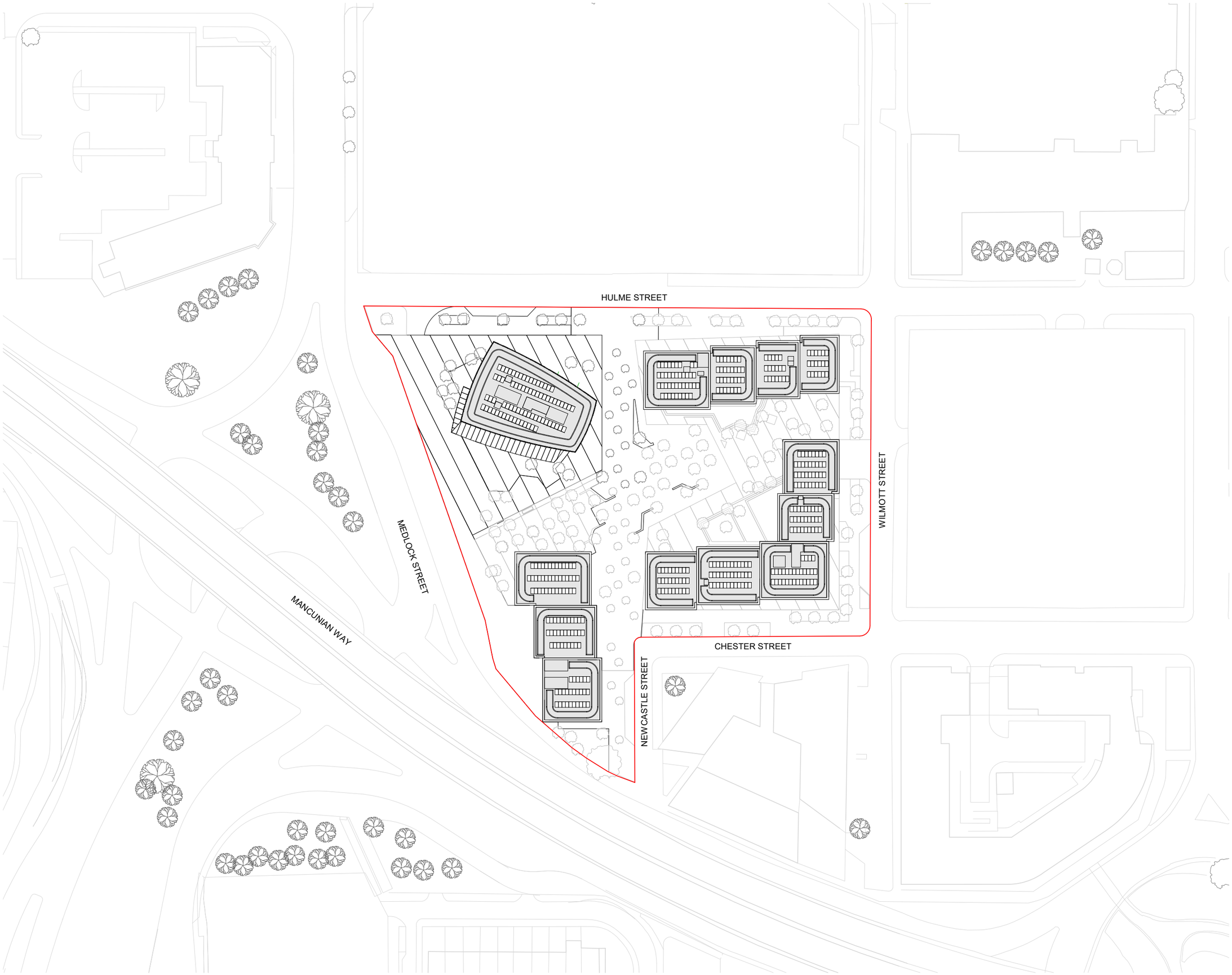
Appendix D Proposed Site Plan



This drawing is copyright
Do not scale off dimensions.
All dimensions to be checked on site by contractor.
Contractor to report any dimensional discrepancies, errors or omissions prior to commencing on site.

NOTE:
DO NOT SCALE OFF DRAWING REFER TO INDICATED DIMENSIONS ONLY.

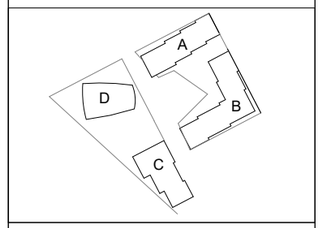
DRAWING TO BE READ IN CONJUNCTION WITH SHP SPECIFICATION.

INDICATIVE DETAILS TO ILLUSTRATE VISUAL INTENT ONLY. ALL TO CONTRACTORS DESIGN.

ALL DETAILS TO BE COORDINATED WITH ADJACENT TRADES AND SE AND M+E ENGINEER DETAILS.

THE CONTRACTOR IS RESPONSIBLE FOR MEETING THE SPECIFIED PERFORMANCE CRITERIA.

EXTERNAL WALL THICKNESS INDICATIVE ONLY AND SUBJECT TO DETAIL DESIGN



North

Rev	Date	Description
-	28-06-2019	FIRST ISSUE
P01	31-07-2019	DESIGN DEVELOPMENT
P02	23-08-2019	DESIGN DEVELOPMENT
P03	11-09-2019	DESIGN DEVELOPMENT
P04	20-09-2019	DESIGN DEVELOPMENT
P05	24-09-2019	DESIGN DEVELOPMENT
P06	30-09-2019	BUILDING A/B/C DESIGN UPDATED
P07	21-10-2019	DESIGN DEVELOPMENT
P08	01-11-2019	DESIGN DEVELOPMENT
P09	04-11-2019	DESIGN DEVELOPMENT
P10	10-01-2020	DESIGN DEVELOPMENT

Project Title
10266
Plot 11, First Street South
Manchester

Drawing Title
General Arrangement
Site Wide
Roof Level

Status
PRELIMINARY

Job No
10266

Scale
1 : 1000@A3

SHP Drawing Code
10266- Z0- A - G200- PL -RF-001
Project Zone Role Uniclass 1.4 Type Location Series

Revision
P10

simpsonhaugh

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Appendix E Flood Risk Maps

Basic view Detailed view

Location Enter a place or postcode in England

Flood risk from rivers or the sea

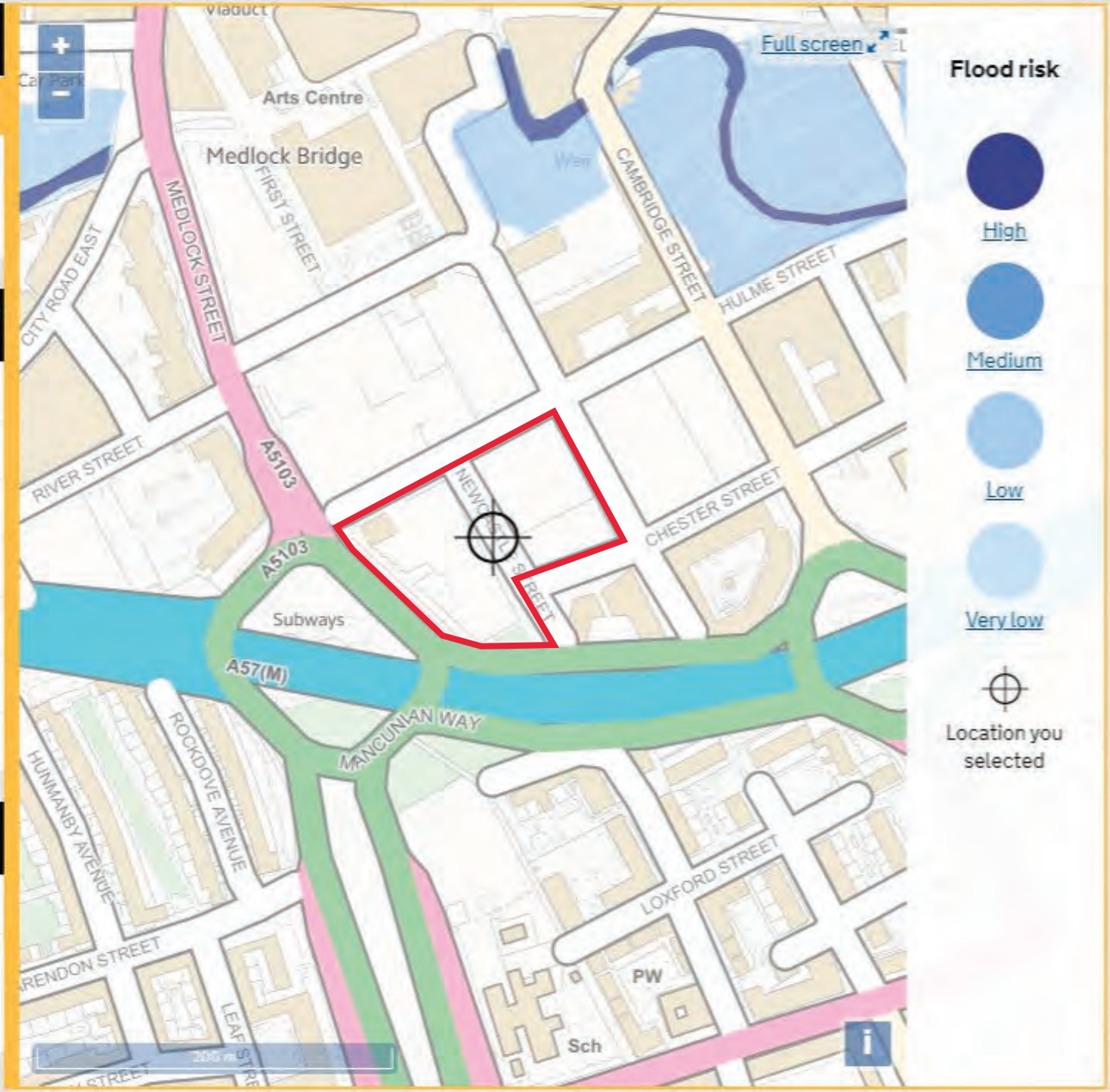
- Extent of flooding
- Depth and flow estimates at monitoring stations

Flood risk from surface water

- Extent of flooding
- High risk: depth
- High risk: velocity
- Medium risk: depth
- Medium risk: velocity
- Low risk: depth
- Low risk: velocity

Flood risk from reservoirs

- Extent of flooding
- Flood depth
- Flood speed



Basic view Detailed view

Location Enter a place or postcode in England

Flood risk from rivers or the sea

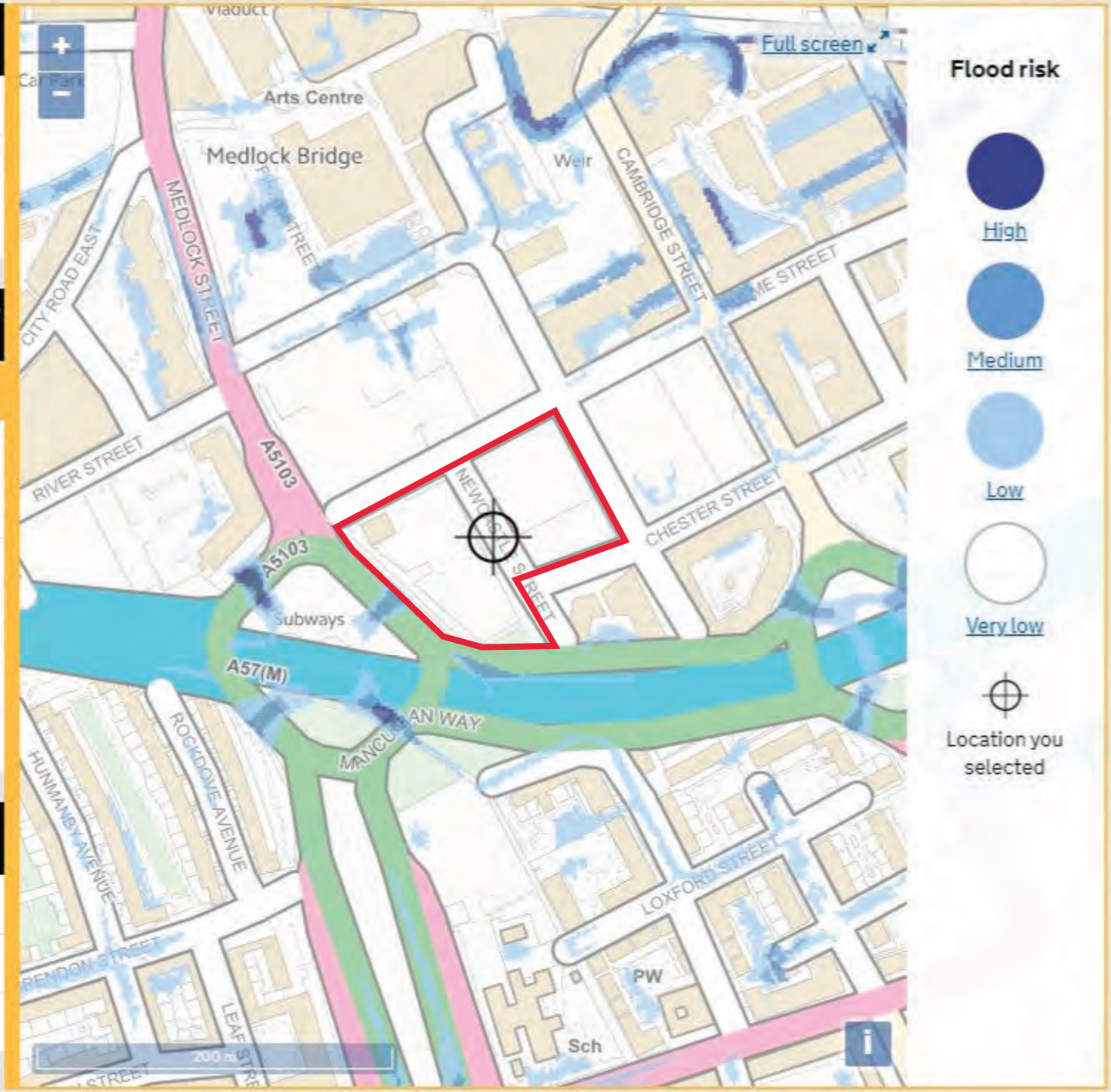
- Extent of flooding
- Depth and flow estimates at monitoring stations

Flood risk from surface water

- Extent of flooding
- High risk: depth
- High risk: velocity
- Medium risk: depth
- Medium risk: velocity
- Low risk: depth
- Low risk: velocity

Flood risk from reservoirs

- Extent of flooding
- Flood depth
- Flood speed



Basic view Detailed view

Location Enter a place or postcode in England

Flood risk from rivers or the sea

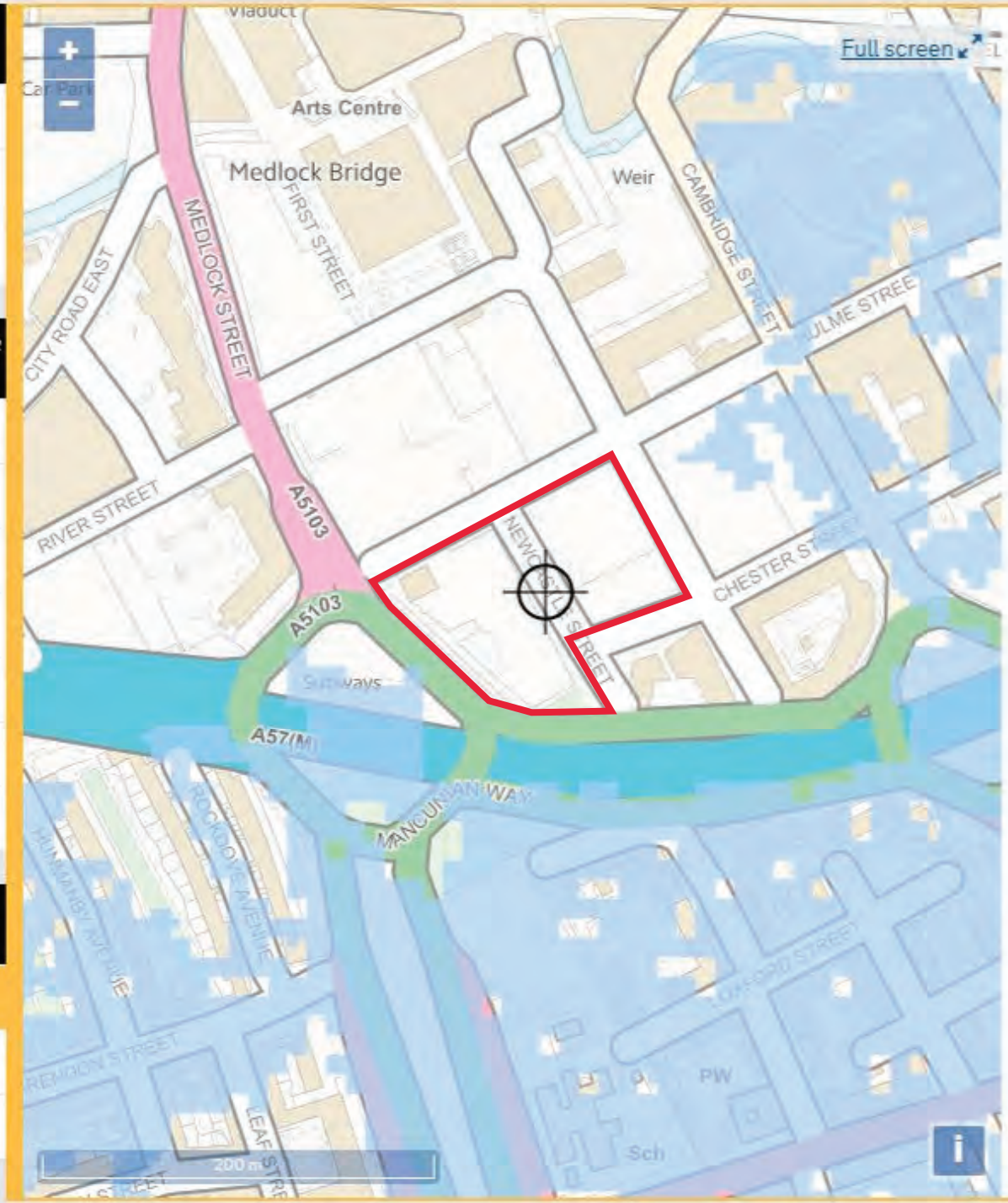
- Extent of flooding
- Depth and flow estimates at monitoring stations

Flood risk from surface water

- Extent of flooding
- High risk: depth
- High risk: velocity
- Medium risk: depth
- Medium risk: velocity
- Low risk: depth
- Low risk: velocity

Flood risk from reservoirs

- Extent of flooding
- Flood depth
- Flood speed



Flood risk

Maximum extent of flooding

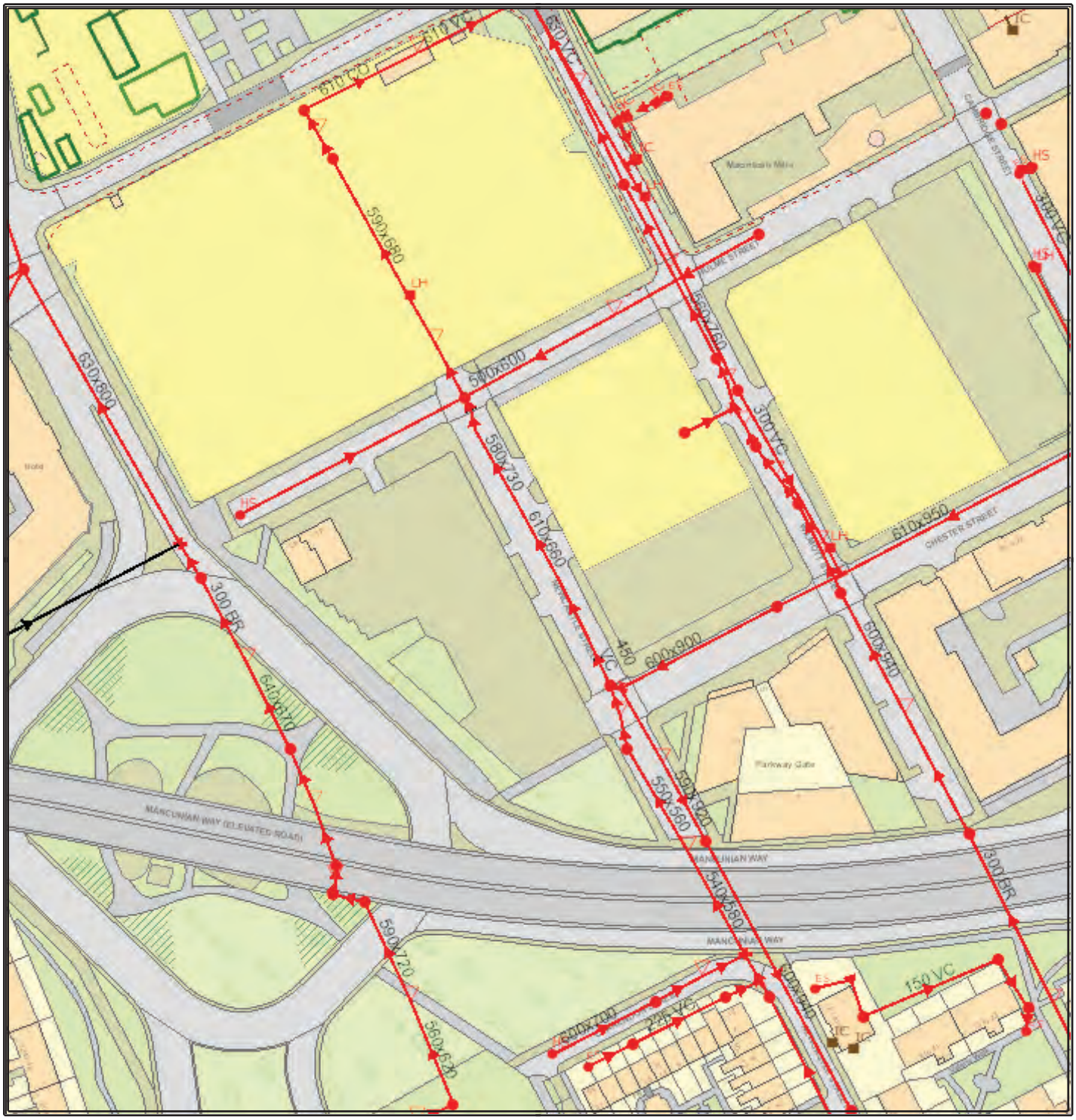
Location you selected

Appendix F United Utilities Map

United Utilities

COMMERCIALDW
DRAINAGE AND WATER ENQUIRY

SEWER RECORD LAND ON THE NORTH SIDE OF HULME STREET MANCHESTER



The position of underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. The actual positions may be different from those shown on the plan and private pipes, sewers or drains may not be recorded. United Utilities Water Limited will not accept any liability for any damage caused by the actual positions being different from those shown.

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Waste Water Symbology

Combined	Foul	Surface	Overflow	
				Manhole
				Manhole, side entry
				Public sewer
				Private sewer
				S104 sewer
				Rising main, public
				Rising main, private
				Rising main, S104
				Highway drain, private
				Screen chamber
DP	DP	DP	DP	Discharge point
				Outfall

CK Control kiosk

Sludge main

Abandoned pipe	
	Public sewer
	Rising main
	Private sewer
	Sludge main

Manhole function	
FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

Sewer shape			
CI	Circular	U	Unspecified
EG	Egg	SQ	Square
OV	Oval	TR	Trapezoidal
FT	Flat top	AR	Arch
RE	Rectangular	BA	Barrel
		HO	Horse shoe

Sewer material			
AC	Asbestos cement	DI	Ductile iron
BR	Brick	VC	Vitrified clay
CO	Concrete	PP	Polypropylene
CSB	Concrete segment	PF	Pitched fibre
CSU	Concrete segment	MA	Masonary, coursed
CC	Concrete box culverted	MA	Masonary, random
PSC	Plastic	RP	Reinforced plastic
GR	Glass reinforced	CI	Cast iron
GRP	Glass reinforced	SI	Spun iron
PVC	Polyvinyl chloride	ST	Steel
PE	Polyethelene	U	Unspecified

			WW pumping station
IC	IC	IC	Inspection chamber
ES	ES	ES	Extent of survey
HS	HS	HS	Head of system
SO		SO	Soakaway
RE	RE	RE	Rodding eye
LH	LH	LH	Lamp hole
			T junction/saddle
GU	GU	GU	Gulley
AV	AV	AV	Air valve
NRV	NRV	NRV	Non return valve
V			Sewer overflow
CA	CA	CA	Cascade
FM	FM	FM	Flow meter
HA	HA	HA	Hatch box
HY	HY	HY	Hydrobrake
IN	IN	IN	Inlet
			Bifurcation
CA	CA	CA	Catchpit
OI	OI	OI	Oil interceptor
PE	PE	PE	Penstock
SM	SM	SM	Summit
VA	VA	VA	Valve
VC	VC	VC	Valve chamber
WO	WO	WO	Washout chamber
DS	DS	DS	Drop shaft
WwTW	WwTW		WW treatment works
ST	ST		Septic tank
			Vent column
			Network storage tank
OP	OP	OP	Orifice plate
			Vortex chamber
			Penstock chamber

John Speers

From: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Sent: 14 April 2020 14:33
To: John Speers
Cc: Wastewater Developer Services
Subject: FW: 219-215 - First Street South, Manchester - Pre-Development Enquiry 4200028919

Categories: 219-215 - First Street Manchester

Good Afternoon John,

Many thanks for your comments.

In light of these, I confirm United Utilities will be happy for surface water to connect to the public combined sewer network at total maximum pass-forward flow rate of 13.4 l/s (the brownfield rate stated in your previous email).

Should you have any further queries please do not hesitate to get in touch (note I am now contactable on the mobile number below whilst working from home).

Kind regards,

Tom

Did you know we now have a live chat facility available to you Mon to Friday 8 -5pm. You just click on the orange live chat box on our webpage and one of our advisors will be ready to chat to you and help you with your enquiry https://www.unitedutilities.com/builders-developers/ or you can email us at WastewaterDeveloperServices@uuplc.co.uk

United Utilities
Water for the North West

Thomas Bethell
Assistant Engineer
Developer Services & Metering
Customer Services
M: 07880 339 195
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From: John Speers [mailto:johnSpeers@ajpstructeng.com]
Sent: 02 April 2020 10:31
To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Cc: Danny Sinclair <DannySinclair@ajpstructeng.com>
Subject: RE: 219-215 - First Street South, Manchester - Pre-Development Enquiry 4200028919

Morning Tom,

Thanks for the below response. Please see AJP comments below in red.

If you want to discuss this over the phone please contact me using my mobile number below.

Many Thanks

John

John Speers CEng MICE
Senior Civil Engineer

Alan Johnston Partnership LLP

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From: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Sent: 17 March 2020 15:51
To: John Speers <johnSpeers@ajpstructeng.com>
Cc: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: FW: 219-215 - First Street South, Manchester - Pre-Development Enquiry 4200028919

Good Afternoon John,

I have discussed the scheme with Neil and have the following comments:

Infiltration:

If 3.5m of ground is being replaced as part of the remediation strategy, could ground that is suitable for infiltration not be used? This would sit above the Glaciofluvial Sheet Deposits and could allow the site to infiltrate all surface water.
The remediation strategy is a 3.5m site turnover, so the ground will simply be reworked and remain on site. Given this and the restrictions imposed by the gas main easements and also the 5m restrictions on soakaways near buildings and highways from Building Regulations Part-H, the areas in which soakaways could be located are minimal. Also, the 3.5m of reworked made ground would limit the use of infiltration as it would still carry the potential for inundation settlement across the site.

Discharge rate (if infiltration not possible):

I note the most recent calculations have not included the highway. However, the remaining impermeable areas are not positively drained and the simulation therefore does not match the existing situation.

Since there is no positive drainage, the site must be classed as greenfield, resulting in the 6 l/s stated in the initial response below. I appreciate that surface water falling on the paving areas (around the perimeter of the site) may well run into the highway drainage, but will this not continue to be the case post-development?
As per the previously attached drainage strategy drawing the footpaths are to be drained via a series of linear drains (aco's) and will therefore not continue to drain onto the positively drained highways. With this is mind will UU accept that the site is brownfield and therefore the previous brownfield runoff calcs are suitable?
If not and UU are insisting that the site is greenfield, as per the previously attached drainage strategy, due to the phases in constructing the proposed development we will require 2no. outlets to the public sewers and as such a total of 6 L/s would only allow us 3 L/s per outfall. As this is less than the minimum 5 L/s discharge rate (to achieve a 100mm diameter orifice) would a total discharge rate of 10 L/s (5 L/s per outfall) be acceptable to UU?

Abandoned pipe:

Since the sewer is on our records as not live, there will not be a need for a S116 application. United Utilities would have no objection to this sewer being formerly grubbed up or grouted up, if investigations find this is required. Unfortunately our records do not have any information on if the sewer has already been grubbed up/grouted – apologies.
Noted.

Kind regards,

Tom

Thomas Bethell
Assistant Engineer
Developer Services & Metering
Customer Services
T: 01925 679 308
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From: John Speers [mailto:johnSpeers@ajpstructeng.com]
Sent: 09 March 2020 17:20
To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Cc: Danny Sinclair <DannySinclair@ajpstructeng.com>
Subject: RE: 219-215 - First Street South, Manchester - Pre-Development Enquiry 4200028919

Tom,

Apologies in the delay in getting back to you on this. I believe Neil O'Brien has now also commented on the planning application for the site, so if possible could you please liaise with Neil regarding the below information.

Due to the extent of the known buried structures across the site, the likelihood of more unknown buried structures and also to ensure a thorough UXO survey is completed, a 3.5m deep turnover of the site is proposed as a remediation strategy. This will therefore result in the majority of the site (excluding the gas main easements) having a minimum depth of 3.5m of made ground. Considering the remediation strategy and also constraints resulting from the numerous gas main easements (see attached drainage strategy drawing with easements in yellow hatching), **can you please confirm that UU are happy that infiltration is not suitable across the site?**

Also, with regards to the surface water discharge rates from the proposed site, you indicated that the sewer in Newcastle Street is shown as abandoned on your maps and therefore I have revised the pre & post development impermeable areas plan and also the existing brownfield runoff rates, see attached. The updated pre & post development impermeable areas plan shows that the pre development impermeable areas total is 1,703m^2, which results in the existing brownfield runoff rates indicated on the attached. Therefore, the required 50% betterment to comply with LLFA requirements, would be applied to these existing discharge rates for all rainfall events up to and including the 1 in 100 year +40% climate change rainfall event. For the 2 year rainfall event this would result in a maximum surface water discharge rate of 13.4 L/s. This will therefore be split across the 2no. separate outfalls, with 5.0 L/s from the Blocks C&D network and 8.4 L/s from the Blocks A & B network. Given the updated brownfield runoff rates and information above, **can you please confirm that UU are happy with the above surface water discharge rates?**

Finally, as the sewer along Newcastle Street is shown as abandoned **can you please confirm what actions, if any, (such as Section 116 application) need to be taken on our part?** Considering the depth of the remediation across the site, **would UU have any restrictions on the abandoned sewer, in terms of the sewer being removed/'grubbed up' as part of the enabling works? Can you also confirm if the sewer has been completely grouted or simply blocked up, as this will have an impact on whether or not it would be practical to remove the abandoned sewer or simply leave it in place?**

If you need any additional information or want to talk through anything, please do not hesitate to contact me using the details below.

Regards

John

John Speers CEng MICE
Senior Civil Engineer

Alan Johnston Partnership LLP

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From: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Sent: 25 November 2019 16:42
To: John Speers <johnSpeers@ajpstructeng.com>
Cc: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: FW: 219-215 - First Street South, Manchester - Pre-Development Enquiry 4200028919

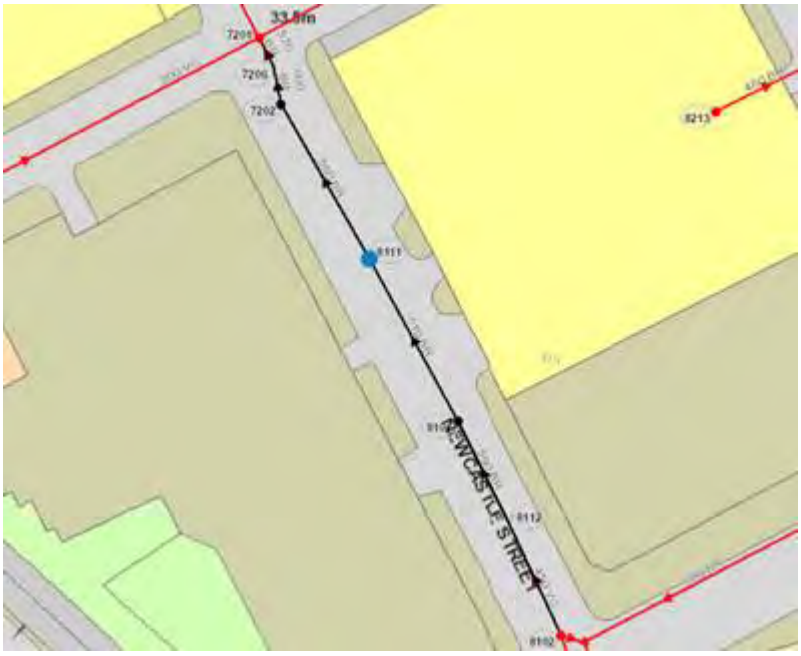
Good Afternoon John,

I am unsure why the sewers on the plans you have received are showing as live. We can only go off the records we have which (as shown below) are showing the sewers to have been abandoned.

Thank you for sending the SI report. Looking at the sectional drawings, I agree that in some areas the made ground is quite deep and does not leave much room for an infiltration system to be in the Glaciofluvial sheet deposits.

However, in some areas there appears to be several meters between the groundwater level and the shallow made ground level. The piped drainage arrangement taking water to any infiltration system will likely be deeper than the made ground levels. Therefore, we would argue further investigation into the potential for infiltration should be done.

Will there be any ground remediation taking place on this site? Please confirm the remediation strategy.



Kind regards,

Tom

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Thomas Bethell
Assistant Developer Engineer
Developer Services & Metering (Wastewater)
Customer Services
United Utilities
01925 679 308

From: John Speers [mailto:johnSpeers@ajpstructeng.com]
Sent: 13 November 2019 09:17

To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: RE: 219-215 - First Street South, Manchester - Pre-Development Enquiry 4200028919

Tom,

Thanks for the response.

The map which we have from United Utilities (see attached) shows that all the sewers in this area are live? Also, regarding the site investigation (extracts attached), it indicates that the site is underlain by large depths of made ground, up to 3.75mbgl and also a number of buried obstructions such as air raid shelters and basements. The made ground and glaciofluvial deposits are then underlain by a substrate of firm to stiff clays (Glacial Till). It is envisaged that BRE365 testing is not required as infiltration into the large depths of made ground and buried obstructions would result in the potential for inundation settlement and also this is underlain by firm to stiff clays (Glacial Till), which as shown within the Drawings section of the SI report seems to fairly impermeable, as what is assumed to be perched groundwater was consistently found just above the Glacial Till strata.

Can you please confirm that the sewer on Newcastle Street is abandoned? Also, given the SI information provided can you please confirm if you still believe BRE365 testing would be required?

Kind Regards

John

John Speers CEng MICE
Senior Civil Engineer

Alan Johnston Partnership LLP

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From: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Sent: 10 November 2019 14:33
To: John Speers <johnSpeers@ajpstructeng.com>
Cc: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: FW: 219-215 - First Street South, Manchester - Pre-Development Enquiry 4200028919

Dear John,

Our reference for this pre-development enquiry: 4200028919

We have carried out an assessment of your application which is based on the information provided; this pre development advice will be valid for 12 months

Foul

Foul will be allowed to drain to the public combined sewer network at an unrestricted rate, and at any conveniant point.

Surface Water

I note your comments regarding infiltration, however the British Geological Survey (BGS) website indicates the area compries of sand and gravel over sandstone, suggesting infiltration is likely feasible. We would therefore expect to see BRE 365 percolation test results that give a good representation of the site (i.e. numerous tests done around the site). In the first instance, please could you provide the site investigation report to support the below?

If infiltration is proven to be infeasible, we would allow surface water to connect to the public combined sewer network. However unfortunately we would stipulate that discharge rates must be restricted to greenfield runoff rates as the sewer which gullies are shown to connect to in Newcastle Road are showing as abandoned sewers on our sewer records suggesting any highway drainage is redundent.

Therefore, in the event that a surface water connection is proven to be required, surface water must be restricted to a maximum pass-forward flow rate of 6 l/s.

General Information:

Please be aware that on site drainage must be designed in accordance with Building Regulations, National Planning Policy, and local flood authority guidelines, we would recommend that you speak and make suitable agreements with the relevant statutory bodies.

Connection Application

Although we may discuss and agree discharge points & rates in principle, please be aware that you will have to apply for a formal sewer connection. This is so that we can assess the method of construction, Health & Safety requirements and to ultimately inspect the connection when it is made. Details of the application process and the form itself can be obtained from our website by following the link below

http://www.unitedutilities.com/connecting-public-sewer.aspx

Many thanks and kind regards,

Tom

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Thomas Bethell
Assistant Developer Engineer
Developer Services & Metering (Wastewater)
Customer Services
United Utilities
01925 679 308

From: John Speers [mailto:johnSpeers@ajpstructeng.com]
Sent: 29 October 2019 16:06
To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: 219-215 - First Street South, Manchester - Pre-Development Enquiry

Please find attached a pre-development form and associated information for your consideration.

The total site covers an area of approximately 1.22ha and is currently a brownfield site. The site currently consists of an existing highway, Newcastle Street through the centre of the site and two areas on either side of the highway, both of which consist of areas of hardstanding associated with the demolition of previous developments. See aerial view attached.

As the buildings on either side of the highway have been demolished for a number of years it is envisaged that any existing drainage within these areas will now be redundant. As such, it is envisaged that only the existing highway areas and associated footpath areas (which drain to the highways) currently have an active drainage system. This has been confirmed via the existing Topo and Utility survey which is attached, which indicates that the existing highway has a number of gullies which drain to the public combined sewer along Newcastle Street. Therefore, only the highway area has been considered during the pre-development impermeable areas calculation.

The Cundall Geotechnical and Geoenvironmental Assessment Report, 1011906.RPT.GL.004, did not undertake any BRE365 complaint infiltration tests but it has indicated that the site is underlain by large depths of made ground, up to 3.75mbgl and also a number of buried obstructions. The made ground and glaciofluvial deposits are then underlain by a substrate of firm to stiff clays.
Even though no BRE 365 compliant soakaway tests were completed as part of the intrusive site investigation, it is envisaged that infiltration is not suitable across the proposed site. This is due to the potential for inundation settlement resulting from infiltration through the large depths of made ground and buried obstructions and also due to the low permeability of firm to stiff clays.
As such, it is envisaged that infiltration is not viable across the site and therefore soakaway tests are not required.

Therefore, discharge to the surrounding pubic sewer network will be the only option for the discharge of the surface water runoff. Discharge to watercourse would be impractical as the nearest watercourse is the River Medlock which is located approximately 145m north of the site, through various plots of developed third party land. As there are no existing surface water sewers within close vicinity of the site, the only viable option would be to discharge to the existing public combined water sewers, surrounding the site.

It is envisaged that the surface water discharge will be restricted to 50% of the existing brownfield run off rates, in line with the Manchester, Salford and Trafford SFRA User Guide. The attached brownfield runoff calculations indicate that the existing brownfield run off rate for the 2-year return period is 48.3 L/s and therefore the proposed discharge from the entire site will be restricted to a rate of 24.2 L/s to achieve the minimum 50% betterment. This discharge rate will be applicable for all rainfall events up to and including the 1 in 100 year + 40% climate change event.

The intention is to drain Blocks A & B together on the same drainage network, with Block C and Block D drained via their own separate networks, therefore totalling 3no. separate drainage networks. The foul and surface water for each network will also be separate networks and then combined adjacent to the site boundary, prior to connecting to the surrounding UU combined sewers. If feasible, any existing drainage systems shall be utilised to connect the proposed drainage systems to the existing UU combined sewers.

Can you confirm that United Utilities are happy with this drainage arrangement and as such have no objections to the drainage strategy or discharge restrictions proposed above?

Please contact me immediately to discuss any matters further.

Regards

John

John Speers CEng MICE
Senior Civil Engineer

Alan Johnston Partnership LLP

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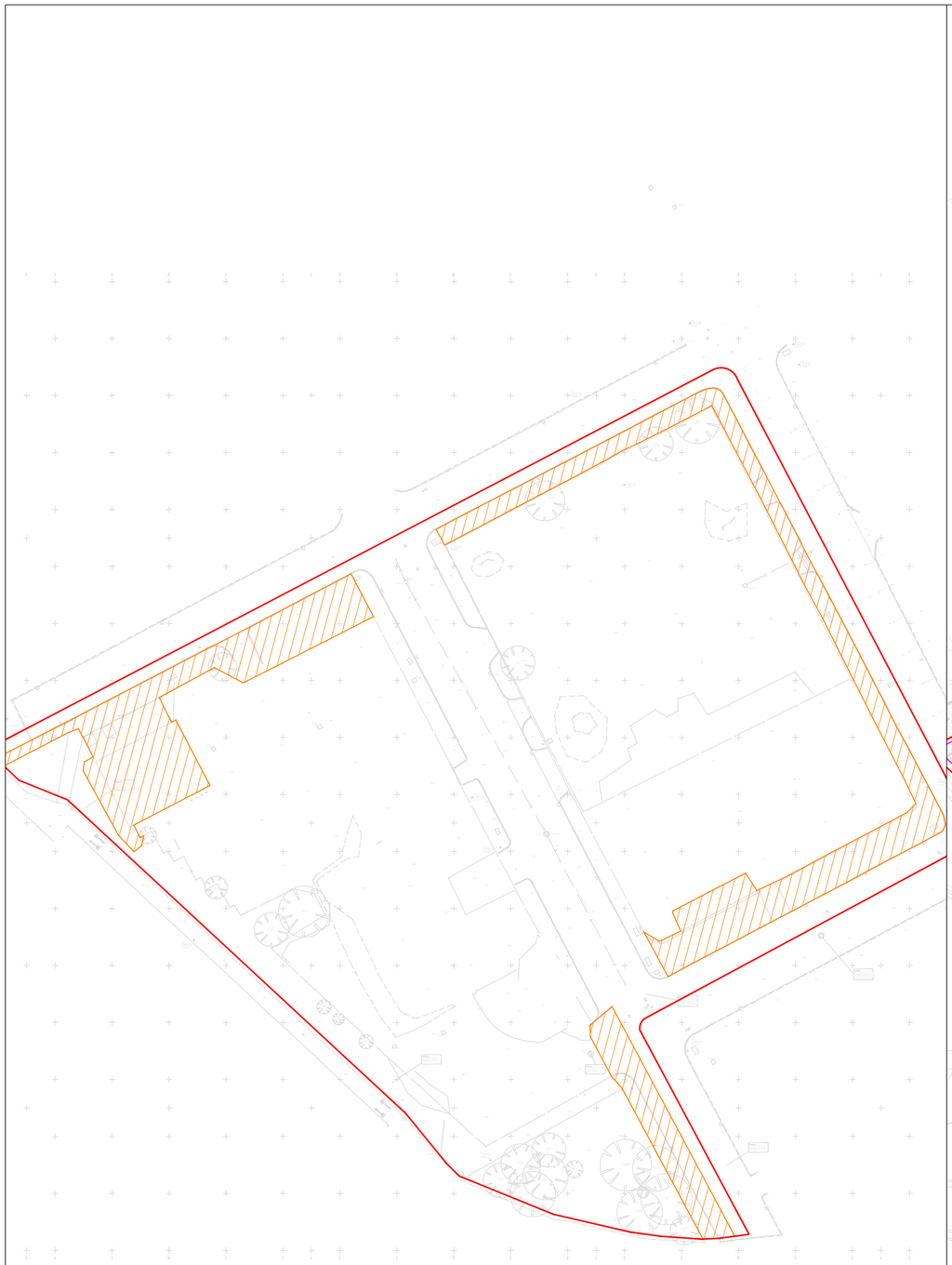
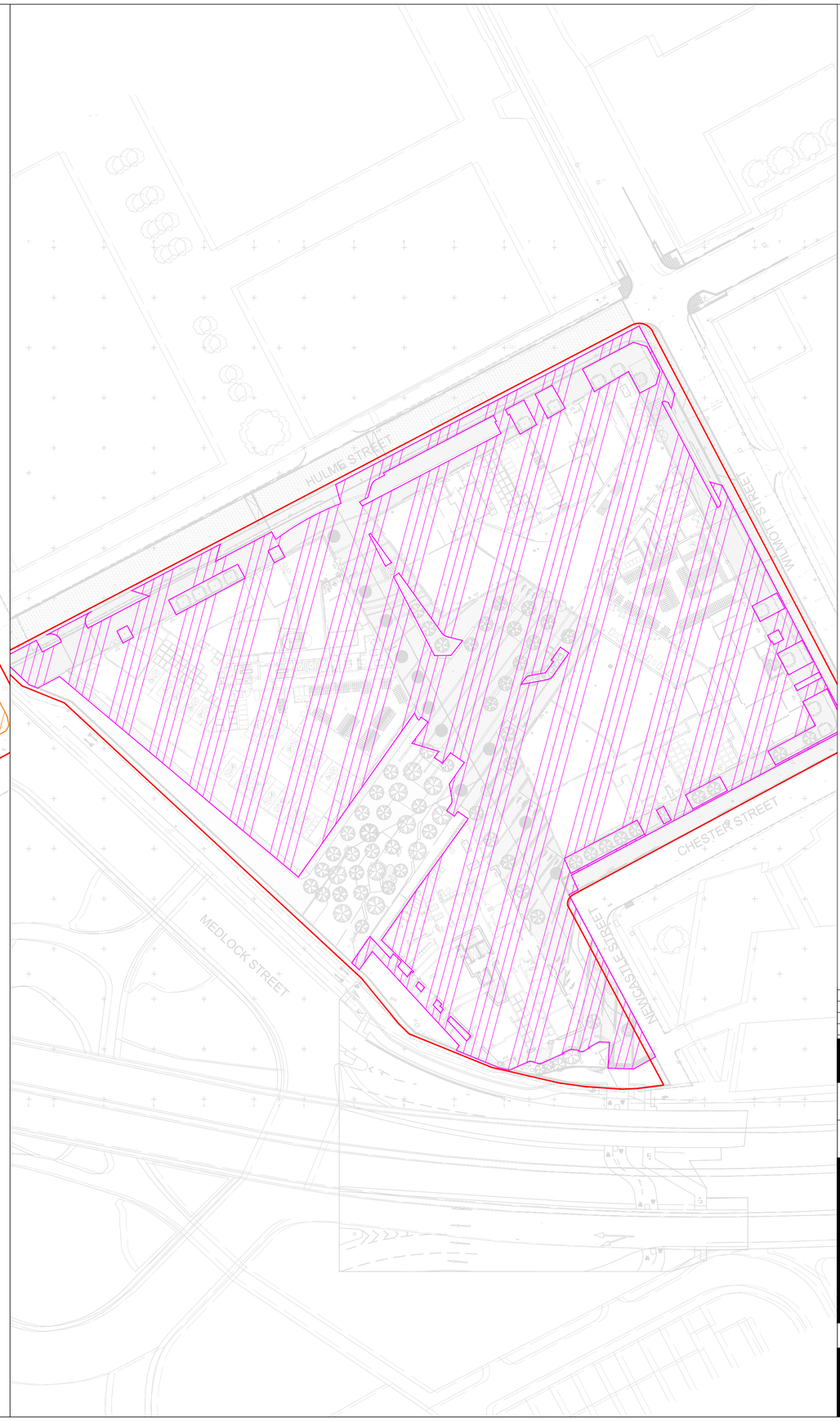
Appendix G Pre & Post Development Impermeable Areas Drawing





PRE-DEVELOPMENT
IMPERMEABLE AREAS = 1,707m²

POST-DEVELOPMENT
IMPERMEABLE AREAS = 10,581m²
(INCLUDES GREEN ROOF &
PERMEABLE PAVING AREAS)

REV	DATE	DESCRIPTION	BY	CHK	APP
P03	13.06.2025	FOR INFORMATION ONLY - UPDATED TO SUIT LATEST SITE PLAN	JRS	DJS	DJS
P02	09.03.2020	FOR INFORMATION ONLY - UPDATED TO SUIT ABANDONED SEWER ON NEWCASTLE STREET	JRS	DJS	DJS
P01	25.10.2019	FOR INFORMATION ONLY	JRS	DJS	DJS

DRAWING STATUS:
INFORMATION

CLIENT:
DOWNING

ARCHITECT:
SIMPSON HAUGH & PARTNERS

PROJECT:
FIRST STREET SOUTH
MANCHESTER

TITLE:
PRE & POST DEVELOPMENT
IMPERMEABLE AREAS

STATUS:	PROJECT No.	PROJECT	ORIGINATOR	VOL/SYS	LEVEL	TYPE	ROLE	DRAWING No.	REV:
S2	219-215	FSS -	AJP -	XX -	00 -	DR -		**SK - 0001**	**P03**

SCALE @ A1:	DESIGNED:	DRAWN:	CHECKED:	APPROVED:	DATE:
1:500	JRS	JRS	DJS	DJS	OCT 2019

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Appendix H Existing Brownfield Discharge Rate

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	30	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.360	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

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
1.000	10.000	0.125	80.0	0.171	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	10.000	0.125	80.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	10.000	0.125	80.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.11	32.875	0.171	0.0	0.0	0.0	1.46	58.2	23.2
1.001	50.00	5.23	32.750	0.171	0.0	0.0	0.0	1.46	58.2	23.2
1.002	50.00	5.34	32.625	0.171	0.0	0.0	0.0	1.46	58.2	23.2

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.002		34.000	32.500	30.000	0	0

Simulation Criteria for Storm

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	18.000
Return Period (years)	30	Ratio R	0.360
Region	England and Wales	Profile Type	Summer

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Synthetic Rainfall Details

Cv (Summer) 0.750 Storm Duration (mins) 30
Cv (Winter) 0.840

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.360 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
1.000	SW01	15 Winter	2	+0%	100/15 Summer				32.995	-0.105	0.000
1.001	SW02	15 Winter	2	+0%	100/15 Summer				32.870	-0.105	0.000
1.002	SW03	15 Winter	2	+0%	100/15 Summer				32.745	-0.105	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW01	0.55		26.5	OK	
1.001	SW02	0.55		26.5	OK	
1.002	SW03	0.55		26.7	OK	

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.360 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
1.000	SW01	15 Winter	30	+0%	100/15 Summer				33.086	-0.014	0.000
1.001	SW02	15 Winter	30	+0%	100/15 Summer				32.932	-0.043	0.000
1.002	SW03	15 Winter	30	+0%	100/15 Summer				32.807	-0.043	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW01	1.00		48.5	OK	
1.001	SW02	1.00		48.5	OK	
1.002	SW03	1.00		48.4	OK	

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.360 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
1.000	SW01	15 Winter	100	+0%	100/15 Summer				33.291	0.191	0.000
1.001	SW02	15 Winter	100	+0%	100/15 Summer				33.096	0.121	0.000
1.002	SW03	15 Winter	100	+0%	100/15 Summer				32.904	0.054	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW01	1.24		59.9	SURCHARGED	
1.001	SW02	1.22		59.2	SURCHARGED	
1.002	SW03	1.23		59.6	SURCHARGED	

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Appendix I Drainage Strategy Drawing & SW Calculations

IMPORTANT NOTES

1. SETTING OUT SHALL BE UNDERTAKEN USING ONLY THE INFORMATION GIVEN. DISTANCES SHOULD NOT BE SCALED FROM THIS DRAWING.
2. ALL SEWERS SHALL BE CONSTRUCTED IN ACCORDANCE WITH SEWERS FOR ADOPTION 7TH EDITION AND UNITED UTILITIES DETAILS & GUIDELINES.
3. THE MINIMUM GRAVITY PIPE DIAMETER UNDER ADOPTABLE HIGHWAYS SHALL BE 150mm.
4. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY ALL INFORMATION GIVEN WITH REGARDS TO EXISTING SERVICES AND DRAINAGE CONNECTIONS ETC. PRIOR TO COMMENCING THE WORKS. THE RATES SHALL INCLUDE FOR HAND DIG AROUND SERVICES WHERE NECESSARY. THE CONTRACTOR SHALL ADHERE TO THE CDM REGULATIONS AT ALL TIMES.
5. THE OUTSIDES OF ALL SEWERS SHALL BE A MINIMUM OF 1.0m FROM KERB LINES AND THE OUTSIDE OF MANHOLES SHALL BE A MINIMUM OF 0.5m FROM KERB LINES.
6. EXISTING FLOWS IN WATERCOURSES, SEWERS AND LAND DRAINS SHALL BE MAINTAINED AT ALL TIMES.
7. ONLY TRAINED PERSONNEL SHALL BE PERMITTED TO ENTER CONFINED SPACES.
8. ALL MATERIALS TO BEAR THE RELEVANT B.S. KITEMARK AND COMPLY FULLY WITH THE SPECIFICATIONS. ALL CONCRETE & CONCRETE PRODUCTS MUST USE SULPHATE RESISTANT CEMENT (UNLESS THE SITE INVESTIGATION REPORT PROVES THAT SULPHATE ATTACK FROM SOILS AND GROUNDWATER WILL NOT OCCUR TO WITHSTAND A CLASS.
9. ALL OPENING NOTICES ETC. AS REQUIRED UNDER HIGHWAYS ACTS ETC. ARE TO BE OBTAINED PRIOR TO COMMENCEMENT OF WORKS. ALL WORKS ARE TO BE INSPECTED BY L.A., NHBC OR THE NETWORK OPERATOR AS APPLICABLE.
10. WHERE "ULTRA RIB" UPVC PIPES (OR SIMILAR APPROVED) ARE USED IN ADOPTABLE DRAINAGE THEY SHALL STILL BE HANDLED AND LAID IN ACCORDANCE WITH THE SPECIFICATION AND GUIDANCE ISSUED BY THE HIGH PERFORMANCE PIPE ASSOCIATION.
11. A CLASS S BED AND SURROUND MUST BE USED FOR SUCH PIPES. TRENCH BACKFILL IN HIGHWAYS TO WITHIN 1M OF HIGHWAY SHALL, AS DIRECTED BY THE HIGHWAY AUTHORITY BE A SUITABLE GRANULAR MATERIAL. ALL IN ACCORDANCE WITH SEWERS FOR ADOPTION CL. 4.3.4.
12. SLAB LEVELS SHALL NOT BE VARIED WITHOUT REFERENCE TO THE ENGINEER FOR GUIDANCE.
13. ALL GULLY CONNECTIONS TO BE 150mm VITRIFIED CLAY UNLESS NOTED OTHERWISE.
14. ALL MANHOLE COVERS TO BE RECESSED TO ACCEPT FINISH AS DETAILED BY LANDSCAPE ARCHITECT.
15. SLOW REST BENDS TO BE USED IN ALL LOCATIONS MADE UP FROM 2No. 45 DEG BENDS (600mm TO INVERT FROM FFL).
16. MANHOLE POSITIONS AND ACCESS COVERS TO BE ACCURATELY SET-OUT BY LANDSCAPE ARCHITECT TO SUIT EXTERNAL FINISHES.
17. ALL DRAINS CAST THROUGH FOUNDATIONS TO HAVE ROCKER PIPES ON BOTH SIDES OF FOUNDATION.
18. ALL POP UP POSTIONS TO BE CONFIRMED SET OUT DIMENSIONS TO BE AGREED & PROVIDED BY OTHERS.
19. ALL DISCHARGE RATES TO BE CONFIRMED BY M&E DESIGNER.
20. ALL SURFACE WATER COLLECTION FEATURES TO BE CONFIRMED BY THE LANDSCAPE ARCHITECT.
21. STORAGE HAS BEEN PROVIDED IN A CELLULAR STORAGE TANK AND UP-SIZED MANHOLES AND PIPES.
22. EXISTING SEWER DEPTHS HAVE BEEN APPROXIMATED FROM LIMITED INFORMATION. NEW CONNECTIONS TO BE CONFIRMED PRIOR TO CONSTRUCTION OF ANY DRAINAGE WORKS.
23. LANDSCAPE ARCHITECT TO CONFIRM GULLY AND DRAINAGE CHANNEL LOCATIONS TO LANDSCAPED AREAS.
24. FOUL NETWORK TO BE CONFIRMED FOLLOWING CONFIRMATION OF BRANCH CONNECTION POINTS FROM BUILDING M&E DESIGNER.
25. CCTV SURVEY OF EXISTING SITE DRAINAGE REQUIRED PRIOR TO THE COMMENCEMENT OF ANY WORKS STARTING ON SITE.

LEGEND

- PROPOSED SURFACE WATER MANHOLE
- PROPOSED FOUL WATER MANHOLE
- PROPOSED COMBINED WATER MANHOLE
- PROPOSED SURFACE WATER PPIC
- PROPOSED FOUL WATER PPIC
- PROPOSED FOUL WATER DRAINAGE
- PROPOSED SURFACE WATER DRAINAGE
- PROPOSED COMBINED WATER DRAINAGE
- AREAS OF NON-INFILTRATION (TANKED) PERMEABLE PAVING
- RE — PROPOSED PERFORATED UNDERDRAIN FOR NON-INFILTRATION PERMEABLE PAVING WITH RODDING EYE
- ACO — PROPOSED ACO DRAIN
- G — PROPOSED GULLY
- EXISTING UNITED UTILITIES COMBINED WATER SEWER
- EXISTING UNITED UTILITIES COMBINED WATER SEWERS TO BE ABANDONED
- EXISTING UNITED UTILITIES COMBINED WATER SEWERS ALREADY ABANDONED
- REQUIRED EASEMENT FOR EXISTING GAS MAINS

REV	DATE	DESCRIPTION	BY	CHK	APP
C14	03.03.2025	PPIC/SILT TRAP SW60 ADDED + ON SITE REVISIONS	JJR	JJR	DJS
C13	05.08.2024	COLLECTION FEATURES ADJUSTED TO SUIT LATEST EXTERNAL FALLS	JJR	JJR	DJS
C12	01.08.2024	FINAL ISSUE - CONSTRUCTION INTENT	JRS	JRS	DJS
C11	03.06.2024	ADDITIONAL ATTENUATION TANK ADDED TO SUIT REVISED SITE LEVELS	JRS	JRS	DJS
C10	09.04.2024	DRAINAGE UPDATED TO SUIT REVISED SITE LEVELS	JJR	JRS	DJS
C09	10.11.2023	BLOCK C UPDATED	JJR	DJS	DJS
C08	13.04.2023	UPDATED TO SUIT CADENT GAS MAIN CROSSING	JJR	JRS	DJS
C07	04.01.2023	UPDATED TO SUIT LATEST AS-BUILT INFO & SITE COMMENTS	JJR	JRS	DJS
C06	07.12.2022	UPDATED TO SUIT LATEST AS-BUILT INFO & SITE COMMENTS	JJR	JRS	DJS
C05	23.11.2022	UPDATED TO SUIT LATEST AS-BUILT INFO & SITE COMMENTS	JRS	JRS	DJS
C04	26.08.2022	UPDATED TO SUIT LATEST BLOCK A POP-UPS AROUND FW26 & BLOCK D TANK LAYOUT	JRS	JRS	DJS
C03	22.07.2022	UPDATED TO SUIT LATEST PLANT LOCATIONS AND COMMENTS	JJR	JRS	DJS
C02	30.06.2022	RAINWATER HARVESTING TANK CONNECTED AND MPB COMMENTS ADDRESSED	JJR	JRS	DJS
C01	21.06.2022	CONSTRUCTION ISSUE	JJR	JRS	DJS
P05	05.04.2022	UPDATED TO SUIT LATEST SITE LAYOUT	JJR	JRS	DJS
P04	04.02.2022	UPDATED TO SUIT LATEST FOUNDATION LAYOUT AND GAS EASEMENT	JJR	JRS	DJS
P03	05.06.2020	RIBA STAGE 3 ISSUE (DEVELOPED DESIGN)	JRS	DJS	DJS
P02	30.04.2020	RIBA STAGE 2 (CONCEPT DESIGN) - UPDATED TO SUIT UNITED UTILITIES REQUIREMENTS	JRS	DJS	DJS
P01	13.12.2019	RIBA STAGE 2 (CONCEPT DESIGN)	JRS	DJS	DJS

DRAWING STATUS:

CONSTRUCTION INTENT

CLIENT:

DOWNING

ARCHITECT:

SIMPSON HAUGH & PARTNERS

PROJECT:

FIRST STREET SOUTH
MANCHESTER

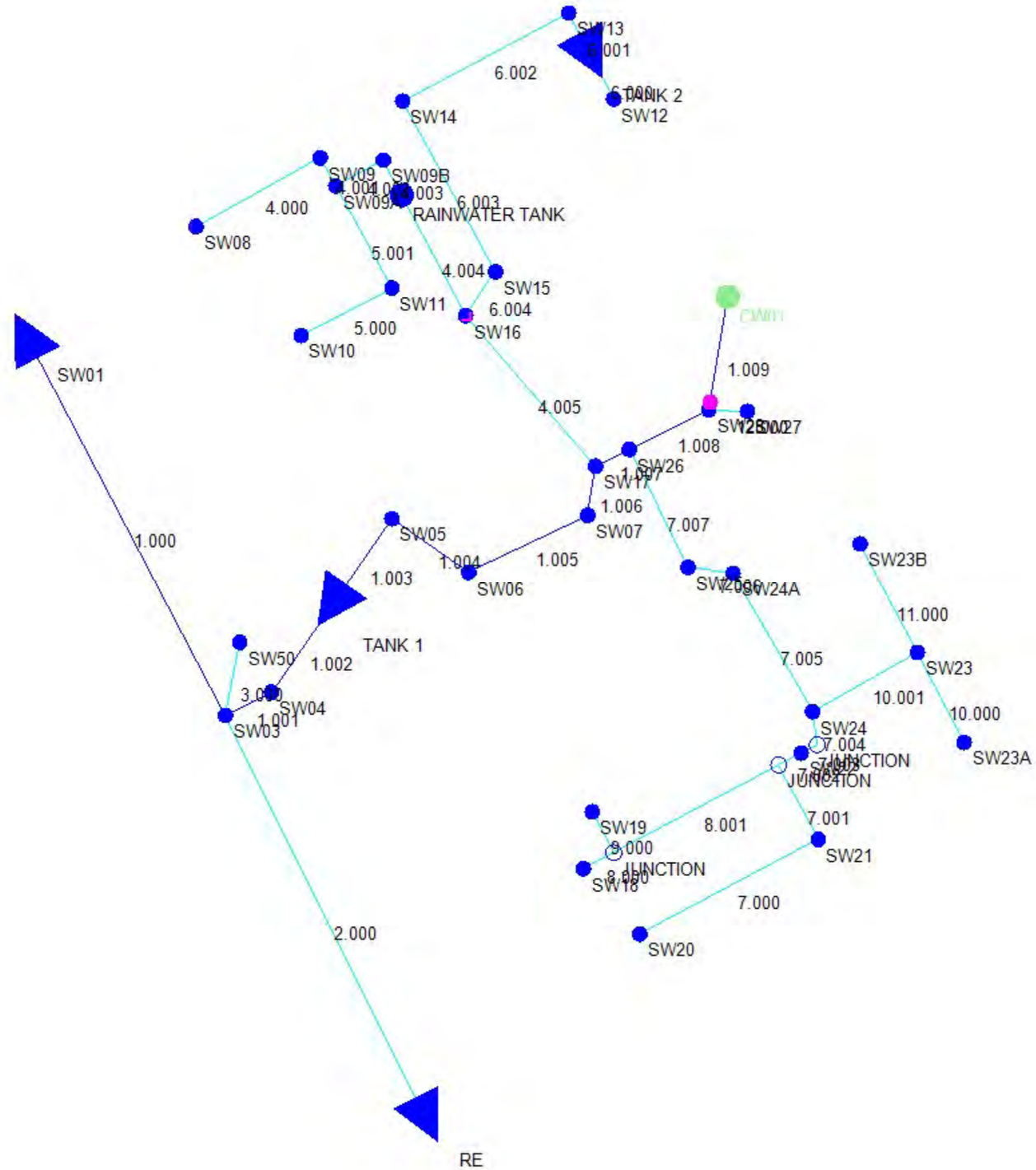
TITLE:

BELOW GROUND DRAINAGE
DRAINAGE STRATEGY

STATUS:	PROJECT No.	PROJECT	ORIGINATOR	VOL/SYS	LEVEL	TYPE	ROLE	DRAWING No.	REV:
S2	219-215	FSS -	AJP -	XX -	00 -	DR -	C -	0001	C14

SCALE @ A0:	DESIGNED:	DRAWN:	CHECKED:	APPROVED:	DATE:
1:200	JRS	JRS	DJS	DJS	NOV 2019

AJP consulting engineers
0151 227 1462 info@ajpltd.co.uk 1 Dale Street, Liverpool, L2 2ET



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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Blocks A&B

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	30	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.360	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Blocks A&B

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.237	4-8	0.076

Total Area Contributing (ha) = 0.313

Total Pipe Volume (m³) = 10.885

Network Design Table for Blocks A&B

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	42.014	0.420	100.0	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	44.168	0.440	100.4	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
3.000	7.283	0.500	14.6	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	5.050	0.130	38.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	10.323	0.025	412.9	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	10.323	0.110	93.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	9.187	0.100	92.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.70	32.815	0.000	0.0	0.0	0.0	1.00	17.8	0.0
2.000	50.00	5.73	33.520	0.000	0.0	0.0	0.0	1.00	17.7	0.0
3.000	50.00	5.05	32.835	0.000	0.0	0.0	0.0	2.65	46.9	0.0
1.001	50.00	5.79	31.940	0.000	0.0	0.0	0.0	1.62	28.6	0.0
1.002	50.00	6.06	31.735	0.000	0.0	0.0	0.0	0.64	25.3	0.0
1.003	50.00	6.18	31.710	0.000	0.0	0.0	0.0	1.35	53.7	0.0
1.004	50.00	6.30	31.600	0.000	0.0	0.0	0.0	1.36	54.2	0.0

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Network Design Table for Blocks A&B

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.005	12.923	0.093	139.0	0.029	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.006	4.893	0.374	13.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.000	13.905	0.140	99.3	0.034	5.00	0.0	0.600	o	150	Pipe/Conduit	
4.001	3.141	0.030	104.7	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
5.000	10.046	0.100	100.5	0.016	5.00	0.0	0.600	o	150	Pipe/Conduit	
5.001	11.390	0.120	94.9	0.010	0.00	0.0	0.600	o	150	Pipe/Conduit	
4.002	5.312	0.050	106.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
4.003	3.869	0.010	386.9	0.023	0.00	0.0	0.600	o	150	Pipe/Conduit	
4.004	13.360	0.150	89.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
6.000	4.745	0.010	474.5	0.008	5.00	0.0	0.600	o	150	Pipe/Conduit	
6.001	4.745	0.010	474.5	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
6.002	18.410	0.245	75.1	0.004	0.00	0.0	0.600	o	150	Pipe/Conduit	
6.003	19.026	0.230	82.7	0.011	0.00	0.0	0.600	o	225	Pipe/Conduit	
6.004	5.206	0.175	29.8	0.018	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.005	19.471	0.442	44.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.007	3.677	0.108	34.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
7.000	19.792	0.200	99.0	0.004	5.00	0.0	0.600	o	150	Pipe/Conduit	
7.001	8.235	0.200	41.2	0.004	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)
1.005	50.00	6.49	31.500	0.029	0.0	0.0	0.0	1.11	44.0	3.9
1.006	50.00	6.51	31.407	0.029	0.0	0.0	0.0	3.63	144.5	3.9
4.000	50.00	5.23	33.000	0.034	0.0	0.0	0.0	1.01	17.8	4.6
4.001	50.00	5.28	32.860	0.034	0.0	0.0	0.0	0.98	17.3	4.6
5.000	50.00	5.17	33.050	0.016	0.0	0.0	0.0	1.00	17.7	2.2
5.001	50.00	5.35	32.950	0.026	0.0	0.0	0.0	1.03	18.2	3.5
4.002	50.00	5.44	32.830	0.060	0.0	0.0	0.0	0.97	17.2	8.1
4.003	50.00	5.57	31.710	0.083	0.0	0.0	0.0	0.51	8.9«	11.2
4.004	50.00	5.78	31.700	0.083	0.0	0.0	0.0	1.07	18.8	11.2
6.000	50.00	5.17	32.220	0.008	0.0	0.0	0.0	0.45	8.0	1.1
6.001	50.00	5.35	32.210	0.008	0.0	0.0	0.0	0.45	8.0	1.1
6.002	50.00	5.61	32.200	0.012	0.0	0.0	0.0	1.16	20.5	1.6
6.003	50.00	5.83	31.880	0.023	0.0	0.0	0.0	1.44	57.2	3.1
6.004	50.00	5.87	31.650	0.041	0.0	0.0	0.0	2.40	95.6	5.6
4.005	50.00	6.03	31.475	0.124	0.0	0.0	0.0	1.98	78.5	16.8
1.007	50.00	6.54	30.958	0.153	0.0	0.0	0.0	2.70	191.1	20.7
7.000	50.00	5.33	32.980	0.004	0.0	0.0	0.0	1.01	17.9	0.5
7.001	50.00	5.41	32.780	0.008	0.0	0.0	0.0	1.57	27.8	1.1

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Network Design Table for Blocks A&B

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
8.000	3.372	0.036	93.7	0.015	5.00	0.0	0.600	o	150	Pipe/Conduit	
9.000	4.511	0.046	98.1	0.030	5.00	0.0	0.600	o	150	Pipe/Conduit	
8.001	18.287	0.194	94.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
7.002	2.484	0.025	99.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
7.003	1.779	0.034	53.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
7.004	3.247	0.061	53.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
10.000	9.914	0.170	58.3	0.001	5.00	0.0	0.600	o	150	Pipe/Conduit	
11.000	12.002	0.200	60.0	0.006	5.00	0.0	0.600	o	150	Pipe/Conduit	
10.001	11.781	0.130	90.5	0.003	0.00	0.0	0.600	o	150	Pipe/Conduit	
7.005	15.600	0.160	97.5	0.017	0.00	0.0	0.600	o	150	Pipe/Conduit	
7.006	4.458	0.087	51.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
7.007	12.891	0.045	286.5	0.034	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.008	8.706	0.423	20.6	0.034	0.00	0.0	0.600	o	300	Pipe/Conduit	
12.000	3.779	0.239	15.8	0.012	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.009	11.212	0.143	78.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
8.000	50.00	5.05	32.810	0.015	0.0	0.0	0.0	1.04	18.4	2.0
9.000	50.00	5.07	32.820	0.030	0.0	0.0	0.0	1.01	17.9	4.1
8.001	50.00	5.37	32.774	0.045	0.0	0.0	0.0	1.04	18.3	6.1
7.002	50.00	5.45	32.580	0.053	0.0	0.0	0.0	1.01	17.8	7.2
7.003	50.00	5.48	32.555	0.053	0.0	0.0	0.0	1.38	24.5	7.2
7.004	50.00	5.52	32.521	0.053	0.0	0.0	0.0	1.38	24.4	7.2
10.000	50.00	5.13	32.760	0.001	0.0	0.0	0.0	1.32	23.3	0.1
11.000	50.00	5.15	32.790	0.006	0.0	0.0	0.0	1.30	23.0	0.8
10.001	50.00	5.34	32.590	0.010	0.0	0.0	0.0	1.06	18.7	1.4
7.005	50.00	5.77	32.460	0.080	0.0	0.0	0.0	1.02	18.0	10.8
7.006	50.00	5.82	32.300	0.080	0.0	0.0	0.0	1.41	24.9	10.8
7.007	50.00	6.10	32.138	0.114	0.0	0.0	0.0	0.77	30.5	15.4
1.008	50.00	6.58	30.850	0.301	0.0	0.0	0.0	3.48	246.0	40.8
12.000	50.00	5.02	33.000	0.012	0.0	0.0	0.0	2.55	45.0	1.6
1.009	50.00	6.70	30.428	0.313	0.0	0.0	0.0	1.48	58.8	42.4

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Manhole Schedules for Blocks A&B

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
SW01	33.865	1.050	Open Manhole	1200	1.000	32.815	150				
RE	34.570	1.050	Open Manhole	150	2.000	33.520	150				
SW50	34.100	1.265	Open Manhole	600	3.000	32.835	150				
SW03	34.100	2.160	Open Manhole	1200	1.001	31.940	150	1.000	32.395	150	455
								2.000	33.080	150	1140
								3.000	32.335	150	395
SW04	34.100	2.365	Open Manhole	1200	1.002	31.735	225	1.001	31.810	150	
TANK 1	34.100	2.390	Open Manhole	1500	1.003	31.710	225	1.002	31.710	225	
SW05	34.400	2.800	Open Manhole	1200	1.004	31.600	225	1.003	31.600	225	
SW06	34.400	2.900	Open Manhole	1200	1.005	31.500	225	1.004	31.500	225	
SW07	34.400	2.993	Open Manhole	1200	1.006	31.407	225	1.005	31.407	225	
SW08	34.300	1.300	Open Manhole	600	4.000	33.000	150				
SW09	34.370	1.510	Open Manhole	1200	4.001	32.860	150	4.000	32.860	150	
SW10	34.400	1.350	Open Manhole	600	5.000	33.050	150				
SW11	34.400	1.450	Open Manhole	1200	5.001	32.950	150	5.000	32.950	150	
SW09A	34.400	1.570	Open Manhole	1200	4.002	32.830	150	4.001	32.830	150	
								5.001	32.830	150	
SW09B	33.230	1.520	Open Manhole	1200	4.003	31.710	150	4.002	32.780	150	1070
RAINWATER TANK	33.230	1.530	Open Manhole	2400	4.004	31.700	150	4.003	31.700	150	
SW12	33.500	1.280	Open Manhole	600	6.000	32.220	150				
TANK 2	33.250	1.040	Open Manhole	1500	6.001	32.210	150	6.000	32.210	150	
SW13	33.250	1.050	Open Manhole	600	6.002	32.200	150	6.001	32.200	150	
SW14	33.860	1.980	Open Manhole	1200	6.003	31.880	225	6.002	31.955	150	
SW15	33.230	1.580	Open Manhole	1200	6.004	31.650	225	6.003	31.650	225	
SW16	34.400	2.925	Open Manhole	1200	4.005	31.475	225	4.004	31.550	150	
								6.004	31.475	225	
SW17	34.400	3.442	Open Manhole	1200	1.007	30.958	300	1.006	31.033	225	
								4.005	31.033	225	
SW20	34.580	1.600	Open Manhole	600	7.000	32.980	150				
SW21	34.580	1.800	Open Manhole	600	7.001	32.780	150	7.000	32.780	150	
SW18	34.600	1.790	Open Manhole	1200	8.000	32.810	150				
SW19	34.600	1.780	Open Manhole	600	9.000	32.820	150				
JUNCTION	34.600	1.826	Junction		8.001	32.774	150	8.000	32.774	150	
								9.000	32.774	150	
JUNCTION	34.600	2.020	Junction		7.002	32.580	150	7.001	32.580	150	
								8.001	32.580	150	
SW22	34.600	2.045	Open Manhole	600	7.003	32.555	150	7.002	32.555	150	
JUNCTION	34.600	2.079	Junction		7.004	32.521	150	7.003	32.521	150	
SW23A	34.550	1.790	Open Manhole	600	10.000	32.760	150				
SW23B	34.380	1.590	Open Manhole	600	11.000	32.790	150				
SW23	34.550	1.960	Open Manhole	600	10.001	32.590	150	10.000	32.590	150	
								11.000	32.590	150	
SW24	34.600	2.140	Open Manhole	1200	7.005	32.460	150	7.004	32.460	150	
								10.001	32.460	150	

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Manhole Schedules for Blocks A&B

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
SW24A	34.400	2.100	Open Manhole	600	7.006	32.300	150	7.005	32.300	150	
SW25	34.400	2.262	Open Manhole	1200	7.007	32.138	225	7.006	32.213	150	
SW26	34.400	3.550	Open Manhole	1200	1.008	30.850	300	1.007	30.850	300	
								7.007	32.093	225	1167
SW27	34.180	1.180	Open Manhole	600	12.000	33.000	150				
SW28	34.170	3.742	Open Manhole	1500	1.009	30.428	225	1.008	30.428	300	
								12.000	32.761	150	2258
CW01	33.900	3.615	Open Manhole	2400		OUTFALL		1.009	30.285	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SW01	383790.934	397215.765	383790.934	397215.765	Required	
RE	383830.253	397139.079	383830.253	397139.079	Required	
SW50	383811.873	397185.718	383811.873	397185.718	Required	
SW03	383810.473	397178.571	383810.473	397178.571	Required	
SW04	383814.973	397180.863	383814.973	397180.863	Required	
TANK 1	383820.899	397189.369	383820.899	397189.369	Required	
SW05	383826.775	397197.803	383826.775	397197.803	Required	
SW06	383834.309	397192.546	383834.309	397192.546	Required	
SW07	383845.960	397198.136	383845.960	397198.136	Required	
SW08	383807.585	397226.416	383807.585	397226.416	Required	
SW09	383819.763	397233.127	383819.763	397233.127	Required	
SW10	383817.886	397215.735	383817.886	397215.735	Required	
SW11	383826.782	397220.404	383826.782	397220.404	Required	

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Manhole Schedules for Blocks A&B

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SW09A	383821.278	397230.376	383821.278	397230.376	Required	
SW09B	383825.943	397232.917	383825.943	397232.917	Required	
RAINWATER TANK	383827.754	397229.498	383827.754	397229.498	Required	
SW12	383848.492	397238.902	383848.492	397238.902	Required	
TANK 2	383846.297	397243.109	383846.297	397243.109	Required	
SW13	383844.102	397247.316	383844.102	397247.316	Required	
SW14	383827.833	397238.700	383827.833	397238.700	Required	
SW15	383836.940	397221.994	383836.940	397221.994	Required	
SW16	383834.007	397217.692	383834.007	397217.692	Required	
SW17	383846.746	397202.966	383846.746	397202.966	Required	
SW20	383851.071	397157.212	383851.071	397157.212	Required	
SW21	383868.561	397166.477	383868.561	397166.477	Required	
SW18	383845.539	397163.602	383845.539	397163.602	Required	
SW19	383846.408	397169.166	383846.408	397169.166	Required	
JUNCTION	383848.519	397165.180			No Entry	
JUNCTION	383864.679	397173.739			No Entry	
SW22	383866.875	397174.899	383866.875	397174.899	Required	
JUNCTION	383868.452	397175.723			No Entry	

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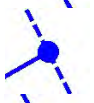
Manhole Schedules for Blocks A&B

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SW23A	383882.844	397175.938	383882.844	397175.938	Required	
SW23B	383872.655	397195.342	383872.655	397195.342	Required	
SW23	383878.258	397184.728	383878.258	397184.728	Required	
SW24	383867.998	397178.938	383867.998	397178.938	Required	
SW24A	383860.206	397192.453	383860.206	397192.453	Required	
SW25	383855.789	397193.053	383855.789	397193.053	Required	
SW26	383850.043	397204.593	383850.043	397204.593	Required	
SW27	383861.613	397208.314	383861.613	397208.314	Required	
SW28	383857.837	397208.473	383857.837	397208.473	Required	
CW01	383859.692	397219.531			No Entry	

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PIPELINE SCHEDULES for Blocks A&B

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)
1.000	o	150	SW01	33.865	32.815	0.900	Open Manhole	1200
2.000	o	150	RE	34.570	33.520	0.900	Open Manhole	150
3.000	o	150	SW50	34.100	32.835	1.115	Open Manhole	600
1.001	o	150	SW03	34.100	31.940	2.010	Open Manhole	1200
1.002	o	225	SW04	34.100	31.735	2.140	Open Manhole	1200
1.003	o	225	TANK 1	34.100	31.710	2.165	Open Manhole	1500
1.004	o	225	SW05	34.400	31.600	2.575	Open Manhole	1200
1.005	o	225	SW06	34.400	31.500	2.675	Open Manhole	1200
1.006	o	225	SW07	34.400	31.407	2.768	Open Manhole	1200
4.000	o	150	SW08	34.300	33.000	1.150	Open Manhole	600
4.001	o	150	SW09	34.370	32.860	1.360	Open Manhole	1200
5.000	o	150	SW10	34.400	33.050	1.200	Open Manhole	600
5.001	o	150	SW11	34.400	32.950	1.300	Open Manhole	1200
4.002	o	150	SW09A	34.400	32.830	1.420	Open Manhole	1200
4.003	o	150	SW09B	33.230	31.710	1.370	Open Manhole	1200
4.004	o	150	RAINWATER TANK	33.230	31.700	1.380	Open Manhole	2400
6.000	o	150	SW12	33.500	32.220	1.130	Open Manhole	600
6.001	o	150	TANK 2	33.250	32.210	0.890	Open Manhole	1500

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)
1.000	42.014	100.0	SW03	34.100	32.395	1.555	Open Manhole	1200
2.000	44.168	100.4	SW03	34.100	33.080	0.870	Open Manhole	1200
3.000	7.283	14.6	SW03	34.100	32.335	1.615	Open Manhole	1200
1.001	5.050	38.8	SW04	34.100	31.810	2.140	Open Manhole	1200
1.002	10.323	412.9	TANK 1	34.100	31.710	2.165	Open Manhole	1500
1.003	10.323	93.8	SW05	34.400	31.600	2.575	Open Manhole	1200
1.004	9.187	92.0	SW06	34.400	31.500	2.675	Open Manhole	1200
1.005	12.923	139.0	SW07	34.400	31.407	2.768	Open Manhole	1200
1.006	4.893	13.1	SW17	34.400	31.033	3.142	Open Manhole	1200
4.000	13.905	99.3	SW09	34.370	32.860	1.360	Open Manhole	1200
4.001	3.141	104.7	SW09A	34.400	32.830	1.420	Open Manhole	1200
5.000	10.046	100.5	SW11	34.400	32.950	1.300	Open Manhole	1200
5.001	11.390	94.9	SW09A	34.400	32.830	1.420	Open Manhole	1200
4.002	5.312	106.2	SW09B	33.230	32.780	0.300	Open Manhole	1200
4.003	3.869	386.9	RAINWATER TANK	33.230	31.700	1.380	Open Manhole	2400
4.004	13.360	89.1	SW16	34.400	31.550	2.700	Open Manhole	1200
6.000	4.745	474.5	TANK 2	33.250	32.210	0.890	Open Manhole	1500
6.001	4.745	474.5	SW13	33.250	32.200	0.900	Open Manhole	600

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PIPELINE SCHEDULES for Blocks A&B

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)
6.002	o	150	SW13	33.250	32.200	0.900	Open Manhole	600
6.003	o	225	SW14	33.860	31.880	1.755	Open Manhole	1200
6.004	o	225	SW15	33.230	31.650	1.355	Open Manhole	1200
4.005	o	225	SW16	34.400	31.475	2.700	Open Manhole	1200
1.007	o	300	SW17	34.400	30.958	3.142	Open Manhole	1200
7.000	o	150	SW20	34.580	32.980	1.450	Open Manhole	600
7.001	o	150	SW21	34.580	32.780	1.650	Open Manhole	600
8.000	o	150	SW18	34.600	32.810	1.640	Open Manhole	1200
9.000	o	150	SW19	34.600	32.820	1.630	Open Manhole	600
8.001	o	150	JUNCTION	34.600	32.774	1.676	Junction	
7.002	o	150	JUNCTION	34.600	32.580	1.870	Junction	
7.003	o	150	SW22	34.600	32.555	1.895	Open Manhole	600
7.004	o	150	JUNCTION	34.600	32.521	1.929	Junction	
10.000	o	150	SW23A	34.550	32.760	1.640	Open Manhole	600
11.000	o	150	SW23B	34.380	32.790	1.440	Open Manhole	600

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)
6.002	18.410	75.1	SW14	33.860	31.955	1.755	Open Manhole	1200
6.003	19.026	82.7	SW15	33.230	31.650	1.355	Open Manhole	1200
6.004	5.206	29.8	SW16	34.400	31.475	2.700	Open Manhole	1200
4.005	19.471	44.1	SW17	34.400	31.033	3.142	Open Manhole	1200
1.007	3.677	34.0	SW26	34.400	30.850	3.250	Open Manhole	1200
7.000	19.792	99.0	SW21	34.580	32.780	1.650	Open Manhole	600
7.001	8.235	41.2	JUNCTION	34.600	32.580	1.870	Junction	
8.000	3.372	93.7	JUNCTION	34.600	32.774	1.676	Junction	
9.000	4.511	98.1	JUNCTION	34.600	32.774	1.676	Junction	
8.001	18.287	94.3	JUNCTION	34.600	32.580	1.870	Junction	
7.002	2.484	99.4	SW22	34.600	32.555	1.895	Open Manhole	600
7.003	1.779	53.0	JUNCTION	34.600	32.521	1.929	Junction	
7.004	3.247	53.2	SW24	34.600	32.460	1.990	Open Manhole	1200
10.000	9.914	58.3	SW23	34.550	32.590	1.810	Open Manhole	600
11.000	12.002	60.0	SW23	34.550	32.590	1.810	Open Manhole	600

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PIPELINE SCHEDULES for Blocks A&B

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)
10.001	o	150	SW23	34.550	32.590	1.810	Open Manhole	600
7.005	o	150	SW24	34.600	32.460	1.990	Open Manhole	1200
7.006	o	150	SW24A	34.400	32.300	1.950	Open Manhole	600
7.007	o	225	SW25	34.400	32.138	2.037	Open Manhole	1200
1.008	o	300	SW26	34.400	30.850	3.250	Open Manhole	1200
12.000	o	150	SW27	34.180	33.000	1.030	Open Manhole	600
1.009	o	225	SW28	34.170	30.428	3.517	Open Manhole	1500

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)
10.001	11.781	90.5	SW24	34.600	32.460	1.990	Open Manhole	1200
7.005	15.600	97.5	SW24A	34.400	32.300	1.950	Open Manhole	600
7.006	4.458	51.2	SW25	34.400	32.213	2.037	Open Manhole	1200
7.007	12.891	286.5	SW26	34.400	32.093	2.082	Open Manhole	1200
1.008	8.706	20.6	SW28	34.170	30.428	3.442	Open Manhole	1500
12.000	3.779	15.8	SW28	34.170	32.761	1.259	Open Manhole	1500
1.009	11.212	78.4	CW01	33.900	30.285	3.390	Open Manhole	2400

Free Flowing Outfall Details for Blocks A&B

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.009	CW01	33.900	30.285	30.285	2400	0

Simulation Criteria for Blocks A&B

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

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	16
Number of Online Controls	2	Number of Storage Structures	4	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	18.000
Return Period (years)	30	Ratio R	0.360
Region	England and Wales	Profile Type	Summer

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Synthetic Rainfall Details

Cv (Summer) 0.750 Storm Duration (mins) 30
Cv (Winter) 0.840

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Online Controls for Blocks A&B

Non Return Valve Manhole: SW16, DS/PN: 4.005, Volume (m³): 3.7

Hydro-Brake® Optimum Manhole: SW28, DS/PN: 1.009, Volume (m³): 7.2

Unit Reference	MD-SHE-0105-8400-3400-8400
Design Head (m)	3.400
Design Flow (l/s)	8.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	105
Invert Level (m)	30.428
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	3.400	8.4	Kick-Flo®	0.940	4.6
Flush-Flo™	0.454	5.8	Mean Flow over Head Range	-	6.2

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.6	0.800	5.3	2.000	6.5	4.000	9.1	7.000	11.8
0.200	5.2	1.000	4.7	2.200	6.8	4.500	9.6	7.500	12.2
0.300	5.7	1.200	5.2	2.400	7.1	5.000	10.1	8.000	12.6
0.400	5.8	1.400	5.5	2.600	7.4	5.500	10.5	8.500	13.0
0.500	5.8	1.600	5.9	3.000	7.9	6.000	11.0	9.000	13.3
0.600	5.7	1.800	6.2	3.500	8.5	6.500	11.4	9.500	13.7

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Storage Structures for Blocks A&B

Porous Car Park Manhole: SW01, DS/PN: 1.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	30.6
Membrane Percolation (mm/hr)	1000	Length (m)	25.0
Max Percolation (l/s)	212.5	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	33.365	Cap Volume Depth (m)	0.300

Porous Car Park Manhole: RE, DS/PN: 2.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	20.0
Membrane Percolation (mm/hr)	1000	Length (m)	16.2
Max Percolation (l/s)	90.0	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	34.070	Cap Volume Depth (m)	0.300

Cellular Storage Manhole: TANK 1, DS/PN: 1.003

Invert Level (m)	31.710	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.97
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	49.5	0.0	1.125	49.5	0.0	1.126	0.0	0.0

Cellular Storage Manhole: TANK 2, DS/PN: 6.001

Invert Level (m)	32.210	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.97
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	32.4	0.0	0.610	32.4	0.0	0.611	0.0	0.0

Time Area Diagram for Green Roof at Pipe Number 1.000 (Blocks A&B)

Area (m³)	319	Evaporation (mm/day)	3
Depression Storage (mm)	5	Decay Coefficient	0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.005797	32	36	0.001170	64	68	0.000236	96	100	0.000048
4	8	0.004746	36	40	0.000958	68	72	0.000193	100	104	0.000039
8	12	0.003886	40	44	0.000785	72	76	0.000158	104	108	0.000032
12	16	0.003181	44	48	0.000642	76	80	0.000130	108	112	0.000026
16	20	0.002605	48	52	0.000526	80	84	0.000106	112	116	0.000021
20	24	0.002133	52	56	0.000431	84	88	0.000087	116	120	0.000018
24	28	0.001746	56	60	0.000353	88	92	0.000071			
28	32	0.001429	60	64	0.000289	92	96	0.000058			

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Time Area Diagram for Green Roof at Pipe Number 2.000 (Blocks A&B)

Area (m³) 322 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.005851	32	36	0.001181	64	68	0.000239	96	100	0.000048
4	8	0.004791	36	40	0.000967	68	72	0.000195	100	104	0.000039
8	12	0.003922	40	44	0.000792	72	76	0.000160	104	108	0.000032
12	16	0.003211	44	48	0.000648	76	80	0.000131	108	112	0.000026
16	20	0.002629	48	52	0.000531	80	84	0.000107	112	116	0.000022
20	24	0.002153	52	56	0.000435	84	88	0.000088	116	120	0.000018
24	28	0.001762	56	60	0.000356	88	92	0.000072			
28	32	0.001443	60	64	0.000291	92	96	0.000059			

Time Area Diagram for Green Roof at Pipe Number 3.000 (Blocks A&B)

Area (m³) 523 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.009504	32	36	0.001919	64	68	0.000387	96	100	0.000078
4	8	0.007781	36	40	0.001571	68	72	0.000317	100	104	0.000064
8	12	0.006371	40	44	0.001286	72	76	0.000260	104	108	0.000052
12	16	0.005216	44	48	0.001053	76	80	0.000213	108	112	0.000043
16	20	0.004270	48	52	0.000862	80	84	0.000174	112	116	0.000035
20	24	0.003496	52	56	0.000706	84	88	0.000143	116	120	0.000029
24	28	0.002863	56	60	0.000578	88	92	0.000117			
28	32	0.002344	60	64	0.000473	92	96	0.000096			

Time Area Diagram for Green Roof at Pipe Number 1.005 (Blocks A&B)

Area (m³) 38 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.000691	32	36	0.000139	64	68	0.000028	96	100	0.000006
4	8	0.000565	36	40	0.000114	68	72	0.000023	100	104	0.000005
8	12	0.000463	40	44	0.000093	72	76	0.000019	104	108	0.000004
12	16	0.000379	44	48	0.000077	76	80	0.000015	108	112	0.000003
16	20	0.000310	48	52	0.000063	80	84	0.000013	112	116	0.000003
20	24	0.000254	52	56	0.000051	84	88	0.000010	116	120	0.000002
24	28	0.000208	56	60	0.000042	88	92	0.000008			
28	32	0.000170	60	64	0.000034	92	96	0.000007			

Time Area Diagram for Green Roof at Pipe Number 1.006 (Blocks A&B)

Area (m³) 260 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.004725	12	16	0.002593	24	28	0.001423	36	40	0.000781
4	8	0.003868	16	20	0.002123	28	32	0.001165	40	44	0.000639
8	12	0.003167	20	24	0.001738	32	36	0.000954	44	48	0.000524

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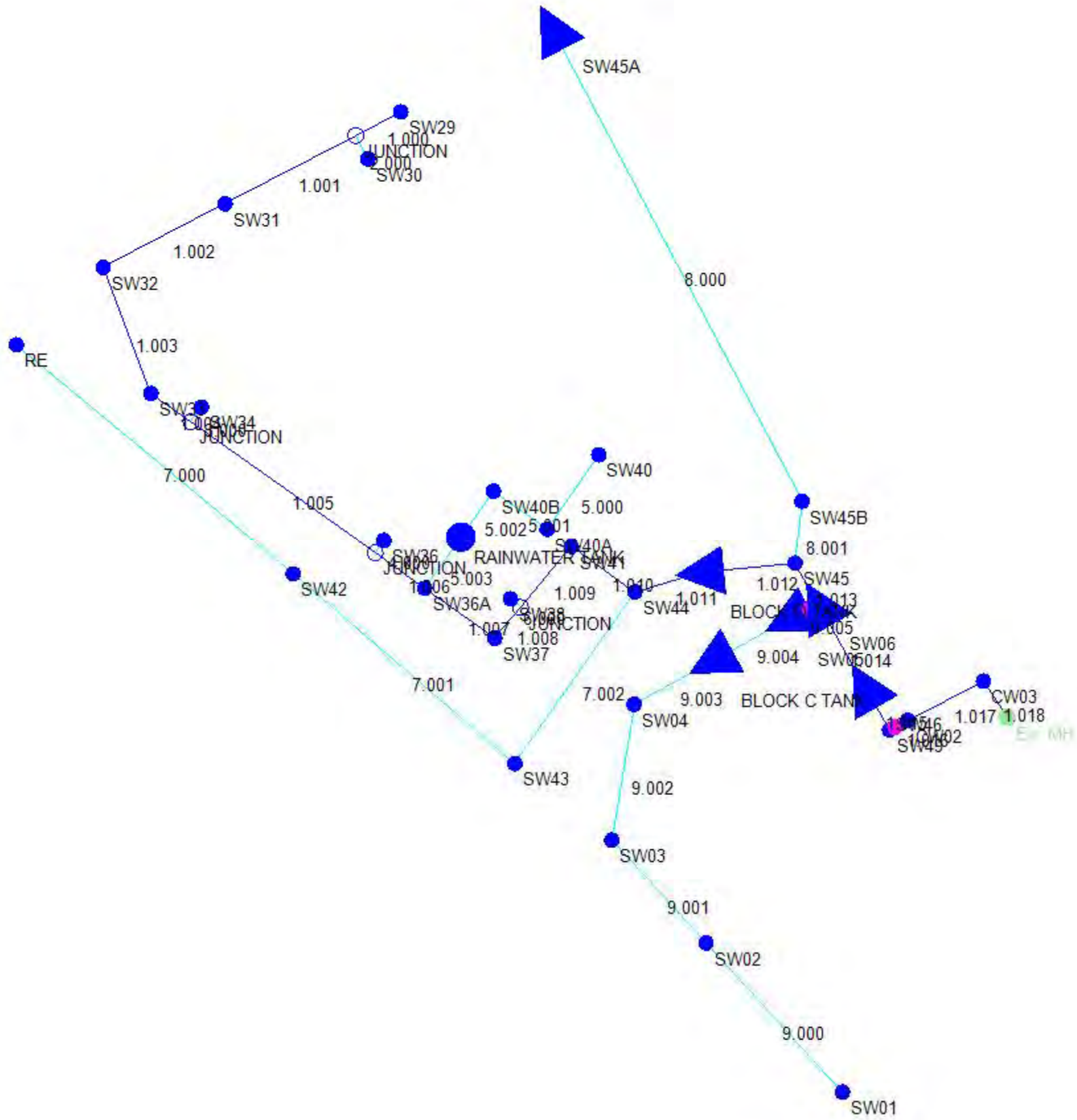
Alan Johnston Partnership		Page 1
1 Dale Street Liverpool L2 2ET	219-215 First Street Blocks C & D SW Network	
Date 13/06/2025 18:06 File SW NETWORKS.MDX	Designed by JJR Checked by JRS	
Innovyze	Network 2020.1.3	



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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Blocks C&D

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	30	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.361	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Blocks C&D

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.124	4-8	0.096

Total Area Contributing (ha) = 0.221

Total Pipe Volume (m³) = 11.611

Network Design Table for Blocks C&D

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
1.000	5.120	0.050	102.4	0.005	5.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	2.661	0.430	6.2	0.018	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	14.876	0.150	99.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	13.839	0.140	98.9	0.009	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	13.570	0.090	150.8	0.021	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	4.939	0.033	150.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
3.000	1.802	0.501	3.6	0.006	5.00	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)
1.000	50.00	5.09	32.170	0.005	0.0	0.0	0.0	0.99	17.5	0.7
2.000	50.00	5.01	32.550	0.018	0.0	0.0	0.0	4.08	72.1	2.4
1.001	50.00	5.33	32.120	0.023	0.0	0.0	0.0	1.01	17.8	3.1
1.002	50.00	5.56	31.970	0.032	0.0	0.0	0.0	1.01	17.9	4.3
1.003	50.00	5.77	31.755	0.053	0.0	0.0	0.0	1.06	42.2	7.2
1.004	50.00	5.85	31.665	0.053	0.0	0.0	0.0	1.06	42.2	7.2
3.000	50.00	5.01	32.220	0.006	0.0	0.0	0.0	5.35	94.5	0.9

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Network Design Table for Blocks C&D

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
1.005	22.778	0.151	150.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.000	1.528	0.463	3.3	0.002	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.006	6.135	0.041	148.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
5.000	9.141	0.290	31.5	0.032	5.00	0.0	0.600	o	150	Pipe/Conduit	
5.001	6.627	0.070	95.3	0.010	0.00	0.0	0.600	o	150	Pipe/Conduit	
5.002	5.676	0.031	184.0	0.024	0.00	0.0	0.600	o	150	Pipe/Conduit	
5.003	6.298	0.035	181.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.007	8.671	0.060	144.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.008	4.033	0.027	150.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
6.000	1.328	0.341	3.9	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.009	7.978	0.053	150.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.010	7.855	0.050	157.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
7.000	36.195	0.240	150.5	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
7.001	29.397	0.200	147.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
7.002	21.097	0.140	150.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.011	6.767	0.050	135.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.012	9.707	0.060	161.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.005	50.00	6.21	31.632	0.059	0.0	0.0	0.0	1.06	42.2	8.1
4.000	50.00	5.00	32.020	0.002	0.0	0.0	0.0	5.59	98.8	0.3
1.006	50.00	6.30	31.481	0.062	0.0	0.0	0.0	1.07	42.6	8.3
5.000	50.00	5.08	31.940	0.032	0.0	0.0	0.0	1.80	31.8	4.3
5.001	50.00	5.19	31.650	0.042	0.0	0.0	0.0	1.03	18.2	5.7
5.002	50.00	5.32	31.580	0.066	0.0	0.0	0.0	0.74	13.0	8.9
5.003	50.00	5.46	31.550	0.066	0.0	0.0	0.0	0.74	13.1	8.9
1.007	50.00	6.44	31.440	0.128	0.0	0.0	0.0	1.09	43.2	17.3
1.008	50.00	6.50	31.380	0.128	0.0	0.0	0.0	1.07	42.4	17.3
6.000	50.00	5.00	31.770	0.000	0.0	0.0	0.0	5.14	90.8	0.0
1.009	50.00	6.62	31.353	0.128	0.0	0.0	0.0	1.07	42.4	17.3
1.010	50.00	6.75	31.300	0.128	0.0	0.0	0.0	1.04	41.4	17.3
7.000	50.00	5.74	33.950	0.000	0.0	0.0	0.0	0.82	14.4	0.0
7.001	50.00	6.33	33.710	0.000	0.0	0.0	0.0	0.83	14.6	0.0
7.002	50.00	6.76	33.510	0.000	0.0	0.0	0.0	0.82	14.4	0.0
1.011	50.00	6.86	31.250	0.128	0.0	0.0	0.0	1.12	44.5	17.3
1.012	50.00	7.02	31.200	0.128	0.0	0.0	0.0	1.03	40.8	17.3

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Network Design Table for Blocks C&D

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
8.000	54.016	0.540	100.0	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
8.001	6.242	0.055	113.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.013	4.741	0.037	129.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
9.000	20.332	0.135	150.6	0.038	5.00	0.0	0.600	o	225	Pipe/Conduit	
9.001	14.068	0.094	149.7	0.038	0.00	0.0	0.600	o	225	Pipe/Conduit	
9.002	13.824	0.093	149.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
9.003	8.801	0.023	382.7	0.017	0.00	0.0	0.600	o	225	Pipe/Conduit	
9.004	8.801	0.094	93.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
9.005	3.531	0.024	147.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.014	9.456	0.073	129.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.015	5.083	0.118	43.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.016	2.039	0.072	28.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.017	8.620	0.090	95.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.018	4.355	0.044	100.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
8.000	50.00	5.90	33.250	0.000	0.0	0.0	0.0	1.00	17.8	0.0
8.001	50.00	6.01	32.710	0.000	0.0	0.0	0.0	0.94	16.7	0.0
1.013	50.00	7.09	31.140	0.128	0.0	0.0	0.0	1.15	45.7	17.3
9.000	50.00	5.32	33.065	0.038	0.0	0.0	0.0	1.06	42.3	5.1
9.001	50.00	5.54	32.930	0.076	0.0	0.0	0.0	1.07	42.4	10.3
9.002	50.00	5.75	32.836	0.076	0.0	0.0	0.0	1.07	42.5	10.3
9.003	50.00	5.98	32.743	0.093	0.0	0.0	0.0	0.66	26.3	12.6
9.004	50.00	6.08	32.720	0.093	0.0	0.0	0.0	1.35	53.9	12.6
9.005	50.00	6.14	32.626	0.093	0.0	0.0	0.0	1.08	42.8	12.6
1.014	50.00	7.23	31.103	0.221	0.0	0.0	0.0	1.15	45.6	29.9
1.015	50.00	7.27	31.030	0.221	0.0	0.0	0.0	2.00	79.5	29.9
1.016	50.00	7.28	30.912	0.221	0.0	0.0	0.0	2.47	98.1	29.9
1.017	50.00	7.39	30.840	0.221	0.0	0.0	0.0	1.34	53.2	29.9
1.018	50.00	7.44	30.750	0.221	0.0	0.0	0.0	1.31	52.0	29.9

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Manhole Schedules for Blocks C&D

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
SW29	33.750	1.580	Open Manhole	600	1.000	32.170	150				
SW30	33.800	1.250	Open Manhole	600	2.000	32.550	150				
JUNCTION	33.750	1.630	Junction		1.001	32.120	150	1.000	32.120	150	
								2.000	32.120	150	
SW31	33.750	1.780	Open Manhole	600	1.002	31.970	150	1.001	31.970	150	
SW32	33.750	1.995	Open Manhole	1200	1.003	31.755	225	1.002	31.830	150	
SW33	33.800	2.135	Open Manhole	1200	1.004	31.665	225	1.003	31.665	225	
SW34	33.800	1.580	Open Manhole	600	3.000	32.220	150				
JUNCTION	33.800	2.168	Junction		1.005	31.632	225	1.004	31.632	225	
								3.000	31.719	150	12
SW36	33.800	1.780	Open Manhole	600	4.000	32.020	150				
JUNCTION	33.800	2.319	Junction		1.006	31.481	225	1.005	31.481	225	
								4.000	31.557	150	1
SW40	33.800	1.860	Open Manhole	600	5.000	31.940	150				
SW40A	33.800	2.150	Open Manhole	600	5.001	31.650	150	5.000	31.650	150	
SW40B	33.800	2.220	Open Manhole	1200	5.002	31.580	150	5.001	31.580	150	
RAINWATER TANK	33.800	2.250	Open Manhole	3000	5.003	31.550	150	5.002	31.550	150	
SW36A	33.800	2.360	Open Manhole	1200	1.007	31.440	225	1.006	31.440	225	
								5.003	31.515	150	
SW37	33.800	2.420	Open Manhole	1200	1.008	31.380	225	1.007	31.380	225	
SW38	33.800	2.030	Open Manhole	600	6.000	31.770	150				
JUNCTION	33.800	2.447	Junction		1.009	31.353	225	1.008	31.353	225	
								6.000	31.429	150	2
SW41	33.800	2.500	Open Manhole	1200	1.010	31.300	225	1.009	31.300	225	
RE	34.700	0.750	Open Manhole	150	7.000	33.950	150				
SW42	34.700	0.990	Open Manhole	1200	7.001	33.710	150	7.000	33.710	150	
SW43	34.700	1.190	Open Manhole	1200	7.002	33.510	150	7.001	33.510	150	
SW44	34.700	3.450	Open Manhole	1200	1.011	31.250	225	1.010	31.250	225	
								7.002	33.370	150	2045
BLOCK D TANK	34.400	3.200	Open Manhole	1500	1.012	31.200	225	1.011	31.200	225	
SW45A	34.000	0.750	Open Manhole	1200	8.000	33.250	150				
SW45B	34.000	1.290	Open Manhole	1200	8.001	32.710	150	8.000	32.710	150	
SW45	34.150	3.010	Open Manhole	1200	1.013	31.140	225	1.012	31.140	225	
								8.001	32.655	150	1440
SW01	34.700	1.635	Open Manhole	1200	9.000	33.065	225				
SW02	34.700	1.770	Open Manhole	1200	9.001	32.930	225	9.000	32.930	225	
SW03	34.700	1.864	Open Manhole	1200	9.002	32.836	225	9.001	32.836	225	
SW04	34.700	1.957	Open Manhole	1200	9.003	32.743	225	9.002	32.743	225	
BLOCK C TANK	34.700	1.980	Open Manhole	1200	9.004	32.720	225	9.003	32.720	225	
SW05	34.700	2.074	Open Manhole	1500	9.005	32.626	225	9.004	32.626	225	
SW06	34.670	3.567	Open Manhole	1500	1.014	31.103	225	1.013	31.103	225	
								9.005	32.602	225	1498
SW46	34.550	3.520	Open Manhole	1200	1.015	31.030	225	1.014	31.030	225	
SW49	34.700	3.788	Open Manhole	1200	1.016	30.912	225	1.015	30.912	225	

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Manhole Schedules for Blocks C&D

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)
CW02	34.650	3.810	Open Manhole	1200	1.017	30.840	225	1.016	30.840	225	
CW03	34.450	3.700	Open Manhole	1200	1.018	30.750	225	1.017	30.750	225	
Ex. MH	34.670	3.964	Open Manhole	1800		OUTFALL		1.018	30.706	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SW29	383769.007	397207.342	383769.007	397207.342	Required	
SW30	383765.701	397202.613	383765.701	397202.613	Required	
JUNCTION	383764.469	397204.971			No Entry	
SW31	383751.284	397198.082	383751.284	397198.082	Required	
SW32	383739.018	397191.673	383739.018	397191.673	Required	
SW33	383743.827	397178.984	383743.827	397178.984	Required	
SW34	383748.900	397177.597	383748.900	397177.597	Required	
JUNCTION	383747.856	397176.128			No Entry	
SW36	383767.309	397164.181	383767.309	397164.181	Required	
JUNCTION	383766.424	397162.935			No Entry	
SW40	383788.977	397172.813	383788.977	397172.813	Required	
SW40A	383783.761	397165.306	383783.761	397165.306	Required	
SW40B	383778.358	397169.144	383778.358	397169.144	Required	
RAINWATER TANK	383775.072	397164.516	383775.072	397164.516	Required	
SW36A	383771.425	397159.382	383771.425	397159.382	Required	

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Manhole Schedules for Blocks C&D

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SW37	383778.495	397154.362	383778.495	397154.362	Required	
SW38	383780.070	397158.306	383780.070	397158.306	Required	
JUNCTION	383781.087	397157.452			No Entry	
SW41	383786.213	397163.565	383786.213	397163.565	Required	
RE	383730.265	397183.894	383730.265	397183.894	Required	
SW42	383758.159	397160.829	383758.159	397160.829	Required	
SW43	383780.513	397141.738	383780.513	397141.738	Required	
SW44	383792.617	397159.017	383792.617	397159.017	Required	
BLOCK D TANK	383799.108	397160.930	383799.108	397160.930	Required	
SW45A	383784.227	397215.883	383784.227	397215.883	Required	
SW45B	383809.453	397168.119	383809.453	397168.119	Required	
SW45	383808.765	397161.915	383808.765	397161.915	Required	
SW01	383813.545	397108.739	383813.545	397108.739	Required	
SW02	383799.790	397123.712	383799.790	397123.712	Required	
SW03	383790.273	397134.072	383790.273	397134.072	Required	
SW04	383792.525	397147.711	383792.525	397147.711	Required	
BLOCK C TANK	383800.240	397151.947	383800.240	397151.947	Required	
SW05	383807.955	397156.183	383807.955	397156.183	Required	

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Manhole Schedules for Blocks C&D

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SW06	383811.100	397157.789	383811.100	397157.789	Required	
SW46	383815.750	397149.555	383815.750	397149.555	Required	
SW49	383818.279	397145.146	383818.279	397145.146	Required	
CW02	383820.086	397146.090	383820.086	397146.090	Required	
CW03	383827.744	397150.048	383827.744	397150.048	Required	
Ex. MH	383830.121	397146.398			No Entry	

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PIPELINE SCHEDULES for Blocks C&D

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)
1.000	o	150	SW29	33.750	32.170	1.430	Open Manhole	600
2.000	o	150	SW30	33.800	32.550	1.100	Open Manhole	600
1.001	o	150	JUNCTION	33.750	32.120	1.480	Junction	
1.002	o	150	SW31	33.750	31.970	1.630	Open Manhole	600
1.003	o	225	SW32	33.750	31.755	1.770	Open Manhole	1200
1.004	o	225	SW33	33.800	31.665	1.910	Open Manhole	1200
3.000	o	150	SW34	33.800	32.220	1.430	Open Manhole	600
1.005	o	225	JUNCTION	33.800	31.632	1.943	Junction	
4.000	o	150	SW36	33.800	32.020	1.630	Open Manhole	600
1.006	o	225	JUNCTION	33.800	31.481	2.094	Junction	
5.000	o	150	SW40	33.800	31.940	1.710	Open Manhole	600
5.001	o	150	SW40A	33.800	31.650	2.000	Open Manhole	600
5.002	o	150	SW40B	33.800	31.580	2.070	Open Manhole	1200
5.003	o	150	RAINWATER TANK	33.800	31.550	2.100	Open Manhole	3000
1.007	o	225	SW36A	33.800	31.440	2.135	Open Manhole	1200
1.008	o	225	SW37	33.800	31.380	2.195	Open Manhole	1200

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)
1.000	5.120	102.4	JUNCTION	33.750	32.120	1.480	Junction	
2.000	2.661	6.2	JUNCTION	33.750	32.120	1.480	Junction	
1.001	14.876	99.2	SW31	33.750	31.970	1.630	Open Manhole	600
1.002	13.839	98.9	SW32	33.750	31.830	1.770	Open Manhole	1200
1.003	13.570	150.8	SW33	33.800	31.665	1.910	Open Manhole	1200
1.004	4.939	150.8	JUNCTION	33.800	31.632	1.943	Junction	
3.000	1.802	3.6	JUNCTION	33.800	31.719	1.931	Junction	
1.005	22.778	150.8	JUNCTION	33.800	31.481	2.094	Junction	
4.000	1.528	3.3	JUNCTION	33.800	31.557	2.093	Junction	
1.006	6.135	148.0	SW36A	33.800	31.440	2.135	Open Manhole	1200
5.000	9.141	31.5	SW40A	33.800	31.650	2.000	Open Manhole	600
5.001	6.627	95.3	SW40B	33.800	31.580	2.070	Open Manhole	1200
5.002	5.676	184.0	RAINWATER TANK	33.800	31.550	2.100	Open Manhole	3000
5.003	6.298	181.0	SW36A	33.800	31.515	2.135	Open Manhole	1200
1.007	8.671	144.5	SW37	33.800	31.380	2.195	Open Manhole	1200
1.008	4.033	150.0	JUNCTION	33.800	31.353	2.222	Junction	

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PIPELINE SCHEDULES for Blocks C&D

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)
6.000	o	150	SW38	33.800	31.770	1.880	Open Manhole	600
1.009	o	225	JUNCTION	33.800	31.353	2.222	Junction	
1.010	o	225	SW41	33.800	31.300	2.275	Open Manhole	1200
7.000	o	150	RE	34.700	33.950	0.600	Open Manhole	150
7.001	o	150	SW42	34.700	33.710	0.840	Open Manhole	1200
7.002	o	150	SW43	34.700	33.510	1.040	Open Manhole	1200
1.011	o	225	SW44	34.700	31.250	3.225	Open Manhole	1200
1.012	o	225	BLOCK D TANK	34.400	31.200	2.975	Open Manhole	1500
8.000	o	150	SW45A	34.000	33.250	0.600	Open Manhole	1200
8.001	o	150	SW45B	34.000	32.710	1.140	Open Manhole	1200
1.013	o	225	SW45	34.150	31.140	2.785	Open Manhole	1200
9.000	o	225	SW01	34.700	33.065	1.410	Open Manhole	1200
9.001	o	225	SW02	34.700	32.930	1.545	Open Manhole	1200
9.002	o	225	SW03	34.700	32.836	1.639	Open Manhole	1200
9.003	o	225	SW04	34.700	32.743	1.732	Open Manhole	1200
9.004	o	225	BLOCK C TANK	34.700	32.720	1.755	Open Manhole	1200
9.005	o	225	SW05	34.700	32.626	1.849	Open Manhole	1500
1.014	o	225	SW06	34.670	31.103	3.342	Open Manhole	1500

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)
6.000	1.328	3.9	JUNCTION	33.800	31.429	2.221	Junction	
1.009	7.978	150.0	SW41	33.800	31.300	2.275	Open Manhole	1200
1.010	7.855	157.1	SW44	34.700	31.250	3.225	Open Manhole	1200
7.000	36.195	150.5	SW42	34.700	33.710	0.840	Open Manhole	1200
7.001	29.397	147.0	SW43	34.700	33.510	1.040	Open Manhole	1200
7.002	21.097	150.2	SW44	34.700	33.370	1.180	Open Manhole	1200
1.011	6.767	135.8	BLOCK D TANK	34.400	31.200	2.975	Open Manhole	1500
1.012	9.707	161.8	SW45	34.150	31.140	2.785	Open Manhole	1200
8.000	54.016	100.0	SW45B	34.000	32.710	1.140	Open Manhole	1200
8.001	6.242	113.2	SW45	34.150	32.655	1.345	Open Manhole	1200
1.013	4.741	129.0	SW06	34.670	31.103	3.342	Open Manhole	1500
9.000	20.332	150.6	SW02	34.700	32.930	1.545	Open Manhole	1200
9.001	14.068	149.7	SW03	34.700	32.836	1.639	Open Manhole	1200
9.002	13.824	149.0	SW04	34.700	32.743	1.732	Open Manhole	1200
9.003	8.801	382.7	BLOCK C TANK	34.700	32.720	1.755	Open Manhole	1200
9.004	8.801	93.2	SW05	34.700	32.626	1.849	Open Manhole	1500
9.005	3.531	147.1	SW06	34.670	32.602	1.843	Open Manhole	1500
1.014	9.456	129.5	SW46	34.550	31.030	3.295	Open Manhole	1200

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PIPELINE SCHEDULES for Blocks C&D

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)
1.015	o	225	SW46	34.550	31.030	3.295	Open Manhole	1200
1.016	o	225	SW49	34.700	30.912	3.563	Open Manhole	1200
1.017	o	225	CW02	34.650	30.840	3.585	Open Manhole	1200
1.018	o	225	CW03	34.450	30.750	3.475	Open Manhole	1200

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)
1.015	5.083	43.1	SW49	34.700	30.912	3.563	Open Manhole	1200
1.016	2.039	28.3	CW02	34.650	30.840	3.585	Open Manhole	1200
1.017	8.620	95.4	CW03	34.450	30.750	3.475	Open Manhole	1200
1.018	4.355	100.0	Ex. MH	34.670	30.706	3.739	Open Manhole	1800

Free Flowing Outfall Details for Blocks C&D

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.018	Ex. MH	34.670	30.706	27.920	1800	0

Simulation Criteria for Blocks C&D

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

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	14
Number of Online Controls	2	Number of Storage Structures	6	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.360		

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Online Controls for Blocks C&D

Hydro-Brake® Optimum Manhole: SW05, DS/PN: 9.005, Volume (m³): 4.0

Unit Reference	MD-SHE-0100-5000-1400-5000
Design Head (m)	1.400
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	100
Invert Level (m)	32.626
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.400	5.0	Kick-Flo®	0.855	4.0
Flush-Flo™	0.416	5.0	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)	Depth (m)	Flow (l/s)
0.100	3.3	0.800	4.3	2.000	5.9	4.000	8.2	7.000	10.7
0.200	4.6	1.000	4.3	2.200	6.2	4.500	8.6	7.500	11.0
0.300	4.9	1.200	4.7	2.400	6.4	5.000	9.1	8.000	11.4
0.400	5.0	1.400	5.0	2.600	6.7	5.500	9.5	8.500	11.7
0.500	5.0	1.600	5.3	3.000	7.1	6.000	9.9	9.000	12.0
0.600	4.9	1.800	5.6	3.500	7.7	6.500	10.3	9.500	12.3

Hydro-Brake® Optimum Manhole: SW49, DS/PN: 1.016, Volume (m³): 4.4

Unit Reference	MD-SHE-0087-5000-2500-5000
Design Head (m)	2.500
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	87
Invert Level (m)	30.912
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)	2.500	5.0	Kick-Flo®	0.777	2.9
Flush-Flo™	0.379	3.6	Mean Flow over Head Range	-	3.8

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.6	0.400	3.6	0.800	2.9	1.400	3.8	2.000	4.5
0.200	3.4	0.500	3.6	1.000	3.3	1.600	4.1	2.200	4.7
0.300	3.6	0.600	3.5	1.200	3.6	1.800	4.3	2.400	4.9

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Hydro-Brake® Optimum Manhole: SW49, DS/PN: 1.016, Volume (m³): 4.4

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)
2.600	5.1	4.000	6.2	5.500	7.2	7.000	8.1	8.500	8.9
3.000	5.4	4.500	6.6	6.000	7.5	7.500	8.4	9.000	9.1
3.500	5.8	5.000	6.9	6.500	7.8	8.000	8.6	9.500	9.4

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Storage Structures for Blocks C&D

Cellular Storage Manhole: BLOCK D TANK, DS/PN: 1.012

Invert Level (m) 31.200 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	31.5	0.0	1.500	31.5	0.0	1.501	0.0	0.0

Porous Car Park Manhole: SW45A, DS/PN: 8.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	5.2
Membrane Percolation (mm/hr)	1000	Length (m)	68.3
Max Percolation (l/s)	98.7	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	33.500	Cap Volume Depth (m)	0.300

Cellular Storage Manhole: BLOCK C TANK, DS/PN: 9.004

Invert Level (m) 32.720 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	38.0	0.0	1.200	38.0	0.0	1.201	0.0	0.0

Porous Car Park Manhole: SW05, DS/PN: 9.005

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	46.3
Max Percolation (l/s)	128.6	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	32.247	Cap Volume Depth (m)	0.300

Porous Car Park Manhole: SW06, DS/PN: 1.014

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	9.7
Membrane Percolation (mm/hr)	1000	Length (m)	47.8
Max Percolation (l/s)	128.8	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	34.170	Cap Volume Depth (m)	0.300

Porous Car Park Manhole: SW46, DS/PN: 1.015

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	6.0
Membrane Percolation (mm/hr)	1000	Length (m)	18.5
Max Percolation (l/s)	30.8	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	34.050	Cap Volume Depth (m)	0.300

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Time Area Diagram for Green Roof at Pipe Number 1.000 (Blocks C&D)

Area (m³) 284 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.005161	32	36	0.001042	64	68	0.000210	96	100	0.000042
4	8	0.004225	36	40	0.000853	68	72	0.000172	100	104	0.000035
8	12	0.003459	40	44	0.000698	72	76	0.000141	104	108	0.000028
12	16	0.002832	44	48	0.000572	76	80	0.000115	108	112	0.000023
16	20	0.002319	48	52	0.000468	80	84	0.000095	112	116	0.000019
20	24	0.001899	52	56	0.000383	84	88	0.000077	116	120	0.000016
24	28	0.001554	56	60	0.000314	88	92	0.000063			
28	32	0.001273	60	64	0.000257	92	96	0.000052			

Time Area Diagram for Green Roof at Pipe Number 2.000 (Blocks C&D)

Area (m³) 111 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.002017	32	36	0.000407	64	68	0.000082	96	100	0.000017
4	8	0.001651	36	40	0.000333	68	72	0.000067	100	104	0.000014
8	12	0.001352	40	44	0.000273	72	76	0.000055	104	108	0.000011
12	16	0.001107	44	48	0.000223	76	80	0.000045	108	112	0.000009
16	20	0.000906	48	52	0.000183	80	84	0.000037	112	116	0.000007
20	24	0.000742	52	56	0.000150	84	88	0.000030	116	120	0.000006
24	28	0.000608	56	60	0.000123	88	92	0.000025			
28	32	0.000497	60	64	0.000100	92	96	0.000020			

Time Area Diagram for Green Roof at Pipe Number 1.002 (Blocks C&D)

Area (m³) 107 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.001944	32	36	0.000393	64	68	0.000079	96	100	0.000016
4	8	0.001592	36	40	0.000321	68	72	0.000065	100	104	0.000013
8	12	0.001303	40	44	0.000263	72	76	0.000053	104	108	0.000011
12	16	0.001067	44	48	0.000215	76	80	0.000043	108	112	0.000009
16	20	0.000874	48	52	0.000176	80	84	0.000036	112	116	0.000007
20	24	0.000715	52	56	0.000144	84	88	0.000029	116	120	0.000006
24	28	0.000586	56	60	0.000118	88	92	0.000024			
28	32	0.000479	60	64	0.000097	92	96	0.000020			

Time Area Diagram for Green Roof at Pipe Number 3.000 (Blocks C&D)

Area (m³) 236 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.004289	12	16	0.002354	24	28	0.001292	36	40	0.000709
4	8	0.003511	16	20	0.001927	28	32	0.001058	40	44	0.000580
8	12	0.002875	20	24	0.001578	32	36	0.000866	44	48	0.000475

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Time Area Diagram for Green Roof at Pipe Number 3.000 (Blocks C&D)

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
48	52	0.000389	68	72	0.000143	88	92	0.000053	108	112	0.000019
52	56	0.000319	72	76	0.000117	92	96	0.000043	112	116	0.000016
56	60	0.000261	76	80	0.000096	96	100	0.000035	116	120	0.000013
60	64	0.000214	80	84	0.000079	100	104	0.000029			
64	68	0.000175	84	88	0.000064	104	108	0.000024			

Time Area Diagram for Green Roof at Pipe Number 4.000 (Blocks C&D)

Area (m³) 30 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.000545	32	36	0.000110	64	68	0.000022	96	100	0.000004
4	8	0.000446	36	40	0.000090	68	72	0.000018	100	104	0.000004
8	12	0.000365	40	44	0.000074	72	76	0.000015	104	108	0.000003
12	16	0.000299	44	48	0.000060	76	80	0.000012	108	112	0.000002
16	20	0.000245	48	52	0.000049	80	84	0.000010	112	116	0.000002
20	24	0.000201	52	56	0.000040	84	88	0.000008	116	120	0.000002
24	28	0.000164	56	60	0.000033	88	92	0.000007			
28	32	0.000134	60	64	0.000027	92	96	0.000005			

Time Area Diagram for Green Roof at Pipe Number 5.000 (Blocks C&D)

Area (m³) 225 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.004089	32	36	0.000825	64	68	0.000167	96	100	0.000034
4	8	0.003348	36	40	0.000676	68	72	0.000136	100	104	0.000028
8	12	0.002741	40	44	0.000553	72	76	0.000112	104	108	0.000023
12	16	0.002244	44	48	0.000453	76	80	0.000091	108	112	0.000018
16	20	0.001837	48	52	0.000371	80	84	0.000075	112	116	0.000015
20	24	0.001504	52	56	0.000304	84	88	0.000061	116	120	0.000012
24	28	0.001231	56	60	0.000249	88	92	0.000050			
28	32	0.001008	60	64	0.000204	92	96	0.000041			

Time Area Diagram for Green Roof at Pipe Number 5.001 (Blocks C&D)

Area (m³) 92 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.001672	32	36	0.000338	64	68	0.000068	96	100	0.000014
4	8	0.001369	36	40	0.000276	68	72	0.000056	100	104	0.000011
8	12	0.001121	40	44	0.000226	72	76	0.000046	104	108	0.000009
12	16	0.000918	44	48	0.000185	76	80	0.000037	108	112	0.000008
16	20	0.000751	48	52	0.000152	80	84	0.000031	112	116	0.000006
20	24	0.000615	52	56	0.000124	84	88	0.000025	116	120	0.000005
24	28	0.000504	56	60	0.000102	88	92	0.000021			
28	32	0.000412	60	64	0.000083	92	96	0.000017			

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Time Area Diagram for Green Roof at Pipe Number 6.000 (Blocks C&D)

Area (m³) 155 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.002817	32	36	0.000569	64	68	0.000115	96	100	0.000023
4	8	0.002306	36	40	0.000466	68	72	0.000094	100	104	0.000019
8	12	0.001888	40	44	0.000381	72	76	0.000077	104	108	0.000016
12	16	0.001546	44	48	0.000312	76	80	0.000063	108	112	0.000013
16	20	0.001266	48	52	0.000256	80	84	0.000052	112	116	0.000010
20	24	0.001036	52	56	0.000209	84	88	0.000042	116	120	0.000009
24	28	0.000848	56	60	0.000171	88	92	0.000035			
28	32	0.000695	60	64	0.000140	92	96	0.000028			

Time Area Diagram for Green Roof at Pipe Number 7.000 (Blocks C&D)

Area (m³) 39 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.000709	32	36	0.000143	64	68	0.000029	96	100	0.000006
4	8	0.000580	36	40	0.000117	68	72	0.000024	100	104	0.000005
8	12	0.000475	40	44	0.000096	72	76	0.000019	104	108	0.000004
12	16	0.000389	44	48	0.000079	76	80	0.000016	108	112	0.000003
16	20	0.000318	48	52	0.000064	80	84	0.000013	112	116	0.000003
20	24	0.000261	52	56	0.000053	84	88	0.000011	116	120	0.000002
24	28	0.000213	56	60	0.000043	88	92	0.000009			
28	32	0.000175	60	64	0.000035	92	96	0.000007			

Time Area Diagram for Green Roof at Pipe Number 7.001 (Blocks C&D)

Area (m³) 45 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.000818	32	36	0.000165	64	68	0.000033	96	100	0.000007
4	8	0.000670	36	40	0.000135	68	72	0.000027	100	104	0.000006
8	12	0.000548	40	44	0.000111	72	76	0.000022	104	108	0.000005
12	16	0.000449	44	48	0.000091	76	80	0.000018	108	112	0.000004
16	20	0.000367	48	52	0.000074	80	84	0.000015	112	116	0.000003
20	24	0.000301	52	56	0.000061	84	88	0.000012	116	120	0.000002
24	28	0.000246	56	60	0.000050	88	92	0.000010			
28	32	0.000202	60	64	0.000041	92	96	0.000008			

Time Area Diagram for Green Roof at Pipe Number 8.000 (Blocks C&D)

Area (m³) 354 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.006433	12	16	0.003530	24	28	0.001938	36	40	0.001063
4	8	0.005267	16	20	0.002890	28	32	0.001586	40	44	0.000871
8	12	0.004312	20	24	0.002367	32	36	0.001299	44	48	0.000713

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Time Area Diagram for Green Roof at Pipe Number 8.000 (Blocks C&D)

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
48	52	0.000584	68	72	0.000215	88	92	0.000079	108	112	0.000029
52	56	0.000478	72	76	0.000176	92	96	0.000065	112	116	0.000024
56	60	0.000391	76	80	0.000144	96	100	0.000053	116	120	0.000019
60	64	0.000320	80	84	0.000118	100	104	0.000043			
64	68	0.000262	84	88	0.000096	104	108	0.000035			

Time Area Diagram for Green Roof at Pipe Number 9.005 (Blocks C&D)

Area (m³) 463 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.008414	32	36	0.001699	64	68	0.000343	96	100	0.000069
4	8	0.006888	36	40	0.001391	68	72	0.000281	100	104	0.000057
8	12	0.005640	40	44	0.001139	72	76	0.000230	104	108	0.000046
12	16	0.004617	44	48	0.000932	76	80	0.000188	108	112	0.000038
16	20	0.003780	48	52	0.000763	80	84	0.000154	112	116	0.000031
20	24	0.003095	52	56	0.000625	84	88	0.000126	116	120	0.000025
24	28	0.002534	56	60	0.000512	88	92	0.000103			
28	32	0.002075	60	64	0.000419	92	96	0.000085			

Time Area Diagram for Green Roof at Pipe Number 1.014 (Blocks C&D)

Area (m³) 463 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.008414	32	36	0.001699	64	68	0.000343	96	100	0.000069
4	8	0.006888	36	40	0.001391	68	72	0.000281	100	104	0.000057
8	12	0.005640	40	44	0.001139	72	76	0.000230	104	108	0.000046
12	16	0.004617	44	48	0.000932	76	80	0.000188	108	112	0.000038
16	20	0.003780	48	52	0.000763	80	84	0.000154	112	116	0.000031
20	24	0.003095	52	56	0.000625	84	88	0.000126	116	120	0.000025
24	28	0.002534	56	60	0.000512	88	92	0.000103			
28	32	0.002075	60	64	0.000419	92	96	0.000085			

Time Area Diagram for Green Roof at Pipe Number 1.015 (Blocks C&D)

Area (m³) 111 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.002017	32	36	0.000407	64	68	0.000082	96	100	0.000017
4	8	0.001651	36	40	0.000333	68	72	0.000067	100	104	0.000014
8	12	0.001352	40	44	0.000273	72	76	0.000055	104	108	0.000011
12	16	0.001107	44	48	0.000223	76	80	0.000045	108	112	0.000009
16	20	0.000906	48	52	0.000183	80	84	0.000037	112	116	0.000007
20	24	0.000742	52	56	0.000150	84	88	0.000030	116	120	0.000006
24	28	0.000608	56	60	0.000123	88	92	0.000025			
28	32	0.000497	60	64	0.000100	92	96	0.000020			

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Blocks C&D

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 14
Number of Online Controls 2 Number of Storage Structures 6 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.360 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
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, 2, 30, 100
Climate Change (%) 0, 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	SW29	60 Winter	1	+0%	100/30 Winter				32.195
2.000	SW30	120 Summer	1	+0%	100/60 Winter				32.557
1.001	JUNCTION	120 Winter	1	+0%					32.145
1.002	SW31	120 Winter	1	+0%	30/240 Winter				32.001
1.003	SW32	120 Winter	1	+0%	30/120 Winter				31.791
1.004	SW33	120 Winter	1	+0%	30/120 Winter				31.705
3.000	SW34	120 Summer	1	+0%	100/30 Winter				32.232
1.005	JUNCTION	120 Winter	1	+0%	30/120 Summer				31.670
4.000	SW36	120 Summer	1	+0%	30/240 Winter				32.022
1.006	JUNCTION	120 Winter	1	+0%	30/60 Winter				31.528
5.000	SW40	120 Winter	1	+0%	30/240 Winter				31.956
5.001	SW40A	60 Winter	1	+0%	30/60 Winter				31.676
5.002	SW40B	15 Winter	1	+0%	30/60 Winter				31.629
5.003	RAINWATER TANK	15 Winter	1	+0%	30/60 Winter				31.595
1.007	SW36A	120 Winter	1	+0%	30/60 Summer				31.494
1.008	SW37	120 Winter	1	+0%	30/60 Summer				31.439
6.000	SW38	120 Summer	1	+0%	30/120 Winter				31.780
1.009	JUNCTION	120 Winter	1	+0%	30/30 Winter				31.412
1.010	SW41	120 Winter	1	+0%	30/30 Winter				31.360
7.000	RE	120 Winter	1	+0%					33.956
7.001	SW42	120 Winter	1	+0%					33.722
7.002	SW43	120 Winter	1	+0%					33.523
1.011	SW44	120 Winter	1	+0%	30/30 Summer				31.311
1.012	BLOCK D TANK	120 Winter	1	+0%	30/30 Summer				31.255
8.000	SW45A	240 Winter	1	+0%	100/240 Winter				33.268
8.001	SW45B	240 Winter	1	+0%	100/120 Summer				32.730
1.013	SW45	240 Winter	1	+0%	2/240 Winter				31.239
9.000	SW01	15 Winter	1	+0%	100/15 Summer				33.117
9.001	SW02	15 Winter	1	+0%	100/15 Summer				33.003
9.002	SW03	15 Winter	1	+0%	100/15 Summer				32.909
9.003	SW04	15 Winter	1	+0%	30/15 Summer				32.860

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Blocks C&D

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW29	-0.125	0.000	0.06			0.9	OK	
2.000	SW30	-0.143	0.000	0.01			0.3	OK	
1.001	JUNCTION	-0.125	0.000	0.07			1.2	OK*	
1.002	SW31	-0.119	0.000	0.09			1.5	OK	
1.003	SW32	-0.189	0.000	0.06			2.2	OK	
1.004	SW33	-0.185	0.000	0.07			2.2	OK	
3.000	SW34	-0.138	0.000	0.02			0.7	OK	
1.005	JUNCTION	-0.187	0.000	0.07			2.9	OK*	
4.000	SW36	-0.148	0.000	0.00			0.1	OK	
1.006	JUNCTION	-0.178	0.000	0.10			3.0	OK*	
5.000	SW40	-0.134	0.000	0.02			0.7	OK	
5.001	SW40A	-0.124	0.000	0.06			1.0	OK	
5.002	SW40B	-0.101	0.000	0.23			2.4	OK	
5.003	RAINWATER TANK	-0.104	0.000	0.20			2.2	OK	
1.007	SW36A	-0.171	0.000	0.13			4.6	OK	
1.008	SW37	-0.166	0.000	0.16			4.6	OK	
6.000	SW38	-0.140	0.000	0.01			0.4	OK	
1.009	JUNCTION	-0.166	0.000	0.15			5.0	OK*	
1.010	SW41	-0.165	0.000	0.16			5.0	OK	
7.000	RE	-0.144	0.000	0.01			0.1	OK	
7.001	SW42	-0.138	0.000	0.02			0.2	OK	
7.002	SW43	-0.137	0.000	0.02			0.2	OK	
1.011	SW44	-0.164	0.000	0.17			5.3	OK	
1.012	BLOCK D TANK	-0.170	0.000	0.14		49	4.7	OK	
8.000	SW45A	-0.132	0.000	0.03		37	0.6	OK	
8.001	SW45B	-0.130	0.000	0.04			0.6	OK	
1.013	SW45	-0.126	0.000	0.13			4.0	OK	
9.000	SW01	-0.173	0.000	0.12			4.5	OK	
9.001	SW02	-0.152	0.000	0.23			8.4	OK	
9.002	SW03	-0.152	0.000	0.23			8.5	OK	
9.003	SW04	-0.108	0.000	0.53			10.0	OK	

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Blocks C&D

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
9.004	BLOCK C TANK	15 Winter	1	+0%	100/120 Winter				32.781
9.005	SW05	1440 Winter	1	+0%	100/120 Summer				32.652
1.014	SW06	240 Winter	1	+0%	2/120 Winter				31.237
1.015	SW46	240 Winter	1	+0%	2/60 Winter				31.233
1.016	SW49	240 Winter	1	+0%	1/120 Winter				31.230
1.017	CW02	240 Winter	1	+0%					30.884
1.018	CW03	240 Winter	1	+0%					30.801

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
9.004	BLOCK C TANK	-0.164	0.000	0.16		11	7.1	OK	
9.005	SW05	-0.198	0.000	0.01			0.4	OK	
1.014	SW06	-0.091	0.000	0.11		26	4.0	OK	
1.015	SW46	-0.022	0.000	0.08		28	3.8	OK	
1.016	SW49	0.093	0.000	0.10			3.6	SURCHARGED	
1.017	CW02	-0.181	0.000	0.09			3.6	OK	
1.018	CW03	-0.173	0.000	0.12			3.6	OK	

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Blocks C&D

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 14
Number of Online Controls 2 Number of Storage Structures 6 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.360 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
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, 2, 30, 100
Climate Change (%) 0, 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	SW29	60 Winter	2	+0%	100/30 Winter				32.200
2.000	SW30	60 Winter	2	+0%	100/60 Winter				32.560
1.001	JUNCTION	60 Winter	2	+0%					32.152
1.002	SW31	60 Winter	2	+0%	30/240 Winter				32.008
1.003	SW32	60 Winter	2	+0%	30/120 Winter				31.798
1.004	SW33	60 Winter	2	+0%	30/120 Winter				31.713
3.000	SW34	60 Winter	2	+0%	100/30 Winter				32.237
1.005	JUNCTION	60 Winter	2	+0%	30/120 Summer				31.678
4.000	SW36	60 Winter	2	+0%	30/240 Winter				32.023
1.006	JUNCTION	60 Winter	2	+0%	30/60 Winter				31.536
5.000	SW40	60 Winter	2	+0%	30/240 Winter				31.960
5.001	SW40A	60 Winter	2	+0%	30/60 Winter				31.680
5.002	SW40B	15 Winter	2	+0%	30/60 Winter				31.636
5.003	RAINWATER TANK	15 Winter	2	+0%	30/60 Winter				31.603
1.007	SW36A	120 Winter	2	+0%	30/60 Summer				31.503
1.008	SW37	60 Winter	2	+0%	30/60 Summer				31.450
6.000	SW38	60 Winter	2	+0%	30/120 Winter				31.785
1.009	JUNCTION	60 Winter	2	+0%	30/30 Winter				31.422
1.010	SW41	240 Winter	2	+0%	30/30 Winter				31.385
7.000	RE	60 Winter	2	+0%					33.959
7.001	SW42	60 Winter	2	+0%					33.725
7.002	SW43	60 Winter	2	+0%					33.526
1.011	SW44	240 Winter	2	+0%	30/30 Summer				31.382
1.012	BLOCK D TANK	240 Winter	2	+0%	30/30 Summer				31.380
8.000	SW45A	120 Winter	2	+0%	100/240 Winter				33.272
8.001	SW45B	240 Winter	2	+0%	100/120 Summer				32.735
1.013	SW45	240 Winter	2	+0%	2/240 Winter				31.377
9.000	SW01	15 Winter	2	+0%	100/15 Summer				33.124
9.001	SW02	15 Winter	2	+0%	100/15 Summer				33.014
9.002	SW03	15 Winter	2	+0%	100/15 Summer				32.921
9.003	SW04	15 Winter	2	+0%	30/15 Summer				32.880

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Blocks C&D

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW29	-0.120	0.000	0.09			1.2	OK	
2.000	SW30	-0.140	0.000	0.01			0.5	OK	
1.001	JUNCTION	-0.118	0.000	0.10			1.8	OK*	
1.002	SW31	-0.112	0.000	0.13			2.2	OK	
1.003	SW32	-0.182	0.000	0.08			2.9	OK	
1.004	SW33	-0.177	0.000	0.10			3.0	OK	
3.000	SW34	-0.133	0.000	0.02			1.1	OK	
1.005	JUNCTION	-0.179	0.000	0.09			3.9	OK*	
4.000	SW36	-0.147	0.000	0.00			0.1	OK	
1.006	JUNCTION	-0.170	0.000	0.14			4.0	OK*	
5.000	SW40	-0.130	0.000	0.04			1.0	OK	
5.001	SW40A	-0.120	0.000	0.09			1.4	OK	
5.002	SW40B	-0.094	0.000	0.29			3.2	OK	
5.003	RAINWATER TANK	-0.097	0.000	0.27			3.0	OK	
1.007	SW36A	-0.161	0.000	0.18			6.2	OK	
1.008	SW37	-0.155	0.000	0.21			6.1	OK	
6.000	SW38	-0.135	0.000	0.02			0.7	OK	
1.009	JUNCTION	-0.155	0.000	0.21			6.8	OK*	
1.010	SW41	-0.140	0.000	0.15			4.9	OK	
7.000	RE	-0.141	0.000	0.01			0.2	OK	
7.001	SW42	-0.134	0.000	0.02			0.3	OK	
7.002	SW43	-0.134	0.000	0.02			0.3	OK	
1.011	SW44	-0.093	0.000	0.16			5.1	OK	
1.012	BLOCK D TANK	-0.045	0.000	0.17		50	5.7	OK	
8.000	SW45A	-0.128	0.000	0.05		35	0.9	OK	
8.001	SW45B	-0.125	0.000	0.07			0.9	OK	
1.013	SW45	0.012	0.000	0.18			5.5	SURCHARGED	
9.000	SW01	-0.166	0.000	0.15			5.8	OK	
9.001	SW02	-0.141	0.000	0.29			10.9	OK	
9.002	SW03	-0.140	0.000	0.29			10.9	OK	
9.003	SW04	-0.088	0.000	0.68			12.9	OK	

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Blocks C&D

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
9.004	BLOCK C TANK	15 Winter	2	+0%	100/120 Winter				32.793
9.005	SW05	1440 Winter	2	+0%	100/120 Summer				32.664
1.014	SW06	240 Winter	2	+0%	2/120 Winter				31.375
1.015	SW46	240 Winter	2	+0%	2/60 Winter				31.371
1.016	SW49	240 Winter	2	+0%	1/120 Winter				31.368
1.017	CW02	360 Winter	2	+0%					30.884
1.018	CW03	480 Winter	2	+0%					30.802

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
9.004	BLOCK C TANK	-0.152	0.000	0.23		10	9.9	OK	
9.005	SW05	-0.187	0.000	0.03			0.7	OK	
1.014	SW06	0.047	0.000	0.13		65	5.1	SURCHARGED	
1.015	SW46	0.116	0.000	0.09		72	4.2	SURCHARGED	
1.016	SW49	0.231	0.000	0.10			3.6	SURCHARGED	
1.017	CW02	-0.181	0.000	0.09			3.6	OK	
1.018	CW03	-0.173	0.000	0.12			3.6	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Blocks C&D

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 14
Number of Online Controls 2 Number of Storage Structures 6 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.360 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
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, 2, 30, 100
Climate Change (%) 0, 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	SW29	360 Winter	30	+0%	100/30 Winter				32.233
2.000	SW30	60 Winter	30	+0%	100/60 Winter				32.566
1.001	JUNCTION	360 Winter	30	+0%					32.233
1.002	SW31	360 Winter	30	+0%	30/240 Winter				32.231
1.003	SW32	360 Winter	30	+0%	30/120 Winter				32.230
1.004	SW33	360 Winter	30	+0%	30/120 Winter				32.229
3.000	SW34	60 Winter	30	+0%	100/30 Winter				32.242
1.005	JUNCTION	480 Winter	30	+0%	30/120 Summer				31.869
4.000	SW36	360 Winter	30	+0%	30/240 Winter				32.227
1.006	JUNCTION	1440 Summer	30	+0%	30/60 Winter				31.707
5.000	SW40	360 Winter	30	+0%	30/240 Winter				32.230
5.001	SW40A	360 Winter	30	+0%	30/60 Winter				32.229
5.002	SW40B	360 Winter	30	+0%	30/60 Winter				32.229
5.003	RAINWATER TANK	360 Winter	30	+0%	30/60 Winter				32.227
1.007	SW36A	360 Winter	30	+0%	30/60 Summer				32.227
1.008	SW37	360 Winter	30	+0%	30/60 Summer				32.225
6.000	SW38	360 Winter	30	+0%	30/120 Winter				32.225
1.009	JUNCTION	1440 Summer	30	+0%	30/30 Winter				31.580
1.010	SW41	360 Winter	30	+0%	30/30 Winter				32.224
7.000	RE	30 Winter	30	+0%					33.966
7.001	SW42	60 Winter	30	+0%					33.732
7.002	SW43	60 Winter	30	+0%					33.532
1.011	SW44	360 Winter	30	+0%	30/30 Summer				32.222
1.012	BLOCK D TANK	360 Winter	30	+0%	30/30 Summer				32.221
8.000	SW45A	60 Winter	30	+0%	100/240 Winter				33.291
8.001	SW45B	60 Winter	30	+0%	100/120 Summer				32.756
1.013	SW45	360 Winter	30	+0%	2/240 Winter				32.219
9.000	SW01	15 Winter	30	+0%	100/15 Summer				33.148
9.001	SW02	15 Winter	30	+0%	100/15 Summer				33.062
9.002	SW03	15 Winter	30	+0%	100/15 Summer				33.018
9.003	SW04	15 Winter	30	+0%	30/15 Summer				32.976

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Blocks C&D

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW29	-0.087	0.000	0.08			1.2	OK	
2.000	SW30	-0.134	0.000	0.02			1.0	OK	
1.001	JUNCTION	-0.037	0.000	0.09			1.6	OK*	
1.002	SW31	0.111	0.000	0.13			2.1	SURCHARGED	
1.003	SW32	0.250	0.000	0.08			3.0	SURCHARGED	
1.004	SW33	0.339	0.000	0.10			3.0	SURCHARGED	
3.000	SW34	-0.128	0.000	0.05			2.1	OK	
1.005	JUNCTION	0.012	0.000	0.08			3.2	SURCHARGED*	
4.000	SW36	0.057	0.000	0.00			0.1	SURCHARGED	
1.006	JUNCTION	0.001	0.000	0.07			2.0	SURCHARGED*	
5.000	SW40	0.140	0.000	0.03			0.9	SURCHARGED	
5.001	SW40A	0.429	0.000	0.08			1.3	SURCHARGED	
5.002	SW40B	0.498	0.000	0.22			2.3	SURCHARGED	
5.003	RAINWATER TANK	0.528	0.000	0.21			2.3	SURCHARGED	
1.007	SW36A	0.562	0.000	0.18			6.2	SURCHARGED	
1.008	SW37	0.621	0.000	0.21			6.0	SURCHARGED	
6.000	SW38	0.305	0.000	0.02			0.6	SURCHARGED	
1.009	JUNCTION	0.002	0.000	0.11			3.5	SURCHARGED*	
1.010	SW41	0.699	0.000	0.20			6.2	SURCHARGED	
7.000	RE	-0.134	0.000	0.03			0.3	OK	
7.001	SW42	-0.128	0.000	0.05			0.7	OK	
7.002	SW43	-0.128	0.000	0.05			0.7	OK	
1.011	SW44	0.747	0.000	0.19			6.1	SURCHARGED	
1.012	BLOCK D TANK	0.796	0.000	0.15		210	5.0	SURCHARGED	
8.000	SW45A	-0.109	0.000	0.16		30	2.8	OK	
8.001	SW45B	-0.104	0.000	0.20			2.8	OK	
1.013	SW45	0.854	0.000	0.17			5.2	SURCHARGED	
9.000	SW01	-0.142	0.000	0.29			11.0	OK	
9.001	SW02	-0.093	0.000	0.61			22.4	OK	
9.002	SW03	-0.043	0.000	0.62			23.0	OK	
9.003	SW04	0.008	0.000	1.46			27.9	SURCHARGED	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Blocks C&D

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
9.004	BLOCK C TANK	15 Winter	30	+0%	100/120 Winter				32.835	-0.110
9.005	SW05	360 Winter	30	+0%	100/120 Summer				32.724	-0.127
1.014	SW06	360 Winter	30	+0%	2/120 Winter				32.218	0.890
1.015	SW46	360 Winter	30	+0%	2/60 Winter				32.214	0.959
1.016	SW49	360 Winter	30	+0%	1/120 Winter				32.211	1.074
1.017	CW02	360 Winter	30	+0%					30.885	-0.180
1.018	CW03	360 Winter	30	+0%					30.802	-0.173

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
9.004	BLOCK C TANK	0.000	0.51		8	22.0	OK	
9.005	SW05	0.000	0.11			3.2	OK	
1.014	SW06	0.000	0.13		239	4.8	SURCHARGED	
1.015	SW46	0.000	0.09		279	4.2	SURCHARGED	
1.016	SW49	0.000	0.10			3.7	SURCHARGED	
1.017	CW02	0.000	0.09			3.7	OK	
1.018	CW03	0.000	0.12			3.7	OK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Blocks C&D

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 14
Number of Online Controls 2 Number of Storage Structures 6 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.360 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
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, 2, 30, 100
Climate Change (%) 0, 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	SW29	360 Winter	100	+40%	100/30 Winter				33.487
2.000	SW30	360 Winter	100	+40%	100/60 Winter				33.486
1.001	JUNCTION	1440 Summer	100	+40%					32.270
1.002	SW31	360 Winter	100	+40%	30/240 Winter				33.484
1.003	SW32	360 Winter	100	+40%	30/120 Winter				33.481
1.004	SW33	360 Winter	100	+40%	30/120 Winter				33.480
3.000	SW34	360 Winter	100	+40%	100/30 Winter				33.479
1.005	JUNCTION	1440 Summer	100	+40%	30/120 Summer				31.869
4.000	SW36	360 Winter	100	+40%	30/240 Winter				33.476
1.006	JUNCTION	15 Summer	100	+40%	30/60 Winter				31.707
5.000	SW40	360 Winter	100	+40%	30/240 Winter				33.481
5.001	SW40A	360 Winter	100	+40%	30/60 Winter				33.480
5.002	SW40B	360 Winter	100	+40%	30/60 Winter				33.479
5.003	RAINWATER TANK	360 Winter	100	+40%	30/60 Winter				33.477
1.007	SW36A	360 Winter	100	+40%	30/60 Summer				33.476
1.008	SW37	360 Winter	100	+40%	30/60 Summer				33.473
6.000	SW38	360 Winter	100	+40%	30/120 Winter				33.472
1.009	JUNCTION	15 Summer	100	+40%	30/30 Winter				31.580
1.010	SW41	360 Winter	100	+40%	30/30 Winter				33.470
7.000	RE	30 Winter	100	+40%					33.971
7.001	SW42	30 Winter	100	+40%					33.741
7.002	SW43	30 Winter	100	+40%					33.542
1.011	SW44	360 Winter	100	+40%	30/30 Summer				33.467
1.012	BLOCK D TANK	360 Winter	100	+40%	30/30 Summer				33.465
8.000	SW45A	360 Winter	100	+40%	100/240 Winter				33.468
8.001	SW45B	360 Winter	100	+40%	100/120 Summer				33.463
1.013	SW45	360 Winter	100	+40%	2/240 Winter				33.462

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Blocks C&D

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW29	1.167	0.000	0.15			2.1	FLOOD RISK	
2.000	SW30	0.786	0.000	0.02			0.8	SURCHARGED	
1.001	JUNCTION	0.000	0.000	0.08			1.4	SURCHARGED*	
1.002	SW31	1.364	0.000	0.21			3.5	FLOOD RISK	
1.003	SW32	1.501	0.000	0.13			4.7	FLOOD RISK	
1.004	SW33	1.590	0.000	0.15			4.4	SURCHARGED	
3.000	SW34	1.109	0.000	0.04			1.8	SURCHARGED	
1.005	JUNCTION	0.012	0.000	0.06			2.6	SURCHARGED*	
4.000	SW36	1.306	0.000	0.00			0.2	SURCHARGED	
1.006	JUNCTION	0.001	0.000	0.41			12.3	SURCHARGED*	
5.000	SW40	1.391	0.000	0.06			1.5	SURCHARGED	
5.001	SW40A	1.680	0.000	0.13			2.0	SURCHARGED	
5.002	SW40B	1.748	0.000	0.32			3.4	SURCHARGED	
5.003	RAINWATER TANK	1.778	0.000	0.29			3.2	SURCHARGED	
1.007	SW36A	1.811	0.000	0.22			7.6	SURCHARGED	
1.008	SW37	1.868	0.000	0.25			7.2	SURCHARGED	
6.000	SW38	1.552	0.000	0.03			1.0	SURCHARGED	
1.009	JUNCTION	0.002	0.000	0.70			22.9	SURCHARGED*	
1.010	SW41	1.945	0.000	0.23			7.1	SURCHARGED	
7.000	RE	-0.129	0.000	0.05			0.7	OK	
7.001	SW42	-0.118	0.000	0.10			1.4	OK	
7.002	SW43	-0.118	0.000	0.10			1.4	OK	
1.011	SW44	1.993	0.000	0.23			7.2	SURCHARGED	
1.012	BLOCK D TANK	2.040	0.000	0.15			5.1	SURCHARGED	
8.000	SW45A	0.068	0.000	0.15		47	2.7	SURCHARGED	
8.001	SW45B	0.603	0.000	0.19			2.7	SURCHARGED	
1.013	SW45	2.097	0.000	0.17			5.2	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Blocks C&D

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
9.000	SW01	360 Winter	100	+40%	100/15 Summer				33.512	0.222
9.001	SW02	360 Winter	100	+40%	100/15 Summer				33.511	0.356
9.002	SW03	360 Winter	100	+40%	100/15 Summer				33.510	0.449
9.003	SW04	360 Winter	100	+40%	30/15 Summer				33.509	0.541
9.004	BLOCK C TANK	360 Winter	100	+40%	100/120 Winter				33.508	0.563
9.005	SW05	360 Winter	100	+40%	100/120 Summer				33.507	0.656
1.014	SW06	360 Winter	100	+40%	2/120 Winter				33.460	2.132
1.015	SW46	360 Winter	100	+40%	2/60 Winter				33.454	2.199
1.016	SW49	360 Winter	100	+40%	1/120 Winter				33.450	2.313
1.017	CW02	360 Winter	100	+40%					30.891	-0.174
1.018	CW03	360 Winter	100	+40%					30.811	-0.163

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
9.000	SW01	0.000	0.08			3.1	SURCHARGED	
9.001	SW02	0.000	0.17			6.2	SURCHARGED	
9.002	SW03	0.000	0.17			6.2	SURCHARGED	
9.003	SW04	0.000	0.40			7.6	SURCHARGED	
9.004	BLOCK C TANK	0.000	0.17		136	7.4	SURCHARGED	
9.005	SW05	0.000	0.17			4.8	SURCHARGED	
1.014	SW06	0.000	0.16			6.0	SURCHARGED	
1.015	SW46	0.000	0.11			5.5	SURCHARGED	
1.016	SW49	0.000	0.13			5.0	SURCHARGED	
1.017	CW02	0.000	0.12			5.0	OK	
1.018	CW03	0.000	0.17			5.0	OK	

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