BUROHAPPOLD ENGINEERING

Stage 4 Drainage Strategy

Mayfield Park

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Revision P07

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1 Introduction

BuroHappold Engineering has been appointed by U+I Group PLC on behalf of the Mayfield Development Partnership LP to prepare a drainage strategy for Mayfield Phase 1 Development, including two commercial office blocks, a multi-storey car park and creation of a city centre park. The Phase 1 site is 7 Ha and is bounded by the Mayfield Depot building to the north, Hoyle Street to the east, the Mancunian Way ring road (A635) to the south and Baring Street (inclusive) to the west. The Site boundary also extends to the London Road junction and access to Baring Street to facilitate road improvements proposed ("the Site").

This report has been prepared to describe the proposed surface water and foul water drainage strategy for the new development, a high-quality urban neighbourhood with residential buildings and public spaces just south of the Manchester Piccadilly Railway Station.



Figure 1-1 Proposed Mayfield Park

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2 Legislation, Policy and Guidelines

Planning Context

The management of water resources is governed by a range of legislative guidance set out within international, national and regional policies and plans. The stormwater strategy has been prepared with due regard to the plans and policies set out in this section.

Planning Policies and the Guidance

The Drainage Strategy has been developed in accordance with the following policies and guidelines:

- National Planning Policy Framework – March 2012
- Water Resources Act 1991 – December 1991
- Flooding and Water Management Act 2010 – April 2010
- Non-statutory Technical Standards for Sustainable Drainage Systems
- Guide to Development in Manchester Supplementary Planning Document and Planning Guidance Adopted - April 2007
- Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA User Guide Final – May 2010
- Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA Level 2 SFRA Final – March 2011
- Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA Canal Hazard Zones, Drawing Number MM_3.2B, Final – March 2011
- Manchester City, Salford City and Trafford Councils (March 2011) Level 2 Hybrid SFRA Critical Drainage Areas, Drawing Number SS_4.5, Final – March 2011
- Manchester City, Salford City and Trafford Councils (March 2011) Level 2 Hybrid SFRA Flood Risk Management, Drawing Number FL_1.1 F, Final – March 2011
- Manchester City Council SuDS Requirements for New Developments
- Manchester Green and Blue Strategy – July 2015
- Manchester Green and Blue Action Plan – July 2015
- Northwest River Basin Management Plan – February 2015
- Environment Agency (EA) Guidelines

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3 Consultation with Manchester City Council and the Environment Agency

Manchester City Council (MCC)

An application has been made with the Manchester City Council (MCC) Drainage team, the LLFA for the area.

Application Number:	CDN/20/0691
Proposal:	Discharge of Conditions 10
Location:	Mayfield Phase 1, Manchester, 1 2AD

Following conversations and meetings with MCC the below parameters were agreed:

- Proposed discharge rate is to be restricted to 50% of the existing brownfield runoff rate with 2l/s/ha to be subtracted from this peak 50% discharge rate.
- Climate change allowance is to be 30%, however, attenuation volumes should also be checked against a 40% allowance.
- No flooding of buildings occurs in 1 in 100-year rainfall event plus climate change allowance. Plot designers will need to accommodate all the necessary surface water attenuation within the plot demise. The attenuation will need to be designed to accommodate the 1 in 100-year storm events plus climate change allowance based on a 50% brownfield rate with a further reduction of 2l/s/ha for long-term storage.
- Surface flooding of open spaces is acceptable for short periods in events over 1 in 30-year return period rainfall events.
- Overland flow routes for extreme events are diverted away from buildings.
- As the existing site is brownfield the 1 in 100-year, 6-hour rainfall runoff volume shall be constrained to a maximum of the existing brownfield runoff volume for the same event.
- For surface car parks (>50 spaces) and areas of unusual pollution risk pollution control measures will be provided (likely to be a combination of petrol interceptors and SuDS features where applicable).

Environment Agency (EA)

After consultation with the EA it was agreed that discharge of surface water into the Medlock River would be acceptable.

Scoping Opinion Response

A scoping opinion was submitted to MCC in July 2019 the comments returned highlighted two key issues for the drainage strategy to address:

The area is situated within the Conurbation Core Critical Drainage Area and in accordance with the Manchester City Council SFRA at least a 50% reduction in surface water runoff should be provided through SUDS as part of any brownfield development with the aim of reducing to the Greenfield runoff rates.

Surface water should be managed to ensure there is no increased surface water from the proposed development and runoff from extreme events should be retained within the site such that the adjacent third-party land is not affected.

And;

The suitability of sustainable drainage systems should be assessed in accordance with paragraphs 051, 079 and 080 of the revised NPPF Planning Practice Guidance for Flood Risk and Coastal Change Sustainable drainage systems should be designed in line with national Non-Statutory Technical Standards for SuDS and local policies EN08, EN14 and EN17 of the Core Strategy.

Hydraulic calculations and drawings to support the design need to be provided along with proposed standards of operation and maintenance in accordance with paragraph 081 of NPPF Planning Practice Guidance.

Both points are addressed as part of the proposed surface water strategy.

Further Consultation with MCC

Following changes to the landscape design and layout of the Phase 1 park the surface water strategy has been updated to reflect this and take the opportunity to further maximise Sustainable Drainage Systems on the site. A meeting was attended on the 09.10.2020 between Buro Happold and MCC to discuss these changes. This meeting was met positively by MCC, with the updated strategy well received for its increased take-up of SuDS. See Appendix H for meeting minutes.

Following this the drainage strategy was issued to MCC on 21st of December 2020. MCC Requested that further information is needed to confirm that the proposed drainage design is adequate to manage flood risk. Full comment: *"Hydraulic model refers to manholes and pipes which don't appear on the drainage layout and some pipe sizes on drainage layout do not correlate with those shown on the drainage layout. This needs to be updated accordingly for review."* Following this the report has been updated and this has been reflected in Section 7

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4 Existing Site

The Mayfield Phase 1 Development Site is 7ha and is in Manchester City Centre to the immediate south/southeast of Piccadilly Railway Station, centred at NGR 385006 397717. The River Medlock meanders through the central area of the Site, flowing from east to west within a deep rectangular brick/stone walled channel. It is culverted beneath Hoyle Street and a central section of the site.

The Site is currently occupied by existing and historical urban development comprising the former (now abandoned) Mayfield Railway Station and associated railway lines, numerous works/factories, a scrap yard, a depot, Hoyle Street Industrial Estate, derelict land and car parking. The immediate surrounding area comprises urban development including residential (student accommodation/private rental), offices, commercial and industrial facilities.

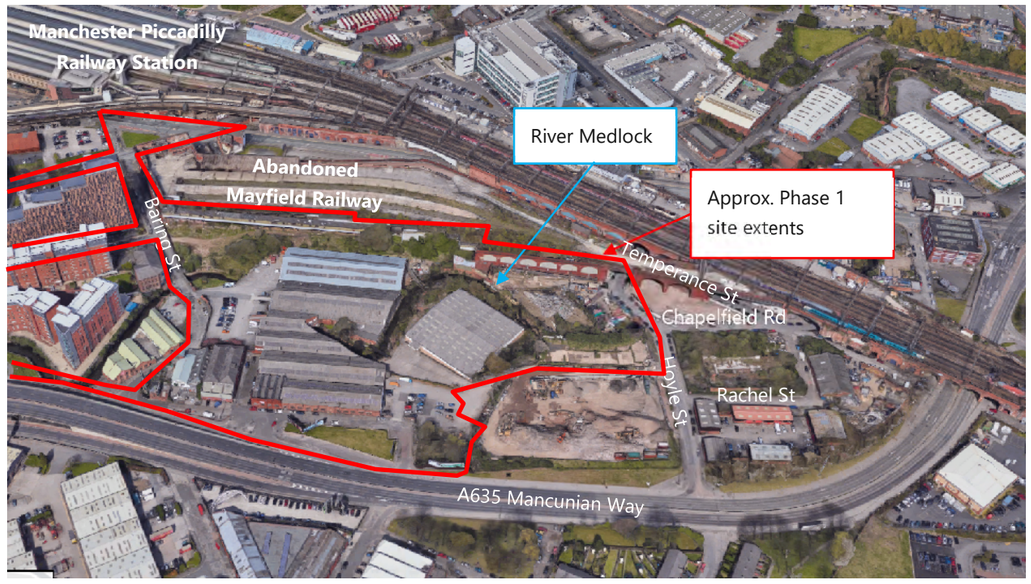


Figure 4-1 Existing Site with the Phase 1 Site Boundary

The condition of the river varies. The river walls are generally in a poor derelict state of repair with parts collapsed into the river. It is assumed that some stormwater is seeping through cracks into the River Medlock. In many locations, siltation has built up on one or both sides of the riverbank. The silt deposits have enabled the dense growth of vegetation along almost the entire corridor. Japanese Knotweed is currently present along the riparian corridor within the site.

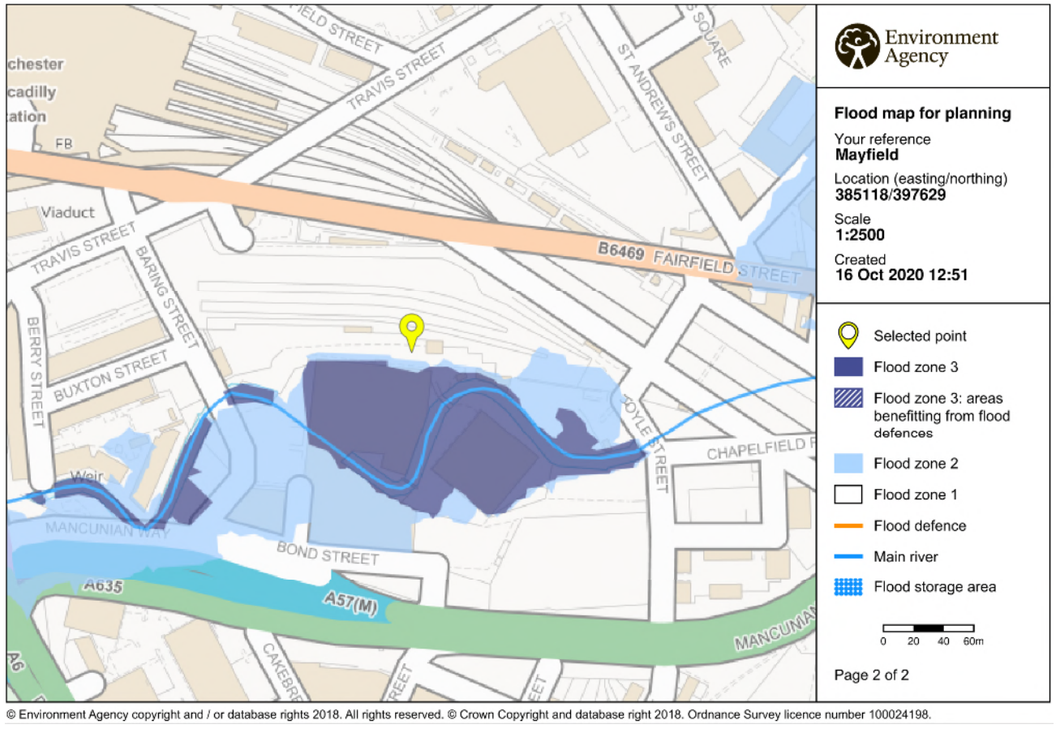
The site is heavily overgrown in areas and is largely covered in impermeable hardstanding and buildings in various states of condition with hardscaping in areas being cracked and deteriorated.

Existing Flood Zones

Extract from River Strategy Report and water chapter of Strategic Regeneration Framework dated 12/10/2017:

"The Environment Agency's flood risk mapping shows parts of the existing site to be highly susceptible to flooding with the River Medlock canalised between the high walls and under industrial buildings. Flooding of the site is concentrated around the Medlock in the central area (Flood Zone 3 High risk) with some Flood Zone 2 (Medium risk) on the margins. However, most of the site is situated within Flood Zone 1 (Low risk) with a flood risk less than 0.1% (on average one occurrence in 1000 years). Flood risk from ground water, surface water and artificial sources is currently considered low to very low at the site.

The regeneration of Mayfield will allow the river corridor and floodplain to be carefully reprofiled using the results of detailed hydraulic modelling, that will ensure the park can reduce the risk of flooding and mitigate for the effects of climate change. The well-considered design will ensure that there will be no detrimental effects upstream or downstream, with finished floor levels for property set well above design flood levels as recommended by the Environment Agency (EA). This will ensure the development is safe, with appropriate pedestrian and vehicular access, even during the 0.1% AEP event for maintenance or improvements works."



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Figure 4-2 Mayfield 2019 Flood Map extract from the Flood Risk Assessment

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5 Existing Surface Water Drainage

Existing Drainage and Outfalls

It is unclear from public sewer records how the current site is drained however the lack of available information would suggest that most of the site is served by private drainage networks. It is likely that the buildings are served by a combination of individual connections to the United Utilities combined sewers that surround the site and direct outfalls into the River Medlock through the river wall.

The site generally slopes towards the River Medlock and it is assumed that it drains into the river. One outfall is shown on the topographic survey conducted by Malcolm Hughes. Visual inspection of the riverbank indicates that there are numerous existing outfalls to the River Medlock (example Figure 5-1).



Figure 5-1 Existing Outfall Observed During Site Visit

A culvert conveyance report was conducted following an inspection on 23/03/2018. The report detailed the location of the existing outfalls through the river wall that were observed in the length within the culvert, these have been summarised in Figure 5-2.

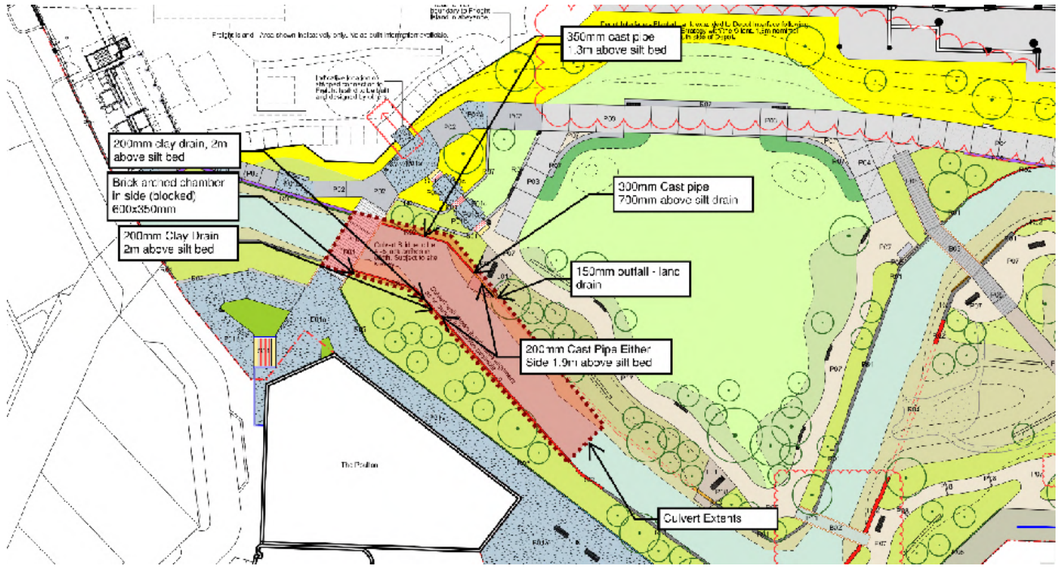


Figure 5-2 Existing river wall outfalls observed in culvert conveyance survey



Figure 5-3 Debris build up within culvert

The existing drainage is assumed to have been designed and installed in accordance with national standards. It is assumed that the existing below ground stormwater drainage system discharges at an uncontrolled rate and no on-site storage exists.

Existing topographic surveys show gullies within Hoyle Street, Baring Street, Temperance Street and Chapelfield Road however the condition and exact layout of these stormwater drains are unknown. It is proposed to retain these drains throughout the resurfacing of these roads.

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6 Existing Foul Water Drainage

Mayfield is served by a network of public combined sewers (conveying both foul and surface water together) situated beneath the principal roads both within the masterplan (Hoyle Street, Baring Street and Chaplefield Road) and immediately beyond its perimeter (Mancunian Way, Fairfield Street and Temperance Street). United Utilities (UU) records show one number site sewer as having been adopted, situated in Amory Street, site of the proposed park.

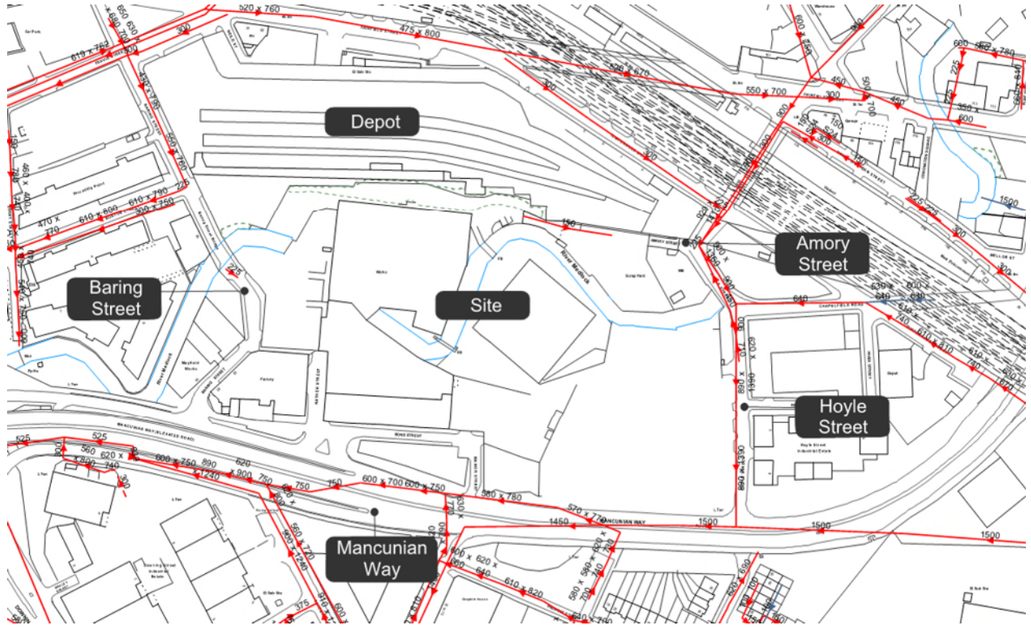


Figure 6-1 United Utilities Sewer Asset Record. (Image courtesy of the United Utilities © United Utilities Water PLC 2017)

UU network pipes sizes vary from 150mm diameter to 1500mm in Mancunian Way. Pipe materials are a mix of vitrified clay and brick and sewer shape varies from circular to egg. Sewer depths appear significant, up to 10m in places, suggesting that they have excavated in rock or possibly constructed within a tunnel heading. UU sewer levels and exact manhole locations are unknown in most cases. A line and level survey at probable points of connection will be required at the next stage.

Information pertaining to the private site foul drainage is limited, and no as-built data is available. UU asset records show a length north of the river serving the Depot, does not appear to drain to an obvious discharge point on the sewer records, however, it is assumed to connect to the public sewer in Amory Street. A known private combined sewer is connected to this run.

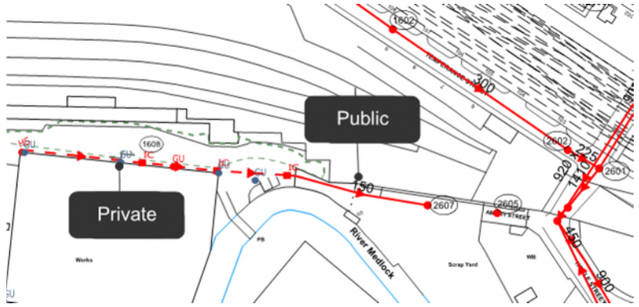


Figure 6-2 Known private site sewerage (Image courtesy of the United Utilities © United Utilities Water PLC 2017)

The sewers that run underneath Chapelfield Road and Hoyle Street are both assumed to be Victorian era, egg-shaped brick combined sewers of unknown condition and are owned by UU. The sewer that runs beneath Chapelfield Road is buried approximately 2-3m deep based on incomplete UU sewer records and is recorded as a 640mm “diameter”. There are two sewers that run-down Hoyle Street in opposite directions. There is a 450mm diameter combined sewer draining northwards at approximately 5m depth that runs for roughly a third of the length of the section of Hoyle Street that is within the site boundary. A much larger and deeper 900mm “diameter” combined sewer flows southwards beneath this sewer at a depth of between 8-14m. It is assumed based on limited ground information that this deep sewer is within rock. The other two sewers may be partly within rock but are likely to be buried within the made ground on site.

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7 Proposed Surface Water Drainage

Proposed Strategy

The proposed drainage strategy shall be designed:

- To protect against flooding
- To reuse rainwater as a resource for the site
- To collect and convey surface water away from developed areas in a safe and controlled manner
- To protect surface receiving waters, in both quality and hydraulic terms
- To be sustainable and maintainable; and
- To ensure structural integrity over the duration of the development design life

The new below ground drainage network shall replace the existing and convey water directly to outfalls into the River Medlock and to outfall into the designed wildscape, to then discharge overland into the river. The system has been designed such that all new sewers will drain by gravity.

The available ground investigation information highlights that contaminated ground is present within the site caused by the previous industrial uses on the land. As there is a possibility that these may create risks around surface water infiltration, the drainage strategy currently does not include any formal infiltration via SuDS structures. However, the location of the designed rain gardens has been selected to promote the schemes position on the SuDS hierarchy, therefore if detailed ground investigation results come back proving that infiltration in these locations is suitable, they will be re-designed to be infiltration structures.

The landscape masterplan has been designed in tandem with the proposed river flood extents, with a designed wildscape area situated to the east of the site, which is intended to intentionally flood in the 1 in 25 year fluvial event and a larger portion of the park designed to flood in the 1 in 100 year +35% cc fluvial event.

The hardscape areas surrounding the park are designed to drain directly onto the softscape areas promoting natural irrigation of the trees and vegetation in the landscaping and replicating the natural water cycle. Two outfalls from the site wide drainage system have been located within the wildscape wetland area to further slow the flow into the River Medlock.

Where hard standing areas could not be directed to wetland or heavily vegetated areas, rain gardens have been placed to capture, treat and convey the flow strategically into the wider network. Whilst maximising SuDS benefits.

The surface water strategy proposes to discharge the vast majority of surface water flows from hardstanding within the park to either the soft landscaping or the wildscape area. For the remaining small catchments that are picked up by formal SuDS features, including a filter strip or by traditional drainage (linear drainage & gulley's) these will either pass through one of the rain gardens before discharging into the river or discharge directly into the river.

All surface water which falls on the surrounding and future buildings will be attenuated on plot with peak flows restricted. The outfalls within the park have been designed to account for these external flows, no additional outfalls into the river Medlock are envisaged as part of future development works. This surface water from the plots will be discharged via a series pipes outside of the park boundary connecting into the park drainage system before discharging into the River Medlock.

Drainage Hierarchy and SuDS Selection

As part of the design process we have approached the discharge strategy in accordance with the hierarchy set out in building regulations and as recommended in the CIRIS SuDS manual. A SuDS appraisal for the site has been undertaken and developed in line with best practise to improve water quality, reduce runoff quantity, provide bio-diversity benefits and amenity space.

Drainage Hierarchy

Surface water disposal should be in accordance with the drainage hierarchy in Building Regulations Part H 2015. This hierarchy is briefly described below:

- Step 1. Disposal on Site - via infiltration SuDS (Sustainable Drainage Systems)

A site investigation is ongoing and will determine the suitability for infiltration features across the site. At present the drainage system has been designed without infiltration due to the potential for contaminants in the ground to be mobilised by infiltration techniques.

- Step 2. Disposal to a Watercourse

The site is located adjacent to the River Medlock and all surface water is currently proposed to discharge to the watercourse.

- Step 3. Disposal to a Public Sewer

This is not envisaged for the park and plot elements of the scheme.

SuDS Selection

The following table indicates the SuDS techniques considered for this scheme.

	SUDS Technique	Flood Reduction	Pollution Reduction	Landscape & Wildlife Benefit	Suitability for the Proposed Development	Provision in Scheme
Most Sustainable ↑	**Living roofs**	√	√	√	**Yes**	Not considered for the infrastructure areas, however, could be considered when proposed plots are developed.
	Basins & ponds	√	√	√	**Yes**	A wetland area is proposed as part of the scheme
	-Constructed Wetlands				**Yes**	
	-Balancing ponds				**No**	
	-Detention basins				**No**	
	-Retention ponds				**No**	
	Filter drains & swales	√	√	√	**Yes**	Included in scheme
	Rain Gardens	√	√	√	**Yes**	Included in scheme
↓	**Infiltration devices**	√	√	√	**No**	Not considered due to potential for contaminated ground.
	-soakaways					
	-infiltration trenches & basins					
	Permeable surfaces	√	√		**Yes**	Majority of park area is designed to drain to permeable areas
	-gravelled areas				**Yes**	Not required
	-solid paving blocks				**Yes**	Not required
	-porous pavers				**Yes**	Not required

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Least Sustainable	**Tanked systems**	√			**Yes**	Only used in areas with minimal space to serve plot drainage
	-over-sized pipes/tanks				**Yes**	Not required
	-attenuation cells				**Yes**	

Wetlands

A wildscape area has been incorporated into the park design as indicated in pink below. This area will flood during high river flow events and a river flow flood model is being developed to help the detailed design of this area. Due to the variable nature of the river flooding, an outfall from the drainage system has also been incorporated into the landscape to provide natural irrigation to the vegetation in this area.



Figure 7-1 Designed wildscape area within the site, highlighted in red

Filter Drains

In the park there are several filter drains provided to drain hardscape and areas of steep slopes. The filter drains will consist of a gravel section with perforated pipe to convey the flow to the drainage system.

Rain Gardens

Three rain gardens have been included within the surface water design, as online storage to manage the 1 in 30 and 1 in 100-year storm events. As the information on ground contamination is unknown at this point these have been sized with zero infiltration, however, if it is found to be that the ground conditions are suitable to accept infiltration the design be updated to suit.

Permeable Surfaces

Paving along the footpaths that are within the park and the flood zones are proposed to be resin bound material, these hardscape areas are designed to discharge onto the into the surrounding soft landscaping, infiltrating through the proposed panting and grassed areas. The surrounding clay pavers and concrete slabs outside of the flood zones are for the most part proposed to be drained by the same SuDS mechanism with a few strategic formal drainage points where levels do not permit.

All soft landscape areas of the park will use a mixture of overland flow to the River Medlock and filter drains connected to the drainage system via filter drains. The areas highlighted in blue below all discharge to permeable surfaces.

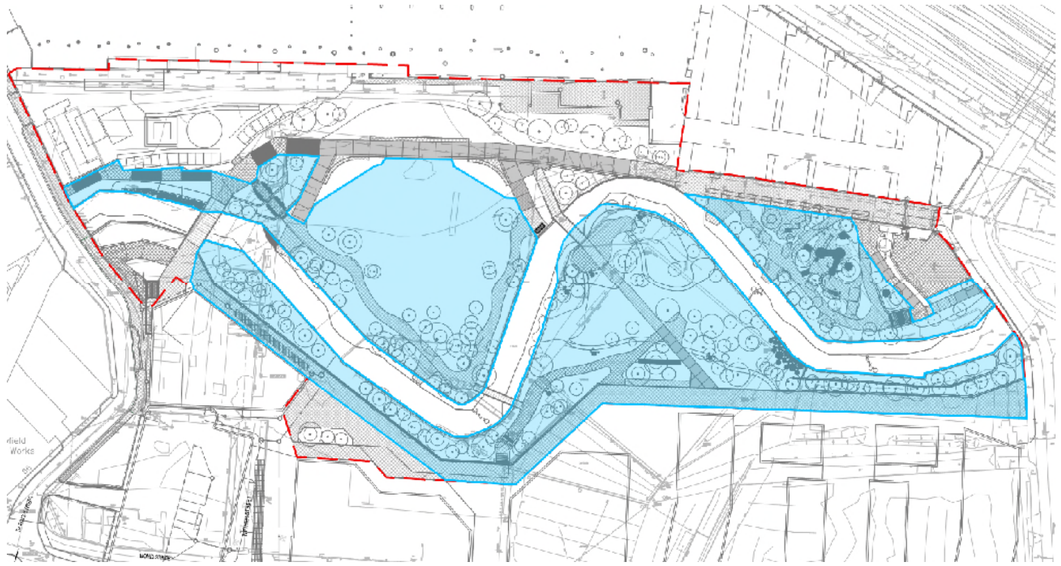


Figure 7-2 Areas drained via overland flow/infiltration

Tanked Systems

Plots 'The Poulton' and 'MSCP' have designed below ground tanks within their boundary in order to restrict their flows to a surface water runoff of 50% of the 1 in 100-year storm brownfield runoff rate minus 2l/s/ha as agreed with MCC.

The discharge of all the plot designers' attenuation will be discharged into the proposed surface water network within the park that transfers surface water to the River Medlock.

Design Parameters

We propose that all new buried drainage provides the following levels of service:

- No surcharge within the pipe network up to and including a 1:2-year storm event;
- No flooding of the drainage system up to and including a 1:30 year storm event;
- Management of flood water up to the 1:100-year storm event.
- Climate change allowance included in the infrastructure design shall be 30%; and
- Proposed discharge rate for plot attenuation shall be restricted to 50% of the existing peak brownfield runoff rate with 2l/s/ha subtracted from this 50% peak discharge rate (1 in 100 year) as per discussions with MCC and the EA.

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Contaminated Ground and Infiltration

Appendix I Soakaway Testing and Contamination Report, highlights the summary of the soakaway testing and leachate testing that was carried out on the site to determine the feasibility of infiltrating on the site. Soakaway results were found in the locations of all rain gardens, this was incorporated into the hydraulic drainage model and it was updated to suit. This was done following the results of the leachate testing. The results of the leachate testing in Rain Garden 3 confirmed that no contamination was present, and infiltrating would be safe. In the instance of Rain Garden 1 and 2 there was some contamination present. To ensure that no contaminants were mobilised into the ground water the design was updated to ensure that at the base of each rain garden the existing ground would be excavated and disposed of, until the existing bedrock material was hit, which was proven to be clean sandstone. The pit would then be backfilled with clean stone and Rain Garden 1 & 2 will infiltrate into this.

Existing vs Proposed Runoff Rates

To ensure the overall surface water runoff rates meet the requirements set out by MCC the following comparison has been presented in Table 7-1. This highlights the existing peak discharge rates as calculated by an analysis of the existing land usage and FEH rainfall data, this has been compared against the new layouts and green space uplift with the engineered flow controls on buildings and some future phases.

It has been calculated that the overall site peak brownfield peak discharge for the full site would have been **1756.13 l/s.** Applying the **50% of brownfield – 2l/s/ha** arrives at an overall target peak discharge of **862.87 l/s.**

Table 7-1 Existing vs Proposed Peak Discharge Requirement (* = Flow Control on this catchment, see Table 7-3)

Outfall	Associated Catchments	Brownfield Peak Discharge (l/s)	Proposed Peak Discharge (l/s)
1a & 1b	C15 C16 B3 B4 B5	C15 = 171.00 C16 = 146.11 B3 = 49.80 B4 = 193.35 B5 = 163.03 **Total = 750.33**	C15 = 83.94* C16= 71.92* B3 = 17.52* B4 = 63.43* B5 = 57.12* **Total = 293.92**
2	C1 C2 C3 Phase 4	C1 = 66.16 C2 = 18.49 C3 = 79.38 Phase 4 = 315.63 **Total = 479.66**	C1 = 34.72 C2 = 17.17 C3 = 62.94 Phase 4 = 151.49* **Total = 266.32**
3	C5 C10 C12 C13 C14 B1a B1b B2	C5 = 9.39 C10 = 17.23 C12 = 59.20 C13 = 12.59 C14 = 7.73 B1a = 34.01 B1b = 47.21 B2 = 64.40 **Total = 479.66**	C5 = 8.63 C10 = 15.11 C12 = 54.16 C13 = 10.57 C14 = 9.05 B1a = 7.5* B1b = 10.7* B2 = 22.96* **Total = 138.68**
Overland Flow to River	C4 C6 C7 C8 C9 C11	C4 = 1.82 C6 = 40.40 C7 = 96.50 C8 = 89.12 C9 = 46.56 C11 = 27.04 **Total = 274.40**	C4 = 1.38 C6 = 23.81 C7 = 41.20 C8 = 58.05 C9 = 21.71 C11 = 17.79 **Total = 163.94**
Total	C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, B1a, B1b, B2, B3, B4, B5, Phase 4	**Total = 1756.13**	**Total = 862.87**

The above calculated peak discharge rates has been compared against the results from the MicroDrainage model for the network, these are summarised in Table 7-2.

Table 7-2 Summary of peak flow at the outfall from MicroDrainage

Outfall	Peak Flow from MicroDrainage	Flow Controls?
Outfall 1a & 1b	285.3 l/s	Yes, upstream control and attenuation of the future buildings and public realm areas outside of phase 1.
Outfall 2	251.4 l/s	Yes, upstream controls are present within the upgraded Depot building (Phase 4). Furthermore, the outfall pipe has been intentionally downsized to a 375mm pipe to restrict the flow into the river.
Outfall 3	135.5 l/s	Yes, upstream controls and attenuation are present within the future buildings in this area.
Overland Flow to River	163.94 l/s	No.
Total	**836.14 l/s**	Note – Total calculated in MicroDrainage is below the discharge requirement of 50% Brownfield – 2l/s/ha.

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The below table summarises the planned flow control devices within the scheme in order to achieve the sites drainage and discharge aims.

Table 7-3 Summary of Flow Control devices within the full site build out

Corresponding Outfall	Upstream Catchment Name	Flow Control (Hydrobrake)
Outfall 1a & 1b	C15	83.94 l/s
	C16	17.92 l/s
	B3	17.52 l/s
	B4	63.43 l/s *(split over 2 outfalls restricted to 31.72 l/s each)*
	B5	57.12 l/s *(split over 2 outfalls restricted to 28.56 l/s each)*
Outfall 2	Phase 4	151.49 l/s *(split over 10 outfalls restricted to 15.15l/s each)*
Outfall 3	B1a	7.5 l/a
	B1b	10.7 l/s
	B2	22.96 l/s

Catchment Areas

Catchment areas have been created based on the landscaping layout. Catchment areas are shown in Table 7-4. The effective areas for each catchment have been calculated using the runoff coefficients of 0.95 for hardscaping and buildings and 0.3 for softscape landscaped areas. The locations of the catchment areas can be seen in Figure 7-3.

Future development phases have been considered as part of the design process for the delivery of the first phase in relation to SuDS and attenuation. Whilst no detailed designs are available at this stage, which will come forward as part of any future application, the methods of managing surface water runoff will be delivered in line with CIRIA SuDS Guidance.

Table 7-4 Proposed Catchment Areas (See Figure 7-3 or location plan)

Catchment Ref.	Catchment Type	Catchment Area (ha)	Hardscape (%)	Softscape (%)	Effective Hardscape Area (ha)	Effective Softscape Area (ha)	Total Effective Area (ha)
C1	Landscape	0.39	0%	100%	0.12	0.00	**0.12**
C2	Landscape	0.09	50%	50%	0.04	0.01	**0.06**
C3	Landscape	0.34	50%	50%	0.16	0.05	**0.21**
C4	Landscape	0.02	0%	100%	0.00	0.00	**0.00**
C5	Landscape	0.04	80%	20%	0.03	0.00	**0.03**
C6	Landscape	0.14	40%	60%	0.05	0.03	**0.08**
C7	Landscape	0.36	14%	86%	0.05	0.09	**0.14**
C8	Landscape	0.39	32%	68%	0.12	0.08	**0.20**
C9	Landscape	0.17	22%	78%	0.03	0.04	**0.07**
C10	Landscape	0.06	82%	18%	0.05	0.00	**0.05**
C11	Landscape	0.10	50%	50%	0.05	0.01	**0.06**
C12	Landscape	0.22	80%	20%	0.17	0.01	**0.18**
C13	Landscape	0.05	55%	45%	0.03	0.01	**0.04**
C14	Landscape	0.03	100%	0%	0.03	0.00	**0.03**
C15	Landscape	0.78	70%	30%	0.52	0.07	**0.59**
C16	Landscape	0.57	85%	15%	0.46	0.03	**0.48**
B1a	Building	0.12	100%	0%	0.12	0.00	**0.12**
B1b	Building	0.17	100%	0%	0.16	0.00	**0.16**
B2	Building	0.26	100%	0%	0.25	0.00	**0.25**
B3	Building	0.20	100%	0%	0.19	0.00	**0.19**
B4	Building	0.72	98%	2%	0.67	0.00	**0.68**
B5	Building	0.65	100%	0%	0.62	0.00	**0.62**
Phase 4	Building	1.72	100%	0%	1.64	0.00	**1.64**
	Total	**7.59**			**5.56**	**0.43**	**6.00**

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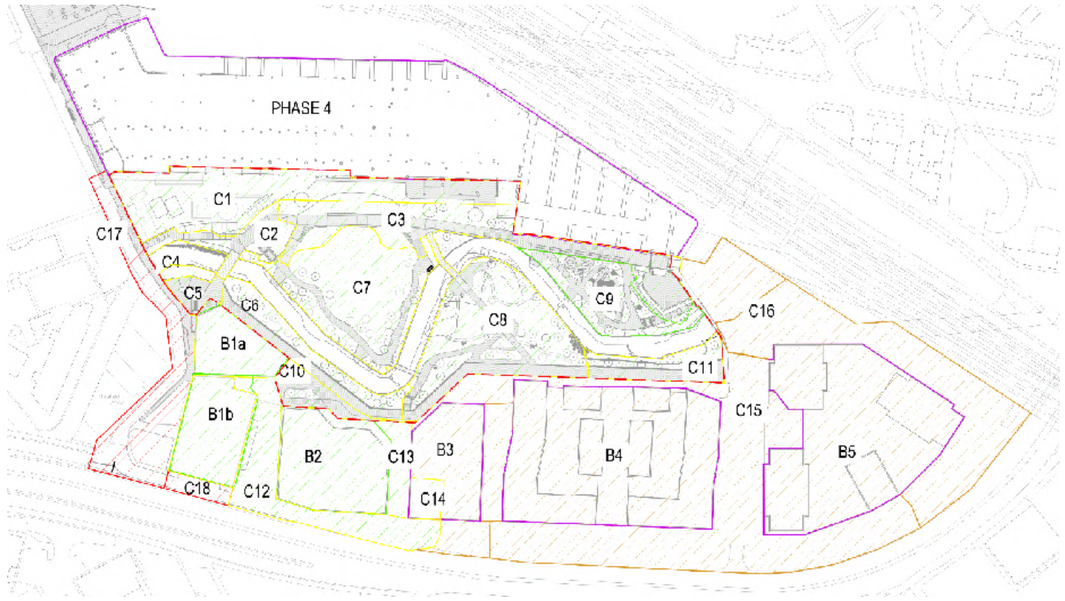


Figure 7-3 Catchment Areas Plan (park boundary shown in red dashed)

All runoff from catchments shown outside of the dashed black boundary in Figure 7-3 will outfall through the park in one of the three discharge points to the River Medlock. However, they must have peak flows restricted to a minimum of 50% brownfield runoff – 2l/s/ha, achieved through a selection of on plot SuDS features and discharge controls on plot. An Exception to this is Catchment C17, which is understood to discharge via the existing highway sewer drainage system in Baring Street, the delivery of this package of works has been pushed back so there is no design available at this stage.

The existing runoff rates within these catchments have been calculated using the topographical survey. The difference between the existing and proposed effective areas within each catchment can be seen in the table below. The proposed scheme has an effective area **0.54ha less than existing**. Due to the reduced effective area the 1 in 100yr 6hr volumetric discharge will be less for the proposed scheme that in the existing brownfield condition. Calculating this as a volume against the rainfall data for the 6-hour storm leaves a deficit of **359.6m³**.

Following MCC comments received on 5th January 2021, full comments in Section 3 , the following clarification has been provided. The MicroDrainage model has been assembled to include Surface Water catchments outside of the Phase 1 boundary, this is because in the full build out of the site they will outfall through Outfall 1 located within the Phase 1 boundary. The affected catchments are: C1, C12, C13, C14, C15, C16, C18, B1a, B1b, B2, B3, B4, B5 and the full Phase 4 Catchment. Attenuation structures, flow controls, manholes and pipes have also been modelled and sized for these areas and these are highlighted in the summary results of the MicroDrainage model. The below screenshots highlight the pipes in these areas for clarity. Full results are shown in Appendix F.

When reviewing the MicroDrainage results within the appendix it should be noted that the Manhole prefix 'F' = Future and represents a manhole that is in the future phases of the project and has not been fully detailed but modelled for conveyance purposes. The 'B' prefix is for manholes located on future buildings to capture their roof areas. The 'D' prefix is there to represent the rain water downpipes from the depot.



Figure 7-4: MircoDrainage Model, Detailing Future Network Outside of Phase 1 Boundary

Table 7-5 Existing Catchment Areas

Catchment Ref.	Hardscape (ha)	Softscape (ha)	Effective Hardscape Area (ha)	Effective Softscape Area (ha)	Total Effective Area (ha)
C1	0.16	0.23	0.16	0.07	0.22
C2	0.05	0.04	0.05	0.01	0.06
C3	0.26	0.09	0.24	0.03	0.27
C4	0.00	0.01	0.00	0.00	0.01
C5	0.03	0.00	0.03	0.00	0.03
C6	0.14	0.00	0.14	0.00	0.14
C7	0.34	0.02	0.32	0.01	0.33
C8	0.29	0.10	0.27	0.03	0.30
C9	0.17	0.00	0.16	0.00	0.16
C10	0.06	0.00	0.06	0.00	0.06
C11	0.10	0.00	0.09	0.00	0.09
C12	0.21	0.02	0.20	0.01	0.20
C13	0.04	0.01	0.04	0.00	0.04
C14	0.03	0.01	0.02	0.00	0.03
C15	0.53	0.25	0.50	0.08	0.58
C16	0.50	0.07	0.47	0.02	0.50
B1a	0.12	0.00	0.12	0.00	0.12
B1b	0.17	0.00	0.16	0.00	0.16
B2	0.22	0.05	0.20	0.01	0.22
B3	0.17	0.03	0.16	0.01	0.17
B4	0.68	0.04	0.64	0.01	0.66
B5	0.55	0.10	0.52	0.03	0.55
Phase 4	1.72	0.00	1.64	0.00	1.64
				Total	**6.54**

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Summary of Building Runoff Rates and Discharge Points

The MCC has stipulated that the surface water discharge from the plots will need to be restricted to 50% of the peak brownfield discharge rate (1 in 100-year storm event) minus 2l/s/ha. Brownfield runoff has been calculated based on the catchment areas of the buildings using the Modified Rational Method. Where the design of the plots is developed the plot, teams have provided flow rates with further reductions for discharging the buildings' surface water into the proposed surface water sewer. These rates have been used in the hydraulic model, in the absence of plot team values the calculated rate has been used.

The surface water system has been designed to consider future runoff from the proposed buildings around the site. Points of connection to the proposed external surface water system for the on-plot attenuation tanks at the required maximum discharge rates are shown in the figure below. See Appendix G for drainage strategies from the plot teams.

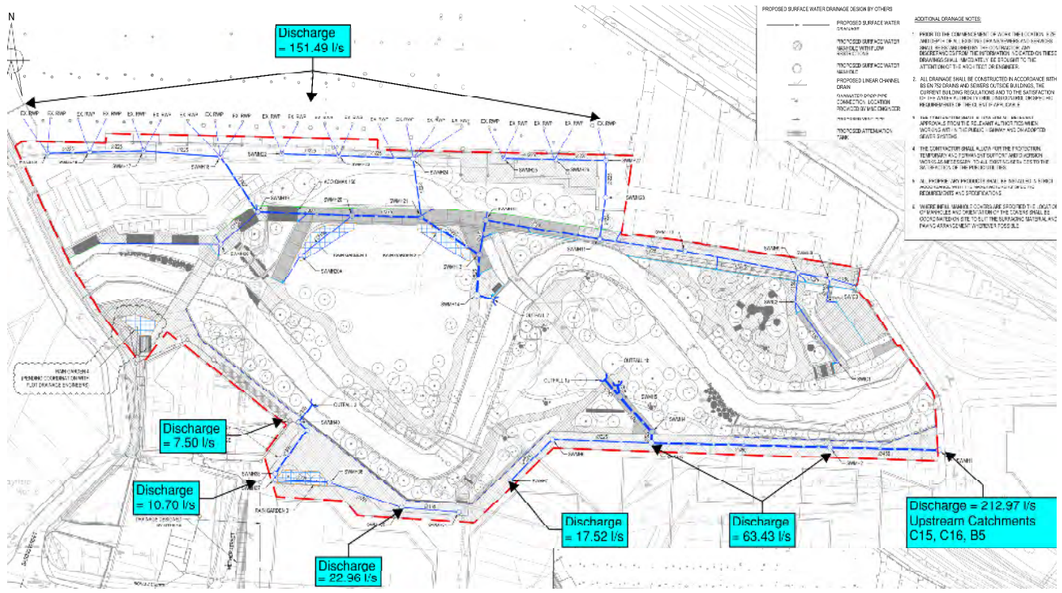


Figure 7-5 Surface Water Plot Connection Points into proposed surface water sewer

Proposed Outfalls

The outfalls are all located within the flood extents of the River Medlock, meaning that they will be submerged during the extreme fluvial events. In order to accurately model this hydraulically an analysis comparing the rainfall flood events probability and the fluvial flood events probability has been undertaken. As the two events are not directly linked the probabilities of different storm and fluvial return periods coinciding was analysed using a Joint Probability analysis, the results of this are below.

Joint Probability Assessment

The below list summarises the parameters used in the joint probability assessment.

Parameters	
River critical duration (hours)	10
Drainage critical duration (hours)	0.25
Level of dependency (CF100)	75 (modestly correlated)

The below table summarises the outputs of the joint probability assessment, in 1 in X terms, for example the likelihood of a 1 in 2-year drainage event and 1 in 5-year fluvial event occurring tougher is 1 in 95.9.

All values are 1 in X	*1 in X event*	**Drainage return period (years)**		
		2	30	100
River return period (years)	5	95.9	641.3	1492.2
	25	296.7	1983.1	4614.8
	100	784.6	5244.4	12203.6

In order to determine the design condition for the system the joint probability assessment summarised below was carried out. This highlighted the extreme unlikelihood of our 1 in 100 storm occurring alongside our 1 in 100 fluvial water level (a probability of 1 in 12203.6, equivalent to 0.008%), which was deemed unsuitable for our analysis. It was therefore selected that the 1 in 5 event for the river water level was used for all drainage return periods, to provide a conservative design.

The flood levels compared against the outfall inverts has been summarised in Figure 7-6, this shows that due to the high river flood levels during high return-period river events stormwater outfalls 1, 2 & 3 will become submerged. For this reason, all outfalls have been fitted with non-return valves to prevent river water backing up into the surface water system.

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Submerged Outfalls

The below diagram summarises the outfalls within Phase 1 with their invert levels against the Fluvial Flood levels for various fluvial events.

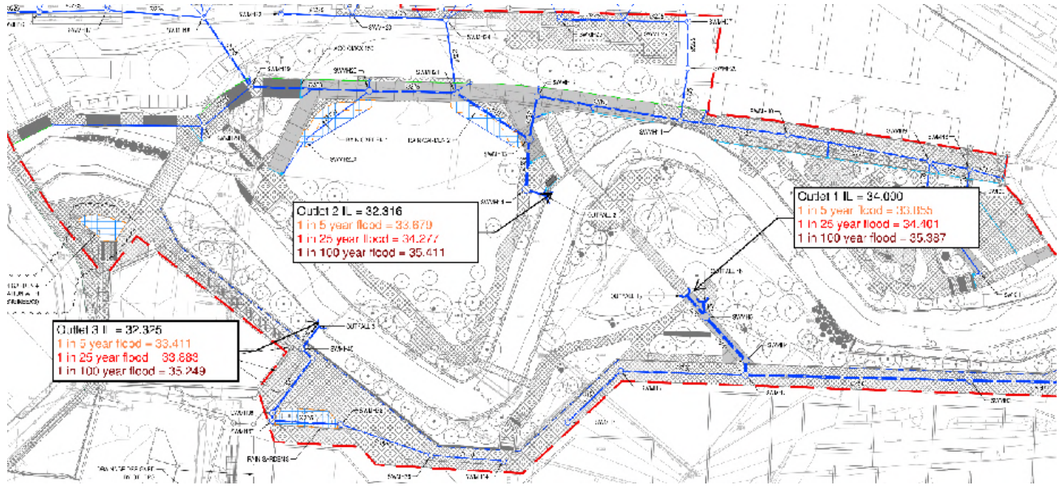


Figure 7-6 1 in 5, 25, 100+cc Year fluvial flood levels and Average Water Levels near proposed outfalls

Outfall 1a and 1b

Outfall 1a and 1b is located within the wildscape wetland area at the low point of the site. This has been designed in this location intentionally to further the SuDS benefits on the site through infiltration and re-use of rainwater from roof drainage in the public realm, further providing cleaning and amenity benefits to the site. Due to this location significant volumes of Surface Water will outfall onto the surface of the wildscape before either infiltrating or percolating overland into the river at the base of the slope. This has meant additional detailing has been provided to ensure the area is resilient to damage and maintenance issues during its operation. This has been fully detailed on drawing 0042912-BHE-XX-XX-DR-C-3300 and plan 0042912-BHE-XX-XX-DR-C-3120. This is also in response to EA and MCC comments received requesting further detail on how Outfall 1 will discharge into the wildscape area. Except shown below in Figure 7-7.

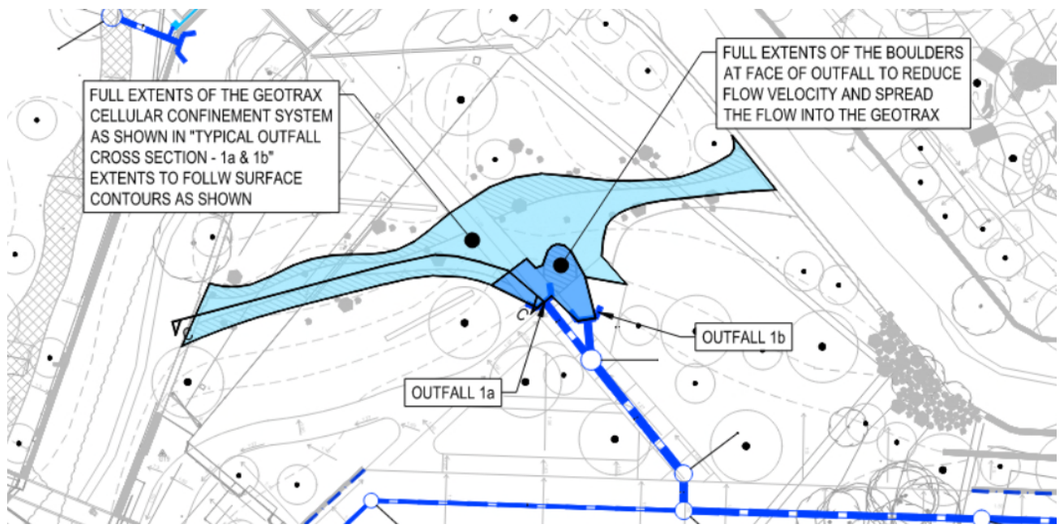


Figure 7-7 Outfall 1a and 1b in the wildscape area

Fluvial Flood Extents

The below figure highlights the extents of the 1 in 100 +35% climate change fluvial flood extent. The flooding has been designed to flood the soft landscaping and wildscape areas, whilst avoiding the hardstanding around the edge of the site.

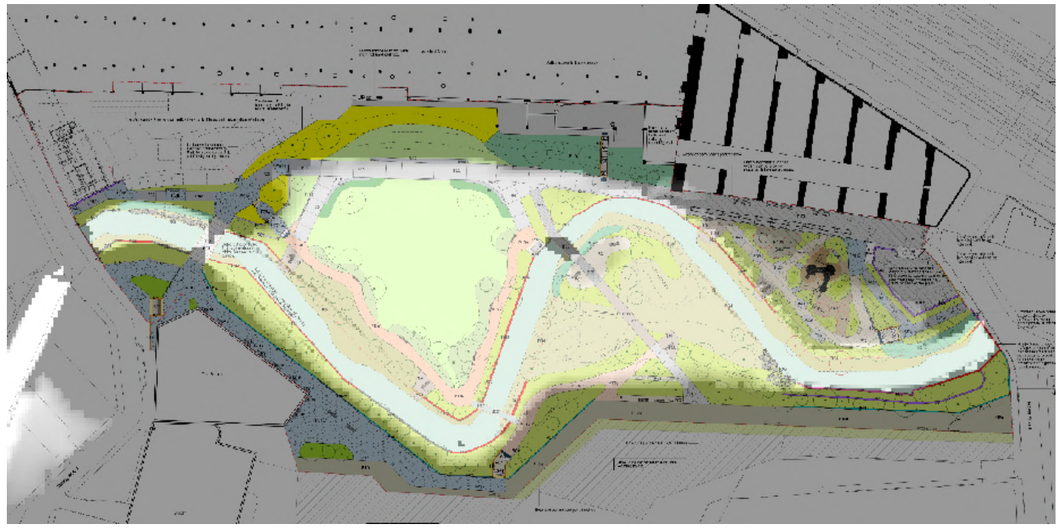


Figure 7-8 1 in 100 + 35%cc Fluvial Flood Extents

Proposed Layout

A hydraulic analysis was completed using the catchment areas and brownfield runoff rates for the full site to determine pipe sizes, gradients and storage volumes. Based on the site topography, building locations and landscape design, the network has been developed to discharge to three locations into the River Medlock. This is a rationalised approach to reduce the number of outfalls into the river. For more detail on the network layout, pipe sizes/gradients, manhole sizes and storage volumes see Appendix D.

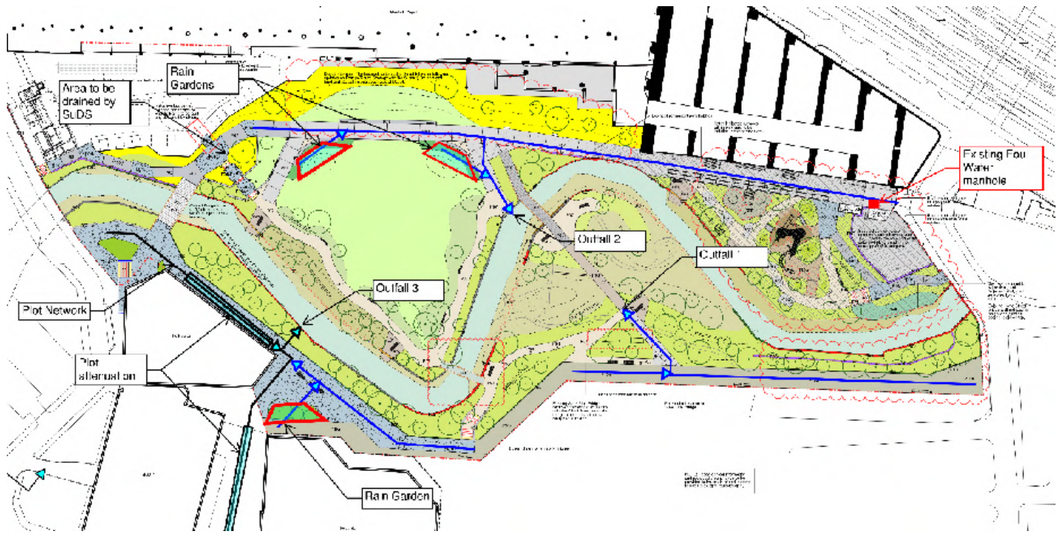


Figure 7-9 Proposed Surface Water Drainage Layout Plan

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Overland Flow and Exceedance Events

The levels of the park are designed so that the park and public realm areas within it all drain towards to River Medlock. In the event of an exceedance event the below graphic summarises the overland flow that would occur.

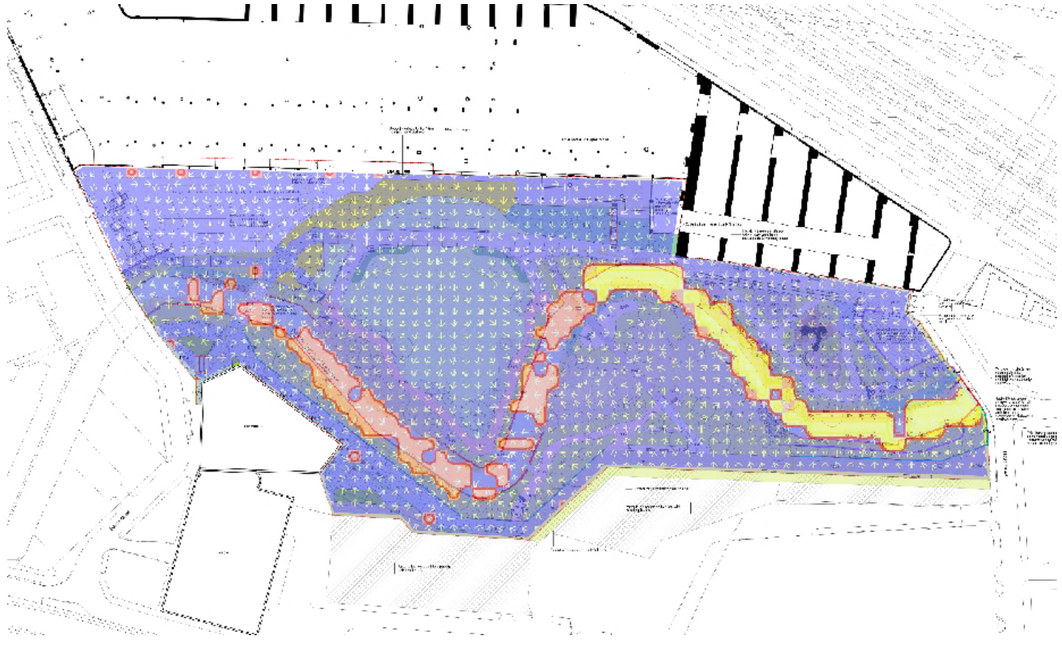


Figure 7-10 Overland flow diagram

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8 Proposed Foul Water Drainage

A proposed foul network has been developed to provide connection for the MSCP and The Poulton. In addition, a connection has been provided in the north-east corner of the park for a toilet block within the park. The proposed network will then connect into the existing UU combined sewer network to the south and east of the site. Plot connections to the proposed foul water sewer are shown below.

A description of the individual plot drainage strategies and details for plot foul water networks can be found in Appendix G.

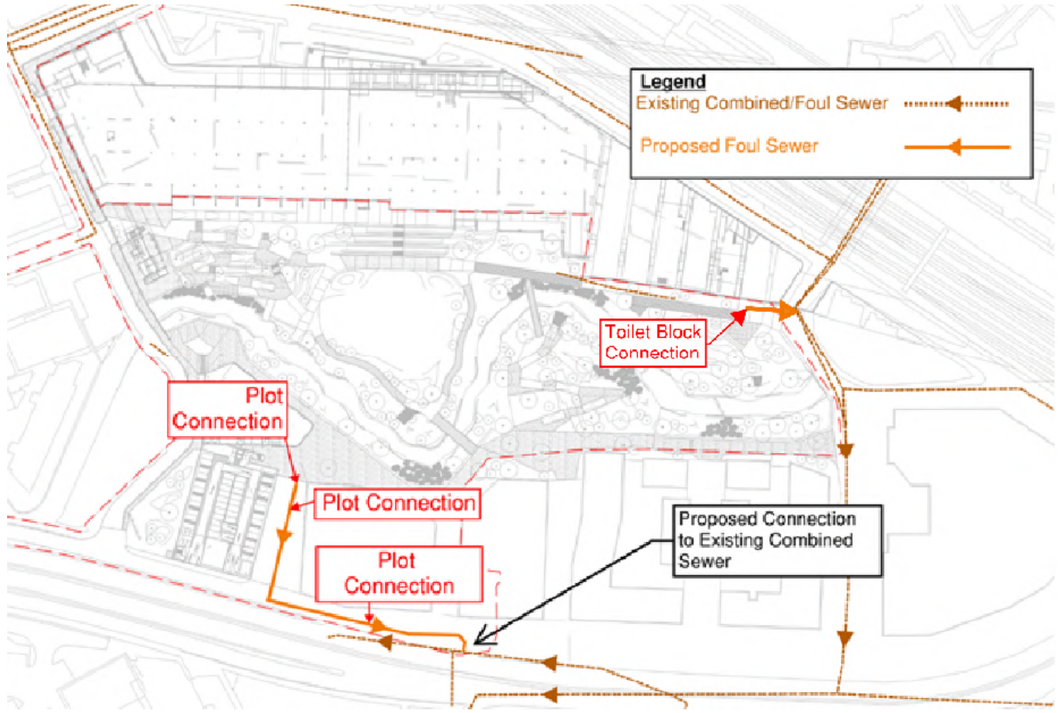


Figure 8-1 Proposed Foul Network

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Appendix A Existing Foul/Combined Sewer Network

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Notes

NOTES:

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LEGEND

EXISTING

EXISTING COMBINED/FOUL WATER SEWER

APPLICATION BOUNDARY

FAIRFIELD STREET

MELLOR ST

INVERT LEVEL = 29.63m AOD

900mmØ

300mmØ

OWNERSHIP BEING CONFIRMED WITH UNITED UTILITIES

APPROX DEPTH TO CROWN OF PIPE = 8.0m

IL APPROX 29.1m AOD

300mmØ

IL APPROX 28.9m AOD

900mmØ

IL APPROX 28.4m AOD

400mmØ

APPROX DEPTH TO CROWN OF PIPE = 8.5m

APPROX DEPTH TO CROWN OF PIPE = 2.5m

640mmØ

IL APPROX 35.5m AOD

INVERT LEVEL = 32.08m AOD

900mmØ

810mm x 740mmØ

610mm x 810mmØ

UNITED UTILITIES COMBINED SEWER

930mm x 670mmØ

APPROX DEPTH TO CROWN OF PIPE = 10.0m

890mm x 1190mmØ

895mmØ

APPROX DEPTH TO CROWN OF PIPE = 14.0m

10 5 0 10 20 30 40

1 : 500

SCALE BEFORE REDUCTION

Rev	Description	Date	Drn	Chkd
B	FOR INFORMATION	30.08.19	JS	AG
A	FOR INFORMATION	29.03.19	RH	AG

INFORMATION

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Architect SEW

Project MAYFIELD DEVELOPMENT PARTNERSHIP

Drg Title EXISTING SITE
FOUL WATER DRAINAGE AND
PROPSED LAYOUT

Scales@A1 1:500
Drawn by RH
Checked by

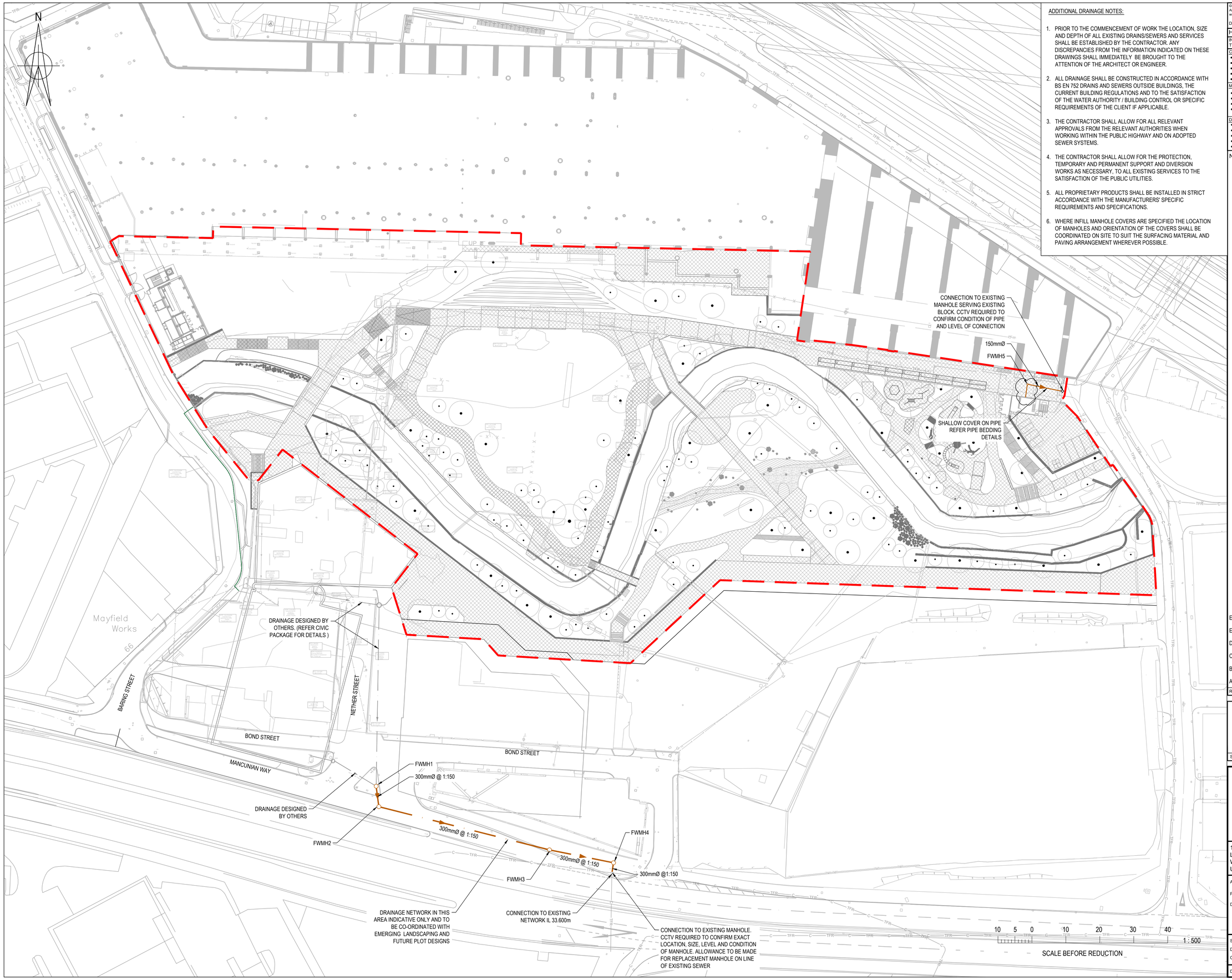
Job No. 0042912
Date MARCH 2019
Rev B

Drawing No. 0042912-BHE-XX-XX-DR-C-0201

Join Success F:\0042912 Mayfield Plot 5\Manchester-shared\Live\0042912-BHE-XX-XX-DR-C-0201.dwg

Appendix B Proposed Foul Network

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ADDITIONAL DRAINAGE NOTES:

1. PRIOR TO THE COMMENCEMENT OF WORK THE LOCATION, SIZE AND DEPTH OF ALL EXISTING DRAINS/SEWERS AND SERVICES SHALL BE ESTABLISHED BY THE CONTRACTOR. ANY DISCREPANCIES FROM THE INFORMATION INDICATED ON THESE DRAWINGS SHALL IMMEDIATELY BE BROUGHT TO THE ATTENTION OF THE ARCHITECT OR ENGINEER.
2. ALL DRAINAGE SHALL BE CONSTRUCTED IN ACCORDANCE WITH BS EN 752 DRAINS AND SEWERS OUTSIDE BUILDINGS, THE CURRENT BUILDING REGULATIONS AND TO THE SATISFACTION OF THE WATER AUTHORITY / BUILDING CONTROL OR SPECIFIC REQUIREMENTS OF THE CLIENT IF APPLICABLE.
3. THE CONTRACTOR SHALL ALLOW FOR ALL RELEVANT APPROVALS FROM THE RELEVANT AUTHORITIES WHEN WORKING WITHIN THE PUBLIC HIGHWAY AND ON ADOPTED SEWER SYSTEMS.
4. THE CONTRACTOR SHALL ALLOW FOR THE PROTECTION, TEMPORARY AND PERMANENT SUPPORT AND DIVERSION WORKS AS NECESSARY, TO ALL EXISTING SERVICES TO THE SATISFACTION OF THE PUBLIC UTILITIES.
5. ALL PROPRIETARY PRODUCTS SHALL BE INSTALLED IN STRICT ACCORDANCE WITH THE MANUFACTURERS' SPECIFIC REQUIREMENTS AND SPECIFICATIONS.
6. WHERE INFILL MANHOLE COVERS ARE SPECIFIED THE LOCATION OF MANHOLES AND ORIENTATION OF THE COVERS SHALL BE COORDINATED ON SITE TO SUIT THE SURFACING MATERIAL AND PAVING ARRANGEMENT WHEREVER POSSIBLE.

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- WORKS ADJACENT TO LIVE ROADS
- WORKS IN CONTAMINATED GROUND CONDITIONS
- WORK IN PROXIMITY TO FLOOD ZONE

MAINTENANCE/CLEANING/OPERATION.
- WORKS WITHIN POTENTIAL CONFINED SPACE CONDITIONS
- WORKS IN PROXIMITY TO LIVE SERVICES
- WORKS ADJACENT TO LIVE ROADS
- WORK IN PROXIMITY TO FLOOD ZONE

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   - BELOW GROUND DRAINAGE GA 1076-01-CE-YY-DR-C-001-T02 RECEIVED FROM PLOT ENGINEERS ON 22/09/2020
   - TOPOGRAPHICAL SURVEY RECEIVED SEPT 2020 FROM SURVEY OPERATIONS.

LEGEND

PARK BOUNDARY

EXISTING

EXISTING COMBINED WATER SEWER

EXISTING FOUL WATER

PROPOSED

UTILITY TO BE REMOVED

FOUL WATER SEWER

FOUL WATER MH

Rev	Description	Date	Drn	Ch'd
E	STAGE 4 ISSUE	29.01.2021	RK	CB
E	STAGE 4 ISSUE	18.12.2020	TEJ	CB
D	STAGE 3 ISSUE	09.10.2020	TEJ	CB
C	STAGE 3 ISSUE	11.12.2019	TJ	AG
B	FOR INFORMATION	13.09.2019	JS	AG
A	FOR INFORMATION	30.08.2019	JS	AG

STAGE 4

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Architect *SEW*

Project **MAYFIELD DEVELOPMENT PARTNERSHIP**

Drg Title PROPOSED SITE WIDE FOUL WATER PLAN

Scales@A1 1:500
Drawn by JS
Checked by AG

Job No. 0042912
Date AUGUST 2019
Rev E

Drawing No. 0042912-BHE-XX-XX-DR-C-3200

Saved: K:\p\Projects\0042912 Mayfield Park Manchester Infrastructure\P03 - Info\03_Sheet\0042912-BHE-XX-XX-DR-C-3200.dwg

Appendix C Proposed Catchment Areas

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LEGEND

CATCHMENT AREA

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Rev	Description	Date	Drn	Ch'd
C	FOR INFORMATION	16.10.2020	JF	CB
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A	FOR INFORMATION	29.03.2019	RH	AG

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Architect SEW

Project MAYFIELD DEVELOPMENT PARTNERSHIP

Drg Title PROPOSED CATCHMENT AREAS

Scales@A0 1:1000
Drawn by RH
Checked by AG

Job No. 0042912
Date MARCH 2019
Rev C

Drawing No. 0042912-BHE-XX-XX-SK-C-0019

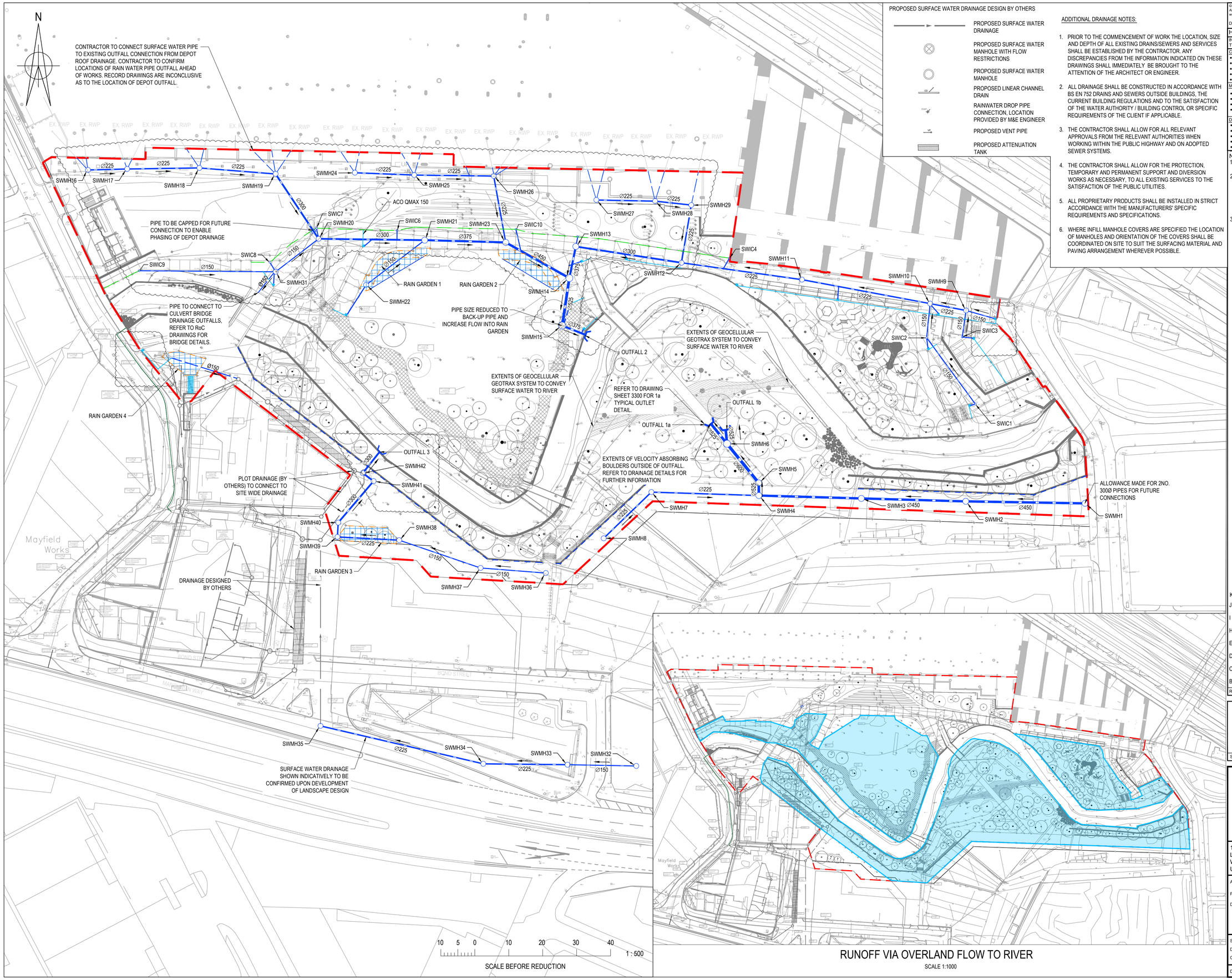
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SCALE BEFORE REDUCTION

James Rainey S:\m-o\mcr00\data\0042912 Mayfield Park Manchester Infrastructure\08 - Info\03_Sheets\03_Sketch\0042912-BHE-XX-XX-SK-C-0019 - Catchments.dwg

Appendix D Proposed Storm Water Layouts

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PROPOSED SURFACE WATER DRAINAGE DESIGN BY OTHERS

- PROPOSED SURFACE WATER DRAINAGE
- PROPOSED SURFACE WATER MANHOLE WITH FLOW RESTRICTIONS
- PROPOSED SURFACE WATER MANHOLE
- PROPOSED LINEAR CHANNEL DRAIN
- RAINWATER DROP PIPE CONNECTION, LOCATION PROVIDED BY M&E ENGINEER
- PROPOSED VENT PIPE
- PROPOSED ATTENUATION TANK

ADDITIONAL DRAINAGE NOTES:

1. PRIOR TO THE COMMENCEMENT OF WORK THE LOCATION, SIZE AND DEPTH OF ALL EXISTING DRAINS/SEWERS AND SERVICES SHALL BE ESTABLISHED BY THE CONTRACTOR. ANY DISCREPANCIES FROM THE INFORMATION INDICATED ON THESE DRAWINGS SHALL IMMEDIATELY BE BROUGHT TO THE ATTENTION OF THE ARCHITECT OR ENGINEER.
2. ALL DRAINAGE SHALL BE CONSTRUCTED IN ACCORDANCE WITH BS EN 752 DRAINS AND SEWERS OUTSIDE BUILDINGS, THE CURRENT BUILDING REGULATIONS AND TO THE SATISFACTION OF THE WATER AUTHORITY / BUILDING CONTROL OR SPECIFIC REQUIREMENTS OF THE CLIENT IF APPLICABLE.
3. THE CONTRACTOR SHALL ALLOW FOR ALL RELEVANT APPROVALS FROM THE RELEVANT AUTHORITIES WHEN WORKING WITHIN THE PUBLIC HIGHWAY AND ON ADOPTED SEWER SYSTEMS.
4. THE CONTRACTOR SHALL ALLOW FOR THE PROTECTION, TEMPORARY AND PERMANENT SUPPORT AND DIVERSION WORKS AS NECESSARY, TO ALL EXISTING SERVICES TO THE SATISFACTION OF THE PUBLIC UTILITIES.
5. ALL PROPRIETARY PRODUCTS SHALL BE INSTALLED IN STRICT ACCORDANCE WITH THE MANUFACTURERS' SPECIFIC REQUIREMENTS AND SPECIFICATIONS.
6. WHERE INFILL MANHOLE COVERS ARE SPECIFIED THE LOCATION OF MANHOLES AND ORIENTATION OF THE COVERS SHALL BE COORDINATED ON SITE TO SUIT THE SURFACING MATERIAL AND PAVING ARRANGEMENT WHEREVER POSSIBLE.

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CONSTRUCTION.
- WORKS WITHIN POTENTIAL CONFINED SPACE CONDITIONS
- WORKS IN PROXIMITY TO LIVE SERVICES
- WORKS ADJACENT TO LIVE ROADS
- WORKS IN CONTAMINATED GROUND CONDITIONS
- WORK IN PROXIMITY TO FLOOD ZONE

MAINTENANCE/CLEANING/OPERATION.
- WORKS WITHIN POTENTIAL CONFINED SPACE CONDITIONS
- WORKS IN PROXIMITY TO LIVE SERVICES
- WORKS ADJACENT TO LIVE ROADS
- WORK IN PROXIMITY TO FLOOD ZONE

DECOMMISSIONING/DEMOLITION.
- WORKS WITHIN POTENTIAL CONFINED SPACE CONDITIONS
- WORKS IN PROXIMITY TO LIVE SERVICES
- WORKS ADJACENT TO LIVE ROADS
- WORKS IN CONTAMINATED GROUND CONDITIONS
- WORK IN PROXIMITY TO FLOOD ZONE

Notes
1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH DRAWING MANHOLE SCHEDULE 042912-BHE-XX-XX-DR-C-3150.
2. THE CONTRACTOR SHALL BE AWARE THAT EXISTING UTILITIES COULD POTENTIALLY BE LIVE AND THERE MAY BE OTHER UNRECORDED SERVICES IN EXISTENCE ON SITE, ACCORDINGLY IT IS THE CONTRACTOR'S RESPONSIBILITY TO IDENTIFY EXISTING UTILITIES AND TO SATISFY THEMSELVES THAT THEY ARE SAFE TO ABANDON/REMOVE.
3. DRAWING BASED ON:
   - ARCHITECT'S PLAN 0345-SEW-ZZ-00-DR-L-007102 RECEIVED FROM SEW ON 16/11/2020,
   - BELOW GROUND DRAINAGE GA 1076-01-CE-YY-DR-C-001-T02 RECEIVED FROM PLOT ENGINEERS ON 22/09/2020
   - TOPOGRAPHICAL SURVEY RECEIVED SEPT 2020 FROM SURVEY OPERATIONS.

LEGEND

EXISTING DRAINAGE
- EXISTING COMBINED WATER SEWER
- EXISTING RWP
- EXISTING SURFACE WATER PIPE (GPR SURVEY)

PROPOSED DRAINAGE
- 375mmØ SURFACE WATER
- SURFACE WATER MANHOLE
- INSPECTION CHAMBER
- OUTFALL
- GULLY
- FILTER DRAIN
- ACO 'MULTIDRAIN' LINEAR DRAIN (UNLESS OTHERWISE STATED)
- LINEAR DRAIN SUMP
- RAIN GARDEN EXTENTS ON SURFACE
- RAIN GARDEN EXTENTS (GRAVEL) BELOW GROUND
- DRAINAGE VIA OPENINGS IN RETAINING WALL TO SOFT LANDSCAPING
- PARK BOUNDARY

Rev	Description	Date	Drn	Ch'd
K	STAGE 4 ISSUE UPDATE	08.02.2021	KH	CB
J	STAGE 4 ISSUE UPDATE	29.01.2021	RK	CB
I	STAGE 4 ISSUE UPDATE	29.01.21	RK	CB
H	STAGE 4 ISSUE	18.12.2020	TEJ	CB
E	STAGE 3 ISSUE	11.12.2019	DJ	AG
D	FOR INFORMATION	13.09.2019	JS	AG
C	FOR INFORMATION	30.08.2019	JS	AG
B	SECONDARY DRAINAGE RUNS ADDED	02.04.2019	JS	AG

STAGE 4

Status of drawing

RUNOFF VIA OVERLAND FLOW TO RIVER

SCALE 1:1000

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Architect SEW

Project MAYFIELD DEVELOPMENT PARTNERSHIP

Drg Title PROPOSED SITE WIDE SURFACE WATER PLAN

Scales@A1 1:500
Drawn by RJL
Checked by CH

Job No. 0042912
Date MARCH 2019
Rev K

Drawing No. 0042912-BHE-XX-XX-DR-C-3120

Xerox Home P:\0042912 Mayfield Park Manchester\Infrastructure\03 - Drawings\04 Sheets\0042912-BHE-XX-XX-DR-C-3120.dwg

Appendix E Proposed Storm Water Manhole Schedule and Details

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MANHOLE SCHEDULE - Proposed SW

NAME	EASTING (m)	NORTHING (m)	TYPE	COVER LEVEL [m]	COVER LOADING	COVER TYPE	DEPTH [m]	INCOMING PIPE DIAMETER [mm]	INCOMING PIPE IL [m]	OUTGOING PIPE DIAMETER [mm]	OUTGOING PIPE IL [m]
SWIC1	385245.195	397572.206	SfA Manhole Type 3 Circular (450 Dia)	36.524	D400	RE	1.350	150	35.174	150	35.174
SWIC2	385230.826	397591.768	SfA Manhole Type 3 Circular (450 Dia)	35.648	D400	RE	1.298	150	34.350	150	34.350
SWIC3	385241.314	397592.004	SfA Manhole Type 3 Circular (450 Dia)	36.597	D400	RE	1.350	150	35.247	150	35.247
SWIC4	385172.721	397615.221	SfA Manhole Type 3 Circular (450 Dia)	35.326	D400	DI	1.351	150	33.975	150	33.975
SWIC5	385128.037	397621.506	SfA Manhole Type 3 Circular (450 Dia)	34.916	D400	DI	1.351	150	33.565	150	33.565
SWIC6	385074.821	397623.353	SfA Manhole Type 3 Circular (450 Dia)	35.020	D400	DI	1.149	150	33.871	150	33.871
SWIC7	385051.064	397624.076	SfA Manhole Type 3 Circular (450 Dia)	35.240	D400	DI	1.325	150	33.915	150	33.915
SWIC8	385037.373	397613.974	SfA Manhole Type 3 Circular (450 Dia)	35.556	D400	RE	1.226	150	34.330	150	34.330
SWIC9	384998.805	397611.510	SfA Manhole Type 3 Circular (450 Dia)	36.663	D400	DI	1.350	150	35.313	150	35.313
SWIC10	385109.844	397623.711	SfA Manhole Type 3 Circular (450 Dia)	35.159	D400	DI	1.459	150	33.700	150	33.700
SWMH1	385277.455	397542.989	SfA Manhole Type 2	38.479	D400	RE	2.269			450	36.210
SWMH2	385242.332	397543.581	SfA Manhole Type 2	37.656	D400	RE	1.622	450	36.034	450	36.034
SWMH3	385211.567	397544.443	SfA Manhole Type 2	36.827	D400	RE	1.150	450	35.015	450	35.015
SWMH4	385181.392	397545.289	SfA Manhole Type 2	35.711	D400	RE	1.472	450 225	34.314 34.539	525	34.239
SWMH5	385181.359	397549.003	SfA Manhole Type 2	35.632	D400	RE	1.484	525	34.223	600	34.148
SWMH6	385172.017	397560.541	SfA Manhole Type 2	35.205	D400	RE	1.158	600	34.089	525 525	34.164 34.164
SWMH7	385149.727	397546.310	SfA Manhole Type 2	35.704	D400	RE	1.150	225	34.649	225	34.649
SWMH8	385135.671	397532.697	SfA Manhole Type 2	36.701	D400	RE	1.726			225	34.975
SWMH9	385242.432	397599.801	SfA Manhole Type 2	35.922	D400	RE	1.204	150 150	34.793 34.793	225	34.718
SWMH10	385231.849	397601.826	SfA Manhole Type 2	35.720	D400	RE	1.541	225 150	34.179 34.254	225	34.179
SWMH11	385194.081	397608.884	SfA Manhole Type 2	35.385	D400	RE	1.511	225	33.874	225	33.874
SWMH12	385158.601	397613.867	SfA Manhole Type 2	35.042	D400	RE	1.311	225 225	33.731 33.731	300	33.656
SWMH13	385127.470	397618.639	SfA Manhole Type 2	34.853	D400	RE	1.767	300 150	33.162 33.312	375	33.087
SWMH14	385125.564	397609.340	SfA Manhole Type 2	34.720	D400	RE	2.258	375 450	32.612 32.537	525	32.462
SWMH15	385123.468	397595.348	SfA Manhole Type 2	34.483	D400	RE	2.219	525	32.264	375	32.414
SWMH16	384983.740	397641.187	SfA Manhole Type 2	38.765	D400	RE	2.459	150	36.381	225	36.306
SWMH17	384995.291	397641.477	SfA Manhole Type 2	38.708	D400	RE	2.873	225	35.650	225	35.650
SWMH18	385016.589	397641.787	SfA Manhole Type 1A	39.250	D400	RE	3.794	225	35.390	225	35.390
SWMH19	385039.028	397640.012	SfA Manhole Type 2	39.186	D400	RE	2.840	225	35.283	300	35.208
SWMH20	385051.714	397620.916	SfA Manhole Type 2	35.243	D400	RE	1.501	150 300 150	33.892 33.742 33.892	300	33.742
SWMH21	385082.955	397620.520	SfA Manhole Type 2	34.866	D400	RE	1.982	300 150	33.034 33.184	375	32.959
SWMH22	385065.689	397607.335	SfA Manhole Type 2	34.489	D400	DI	1.203	150	33.286	150	33.286
SWMH23	385106.826	397619.852	SfA Manhole Type 2	34.857	D400	RE	2.285	375 225	32.647 32.797	450	32.572
SWMH24	385062.364	397640.374	SfA Manhole Type 2	39.250	D400	DI	1.600	150	37.650	225	37.575
SWMH25	385079.882	397639.694	SfA Manhole Type 2	39.247	D400	DI	1.989	225	37.258	225	37.258
SWMH26	385103.283	397639.408	SfA Manhole Type 1A	39.060	D400	DI	4.613	225	36.447	225	34.447
SWMH27	385133.512	397632.357	SfA Manhole Type 2	39.550	D400	RE	1.975	150	37.500	225	37.575
SWMH28	385150.820	397632.007	SfA Manhole Type 2	39.600	D400	RE	2.310	225	37.290	225	37.290
SWMH29	385161.490	397630.859	SfA Manhole Type 1A	39.500	D400	RE	4.900	225	36.300	225	34.600
SWMH30			No Longer Required								
SWMH31	385039.037	397611.201	SfA Manhole Type 2	35.714	D400	RE	1.414	150 150	34.300 34.300	150	34.300
SWMH32	385145.274	397465.640	SfA Manhole Type 2	38.100	D400	RE	0.900			150	37.200
SWMH33	385125.020	397466.012	SfA Manhole Type 2	39.650	D400	RE	2.550	150	37.100	225	37.025
SWMH34	385100.214	397466.275	SfA Manhole Type 2	39.450	D400	RE	2.600	225	36.850	225	36.850
SWMH35	385052.249	397477.448	SfA Manhole Type 2	37.750	D400	RE	1.439	225	36.311	300	36.236
SWMH36	385118.629	397522.461	SfA Manhole Type 2	36.021	D400	RE	1.344			150	34.677
SWMH37	385099.411	397523.959	SfA Manhole Type 2	36.044	D400	RE	1.535	150	34.509	150	34.509
SWMH38	385075.437	397532.145	SfA Manhole Type 2	36.084	D400	RE	1.906	150	34.253	225	34.178
SWMH39	385057.256	397533.099	SfA Manhole Type 2	36.082	D400	RE	2.071	225	34.011	225	34.011
SWMH40	385057.481	397537.325	SfA Manhole Type 2	36.092	D400	RE	2.224	225	33.943	300	33.868
SWMH41	385067.903	397549.537	SfA Manhole Type 2	36.100	D400	RE	2.725	300	33.375	300	33.375
SWMH42	385064.722	397551.896	SfA Manhole Type 2	36.095	D400	RE	2.784	300	33.311	300	33.311

MANHOLE SCHEDULE - Proposed FW

NAME	EASTING (m)	NORTHING (m)	TYPE	COVER LEVEL [m]	COVER LOADING	COVER TYPE	DEPTH [m]	INCOMING PIPE DIAMETER [mm]	INCOMING PIPE IL [m]	OUTGOING PIPE DIAMETER [mm]	OUTGOING PIPE IL [m]
FWMH5	385240.668	397601.336	SfA Manhole Type 3 Circular (450 Dia)	35.870	D400	RE	1.200			150	34.670

COVER TYPE ABBREVIATIONS
RE - RECESSED/ INFILLED
DI - DUCTILE IRON

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Notes

1. TO BE READ IN CONJUNCTION WITH DRAWINGS 0042912-BHE-XX-XX-DR-C-3120 FOR SURFACE WATER DRAINAGE AND DRAWING 0042912-BHE-XX-XX-DR-C-3200 FOR FOUL WATER DRAINAGE.
2. MANHOLE SIZES ARE TO BE IN ACCORDANCE WITH TABLE BELOW (TAKEN FROM SEWERS FOR ADOPTION)

Nominal Internal diameter of largest pipe in manhole (mm)	Minimum nominal internal dimension of manhole (mm)
Less than 375	1200
375 - 450	1350
500 - 700	1500
750 - 900	1800
Greater than 900	Pipe Diameter + 900

Rev	Description	Date	Drn	Ch'd
E	STAGE 4 REVISED ISSUE	08.02.2021	KH	CB
D	STAGE 4 ISSUE	29.01.2021	JF	CB
C	STAGE 4 ISSUE	18.12.2020	TEJ	CB
B	STAGE 3 ISSUE	09.10.2020	TEJ	CB
A	STAGE 3 ISSUE	11.12.2019	TEJ	JS

STAGE 4

Status of drawing

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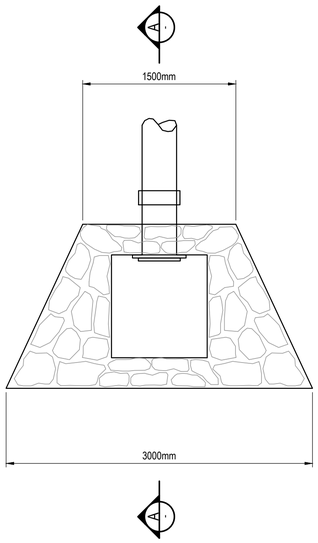
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Project MAYFIELD DEVELOPMENT PARTNERSHIP
Drg Title PROPOSED MANHOLE SCHEDULE

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Drawn by TEJ
Checked by JS

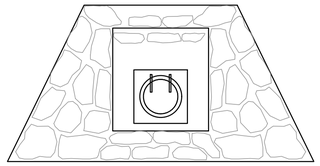
Job No. 0042912
Date DECEMBER 2019
Rev E

Drawing No. 0042912-BHE-XX-XX-DR-C-3150

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PLAN

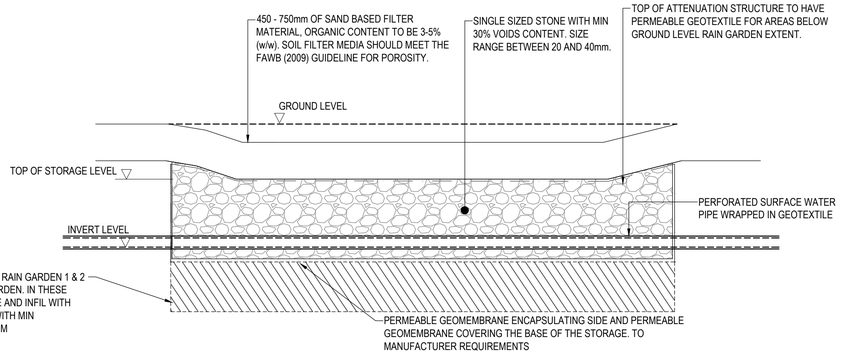


SECTION B-B - ELEVATION

DETAIL OF OUTFALL 1a & 1b TO WATERCOURSE

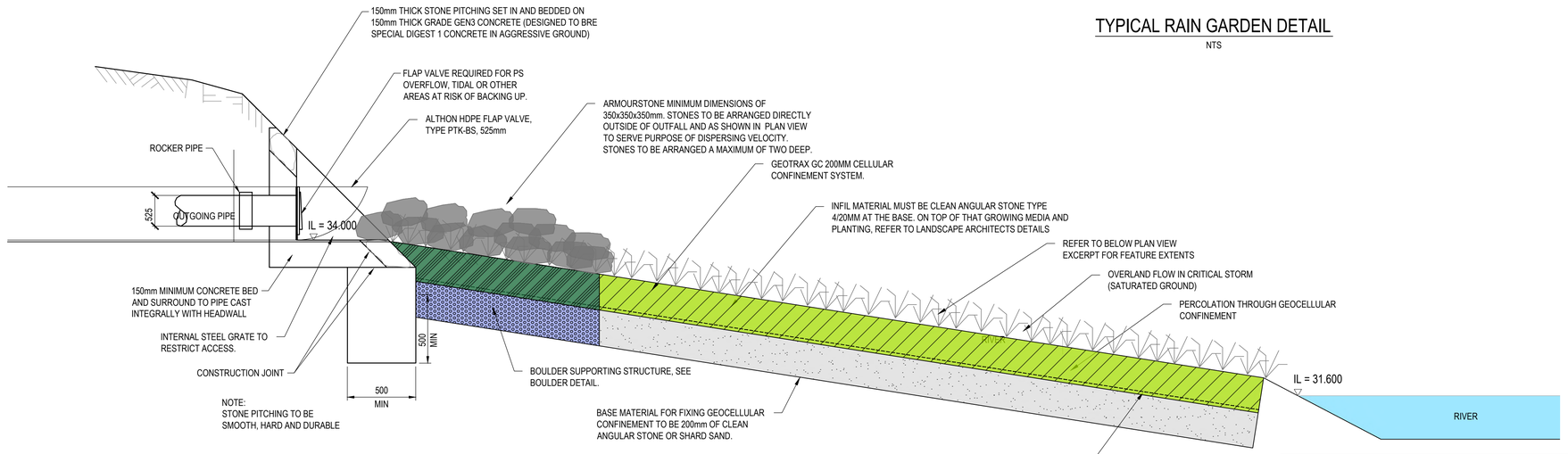
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RAIN GARDEN DETAILS				
RAIN GARDEN	1	2	3	4
TOTAL SHINGLE VOLUME	73.3m^3	117m^3	84m^3	43m^3
VOIDS VOLUME	22.0m^3	35.1m^3	25.2m^3	13m^3
STORAGE INVERT LEVEL	33.135m	32.540m	34.069m	34.800m
TOP OF STORAGE LEVEL	33.868m	33.840m	35.269m	35.400m
GROUND LEVEL	34.664m	34.723m	36.072m	36.000m



TYPICAL RAIN GARDEN DETAIL

NTS

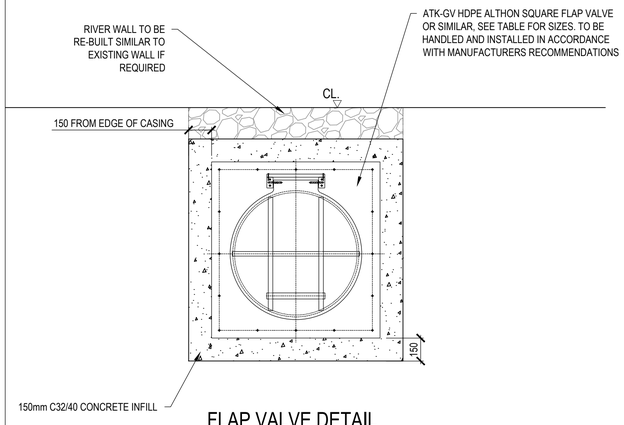


SECTION-A

TYPICAL OUTFALL CROSS SECTION C-C - 1a & 1b

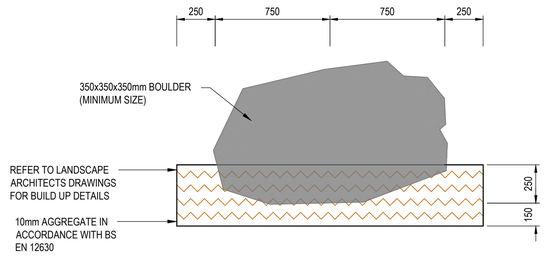
N.T.S

RIVER WALL OUTFALL DETAILS		
OUTFALL NUMBER	2	3
PIPE SIZE	375mm	300mm
TOP OF WALL LEVEL	34.000m	33.350m
PIPE INVERT LEVEL	32.317m	32.325m
FLAP VALVE SPECIFICATION	ALTHON HDPE 375mm FLAP VALVE	ALTHON HDPE 300mm FLAP VALVE
RIVER WATER LEVEL	31.870m	31.325m
RIVER WATER LEVEL (FLUVIAL RETURN PERIOD)	1 in 5yr = 33.679m 1 in 25yr = 34.277m 1 in 100yr +CC = 35.411m	1 in 5yr = 33.679m 1 in 25yr = 34.277m 1 in 100yr +CC = 35.411m



FLAP VALVE DETAIL

SCALE 1:20



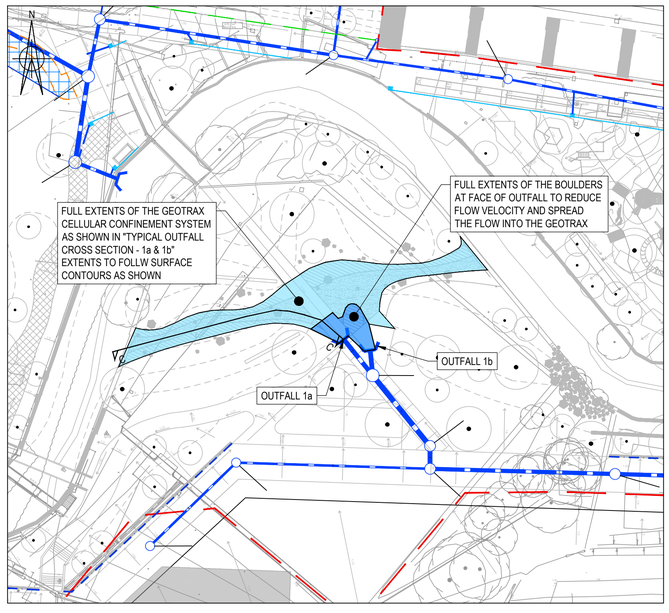
BOULDER DETAIL

NTS

10 5 0 10 20 30 40

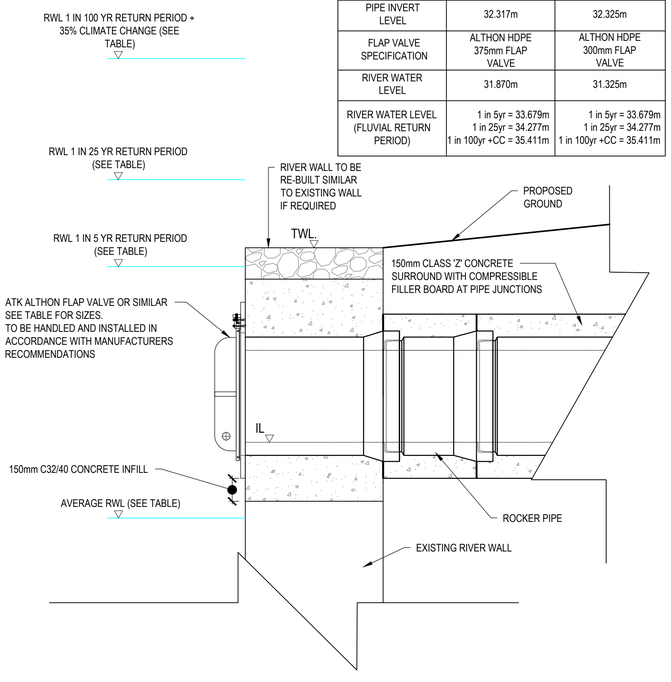
1 : 500

SCALE BEFORE REDUCTION



PLAN VIEW OUTFALL 1 - WILDSCAPE AREA

SCALE 1:500



OUTFALL AT RIVER WALL DETAIL

SCALE 1:20

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MAINTENANCE/CLEANING/OPERATION.
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Notes

1. TO BE READ IN CONJUNCTION WITH SURFACE WATER PLAN 0042912-BHE-XX-XX-DR-C-3120

Rev	Description	Date	Drn	Ch'd
F	STAGE 4 UPDATE	29.01.2021	RK	CB
E	STAGE 4 UPDATE	29.01.2021	DJ	CB
D	STAGE 4 ISSUE	18.12.2020	TEJ	CB
C	STAGE 3 ISSUE	09.10.2020	TEJ	CB
B	STAGE 3 ISSUE	11.12.2019	RH	AG
A	FOR INFORMATION	29.03.2019	RH	AG

STAGE 4

Status of drawing

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Architect *SEW*

Project **MAYFIELD DEVELOPMENT PARTNERSHIP**

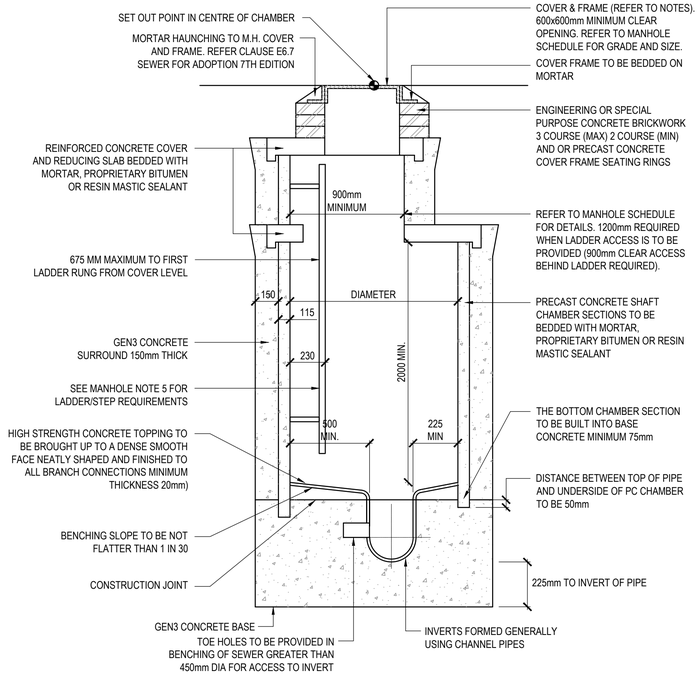
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Scales@A1 AS SHOWN
Drawn by RH
Checked by AG

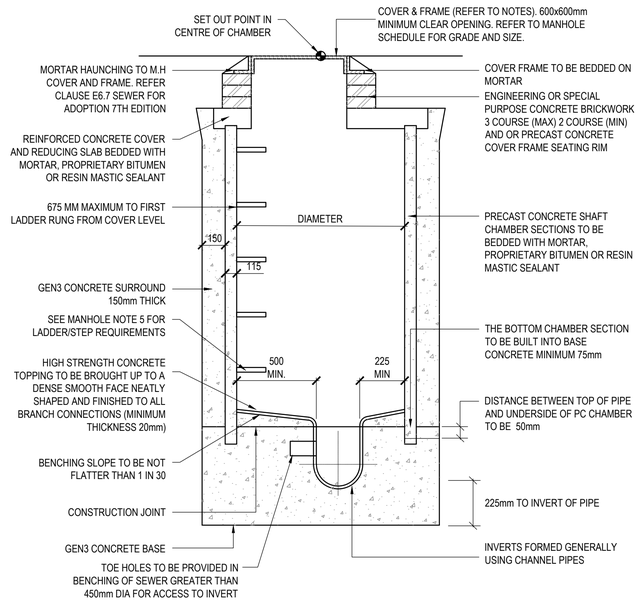
Job No. 0042912
Date MARCH 2019
Rev F

Drawing No. 0042912-BHE-XX-XX-DR-C-3300

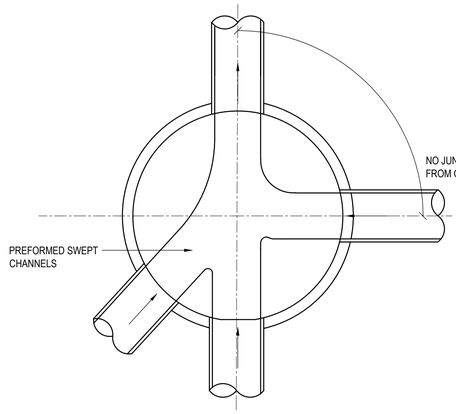
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SECTION 'A-A'



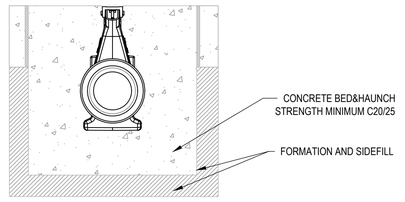
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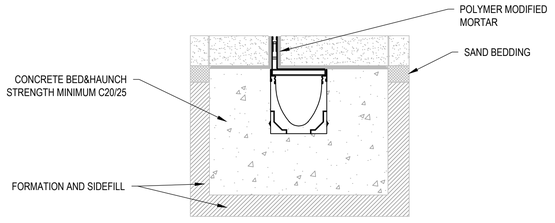


TYPICAL ARRANGEMENT OF PIPE JUNCTIONS WITHIN MANHOLES

SCALE N.T.S.

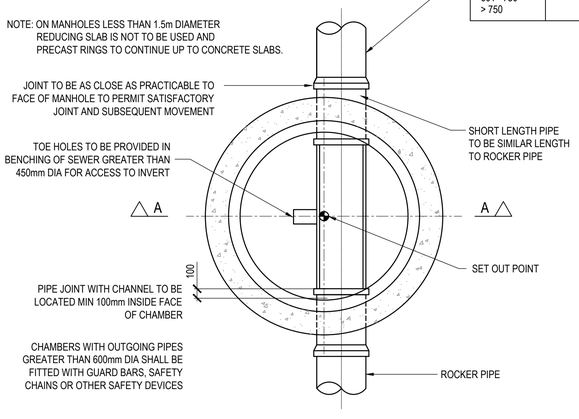
FOR CONSTRUCTION DETAILS REFER TO MANUFACTURER REQUIREMENTS CONSIDERING LOADING, LOCATION AND GROUND CONDITIONS.





TYPICAL LINEAR DRAIN DETAIL (QMAX&MULTIDRAIN)

NTS

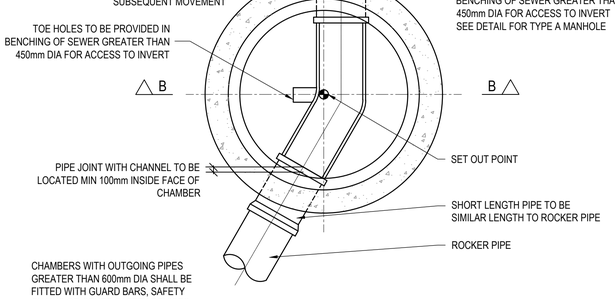


PIPE DIA	ROCKER PIPE LENGTH
150 - 600	600
601 - 750	1000
> 750	1250

MANHOLE DETAIL TYPE 1A

DEPTH TO SOFFIT 3 TO 6m

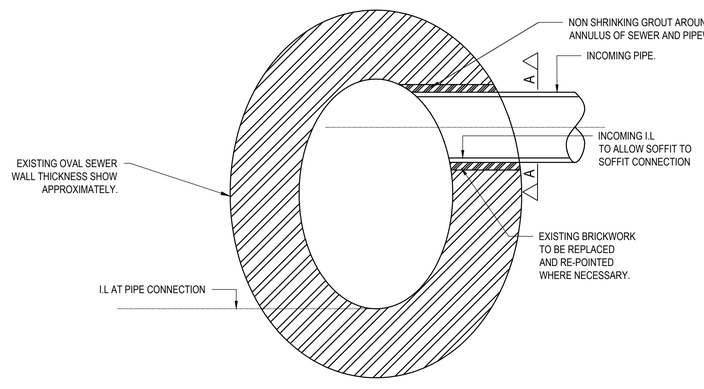
SCALE 1:20



MANHOLE DETAIL TYPE 2

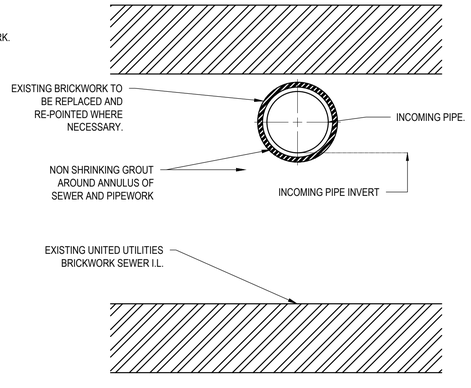
DEPTH TO SOFFIT 1.35m TO 3.0m

SCALE 1:20



BRICK SEWER CONNECTION DETAIL

SCALE 1:20



SECTION A-A

SCALE 1:20

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- WORKS IN PROXIMITY TO LIVE SERVICES
- WORKS ADJACENT TO LIVE ROADS
- WORKS IN CONTAMINATED GROUND CONDITIONS
- WORK IN PROXIMITY TO FLOOD ZONE

MAINTENANCE/CLEANING/OPERATION.
- WORKS WITHIN POTENTIAL CONFINED SPACE CONDITIONS
- WORKS IN PROXIMITY TO LIVE SERVICES
- WORKS ADJACENT TO LIVE ROADS
- WORK IN PROXIMITY TO FLOOD ZONE

DECOMMISSIONING/DEMOLITION.
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Notes

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   - 1.4 ALL MANHOLE COVERS SHALL BE THE NON VENTILATING TYPE AND SHALL HAVE CLOSED KEYWAYS.
2. ALL PRECAST CONCRETE SECTIONS/SLABS AND IN-SITU CONCRETE TO BE A MINIMUM GEN 3 (DESIGNED TO BE SPECIAL DIGEST 1 CONCRETE IN AGGRESSIVE GROUND).
3. PRE-CAST CONCRETE RECTANGULAR SECTIONS CAN BE USED IN LIEU OF BRICKWORK.
4. ALL CONCRETE FOR MANHOLES, BEDDING AND BACKING FOR PRE-CAST KERB DRAINAGE TO BE ST4 GRADE CONCRETE.
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   - WHERE DEPTH TO SOFFIT OF PIPE EXCEEDS 3.00m: A LADDER TO BS4211:2005 (CLASS A) SHALL BE PROVIDED.
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   - POSITIONS OF LADDERS AND STEP IRONS TO BE RELATIVE TO ACCESS SUCH THAT MINIMUM CLEAR OPENING IS NOT OBSTRUCTED.
6. ALL MANHOLES TO BE LAID WITH 1:10 MIN. FALL TO OUTLET PIPE.
7. MANHOLE COVERS TO BE ALIGNED WITH PAVING AND LANDSCAPING FEATURES

Rev	Description	Date	Drn	Ch'd
E	STAGE 4 UPDATES	29.01.2021	JF	CB
D	STAGE 4 ISSUE	18.12.2020	TEJ	CB
C	STAGE 3 ISSUE	09.10.2020	TEJ	CB
B	STAGE 3 ISSUE	NOT ISSUED		
A	STAGE 3 ISSUE	11.12.2019	RH	AG

STAGE 4

Status of drawing

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Architect SEW

Project MAYFIELD DEVELOPMENT PARTNERSHIP

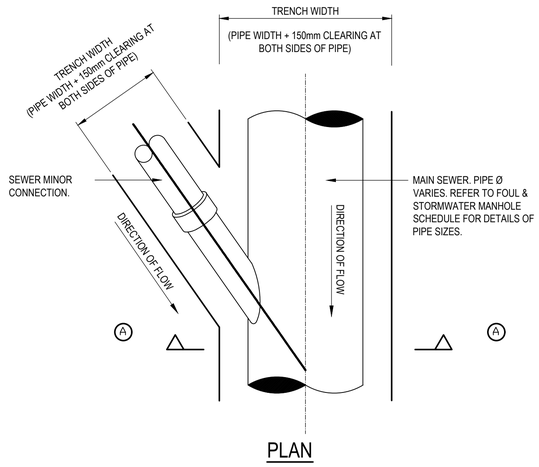
Drg Title DRAINAGE DETAILS SHEET 2 OF 2

Scales@A1 AS SHOWN
Drawn by JS
Checked by AG

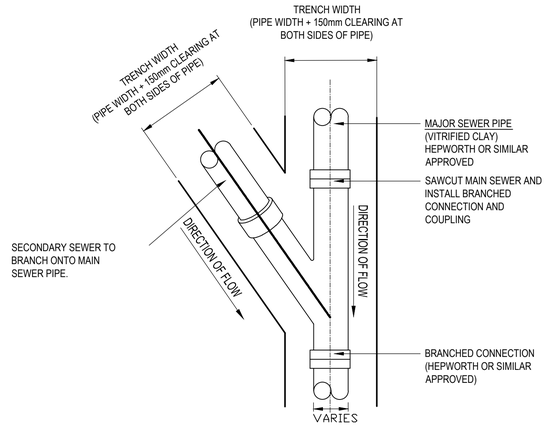
Job No. 0042912
Date DECEMBER 2019
Rev E

Drawing No. 0042912-BHE-XX-XX-DR-C-3301

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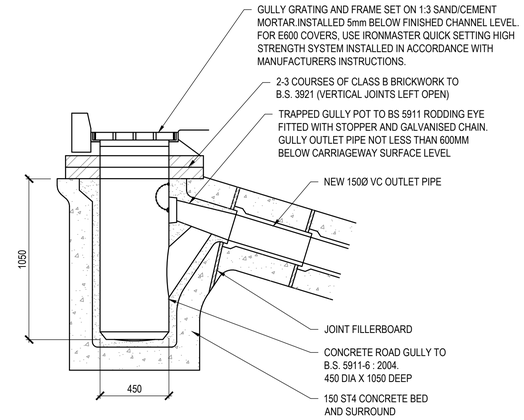


PLAN



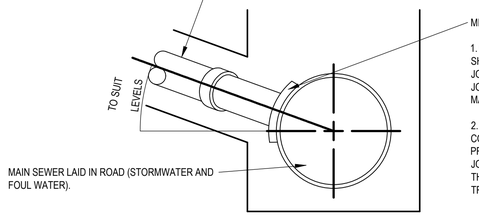
BRANCHED CONNECTION DETAILS

(FOR SIMILAR DIA. SECONDARY CONNECTION TO MAIN SEWER)



TYPICAL GULLY

FOR STORMWATER GULLY CONNECTIONS, ALL PIPES TO BE 150Ø SUPER STRENGTH VITRIFIED CLAY TO SHW TO CLAUSE 501. NO PIPE CONNECTION FOR FOUL WATER PROVIDED BY DEVELOPER AT PRESENT.



MINOR TO MAIN SEWER CONNECTIONS:

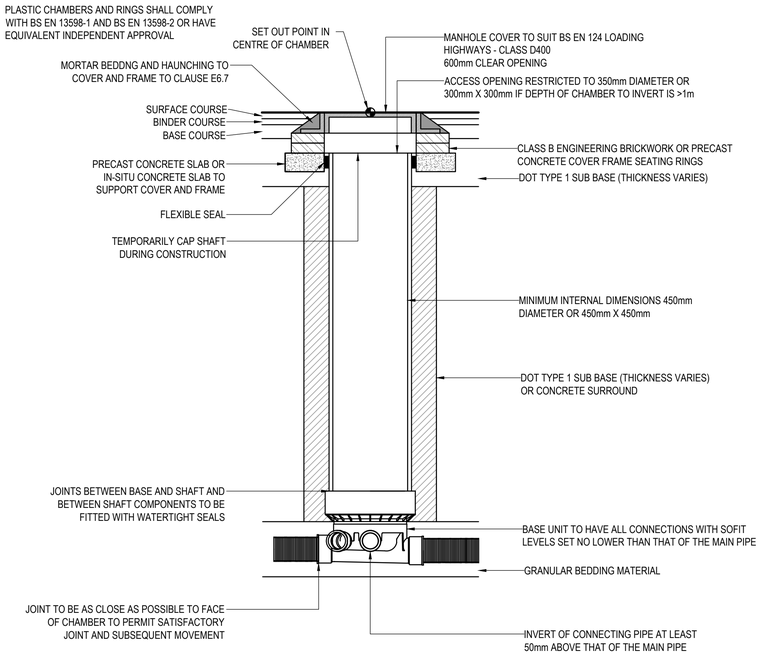
1. WHERE THE MAIN SEWER IS 600mm OR GREATER, THE SADDLE JUNCTION SHALL BE CONSTRUCTED USING CORE DRILLED EPOXY FABEKUN SADDLE JOINTS AND NOT THE TRADITIONAL METHOD OF CONSTRUCTING SADDLE JOINTS. THE JOINT SHALL BE INSTALLED IN ACCORDANCE TO THE MANUFACTURER'S INSTALLATION GUIDELINES. CONTACT - KS PROFILES Ltd.

2. WHERE THE MAIN SEWER IS LESS THAN 600mm DIAMETER, THE CONTRACTOR SHALL USE PREFABRICATED PIPES WITH THE SADDLE JOINT PROVIDED. THE CONNECTIONS SHALL BE 45° OBLIQUE JUNCTIONS LAID AND JOINTED TO THE MANUFACTURERS RECOMMENDATIONS. AT NO TIME SHALL THE CONTRACTOR CONSTRUCT A SADDLE CONNECTION USING THE TRADITIONAL METHOD UNLESS AGREED BY THE ENGINEER.

SECTION A-A

SEWER CONNECTION DETAIL FOR MINOR PIPES CONNECTING INTO MAIN SEWER IN ROAD

PLASTIC CHAMBERS AND RINGS SHALL COMPLY WITH BS EN 13598-1 AND BS EN 13598-2 OR HAVE EQUIVALENT INDEPENDENT APPROVAL

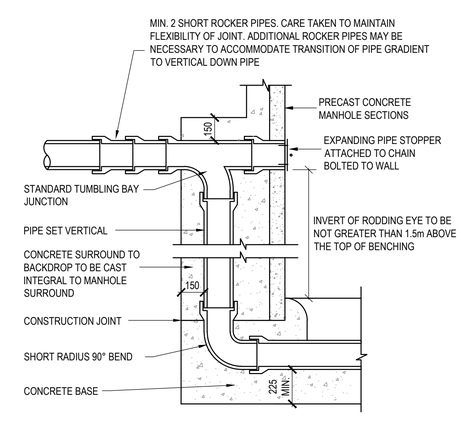


NOTE: WHERE THE ACCESS CHAMBER IS IN THE HIGHWAY THE HIGHWAY AUTHORITY CAN HAVE SPECIFIC REQUIREMENTS

TYPICAL INSPECTION CHAMBER DETAIL - TYPE 3 (FLEXIBLE MATERIAL DETAIL)

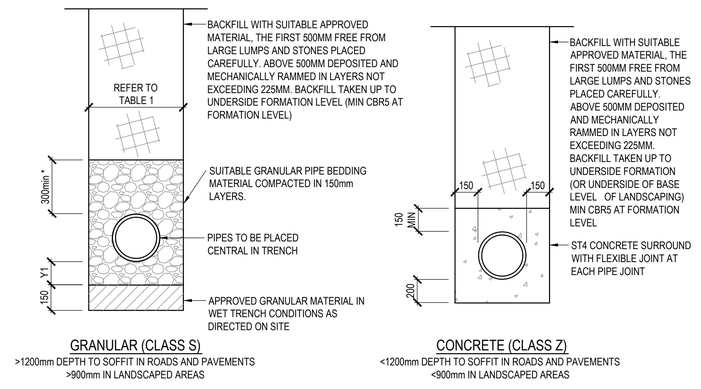
MAXIMUM DEPTH FROM COVER LEVEL TO SOFFIT OF PIPE IN AREAS SUBJECT TO VEHICLE LOADING 3m, NON ENTRY

NOT TO SCALE



EXTERNAL MANHOLE BACKDROP DETAIL

SCALE 1:20

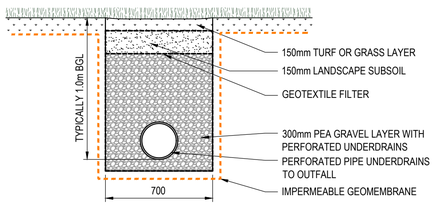


GRANULAR (CLASS S)
>1200mm DEPTH TO SOFFIT IN ROADS AND PAVEMENTS
>900mm IN LANDSCAPED AREAS

CONCRETE (CLASS Z)
<1200mm DEPTH TO SOFFIT IN ROADS AND PAVEMENTS
<900mm IN LANDSCAPED AREAS

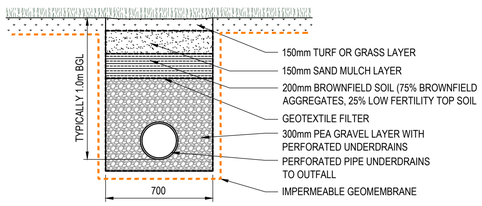
PIPE BEDDING DETAILS

SCALE 1:20



FILTER DRAIN DETAIL

SCALE 1:20



FILTER DRAIN DETAIL

SCALE 1:20

PIPE DIA.	GRANULAR BEDDING Y1 MIN.	MIN. TRENCH WIDTH	MAX. TRENCH WIDTH
150	100	600	900
225	100	700	1000
300	100	850	1150
375	100	1050	1350
450	100	1150	1450
525	115	1200	1500
600	130	1350	1650
750	155	1500	1800
1050	210	2100	2400

TABLE 1: DIMENSIONS FOR BEDDINGS AND TRENCH WIDTHS

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MAINTENANCE/CLEANING/OPERATION.
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DECOMMISSIONING/DEMOLITION.
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STAGE 4

Status of drawing

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Architect *SEW*

Project **MAYFIELD DEVELOPMENT PARTNERSHIP**

Drg Title DRAINAGE DETAILS SHEET 3 OF 3

Scales@A1 AS SHOWN
Drawn by JS
Checked by AG

Job No. 0042912
Date DECEMBER 2019
Rev E

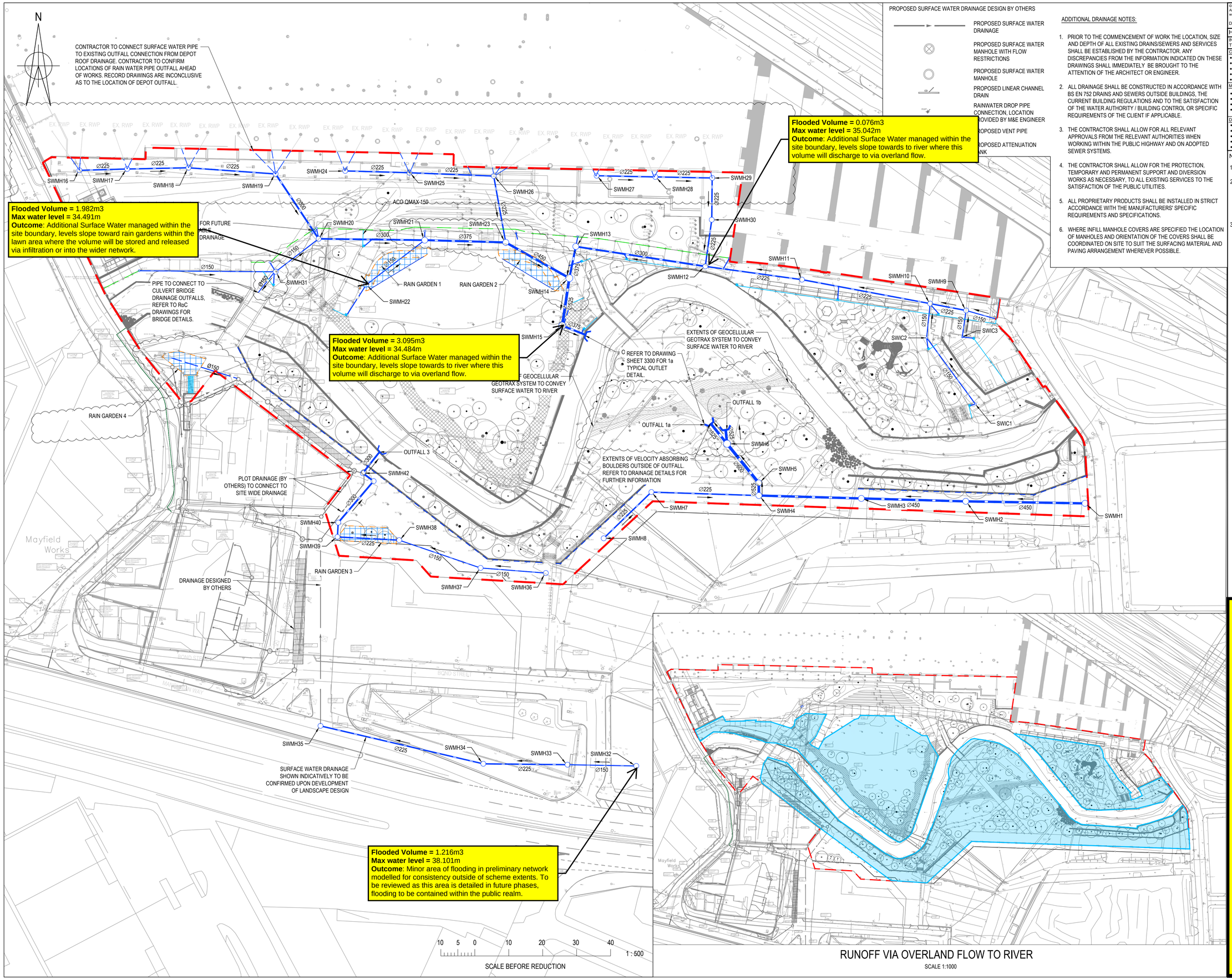
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Appendix F MicroDrainage Results



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PROPOSED SURFACE WATER DRAINAGE DESIGN BY OTHERS

- PROPOSED SURFACE WATER DRAINAGE
- PROPOSED SURFACE WATER MANHOLE WITH FLOW RESTRICTIONS
- PROPOSED SURFACE WATER MANHOLE
- PROPOSED LINEAR CHANNEL DRAIN
- RAINWATER DROP PIPE CONNECTION, LOCATION PROVIDED BY M&E ENGINEER
- PROPOSED VENT PIPE
- PROPOSED ATTENUATION TANK

ADDITIONAL DRAINAGE NOTES:

1. PRIOR TO THE COMMENCEMENT OF WORK THE LOCATION, SIZE AND DEPTH OF ALL EXISTING DRAINS/SEWERS AND SERVICES SHALL BE ESTABLISHED BY THE CONTRACTOR. ANY DISCREPANCIES FROM THE INFORMATION INDICATED ON THESE DRAWINGS SHALL IMMEDIATELY BE BROUGHT TO THE ATTENTION OF THE ARCHITECT OR ENGINEER.
2. ALL DRAINAGE SHALL BE CONSTRUCTED IN ACCORDANCE WITH BS EN 752 DRAINS AND SEWERS OUTSIDE BUILDINGS, THE CURRENT BUILDING REGULATIONS AND TO THE SATISFACTION OF THE WATER AUTHORITY / BUILDING CONTROL OR SPECIFIC REQUIREMENTS OF THE CLIENT IF APPLICABLE.
3. THE CONTRACTOR SHALL ALLOW FOR ALL RELEVANT APPROVALS FROM THE RELEVANT AUTHORITIES WHEN WORKING WITHIN THE PUBLIC HIGHWAY AND ON ADOPTED SEWER SYSTEMS.
4. THE CONTRACTOR SHALL ALLOW FOR THE PROTECTION, TEMPORARY AND PERMANENT SUPPORT AND DIVERSION WORKS AS NECESSARY, TO ALL EXISTING SERVICES TO THE SATISFACTION OF THE PUBLIC UTILITIES.
5. ALL PROPRIETARY PRODUCTS SHALL BE INSTALLED IN STRICT ACCORDANCE WITH THE MANUFACTURERS' SPECIFIC REQUIREMENTS AND SPECIFICATIONS.
6. WHERE INFILL MANHOLE COVERS ARE SPECIFIED THE LOCATION OF MANHOLES AND ORIENTATION OF THE COVERS SHALL BE COORDINATED ON SITE TO SUIT THE SURFACING MATERIAL AND PAVING ARRANGEMENT WHEREVER POSSIBLE.

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- WORKS IN CONTAMINATED GROUND CONDITIONS
- WORK IN PROXIMITY TO FLOOD ZONE

Notes

1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH DRAWING MANHOLE SCHEDULE 042912-BHE-XX-XX-DR-C-3150.
2. THE CONTRACTOR SHALL BE AWARE THAT EXISTING UTILITIES COULD POTENTIALLY BE LIVE AND THERE MAY BE OTHER UNRECORDED SERVICES IN EXISTENCE ON SITE, ACCORDINGLY IT IS THE CONTRACTOR'S RESPONSIBILITY TO IDENTIFY EXISTING UTILITIES AND TO SATISFY THEMSELVES THAT THEY ARE SAFE TO ABANDON/REMOVE.
3. DRAWING BASED ON:
   - ARCHITECT'S PLAN 0345-SEW-ZZ-00-DR-L-007102 RECEIVED FROM SEW ON 16/11/2020,
   - BELOW GROUND DRAINAGE GA 1076-01-CE-YY-DR-C-001-T02 RECEIVED FROM PLOT ENGINEERS ON 22/09/2020
   - TOPOGRAPHICAL SURVEY RECEIVED SEPT 2020 FROM SURVEY OPERATIONS.

LEGEND

EXISTING DRAINAGE
- EXISTING COMBINED WATER SEWER
- EXISTING RWP
- EXISTING SURFACE WATER PIPE (GPR SURVEY)

PROPOSED DRAINAGE
- 375mmØ SURFACE WATER
- SURFACE WATER MANHOLE
- INSPECTION CHAMBER
- OUTFALL
- GULLY
- FILTER DRAIN
- ACO 'MULTIDRAIN' LINEAR DRAIN (UNLESS OTHERWISE STATED)
- LINEAR DRAIN SUMP
- RAIN GARDEN EXTENTS ON SURFACE
- RAIN GARDEN EXTENTS (GRAVEL) BELOW GROUND
- DRAINAGE VIA OPENINGS IN RETAINING WALL TO SOFT LANDSCAPING
- PARK BOUNDARY

Summary of Flooded Areas

Event: 1 in 100 year storm + 40% CC

Results: MicroDrainage

Date: 01.03.2021
JF

RUNOFF VIA OVERLAND FLOW TO RIVER
SCALE 1:1000

James Feeley, \\Srv-bowdon02\Jobs\042912 Mayfield Park Manchester Infrastructure\PSB - Infra\01 Sheets\042912-BHE-XX-XX-DR-C-1301.dwg

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Outlet 1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	36.754	0.638	57.6	0.073	5.00	0.0	0.600	o	300	Pipe/Conduit	
S1.001	36.830	0.217	170.0	0.061	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	10.155	0.102	100.0	0.020	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.000	43.098	0.431	100.0	0.099	5.00	0.0	0.600	o	300	Pipe/Conduit	
S2.001	66.820	0.445	150.0	0.133	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.003	38.456	0.118	325.9	0.078	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.004	15.920	0.159	100.1	0.093	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.005	15.920	0.159	100.1	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S3.000	2.265	0.010	226.5	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	
S3.001	11.732	0.220	53.4	0.308	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.006	16.660	0.042	400.0	0.047	0.00	0.0	0.600	o	525	Pipe/Conduit	
S4.000	30.203	0.604	50.0	0.064	5.00	0.0	0.600	o	225	Pipe/Conduit	
S4.001	37.018	1.025	36.1	0.091	0.00	0.0	0.600	o	450	Pipe/Conduit	
S4.002	31.819	0.265	120.0	0.055	0.00	0.0	0.600	o	450	Pipe/Conduit	
S5.000	2.482	0.012	206.9	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	
S5.001	6.442	0.133	48.4	0.305	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.003	25.890	0.917	28.2	0.039	0.00	0.0	0.600	o	525	Pipe/Conduit	
S4.004	32.462	0.646	50.2	0.098	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.30	41.175	0.073	0.0	0.0	0.0	2.08	146.7	9.8
S1.001	50.00	5.81	40.489	0.134	0.0	0.0	0.0	1.20	85.0	18.1
S1.002	50.00	5.91	40.270	0.154	0.0	0.0	0.0	1.57	111.1	20.8
S2.000	50.00	5.46	39.550	0.099	0.0	0.0	0.0	1.57	111.1	13.4
S2.001	50.00	6.21	39.119	0.232	0.0	0.0	0.0	1.48	163.1	31.4
S1.003	50.00	6.73	37.000	0.464	0.0	0.0	0.0	1.24	267.4	62.8
S1.004	50.00	6.88	36.500	0.557	0.0	0.0	0.0	1.81	200.0	75.5
S1.005	50.00	7.02	36.341	0.557	0.0	0.0	0.0	1.81	200.0	75.5
S3.000	50.00	5.04	43.000	0.000	0.0	0.0	0.0	0.86	34.4	0.0
S3.001	50.00	5.11	39.000	0.308	0.0	0.0	0.0	2.79	443.4	41.8
S1.006	50.00	7.27	36.250	0.913	0.0	0.0	0.0	1.11	241.1	123.6
S4.000	50.00	5.27	40.665	0.064	0.0	0.0	0.0	1.85	73.7	8.6
S4.001	50.00	5.45	40.061	0.155	0.0	0.0	0.0	3.39	539.4	21.0
S4.002	50.00	5.74	38.961	0.210	0.0	0.0	0.0	1.85	295.0	28.4
S5.000	50.00	5.05	42.000	0.000	0.0	0.0	0.0	0.91	36.0	0.0
S5.001	50.00	5.09	39.000	0.305	0.0	0.0	0.0	2.26	160.1	41.3
S4.003	50.00	5.84	37.700	0.554	0.0	0.0	0.0	4.23	915.1	75.0
S4.004	50.00	6.08	37.779	0.651	0.0	0.0	0.0	2.22	157.2	88.2

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STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Outlet 1

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
S4.005	32.462	0.646	50.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.006	21.650	0.054	400.9	0.058	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.007	36.344	0.202	179.9	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S6.000	2.034	0.010	203.4	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	
S6.001	7.808	0.073	107.2	0.330	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.008	59.638	1.325	45.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S7.000	3.366	0.022	150.0	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	
S7.001	10.654	0.426	25.0	0.352	0.00	0.0	0.600	o	375	Pipe/Conduit	
S8.000	1.451	0.009	161.2	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	
S8.001	5.510	0.055	100.2	0.188	0.00	0.0	0.600	o	300	Pipe/Conduit	
S8.002	19.567	0.326	60.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S8.003	33.111	0.331	100.0	0.101	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.009	2.828	0.016	176.8	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.010	21.454	0.059	363.6	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.011	3.370	0.034	99.1	0.000	0.00	0.0	0.600	o	600	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)
S4.005	50.00	6.33	37.133	0.651	0.0	0.0	0.0	2.22	157.2	88.2
S4.006	50.00	6.69	36.250	0.709	0.0	0.0	0.0	1.01	160.5	96.0
S1.007	50.00	7.67	36.210	1.622	0.0	0.0	0.0	1.51	240.6	219.7
S6.000	50.00	5.04	38.000	0.000	0.0	0.0	0.0	0.91	36.3	0.0
S6.001	50.00	5.12	35.200	0.330	0.0	0.0	0.0	1.52	107.3	44.6
S1.008	50.00	8.00	36.034	1.952	0.0	0.0	0.0	3.04	483.0	264.3
S7.000	50.00	5.05	38.000	0.000	0.0	0.0	0.0	1.07	42.4	0.0
S7.001	50.00	5.10	35.056	0.352	0.0	0.0	0.0	3.64	401.7	47.7
S8.000	50.00	5.02	38.000	0.000	0.0	0.0	0.0	1.03	40.8	0.0
S8.001	50.00	5.08	35.000	0.188	0.0	0.0	0.0	1.57	111.0	25.4
S8.002	50.00	5.24	34.975	0.188	0.0	0.0	0.0	2.03	143.7	25.4
S8.003	50.00	5.59	34.649	0.289	0.0	0.0	0.0	1.57	111.1	39.2
S1.009	50.00	8.03	34.239	2.593	0.0	0.0	0.0	1.68	364.1	351.2
S1.010	50.00	8.31	34.148	2.593	0.0	0.0	0.0	1.27	359.4	351.2
S1.011	50.00	8.33	34.128	2.593	0.0	0.0	0.0	2.45	691.7	351.2

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Area Summary for Outlet 1

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	90	0.081	0.073	0.073
1.001	User	-	90	0.068	0.061	0.061
1.002	User	-	90	0.022	0.020	0.020
2.000	User	-	90	0.110	0.099	0.099
2.001	User	-	90	0.148	0.133	0.133
1.003	User	-	90	0.087	0.078	0.078
1.004	User	-	90	0.104	0.093	0.093
1.005	-	-	100	0.000	0.000	0.000
3.000	-	-	100	0.000	0.000	0.000
3.001	User	-	95	0.325	0.308	0.308
1.006	User	-	90	0.053	0.047	0.047
4.000	User	-	90	0.071	0.064	0.064
4.001	User	-	90	0.101	0.091	0.091
4.002	User	-	90	0.061	0.055	0.055
5.000	-	-	100	0.000	0.000	0.000
5.001	User	-	95	0.321	0.305	0.305
4.003	User	-	90	0.044	0.039	0.039
4.004	User	-	90	0.109	0.098	0.098
4.005	-	-	100	0.000	0.000	0.000
4.006	User	-	90	0.064	0.058	0.058
1.007	-	-	100	0.000	0.000	0.000
6.000	-	-	100	0.000	0.000	0.000
6.001	User	-	95	0.347	0.330	0.330
1.008	-	-	100	0.000	0.000	0.000
7.000	-	-	100	0.000	0.000	0.000
7.001	User	-	95	0.371	0.352	0.352
8.000	-	-	100	0.000	0.000	0.000
8.001	User	-	95	0.198	0.188	0.188
8.002	-	-	100	0.000	0.000	0.000
8.003	User	-	95	0.107	0.101	0.101
1.009	-	-	100	0.000	0.000	0.000
1.010	-	-	100	0.000	0.000	0.000
1.011	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				2.789	2.593	2.593

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Online Controls for Outlet 1

Hydro-Brake® Optimum Manhole: SWMHB4, DS/PN: S3.001, Volume (m³): 8.6

Unit Reference	MD-SHE-0218-2860-2000-2860
Design Head (m)	2.000
Design Flow (l/s)	28.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	218
Invert Level (m)	39.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	28.6	Kick-Flo®	1.269	23.0
Flush-Flo™	0.590	28.6	Mean Flow over Head Range	-	24.8

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	7.4	0.800	28.2	2.000	28.6	4.000	39.9	7.000	52.2
0.200	21.4	1.000	27.1	2.200	29.9	4.500	42.2	7.500	54.0
0.300	26.5	1.200	24.6	2.400	31.2	5.000	44.4	8.000	55.7
0.400	27.9	1.400	24.1	2.600	32.4	5.500	46.5	8.500	57.4
0.500	28.5	1.600	25.7	3.000	34.7	6.000	48.5	9.000	59.0
0.600	28.6	1.800	27.2	3.500	37.4	6.500	50.4	9.500	60.6

Hydro-Brake® Optimum Manhole: SWMHF6, DS/PN: S1.006, Volume (m³): 11.1

Unit Reference	MD-SHE-0402-1125-2000-1125
Design Head (m)	2.000
Design Flow (l/s)	112.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	402
Invert Level (m)	36.250
Minimum Outlet Pipe Diameter (mm)	450
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	112.5	Kick-Flo®	1.431	95.6
Flush-Flo™	0.693	112.1	Mean Flow over Head Range	-	94.5

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	11.0	0.400	106.5	0.800	111.7	1.400	97.8	2.000	112.5
0.200	39.5	0.500	110.0	1.000	109.6	1.600	100.9	2.200	117.8
0.300	76.4	0.600	111.6	1.200	106.0	1.800	106.9	2.400	122.9

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Hydro-Brake® Optimum Manhole: SWMHF6, DS/PN: S1.006, Volume (m³): 11.1

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	127.8	4.000	157.7	5.500	184.2	7.000	207.3	8.500	228.0
3.000	137.0	4.500	167.0	6.000	192.2	7.500	214.4	9.000	234.5
3.500	147.7	5.000	175.8	6.500	199.9	8.000	221.3	9.500	240.8

Hydro-Brake® Optimum Manhole: SWMHB2, DS/PN: S5.001, Volume (m³): 4.0

Unit Reference	MD-SHE-0218-2860-2000-2860
Design Head (m)	2.000
Design Flow (l/s)	28.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	218
Invert Level (m)	39.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	28.6	Kick-Flo®	1.269	23.0
Flush-Flo™	0.590	28.6	Mean Flow over Head Range	-	24.8

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	7.4	0.800	28.2	2.000	28.6	4.000	39.9	7.000	52.2
0.200	21.4	1.000	27.1	2.200	29.9	4.500	42.2	7.500	54.0
0.300	26.5	1.200	24.6	2.400	31.2	5.000	44.4	8.000	55.7
0.400	27.9	1.400	24.1	2.600	32.4	5.500	46.5	8.500	57.4
0.500	28.5	1.600	25.7	3.000	34.7	6.000	48.5	9.000	59.0
0.600	28.6	1.800	27.2	3.500	37.4	6.500	50.4	9.500	60.6

Hydro-Brake® Optimum Manhole: SWMHF14, DS/PN: S4.006, Volume (m³): 7.6

Unit Reference	MD-SHE-0383-1005-2000-1005
Design Head (m)	2.000
Design Flow (l/s)	100.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	383
Invert Level (m)	36.250
Minimum Outlet Pipe Diameter (mm)	450
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	100.4	Kick-Flo®	1.418	85.0
Flush-Flo™	0.671	100.4	Mean Flow over Head Range	-	84.9

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

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Hydro-Brake® Optimum Manhole: SWMHF14, DS/PN: S4.006, Volume (m³): 7.6

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	10.7	0.800	99.9	2.000	100.4	4.000	140.7	7.000	185.0
0.200	38.1	1.000	97.9	2.200	105.2	4.500	149.1	7.500	191.4
0.300	72.6	1.200	94.4	2.400	109.7	5.000	156.9	8.000	197.5
0.400	96.0	1.400	86.3	2.600	114.1	5.500	164.4	8.500	203.5
0.500	98.9	1.600	90.1	3.000	122.3	6.000	171.6	9.000	209.3
0.600	100.2	1.800	95.4	3.500	131.9	6.500	178.4	9.500	214.9

Hydro-Brake® Optimum Manhole: SWMHB6, DS/PN: S6.001, Volume (m³): 5.5

Unit Reference	MD-SHE-0244-3170-0850-3170
Design Head (m)	0.850
Design Flow (l/s)	31.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	244
Invert Level (m)	35.200
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.850	31.7	Kick-Flo®	0.663	28.1
Flush-Flo™	0.371	31.7	Mean Flow over Head Range	-	25.5

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.0	0.800	30.8	2.000	47.8	4.000	66.9	7.000	87.9
0.200	24.8	1.000	34.3	2.200	50.1	4.500	70.9	7.500	90.9
0.300	31.4	1.200	37.4	2.400	52.2	5.000	74.6	8.000	93.8
0.400	31.6	1.400	40.3	2.600	54.3	5.500	78.1	8.500	96.6
0.500	31.0	1.600	43.0	3.000	58.2	6.000	81.5	9.000	98.8
0.600	29.7	1.800	45.5	3.500	62.7	6.500	84.8	9.500	101.5

Hydro-Brake® Optimum Manhole: SWMHB8, DS/PN: S7.001, Volume (m³): 7.2

Unit Reference	MD-SHE-0228-3170-2000-3170
Design Head (m)	2.000
Design Flow (l/s)	31.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	228
Invert Level (m)	35.056
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	31.7	Kick-Flo®	1.275	25.6
Flush-Flo™	0.590	31.7	Mean Flow over Head Range	-	27.5

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

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Hydro-Brake® Optimum Manhole: SWMHB8, DS/PN: S7.001, Volume (m³): 7.2

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	7.6	0.800	31.2	2.000	31.7	4.000	44.2	7.000	58.0
0.200	22.8	1.000	30.0	2.200	33.2	4.500	46.8	7.500	60.0
0.300	29.4	1.200	27.4	2.400	34.6	5.000	49.3	8.000	61.9
0.400	30.9	1.400	26.7	2.600	35.9	5.500	51.6	8.500	63.7
0.500	31.5	1.600	28.5	3.000	38.5	6.000	53.8	9.000	65.5
0.600	31.7	1.800	30.1	3.500	41.5	6.500	55.9	9.500	67.3

Hydro-Brake® Optimum Manhole: SWMHB10, DS/PN: S8.001, Volume (m³): 5.7

Unit Reference	MD-SHE-0172-1750-2000-1750
Design Head (m)	2.000
Design Flow (l/s)	17.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	172
Invert Level (m)	35.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	17.5	Kick-Flo®	1.219	13.8
Flush-Flo™	0.581	17.4	Mean Flow over Head Range	-	15.2

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	6.1	0.800	17.1	2.000	17.5	4.000	24.3	7.000	31.9
0.200	14.6	1.000	16.2	2.200	18.3	4.500	25.8	7.500	32.9
0.300	16.2	1.200	14.2	2.400	19.1	5.000	27.1	8.000	34.0
0.400	17.0	1.400	14.8	2.600	19.8	5.500	28.4	8.500	35.0
0.500	17.3	1.600	15.7	3.000	21.2	6.000	29.6	9.000	36.0
0.600	17.4	1.800	16.6	3.500	22.8	6.500	30.7	9.500	36.9

Non Return Valve Manhole: SWMH6, DS/PN: S1.011, Volume (m³): 7.5

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

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 8 Number of Storage Structures 7 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model		FEH	Data Type Point
FEH Rainfall Version		2013	Cv (Summer) 0.750
Site Location	GB 385108 397575 SJ 85108 97575		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, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 30, 40

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)
S1.000	SWMHF1	15 Winter	100	+40%					41.300	-0.175
S1.001	SWMHF2	15 Winter	100	+40%	100/15 Summer				40.871	0.082
S1.002	SWMHF3	15 Winter	100	+40%	100/15 Summer				40.607	0.036
S2.000	SWMHF4	15 Winter	100	+40%					39.726	-0.124
S2.001	SWMHF5	15 Winter	100	+40%					39.455	-0.039
S1.003	SWMHF4	15 Winter	100	+40%	100/15 Summer				37.671	0.146
S1.004	SWMHF5	15 Winter	100	+40%	30/15 Summer				37.524	0.649
S1.005	SWMHF16	60 Winter	100	+40%	30/15 Summer				37.226	0.510
S3.000	SWMHB3	1440 Winter	2	+0%					43.000	-0.225
S3.001	SWMHB4	60 Winter	100	+40%	30/30 Winter				39.849	0.399
S1.006	SWMHF6	120 Winter	100	+40%	30/15 Winter				37.365	0.590
S4.000	SWMHF9	15 Winter	100	+40%					40.794	-0.096
S4.001	SWMHF10	15 Winter	100	+40%					40.206	-0.305
S4.002	SWMHF11	15 Winter	100	+40%					39.222	-0.190
S5.000	SWMHB1	1440 Winter	2	+0%					42.000	-0.225
S5.001	SWMHB2	60 Winter	100	+40%	30/15 Summer				39.830	0.530
S4.003	SWMHF12	15 Winter	100	+40%	30/15 Summer				39.156	0.931
S4.004	SWMHF13	15 Winter	100	+40%	30/15 Summer				39.105	1.026
S4.005	SWMHF15	30 Winter	100	+40%					37.407	-0.026
S4.006	SWMHF14	30 Winter	100	+40%	30/15 Summer				37.170	0.470
S1.007	SWMH1	60 Winter	100	+40%					36.569	-0.091
S6.000	SWMHB5	1440 Winter	2	+0%					38.000	-0.225
S6.001	SWMHB6	60 Winter	100	+40%	2/15 Summer				37.127	1.627
S1.008	SWMH2	60 Winter	100	+40%					36.271	-0.213
S7.000	SWMHB7	1440 Winter	2	+0%					38.000	-0.225
S7.001	SWMHB8	60 Winter	100	+40%	30/15 Summer				36.542	1.111
S8.000	SWMHB9	1440 Winter	2	+0%					38.000	-0.225
S8.001	SWMHB10	60 Winter	100	+40%	30/15 Summer				36.442	1.142
S8.002	SWMH8	60 Winter	100	+40%					35.063	-0.212
S8.003	SWMH7	60 Winter	100	+40%	100/30 Summer				35.035	0.086
S1.009	SWMH4	60 Winter	100	+40%	30/30 Winter				34.966	0.202

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

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	SWMHF1	0.000	0.35		48.0	OK	
S1.001	SWMHF2	0.000	1.09		85.7	SURCHARGED	4
S1.002	SWMHF3	0.000	1.21		97.0	SURCHARGED	4
S2.000	SWMHF4	0.000	0.62		64.8	OK	72
S2.001	SWMHF5	0.000	1.00		153.7	OK	72
S1.003	SWMHF4	0.000	1.27		293.1	SURCHARGED	
S1.004	SWMHF5	0.000	2.06		322.3	SURCHARGED	
S1.005	SWMHF16	0.000	0.52		81.5	SURCHARGED	
S3.000	SWMHB3	0.000	0.00		0.0	OK	
S3.001	SWMHB4	0.000	0.11		28.5	SURCHARGED*	
S1.006	SWMHF6	0.000	0.62		101.8	SURCHARGED	
S4.000	SWMHF9	0.000	0.61		42.2	OK	
S4.001	SWMHF10	0.000	0.22		106.9	OK	
S4.002	SWMHF11	0.000	0.57		144.6	OK	3
S5.000	SWMHB1	0.000	0.00		0.0	OK	
S5.001	SWMHB2	0.000	0.31		28.6	SURCHARGED	
S4.003	SWMHF12	0.000	0.25		181.7	SURCHARGED	3
S4.004	SWMHF13	0.000	1.60		230.0	FLOOD RISK	10
S4.005	SWMHF15	0.000	0.67		96.8	OK	
S4.006	SWMHF14	0.000	0.76		100.0	SURCHARGED	28
S1.007	SWMH1	0.000	1.00		210.7	OK	
S6.000	SWMHB5	0.000	0.00		0.0	OK	
S6.001	SWMHB6	0.000	0.47		32.1	SURCHARGED	
S1.008	SWMH2	0.000	0.55		242.8	OK	
S7.000	SWMHB7	0.000	0.00		0.0	OK	
S7.001	SWMHB8	0.000	0.12		31.5	SURCHARGED	
S8.000	SWMHB9	0.000	0.00		0.0	OK	
S8.001	SWMHB10	0.000	0.28		17.4	SURCHARGED	
S8.002	SWMH8	0.000	0.14		17.4	OK	
S8.003	SWMH7	0.000	0.50		50.8	SURCHARGED	
S1.009	SWMH4	0.000	1.80		309.7	SURCHARGED	72

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

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)
S1.010	SWMH5	60 Winter	100	+40%	100/30 Winter				34.803	0.055	0.000
S1.011	SWMH6	60 Winter	100	+40%					34.728	0.000	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.010	SWMH5	1.13		309.6	SURCHARGED	
S1.011	SWMH6	1.06		309.4	OK	72

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STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Outlet 2

« - 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
S6.000	15.093	0.322	46.8	0.157	5.00	0.0	0.600	o	300	Pipe/Conduit	
S6.001	15.093	0.539	28.0	0.014	0.00	0.0	0.600	o	300	Pipe/Conduit	
S6.002	30.186	0.305	99.0	0.020	0.00	0.0	0.600	o	300	Pipe/Conduit	
S6.003	28.739	0.412	69.8	0.016	0.00	0.0	0.600	o	300	Pipe/Conduit	
S7.000	1.952	0.043	45.4	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit	
S7.001	9.035	0.146	61.9	0.149	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.002	17.309	0.285	60.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.000	1.913	0.036	53.1	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit	
S8.001	9.730	0.160	60.8	0.149	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.003	16.743	0.342	49.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S9.000	2.692	0.046	58.5	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit	
S9.001	9.107	0.148	61.5	0.074	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.004	26.115	0.204	128.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S6.004	39.638	0.164	241.7	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S6.005	9.817	0.041	239.4	0.019	0.00	0.0	0.600	o	375	Pipe/Conduit	
S10.000	20.831	0.595	35.0	0.000	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)
S6.000	50.00	5.11	35.040	0.157	0.0	0.0	0.0	2.30	162.8	21.2
S6.001	50.00	5.19	34.718	0.171	0.0	0.0	0.0	2.98	210.8	23.1
S6.002	50.00	5.51	34.179	0.190	0.0	0.0	0.0	1.58	111.7	25.8
S6.003	50.00	5.77	33.874	0.206	0.0	0.0	0.0	1.89	133.2	27.9
S7.000	50.00	5.03	42.000	0.000	0.0	0.0	0.0	1.15	9.0	0.0
S7.001	50.00	5.12	38.500	0.149	0.0	0.0	0.0	1.67	66.2	20.2
S7.002	50.00	5.29	37.575	0.149	0.0	0.0	0.0	1.68	66.8	20.2
S8.000	50.00	5.03	42.000	0.000	0.0	0.0	0.0	1.06	8.3	0.0
S8.001	50.00	5.13	38.500	0.149	0.0	0.0	0.0	1.68	66.8	20.2
S7.003	50.00	5.44	37.290	0.298	0.0	0.0	0.0	1.87	74.5	40.4
S9.000	50.00	5.04	42.000	0.000	0.0	0.0	0.0	1.01	7.9	0.0
S9.001	50.00	5.14	38.500	0.074	0.0	0.0	0.0	1.67	66.4	10.0
S7.004	50.00	5.82	34.600	0.372	0.0	0.0	0.0	1.15	45.9«	50.4
S6.004	50.00	6.47	33.656	0.578	0.0	0.0	0.0	1.01	71.2«	78.2
S6.005	50.00	6.61	33.087	0.597	0.0	0.0	0.0	1.17	128.8	80.9
S10.000	50.00	5.20	34.300	0.000	0.0	0.0	0.0	1.71	30.2	0.0

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STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Outlet 2

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
S11.000	2.451	0.025	98.0	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit	
S11.001	8.182	0.081	101.0	0.149	0.00	0.0	0.600	o	225	Pipe/Conduit	
S12.000	3.125	0.035	89.3	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit	
S12.001	8.372	0.144	58.1	0.149	0.00	0.0	0.600	o	150	Pipe/Conduit	
S12.002	14.056	0.656	21.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S11.002	18.076	0.110	164.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S13.000	2.462	0.044	56.0	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit	
S13.001	7.492	0.167	44.9	0.149	0.00	0.0	0.600	o	225	Pipe/Conduit	
S11.003	25.729	0.107	240.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S14.000	2.909	0.016	181.8	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit	
S14.001	7.961	0.212	37.6	0.223	0.00	0.0	0.600	o	300	Pipe/Conduit	
S11.004	22.541	1.541	14.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S10.001	31.139	0.380	81.9	0.070	0.00	0.0	0.600	o	375	Pipe/Conduit	
S15.000	8.837	0.151	58.5	0.012	5.00	0.0	0.600	o	150	Pipe/Conduit	
S15.001	8.837	0.151	58.5	0.030	0.00	0.0	0.600	o	150	Pipe/Conduit	
S10.002	20.003	0.062	322.6	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S11.000	50.00	5.05	42.000	0.000	0.0	0.0	0.0	0.78	6.1	0.0
S11.001	50.00	5.16	36.000	0.149	0.0	0.0	0.0	1.30	51.7	20.2
S12.000	50.00	5.06	42.000	0.000	0.0	0.0	0.0	0.81	6.4	0.0
S12.001	50.00	5.17	36.450	0.149	0.0	0.0	0.0	1.32	23.4	20.2
S12.002	50.00	5.28	36.306	0.149	0.0	0.0	0.0	2.19	38.6	20.2
S11.002	50.00	5.57	35.650	0.298	0.0	0.0	0.0	1.02	40.4	40.4
S13.000	50.00	5.04	42.000	0.000	0.0	0.0	0.0	1.03	8.1	0.0
S13.001	50.00	5.10	37.000	0.149	0.0	0.0	0.0	1.96	77.9	20.2
S11.003	50.00	6.00	35.390	0.447	0.0	0.0	0.0	1.01	71.4	60.5
S14.000	50.00	5.09	42.000	0.000	0.0	0.0	0.0	0.57	4.5	0.0
S14.001	50.00	5.14	38.000	0.223	0.0	0.0	0.0	2.57	181.9	30.2
S11.004	50.00	6.09	35.208	0.670	0.0	0.0	0.0	4.13	292.1	90.7
S10.001	50.00	6.35	33.742	0.740	0.0	0.0	0.0	2.00	221.2	100.2
S15.000	50.00	5.11	33.286	0.012	0.0	0.0	0.0	1.32	23.3	1.6
S15.001	50.00	5.22	33.135	0.042	0.0	0.0	0.0	1.32	23.3	5.7
S10.002	50.00	6.64	32.959	0.782	0.0	0.0	0.0	1.13	179.1	105.9

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STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Outlet 2

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
S16.000	1.968	0.015	131.2	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit	
S16.001	8.168	0.856	9.5	0.149	0.00	0.0	0.600	o	225	Pipe/Conduit	
S16.002	18.909	0.317	59.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S17.000	2.005	0.013	154.2	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit	
S17.001	8.769	0.321	27.3	0.223	0.00	0.0	0.600	o	300	Pipe/Conduit	
S16.003	24.856	0.736	33.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S18.000	1.770	0.042	42.1	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	
S18.001	9.946	0.558	17.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S16.004	19.496	0.975	20.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S10.003	12.492	0.031	403.0	0.036	0.00	0.0	0.600	o	450	Pipe/Conduit	
S10.004	12.492	0.031	400.9	0.017	0.00	0.0	0.600	o	450	Pipe/Conduit	
S6.006	14.867	0.033	450.5	0.008	0.00	0.0	0.600	o	525	Pipe/Conduit	
S6.007	4.234	0.085	49.8	0.000	0.00	0.0	0.600	o	375	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)
S16.000	50.00	5.05	42.000	0.000	0.0	0.0	0.0	0.67	5.3	0.0
S16.001	50.00	5.08	39.000	0.149	0.0	0.0	0.0	4.26	169.4	20.2
S16.002	50.00	5.27	37.575	0.149	0.0	0.0	0.0	1.70	67.5	20.2
S17.000	50.00	5.05	42.000	0.000	0.0	0.0	0.0	0.62	4.8	0.0
S17.001	50.00	5.10	38.500	0.223	0.0	0.0	0.0	3.02	213.5	30.2
S16.003	50.00	5.45	37.258	0.372	0.0	0.0	0.0	2.26	89.8	50.4
S18.000	50.00	5.01	42.000	0.000	0.0	0.0	0.0	2.02	80.4	0.0
S18.001	50.00	5.07	39.000	0.000	0.0	0.0	0.0	3.11	123.8	0.0
S16.004	50.00	5.56	34.447	0.372	0.0	0.0	0.0	2.94	116.9	50.4
S10.003	50.00	6.85	32.572	1.190	0.0	0.0	0.0	1.01	160.1«	161.2
S10.004	50.00	7.06	32.540	1.207	0.0	0.0	0.0	1.01	160.5«	163.4
S6.006	50.00	7.29	32.462	1.812	0.0	0.0	0.0	1.05	227.0«	245.4
S6.007	50.00	7.32	32.414	1.812	0.0	0.0	0.0	2.57	284.1	245.4

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Area Summary for Outlet 2

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
6.000	User	-	80	0.068	0.055	0.055
	User	-	80	0.128	0.102	0.157
6.001	User	-	90	0.015	0.014	0.014
6.002	User	-	90	0.022	0.020	0.020
6.003	User	-	90	0.017	0.016	0.016
7.000	-	-	100	0.000	0.000	0.000
7.001	-	-	100	0.149	0.149	0.149
7.002	-	-	100	0.000	0.000	0.000
8.000	-	-	100	0.000	0.000	0.000
8.001	-	-	100	0.149	0.149	0.149
7.003	-	-	100	0.000	0.000	0.000
9.000	-	-	100	0.000	0.000	0.000
9.001	-	-	100	0.074	0.074	0.074
7.004	-	-	100	0.000	0.000	0.000
6.004	-	-	100	0.000	0.000	0.000
6.005	User	-	95	0.020	0.019	0.019
10.000	-	-	100	0.000	0.000	0.000
11.000	-	-	100	0.000	0.000	0.000
11.001	-	-	100	0.149	0.149	0.149
12.000	-	-	100	0.000	0.000	0.000
12.001	-	-	100	0.149	0.149	0.149
12.002	-	-	100	0.000	0.000	0.000
11.002	-	-	100	0.000	0.000	0.000
13.000	-	-	100	0.000	0.000	0.000
13.001	-	-	100	0.149	0.149	0.149
11.003	-	-	100	0.000	0.000	0.000
14.000	-	-	100	0.000	0.000	0.000
14.001	-	-	100	0.223	0.223	0.223
11.004	-	-	100	0.000	0.000	0.000
10.001	User	-	30	0.015	0.005	0.005
	User	-	30	0.218	0.065	0.070
15.000	User	-	80	0.003	0.003	0.003
	User	-	95	0.010	0.009	0.012
15.001	User	-	95	0.015	0.014	0.014
	User	-	30	0.008	0.003	0.017
	User	-	30	0.045	0.014	0.030
10.002	-	-	100	0.000	0.000	0.000
16.000	-	-	100	0.000	0.000	0.000
16.001	-	-	100	0.149	0.149	0.149
16.002	-	-	100	0.000	0.000	0.000
17.000	-	-	100	0.000	0.000	0.000
17.001	-	-	100	0.223	0.223	0.223
16.003	-	-	100	0.000	0.000	0.000
18.000	-	-	100	0.000	0.000	0.000
18.001	-	-	100	0.000	0.000	0.000
16.004	-	-	100	0.000	0.000	0.000
10.003	User	-	95	0.007	0.007	0.007
	User	-	30	0.096	0.029	0.036
10.004	User	-	95	0.014	0.013	0.013
	User	-	30	0.012	0.003	0.017
6.006	User	-	80	0.010	0.008	0.008
6.007	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				2.139	1.812	1.812

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Online Controls for Outlet 2

Hydro-Brake® Optimum Manhole: SWMHD16, DS/PN: S7.001, Volume (m³): 7.4

Unit Reference	MD-SHE-0161-1520-2000-1520
Design Head (m)	2.000
Design Flow (l/s)	15.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	161
Invert Level (m)	38.500
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	15.2	Kick-Flo®	1.223	12.0
Flush-Flo™	0.587	15.2	Mean Flow over Head Range	-	13.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.8	0.800	14.9	2.000	15.2	4.000	21.1	7.000	27.7
0.200	12.7	1.000	14.2	2.200	15.9	4.500	22.4	7.500	28.6
0.300	14.1	1.200	12.4	2.400	16.6	5.000	23.5	8.000	29.5
0.400	14.8	1.400	12.8	2.600	17.2	5.500	24.6	8.500	30.4
0.500	15.1	1.600	13.7	3.000	18.4	6.000	25.7	9.000	31.2
0.600	15.2	1.800	14.4	3.500	19.8	6.500	26.7	9.500	32.0

Hydro-Brake® Optimum Manhole: SWMHD18, DS/PN: S8.001, Volume (m³): 7.4

Unit Reference	MD-SHE-0161-1520-2000-1520
Design Head (m)	2.000
Design Flow (l/s)	15.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	161
Invert Level (m)	38.500
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	15.2	Kick-Flo®	1.223	12.0
Flush-Flo™	0.587	15.2	Mean Flow over Head Range	-	13.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.8	0.400	14.8	0.800	14.9	1.400	12.8	2.000	15.2
0.200	12.7	0.500	15.1	1.000	14.2	1.600	13.7	2.200	15.9
0.300	14.1	0.600	15.2	1.200	12.4	1.800	14.4	2.400	16.6

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Hydro-Brake® Optimum Manhole: SWMHD18, DS/PN: S8.001, Volume (m³): 7.4

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	17.2	4.000	21.1	5.500	24.6	7.000	27.7	8.500	30.4
3.000	18.4	4.500	22.4	6.000	25.7	7.500	28.6	9.000	31.2
3.500	19.8	5.000	23.5	6.500	26.7	8.000	29.5	9.500	32.0

Hydro-Brake® Optimum Manhole: SWMHD20, DS/PN: S9.001, Volume (m³): 7.4

Unit Reference	MD-SHE-0161-1520-2000-1520
Design Head (m)	2.000
Design Flow (l/s)	15.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	161
Invert Level (m)	38.500
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	15.2	Kick-Flo®	1.223	12.0
Flush-Flo™	0.587	15.2	Mean Flow over Head Range	-	13.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.8	0.800	14.9	2.000	15.2	4.000	21.1	7.000	27.7
0.200	12.7	1.000	14.2	2.200	15.9	4.500	22.4	7.500	28.6
0.300	14.1	1.200	12.4	2.400	16.6	5.000	23.5	8.000	29.5
0.400	14.8	1.400	12.8	2.600	17.2	5.500	24.6	8.500	30.4
0.500	15.1	1.600	13.7	3.000	18.4	6.000	25.7	9.000	31.2
0.600	15.2	1.800	14.4	3.500	19.8	6.500	26.7	9.500	32.0

Hydro-Brake® Optimum Manhole: SWMHD4, DS/PN: S11.001, Volume (m³): 10.2

Unit Reference	MD-SHE-0161-1520-2000-1520
Design Head (m)	2.000
Design Flow (l/s)	15.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	161
Invert Level (m)	36.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	15.2	Kick-Flo®	1.223	12.0
Flush-Flo™	0.587	15.2	Mean Flow over Head Range	-	13.3

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

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Hydro-Brake® Optimum Manhole: SWMHD4, DS/PN: S11.001, Volume (m³): 10.2

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	5.8	0.800	14.9	2.000	15.2	4.000	21.1	7.000	27.7
0.200	12.7	1.000	14.2	2.200	15.9	4.500	22.4	7.500	28.6
0.300	14.1	1.200	12.4	2.400	16.6	5.000	23.5	8.000	29.5
0.400	14.8	1.400	12.8	2.600	17.2	5.500	24.6	8.500	30.4
0.500	15.1	1.600	13.7	3.000	18.4	6.000	25.7	9.000	31.2
0.600	15.2	1.800	14.4	3.500	19.8	6.500	26.7	9.500	32.0

Hydro-Brake® Optimum Manhole: SWMHD6, DS/PN: S13.001, Volume (m³): 9.1

Unit Reference	MD-SHE-0161-1520-2000-1520
Design Head (m)	2.000
Design Flow (l/s)	15.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	161
Invert Level (m)	37.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	15.2	Kick-Flo®	1.223	12.0
Flush-Flo™	0.587	15.2	Mean Flow over Head Range	-	13.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.8	0.800	14.9	2.000	15.2	4.000	21.1	7.000	27.7
0.200	12.7	1.000	14.2	2.200	15.9	4.500	22.4	7.500	28.6
0.300	14.1	1.200	12.4	2.400	16.6	5.000	23.5	8.000	29.5
0.400	14.8	1.400	12.8	2.600	17.2	5.500	24.6	8.500	30.4
0.500	15.1	1.600	13.7	3.000	18.4	6.000	25.7	9.000	31.2
0.600	15.2	1.800	14.4	3.500	19.8	6.500	26.7	9.500	32.0

Hydro-Brake® Optimum Manhole: SWMHD8, DS/PN: S14.001, Volume (m³): 7.9

Unit Reference	MD-SHE-0161-1520-2000-1520
Design Head (m)	2.000
Design Flow (l/s)	15.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	161
Invert Level (m)	38.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	15.2	Kick-Flo®	1.223	12.0
Flush-Flo™	0.587	15.2	Mean Flow over Head Range	-	13.3

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

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Hydro-Brake® Optimum Manhole: SWMHD8, DS/PN: S14.001, Volume (m³): 7.9

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	5.8	0.800	14.9	2.000	15.2	4.000	21.1	7.000	27.7
0.200	12.7	1.000	14.2	2.200	15.9	4.500	22.4	7.500	28.6
0.300	14.1	1.200	12.4	2.400	16.6	5.000	23.5	8.000	29.5
0.400	14.8	1.400	12.8	2.600	17.2	5.500	24.6	8.500	30.4
0.500	15.1	1.600	13.7	3.000	18.4	6.000	25.7	9.000	31.2
0.600	15.2	1.800	14.4	3.500	19.8	6.500	26.7	9.500	32.0

Hydro-Brake® Optimum Manhole: SWMHD10, DS/PN: S16.001, Volume (m³): 6.8

Unit Reference	MD-SHE-0161-1520-2000-1520
Design Head (m)	2.000
Design Flow (l/s)	15.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	161
Invert Level (m)	39.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	15.2	Kick-Flo®	1.223	12.0
Flush-Flo™	0.587	15.2	Mean Flow over Head Range	-	13.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.8	0.800	14.9	2.000	15.2	4.000	21.1	7.000	27.7
0.200	12.7	1.000	14.2	2.200	15.9	4.500	22.4	7.500	28.6
0.300	14.1	1.200	12.4	2.400	16.6	5.000	23.5	8.000	29.5
0.400	14.8	1.400	12.8	2.600	17.2	5.500	24.6	8.500	30.4
0.500	15.1	1.600	13.7	3.000	18.4	6.000	25.7	9.000	31.2
0.600	15.2	1.800	14.4	3.500	19.8	6.500	26.7	9.500	32.0

Hydro-Brake® Optimum Manhole: SWMHD12, DS/PN: S17.001, Volume (m³): 7.4

Unit Reference	MD-SHE-0161-1520-2000-1520
Design Head (m)	2.000
Design Flow (l/s)	15.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	161
Invert Level (m)	38.500
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	15.2	Kick-Flo®	1.223	12.0
Flush-Flo™	0.587	15.2	Mean Flow over Head Range	-	13.3

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Hydro-Brake® Optimum Manhole: SWMHD12, DS/PN: S17.001, Volume (m³): 7.4

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	5.8	0.800	14.9	2.000	15.2	4.000	21.1	7.000	27.7
0.200	12.7	1.000	14.2	2.200	15.9	4.500	22.4	7.500	28.6
0.300	14.1	1.200	12.4	2.400	16.6	5.000	23.5	8.000	29.5
0.400	14.8	1.400	12.8	2.600	17.2	5.500	24.6	8.500	30.4
0.500	15.1	1.600	13.7	3.000	18.4	6.000	25.7	9.000	31.2
0.600	15.2	1.800	14.4	3.500	19.8	6.500	26.7	9.500	32.0

Hydro-Brake® Optimum Manhole: SWMHD14, DS/PN: S18.001, Volume (m³): 6.8

Unit Reference	MD-CHE-0151-1520-2000-1520
Design Head (m)	2.000
Design Flow (l/s)	15.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	No
Diameter (mm)	151
Invert Level (m)	39.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	15.2	Kick-Flo®	0.529	8.1
Flush-Flo™	0.376	14.6	Mean Flow over Head Range	-	11.2

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	4.5	0.800	9.7	2.000	15.2	4.000	21.4	7.000	28.1
0.200	9.9	1.000	10.8	2.200	15.9	4.500	22.7	7.500	29.1
0.300	13.2	1.200	11.8	2.400	16.6	5.000	23.9	8.000	30.0
0.400	14.3	1.400	12.8	2.600	17.3	5.500	25.0	8.500	31.0
0.500	8.2	1.600	13.6	3.000	18.6	6.000	26.1	9.000	31.8
0.600	8.4	1.800	14.4	3.500	20.0	6.500	27.1	9.500	32.7

Non Return Valve Manhole: SWMH15, DS/PN: S6.007, Volume (m³): 6.5

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Summary of Critical Results by Maximum Level (Rank 1) for Outlet 2

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 10 Number of Storage Structures 12 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model		FEH	Data Type Point
FEH Rainfall Version		2013 Cv (Summer)	0.750
Site Location	GB 385108 397575 SJ 85108 97575	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, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 30, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S6.000	SWMHn/a	15 Winter	100	+40%	100/15 Summer				35.741
S6.001	SWMH9	15 Winter	100	+40%	100/15 Summer				35.635
S6.002	SWMH10	15 Winter	100	+40%	30/15 Summer				35.516
S6.003	SWMH11	15 Winter	100	+40%	30/15 Summer				35.274
S7.000	SWMHD15	1440 Winter	2	+0%					42.000
S7.001	SWMHD16	60 Winter	100	+40%	30/15 Summer				40.152
S7.002	SWMH27	15 Summer	100	+40%					37.652
S8.000	SWMHD17	1440 Winter	2	+0%					42.000
S8.001	SWMHD18	60 Winter	100	+40%	30/15 Summer				40.152
S7.003	SWMH28	15 Summer	100	+40%					37.397
S9.000	SWMHD19	1440 Winter	2	+0%					42.000
S9.001	SWMHD20	30 Winter	100	+40%	30/15 Summer				39.100
S7.004	SWMH29	30 Winter	100	+40%	30/15 Summer				35.234
S6.004	SWMH12	30 Winter	100	+40%	30/15 Summer	100/30 Winter			35.042
S6.005	SWMH13	30 Winter	100	+40%	2/15 Summer	30/180 Summer			34.478
S10.000	SWMH31	30 Winter	100	+40%	100/30 Summer				34.627
S11.000	SWMHD3	1440 Winter	2	+0%					42.000
S11.001	SWMHD4	60 Winter	100	+40%	30/15 Summer				37.658
S12.000	SWMHD1	1440 Winter	2	+0%					42.000
S12.001	SWMHD1	30 Winter	100	+40%	30/15 Summer				37.067
S12.002	SWMH16	30 Winter	100	+40%	30/15 Winter				36.623
S11.002	SWMH17	30 Winter	100	+40%	30/15 Summer				35.957
S13.000	SWMHD5	30 Winter	100	+40%	100/15 Summer				42.453
S13.001	SWMHD6	30 Winter	100	+40%	2/15 Summer				42.453
S11.003	SWMH18	30 Winter	100	+40%	30/15 Summer				35.711
S14.000	SWMHD7	1440 Winter	2	+0%					42.000
S14.001	SWMHD8	60 Winter	100	+40%	30/15 Summer				39.590
S11.004	SWMH19	30 Winter	100	+40%					35.328
S10.001	SWMH20	30 Winter	100	+40%	30/15 Summer				34.629
S15.000	SWMH22	60 Summer	100	+40%	2/15 Summer	100/30 Summer			34.491
S15.001	SWMHRG1	30 Winter	100	+40%	2/15 Summer				34.532

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Summary of Critical Results by Maximum Level (Rank 1) for Outlet 2

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S6.000	SWMHn/a	0.400	0.000	0.70		95.7	SURCHARGED	
S6.001	SWMH9	0.617	0.000	0.53		92.9	FLOOD RISK	
S6.002	SWMH10	1.037	0.000	0.95		96.3	FLOOD RISK	
S6.003	SWMH11	1.100	0.000	0.83		100.3	FLOOD RISK	
S7.000	SWMHD15	-0.100	0.000	0.00		0.0	OK	
S7.001	SWMHD16	1.427	0.000	0.28		15.1	SURCHARGED	
S7.002	SWMH27	-0.148	0.000	0.25		15.1	OK	
S8.000	SWMHD17	-0.100	0.000	0.00		0.0	OK	
S8.001	SWMHD18	1.427	0.000	0.27		15.1	SURCHARGED	
S7.003	SWMH28	-0.118	0.000	0.46		30.3	OK	
S9.000	SWMHD19	-0.100	0.000	0.00		0.0	OK	
S9.001	SWMHD20	0.375	0.000	0.28		15.1	SURCHARGED	
S7.004	SWMH29	0.409	0.000	1.05		44.6	SURCHARGED	
S6.004	SWMH12	1.086	0.076	1.88		124.3	FLOOD	1
S6.005	SWMH13	1.016	0.000	1.38		130.2	SURCHARGED	
S10.000	SWMH31	0.177	0.000	0.04		1.1	SURCHARGED	
S11.000	SWMHD3	-0.100	0.000	0.00		0.0	OK	
S11.001	SWMHD4	1.433	0.000	0.38		15.1	SURCHARGED	
S12.000	SWMHD1	-0.100	0.000	0.00		0.0	OK	
S12.001	SWMHD1	0.467	0.000	1.76		35.9	SURCHARGED	
S12.002	SWMH16	0.167	0.000	1.01		35.7	SURCHARGED	
S11.002	SWMH17	0.082	0.000	1.36		49.3	SURCHARGED	
S13.000	SWMHD5	0.353	0.000	0.13		0.7	SURCHARGED	
S13.001	SWMHD6	5.228	0.000	0.43		24.5	SURCHARGED	
S11.003	SWMH18	0.021	0.000	1.15		73.8	SURCHARGED	
S14.000	SWMHD7	-0.100	0.000	0.00		0.0	OK	
S14.001	SWMHD8	1.290	0.000	0.13		15.2	SURCHARGED	
S11.004	SWMH19	-0.180	0.000	0.34		86.7	OK	
S10.001	SWMH20	0.512	0.000	0.58		114.8	SURCHARGED	
S15.000	SWMH22	1.055	1.982	0.56		11.4	FLOOD	
S15.001	SWMHRG1	1.247	0.000	0.75		15.4	SURCHARGED	

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Summary of Critical Results by Maximum Level (Rank 1) for Outlet 2

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)
S10.002	SWMH21	30 Winter	100	+40%	2/15 Summer				34.516	1.107
S16.000	SWMHD9	1440 Winter	2	+0%					42.000	-0.100
S16.001	SWMHD10	60 Winter	100	+40%	30/15 Summer				39.908	0.683
S16.002	SWMH24	60 Winter	100	+40%					37.650	-0.150
S17.000	SWMHD11	1440 Winter	2	+0%					42.000	-0.100
S17.001	SWMHD12	60 Winter	100	+40%	30/15 Summer				40.338	1.538
S16.003	SWMH25	60 Winter	100	+40%					37.350	-0.133
S18.000	SWMHD13	1440 Winter	2	+0%					42.000	-0.225
S18.001	SWMHD14	1440 Winter	2	+0%					39.000	-0.225
S16.004	SWMH26	30 Winter	100	+40%					34.538	-0.134
S10.003	SWMH23	30 Winter	100	+40%	2/15 Summer				34.473	1.451
S10.004	SWMHRG2	30 Winter	100	+40%	2/15 Summer	30/120 Summer			34.422	1.432
S6.006	SWMH14	480 Summer	100	+40%	2/15 Summer	30/180 Summer			34.474	1.487
S6.007	SWMH15	480 Summer	100	+40%	2/15 Summer	2/1440 Summer			34.484	1.695

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S10.002	SWMH21	0.000	0.79		113.9	SURCHARGED	
S16.000	SWMHD9	0.000	0.00		0.0	OK	
S16.001	SWMHD10	0.000	0.11		14.7	SURCHARGED	
S16.002	SWMH24	0.000	0.24		14.7	OK	
S17.000	SWMHD11	0.000	0.00		0.0	OK	
S17.001	SWMHD12	0.000	0.11		15.0	SURCHARGED	
S16.003	SWMH25	0.000	0.35		29.3	OK	
S18.000	SWMHD13	0.000	0.00		0.0	OK	
S18.001	SWMHD14	0.000	0.00		0.0	OK	
S16.004	SWMH26	0.000	0.27		28.8	OK	
S10.003	SWMH23	0.000	1.49		151.6	SURCHARGED	
S10.004	SWMHRG2	0.000	1.53		156.5	SURCHARGED	
S6.006	SWMH14	0.000	1.21		163.8	FLOOD RISK	
S6.007	SWMH15	3.095	1.31		149.4	FLOOD	14

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STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Outlet 3

« - 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
S7.000	20.257	0.346	58.5	0.053	5.00	0.0	0.600	o	150	Pipe/Conduit	
S7.001	24.716	0.249	99.3	0.039	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.002	52.605	1.584	33.2	0.045	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.003	56.837	1.573	36.1	0.021	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.000	21.216	0.063	336.8	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	
S8.001	21.855	0.146	150.0	0.254	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.002	6.521	0.076	85.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.004	20.129	0.228	88.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S9.000	3.527	0.017	210.7	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
S9.001	8.022	0.673	11.9	0.247	0.00	0.0	0.600	o	225	Pipe/Conduit	
S10.000	19.276	0.167	115.4	0.051	5.00	0.0	0.600	o	150	Pipe/Conduit	
S10.001	25.532	0.256	99.7	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S9.002	8.281	0.058	142.8	0.064	0.00	0.0	0.600	o	225	Pipe/Conduit	
S9.003	6.987	0.058	120.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S9.004	1.854	0.068	27.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S9.005	16.617	0.068	244.4	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S9.006	6.912	0.535	12.9	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S11.000	4.031	0.027	149.3	0.000	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)
S7.000	50.00	5.26	37.200	0.053	0.0	0.0	0.0	1.32	23.3	7.2
S7.001	50.00	5.57	37.025	0.093	0.0	0.0	0.0	1.31	52.2	12.5
S7.002	50.00	5.96	36.850	0.137	0.0	0.0	0.0	2.28	90.6	18.6
S7.003	50.00	6.39	36.236	0.159	0.0	0.0	0.0	2.18	86.8	21.5
S8.000	50.00	5.50	33.850	0.000	0.0	0.0	0.0	0.71	28.1	0.0
S8.001	50.00	5.84	33.790	0.254	0.0	0.0	0.0	1.07	42.4	34.4
S8.002	50.00	5.92	33.644	0.254	0.0	0.0	0.0	1.41	56.2	34.4
S7.004	50.00	6.59	33.493	0.412	0.0	0.0	0.0	1.67	118.3	55.8
S9.000	50.00	5.09	36.140	0.000	0.0	0.0	0.0	0.69	12.2	0.0
S9.001	50.00	5.12	34.800	0.247	0.0	0.0	0.0	3.81	151.5	33.5
S10.000	50.00	5.34	34.677	0.051	0.0	0.0	0.0	0.93	16.5	6.8
S10.001	50.00	5.77	34.509	0.051	0.0	0.0	0.0	1.01	17.8	6.8
S9.002	50.00	5.89	34.178	0.361	0.0	0.0	0.0	1.09	43.4«	48.9
S9.003	50.00	5.99	34.069	0.361	0.0	0.0	0.0	1.19	47.3«	48.9
S9.004	50.00	6.00	34.011	0.361	0.0	0.0	0.0	2.52	100.0	48.9
S9.005	50.00	6.28	33.868	0.361	0.0	0.0	0.0	1.00	70.8	48.9
S9.006	50.00	6.31	33.375	0.361	0.0	0.0	0.0	4.40	310.8	48.9
S11.000	50.00	5.08	36.140	0.000	0.0	0.0	0.0	0.82	14.5	0.0

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STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Outlet 3

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
S11.001	7.800	0.050	156.0	0.151	0.00	0.0	0.600	o	150	Pipe/Conduit	
S11.002	3.098	0.021	147.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.005	7.547	0.252	29.9	0.000	0.00	0.0	0.600	o	300	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)
S11.001	50.00	5.24	33.500	0.151	0.0	0.0	0.0	0.80	14.2«	20.5
S11.002	50.00	5.29	33.375	0.151	0.0	0.0	0.0	1.07	42.7	20.5
S7.005	50.00	6.63	33.311	0.925	0.0	0.0	0.0	2.88	203.8	125.2

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Area Summary for Outlet 3

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
7.000	User	-	95	0.056	0.053	0.053
7.001	User	-	95	0.041	0.039	0.039
7.002	User	-	95	0.047	0.045	0.045
7.003	User	-	95	0.022	0.021	0.021
8.000	-	-	100	0.000	0.000	0.000
8.001	User	-	95	0.267	0.254	0.254
8.002	-	-	100	0.000	0.000	0.000
7.004	-	-	100	0.000	0.000	0.000
9.000	-	-	100	0.000	0.000	0.000
9.001	User	-	95	0.260	0.247	0.247
10.000	User	-	95	0.053	0.051	0.051
10.001	-	-	100	0.000	0.000	0.000
9.002	User	-	100	0.064	0.064	0.064
9.003	-	-	100	0.000	0.000	0.000
9.004	-	-	100	0.000	0.000	0.000
9.005	-	-	100	0.000	0.000	0.000
9.006	-	-	100	0.000	0.000	0.000
11.000	-	-	100	0.000	0.000	0.000
11.001	User	-	95	0.159	0.151	0.151
11.002	-	-	100	0.000	0.000	0.000
7.005	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.970	0.925	0.925

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Online Controls for Outlet 3

Hydro-Brake® Optimum Manhole: SWMHF7, DS/PN: S8.002, Volume (m³): 3.7

Unit Reference	MD-SHE-0147-1070-1200-1070
Design Head (m)	1.200
Design Flow (l/s)	10.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	147
Invert Level (m)	33.644
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	10.7	Kick-Flo®	0.782	8.8
Flush-Flo™	0.357	10.7	Mean Flow over Head Range	-	9.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.3	0.800	8.8	2.000	13.6	4.000	19.0	7.000	24.8
0.200	10.1	1.000	9.8	2.200	14.3	4.500	20.1	7.500	25.6
0.300	10.6	1.200	10.7	2.400	14.9	5.000	21.1	8.000	26.4
0.400	10.7	1.400	11.5	2.600	15.4	5.500	22.1	8.500	27.2
0.500	10.5	1.600	12.3	3.000	16.5	6.000	23.0	9.000	28.0
0.600	10.2	1.800	13.0	3.500	17.8	6.500	23.9	9.500	28.7

Hydro-Brake® Optimum Manhole: SWMHB12, DS/PN: S9.001, Volume (m³): 8.2

Unit Reference	MD-SHE-0197-2300-2000-2300
Design Head (m)	2.000
Design Flow (l/s)	23.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	197
Invert Level (m)	34.800
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	23.0	Kick-Flo®	1.246	18.4
Flush-Flo™	0.586	23.0	Mean Flow over Head Range	-	20.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.8	0.400	22.4	0.800	22.6	1.400	19.4	2.000	23.0
0.200	18.4	0.500	22.9	1.000	21.6	1.600	20.7	2.200	24.1
0.300	21.3	0.600	23.0	1.200	19.3	1.800	21.9	2.400	25.1

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Hydro-Brake® Optimum Manhole: SWMHB12, DS/PN: S9.001, Volume (m³): 8.2

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	26.1	4.000	32.0	5.500	37.4	7.000	42.0	8.500	46.1
3.000	27.9	4.500	33.9	6.000	39.0	7.500	43.4	9.000	47.4
3.500	30.1	5.000	35.7	6.500	40.5	8.000	44.8	9.500	48.7

Orifice Manhole: SWMH39, DS/PN: S9.004, Volume (m³): 2.6

Diameter (m) 0.150 Discharge Coefficient 0.600 Invert Level (m) 34.011

Hydro-Brake® Optimum Manhole: SWMHF20, DS/PN: S11.002, Volume (m³): 3.0

Unit Reference	MD-SHE-0125-7500-1200-7500
Design Head (m)	1.200
Design Flow (l/s)	7.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	125
Invert Level (m)	33.450
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)	1.200	7.5	Kick-Flo®	0.763	6.1
Flush-Flo™	0.356	7.5	Mean Flow over Head Range	-	6.5

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.5	0.800	6.2	2.000	9.5	4.000	13.2	7.000	17.3
0.200	7.1	1.000	6.9	2.200	10.0	4.500	14.0	7.500	17.9
0.300	7.5	1.200	7.5	2.400	10.4	5.000	14.7	8.000	18.4
0.400	7.5	1.400	8.1	2.600	10.8	5.500	15.4	8.500	19.0
0.500	7.4	1.600	8.6	3.000	11.5	6.000	16.1	9.000	19.5
0.600	7.1	1.800	9.1	3.500	12.4	6.500	16.7	9.500	20.0

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Summary of Critical Results by Maximum Level (Rank 1) for Outlet 3

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 4 Number of Storage Structures 4 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model		FEH	Data Type Point
FEH Rainfall Version		2013	Cv (Summer) 0.750
Site Location	GB 385108 397575 SJ 85108 97575		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, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 30, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S7.000	SWMH32	15 Winter	100	+40%	30/15 Summer	100/15 Summer			38.101
S7.001	SWMH33	15 Winter	100	+40%	100/15 Summer				37.772
S7.002	SWMH34	15 Winter	100	+40%	100/15 Summer				37.553
S7.003	SWMH35	15 Winter	100	+40%	100/15 Winter				36.462
S8.000	SWMHB15	60 Winter	100	+40%	30/15 Summer				34.854
S8.001	SWMHB16	60 Winter	100	+40%	30/15 Summer				34.856
S8.002	SWMHF7	120 Winter	100	+40%	2/15 Summer				34.997
S7.004	SWMHF27	15 Winter	100	+40%	100/15 Summer				33.893
S9.000	SWMHB11	1440 Winter	2	+0%					36.140
S9.001	SWMHB12	60 Winter	100	+40%	30/15 Summer				35.770
S10.000	SWMH36	15 Winter	100	+40%	30/15 Summer				35.977
S10.001	SWMH37	15 Winter	100	+40%	30/15 Summer				35.565
S9.002	SWMH38	30 Winter	100	+40%	30/15 Summer				35.245
S9.003	SWMHRG3	30 Winter	100	+40%	30/15 Summer				35.129
S9.004	SWMH39	30 Winter	100	+40%	2/15 Winter				35.032
S9.005	SWMH40	30 Winter	100	+40%					34.059
S9.006	SWMH41	15 Winter	100	+40%	100/15 Summer				33.721
S11.000	SWMHB13	1440 Winter	2	+0%					36.140
S11.001	SWMHB14	60 Winter	100	+40%	30/15 Summer				34.548
S11.002	SWMHF20	60 Winter	100	+40%	2/15 Winter				34.527
S7.005	SWMH42	15 Winter	100	+40%	100/15 Summer				33.704

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S7.000	SWMH32	0.751	1.216	1.46		31.9	FLOOD	
S7.001	SWMH33	0.522	0.000	0.95		45.5	SURCHARGED	
S7.002	SWMH34	0.478	0.000	0.83		72.2	SURCHARGED	
S7.003	SWMH35	0.001	0.000	1.00		83.7	SURCHARGED	72

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Summary of Critical Results by Maximum Level (Rank 1) for Outlet 3

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S8.000	SWMHB15	0.779	0.000	0.01		0.1	SURCHARGED	
S8.001	SWMHB16	0.841	0.000	0.31		12.0	SURCHARGED	
S8.002	SWMHF7	1.128	0.000	0.27		10.7	SURCHARGED	
S7.004	SWMHF27	0.100	0.000	0.91		93.9	SURCHARGED	
S9.000	SWMHB11	-0.150	0.000	0.00		0.0	OK	
S9.001	SWMHB12	0.745	0.000	0.20		22.9	SURCHARGED	
S10.000	SWMH36	1.150	0.000	1.60		24.9	FLOOD RISK	
S10.001	SWMH37	0.906	0.000	1.38		23.4	SURCHARGED	
S9.002	SWMH38	0.842	0.000	2.06		70.1	SURCHARGED	
S9.003	SWMHRG3	0.835	0.000	1.30		44.0	SURCHARGED	
S9.004	SWMH39	0.796	0.000	1.20		43.9	SURCHARGED	
S9.005	SWMH40	-0.109	0.000	0.73		43.9	OK	
S9.006	SWMH41	0.046	0.000	0.23		42.3	SURCHARGED	
S11.000	SWMHB13	-0.150	0.000	0.00		0.0	OK	
S11.001	SWMHB14	0.898	0.000	0.69		8.4	SURCHARGED	
S11.002	SWMHF20	0.927	0.000	0.27		7.5	SURCHARGED	
S7.005	SWMH42	0.093	0.000	1.08		135.5	SURCHARGED	

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Appendix G Drainage Plans from Plot Teams of Building Plots O, N

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Civic Engineers' proposals have been overlayed onto up to date SEW Landscape Architect's drawing 0345-SEW-ZZ-00-DR-L-007102 (received 25.03.2020). Latest SEW drawing does not reflect a number of elements of the proposals agreed with the client since its issue including but not limited to;

- New retaining wall at Plot O Bike store entrance.
- External staircase in Plot O Plaza has shifted northwards and green space reduced.
- Retention of the existing masonry river wall.
- Retention of section of existing culvert lid.

Civic Engineers' have developed this proposal for Tender based on SEW's concept landscaping drawing amending the SEW electronic information to reflect the above. Civic Engineers reserves the right to amend proposals upon receipt of final Landscape Architect's proposals.

HEALTH & SAFETY: The works shall be carried out by specialist competent and experienced contractors. All operatives shall have received full and appropriate training with appropriate qualifications for the operations they are required to undertake. All work shall be carried out in accordance with the relevant Health & Safety Regulations.

DRAINAGE NOTES

All discrepancies shall be reported to the engineer for action prior to any new construction

All drainage works shall be carried out in accordance with the requirement of the local authority and in conjunction with all relevant British Standards, Codes of Practice and 'Sewers for Adoption' 7th Edition and addendums as appropriate.

All drainage shall comply with the typical drainage construction details and the requirements of BS EN 752.

Access covers and frames shall comply with the loadings specified and to BS EN 124 and kitemarked or if recessed covers are specified then in accordance with FACTA association equivalent. Allow for recess manhole covers to accept landscape architect finishes to all landscaped areas (total 9No. covers)

The proposed building outlines shown on this drawing are for information only. Refer to Architects plans for precise location setting out information and details. For setting out dimensions of SS's, SVP's, RWP's, Floor Gully & other drainage 'pop up' locations, refer to Architects or Mechanical & Electrical Engineers drawings.

All underslab drainage shall be laid at gradients of 1:80 min. for foul pipework and 1:100 min. for surface water unless noted otherwise. All pipework to be: Foul 100mm and Surface Water 150mm unless otherwise stated.

All underslab drainage shall be clear of foundations unless shown otherwise with long radius bends kept to a minimum and used where unavoidable.
All surface water drop down positions shall have a bend set at invert level no greater than 1.3m below finish floor level.

At least one soil pipe at the head of each foul run shall be vented to the atmosphere. All SVPs and rainwater downpipes shall be accessible at ground lever for rodding purposes.

All existing drainage levels to which the the proposed drainage is to connect is to be clarified on site. Proposed drainage shown on this drawing subject to change once existing drainage levels are confirmed.

Cover levels shown on this drawing are approximate and shall be adjusted to suit finished pavement levels on site by Contractor. Covers shall be orientated to suit pavement finishes where appropriate.

Surface water connections to existing drainage are subject to local planners and statutory organisation approvals.

Existing details shown on this drawing including kerblines, existing drains, chambers, sewers, pipework, stub connections where new connections, diversions or abandonment are shown, invert levels and pipe sizes shall be checked and confirmed to the engineer prior to the commencement of any works. Any discrepancies shall be reported to the engineer for action prior to any new construction.
All drainage works shall be carried out in accordance with the requirements of the local authority and in conjunction with all relevant British Standards, Codes of Practice and 'Sewers for Adoption' 7th Edition and addendums as appropriate.

All private drainage pipework for foul and surface water systems have been designed on the basis of UPVC to BS EN 1401-1, unless noted otherwise.

All drainage pipework shall be laid soffit to soffit unless noted otherwise.

Where new drainage is situated within 5 metres of new or existing trees the pipework shall be encased in concrete to reduce the risk of root ingress.

Concrete encasement of the pipework shall be required where the vertical clearance between two pipes crossing is less than 300mm.

All existing drainage shall be assumed to be 'live' and shall be maintained at all times during the works. Existing drainage shall be reconnected to the new drainage system unless proven to be redundant for abandonment. All existing drainage to be abandoned shall be sealed by appropriate means.

All drainage connecting to the public sewer network shall not commence until receipt of the approval from the drainage authority and shall comply with requirements using vitrified clay pipework to BS EN 295 with plain sleeved or socketed flexible joints subject to their approval.
Where drainage works are carried out in the public highway the relevant necessary approvals and road opening notices shall be obtained from the highway authority and utility companies.

Prior to construction the flow control manufacturer's drawing and hydraulic table shall be provided to the engineer for approval
Prior to construction the attenuation tank manufacturer's drawings shall be provided to the engineer for approval

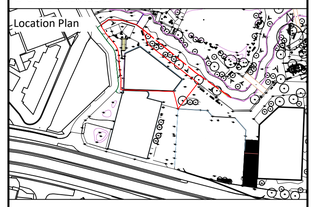
Upon completion all new drainage installation together with any existing drainage retained shall be jetted and CCTV surveyed upon completion. Contractor to ensure that the drainage system is fully operational, free of excess debris/silt and all identified faults rectified.

Standard Notes

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2. This drawing should not be scaled.
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Location Plan



Notes
1. This Drawing has been based on the following;
   - Masterplan layout (0345-SEW-N0-00-DR-L-001700) provided by Studio Egret West on 25/03/20
   - Site Wide SW Strategy (0042912-BHE-XX-XX-DR-C -3120) provided by Buro Happold on 19/09/19
   - Site Wide FW Strategy (0292-SEW-ZZ-03 -SK1009) provided by Buro Happold on 21/03/19
   - Proposed Internal Layouts (1811-BA-XX-00-MP-A-20-0099) by Bennetts on 21/04/20
   - M&E Stage 3 design (0405907-HLEA-XX-B1-DR-P-520-0001) provided by Hoare Lea on 22/04/20
   - Topographic Survey (170929 Utilities and Topo) provided by Faithful & Gould on 18/08/18

Key

- OWNERSHIP BOUNDARY
- WORKS BOUNDARY
- PROPOSED FOUL WATER DRAINAGE
- PROPOSED SURFACE WATER DRAINAGE
- PROPOSED SLEEVE THROUGH FOUNDATION
- PROPOSED STRATEGIC FOUL WATER CARRIER MANHOLE
- PROPOSED FOUL WATER MANHOLE (RECTANGULAR)
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- PROPOSED YARD GULLY
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Date	Rev	Description	Drawn	Chkd
12.06.20	T02	STAGE 3 TENDER UPDATE	LH	RD
24.04.20	T01	STAGE 3 TENDER	EMM	PM
06.04.20	P04	STAGE 3 ISSUE - DRAFT	EMM	-
17.12.19	P03	ISSUED FOR PLANNING	EMM	PM

Civic Engineers
MANCHESTER Carver's Warehouse, 77 Dale Street, Manchester, M1 2HG. Tel: 0161 228 6707
LONDON Reels Wharf, 1 Mill Street, London SE1 2AX. Tel: 020 3763 2727
LEEDS Tower Works, Unit 02-01, Globe Road, Leeds, LS11 5QG. Tel: 0113 2025 130
GLASGOW Gresham Chambers, 45 West Nile St, Glasgow, G1 2PT. Tel: 0141 370 1829
www.civicengineers.com

Project
MAYFIELD MANCHESTER
THE POULTON

Title
BELOW GROUND DRAINAGE
GENERAL ARRANGEMENT

Status
STAGE 3 TENDER

Scale @ A1	Date Created	Drawn	Checked
1:125	05/09/19	EMM	PM

Project Number	Originator	Discipline	Drawing Number	Revision
1076-01	CE	C	0001	T02

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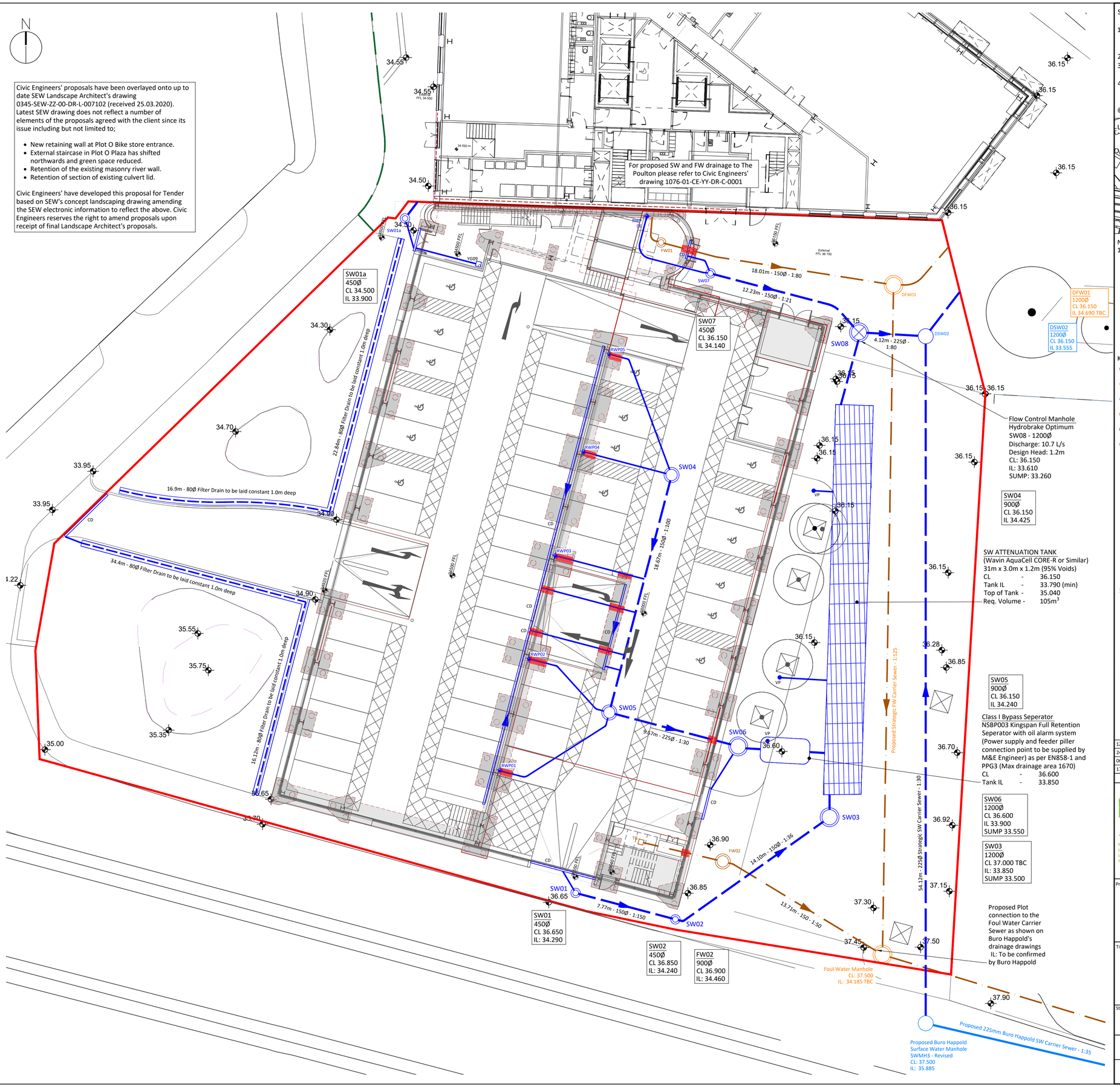
BELOW GROUND DRAINAGE DESIGN SUBJECT TO RECEIPT OF THE FOLLOWING INFORMATION:
- FLOW RATES BY M&E ENGINEER
- EXTERNAL LANDSCAPING AND LEVELS TO BE CONFIRMED BY LANDSCAPE ARCHITECT

PIPE SIZES SUBJECT TO CONFIRMATION FOLLOWING FINAL MODEL AND DESIGN

Civic Engineers' proposals have been overlayed onto up to date SEW Landscape Architect's drawing 0345-SEW-ZZ-00-DR-L-007102 (received 25.03.2020). Latest SEW drawing does not reflect a number of elements of the proposals agreed with the client since its issue including but not limited to;

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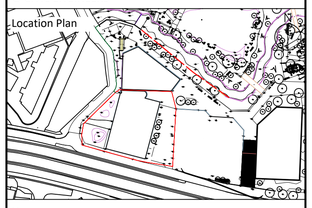


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Civic Engineers
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LEEDS Tower Works, Unit 10.01, Globe Road, Leeds, LS11 5QG. Tel: 0113 2025 130
GLASGOW Grosham Chambers, 45 West Nile St, Glasgow, G1 2PT. Tel: 0141 370 1929
www.civicengineers.com

Project
MAYFIELD MANCHESTER
BARING STREET MSCP

Title
BELOW GROUND DRAINAGE
GENERAL ARRANGEMENT

Status
STAGE 3 TENDER

Scale @ A1	Date Created	Drawn	Checked
1:150	05/09/19	EMM	PM

Project Number	Originator	Discipline	Drawing Number	Revision
1076-02	CE	C	0001	T02

Appendix H MCC Correspondence

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BURO HAPPOLD

Minutes

Subject	Mayfield Park Drainage Strategy	Job no	0046688
Place		Date	12 October 2020
Present	Laura Peacock – MCC Oliver Timmins – MCC A. Leckie – MCC James Forsey – BH Paul Thomson – BH Rodoula Gregoriou – BH Hannah Graham – Deloitte	Apologies	Colin Byrne (BH) Andy Davis (EA) Andy Potter (F+G)
Distribution	As above		

Objective of meeting: Review of Mayfield Park Drainage Strategy

Item	Action
1.0 Overview	
1.1 BH provided overview of scheme updates	
1.2 BH presented updated drainage strategy, including: • Outfall strategy • Rain gardens • Runoff to softscape areas • Runoff to wildscape area	
1.3 MCC supportive of strategy, particularly integration of green infrastructure and requested additional information to be included in updated planning documents, as per the following: • Confirmation of drainage discharge from future plots. • Review SI results and confirm suitability for infiltration. • Rain garden query online or offline – Online • 100year flood boundary to be included on surface water plan.	BH
1.4 Additional information requested • Raster flood information. • Access strategy during flooding. • Updated flood model results. • Wetland wildscape flood level – morphology calcs.	BH

Minutes taken by: Colin Byrne

The minutes detailed herein reflect the author's recollection of the discussions held during the meeting detailed above. If you feel that these minutes are inaccurate; proposed additions, corrections and/or comments must be submitted to the author in writing within five working days of the date of these minutes. If no written responses are received within this period, these minutes will be deemed the official record of the meeting.

Appendix I Soakaway Testing and Contamination Report

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AS/P2/SOAK/mh 041220

Mr Mike Harrison
U+I
Mayfield,
The Gatehouse,
11 Baring St,
Manchester
M1 2PY

4th December 2020

To Mr Harrison,

Re: Soakaway Testing Report

Mayfield Park

Further to discussions with the flood risk and drainage design consultants Buro Happold, RoC Consulting completed a program of Soakaway testing within the proposed park in order to establish soil infiltration rates. A total of 3 test pits were completed at (or as close as site constraints would allow) to the proposed locations of soakaway pits indicated on Buro Happold drainage layout plan ref: 0042912-BHE-XX-XX-DR-C-3120.

Test pit locations and other relevant information are as follows,

Test Pit ID	Location	Easting	Northing	Current Surface Level	Proposed Invert Level	Strata at invert level
SA1	Rain Garden 1	385055.3	397609.3	34.35mAOD	33.13mAOD	Made ground (Demolition type fill material held in Sand and Gravel matrix with frequent semi intact brick inclusions)
SA2	Rain Garden 2	385127.0	397612.14	34.49mAOD	32.54mAOD	
SA3*	Rain Garden 3	385081.3	397527.17	33.18mAOD	34.06mAOD	Sandstone bedrock

* Proposed invert level for SA3 is above that of existing ground level, test taken at base of existing concrete floor slab within Sandstone bedrock

Test pit locations are indicated RoC Consulting sketch 4153 SOAK101 provided as an inclusion to this note.

Test Method & Results

Tests pits were excavated by contractors PP O'Connor's between the 25th and 26th November 2020 in accordance with the BRE 365. Pits were excavated to indicated to indicated invert levels and filled with water from a bowser 3 times with observations made on resting water levels.

Measurements of pit dimensions was taken prior to commencement of each test with water levels recorded at the start of each test, and at regular intervals throughout. A copy of the results from these measurements (including pit dimensions) has been provided as an inclusion to this note.

Contamination Analysis

Soil samples were obtained at the base of each test pit for leachate analysis at a UKAS accredited chemical testing facility against a range of determinands synonymous with previous site operations (namely Heavy Metals, Total Petroleum Hydrocarbons and Poly Aromatic Hydrocarbons). The purpose of this testing was to establish the risks of increased contaminant mobility as a result of rainwater infiltration into soils in and around proposed soakaway locations.

Copies of laboratory testing certificates have been provided as an inclusion to this note. Results indicate these soils contain elevated levels of heavy metals and PAH which could pose a risk to controlled waters.

In order to mitigate these risks, we would recommend consideration is given excavating and replacing soils at the base of soakaway pits until clean natural strata is encountered, and then backfilling pits to desired level with suitable permeable clean inert strata. The use of a liner system would also be prudent to seal the pit sites and prevent lateral mobilisation of contaminants the surrounding soils. Records from nearby exploratory borehole / trial pit locations indicate deeper ground conditions in the area of proposed rain gardens is as follows

Rain Garden 1: Made ground overlying Sandstone bedrock at depth circa 1.5 to 2.0m (c32.97mAOD), based on nearby borehole “WS314”

Rain Garden 2: Made ground overlying clayey silty fine to coarse sand at depth circa 1.5m (c32.92mAOD), based on nearby borehole “WS306”

In the area of Rain Garden 3 weathered Sandstone bedrock was reported at the base of the existing concrete floor slab and the need to adopt remedial measures in the construction of this pit is not considered justified, although any demolition type made ground materials encountered during the formation of the pit should be removed.

We trust the enclosed is self-explanatory and would welcome your comments on the points raised. Should any aspect require clarification please do not hesitate to get in touch.

Yours Sincerely



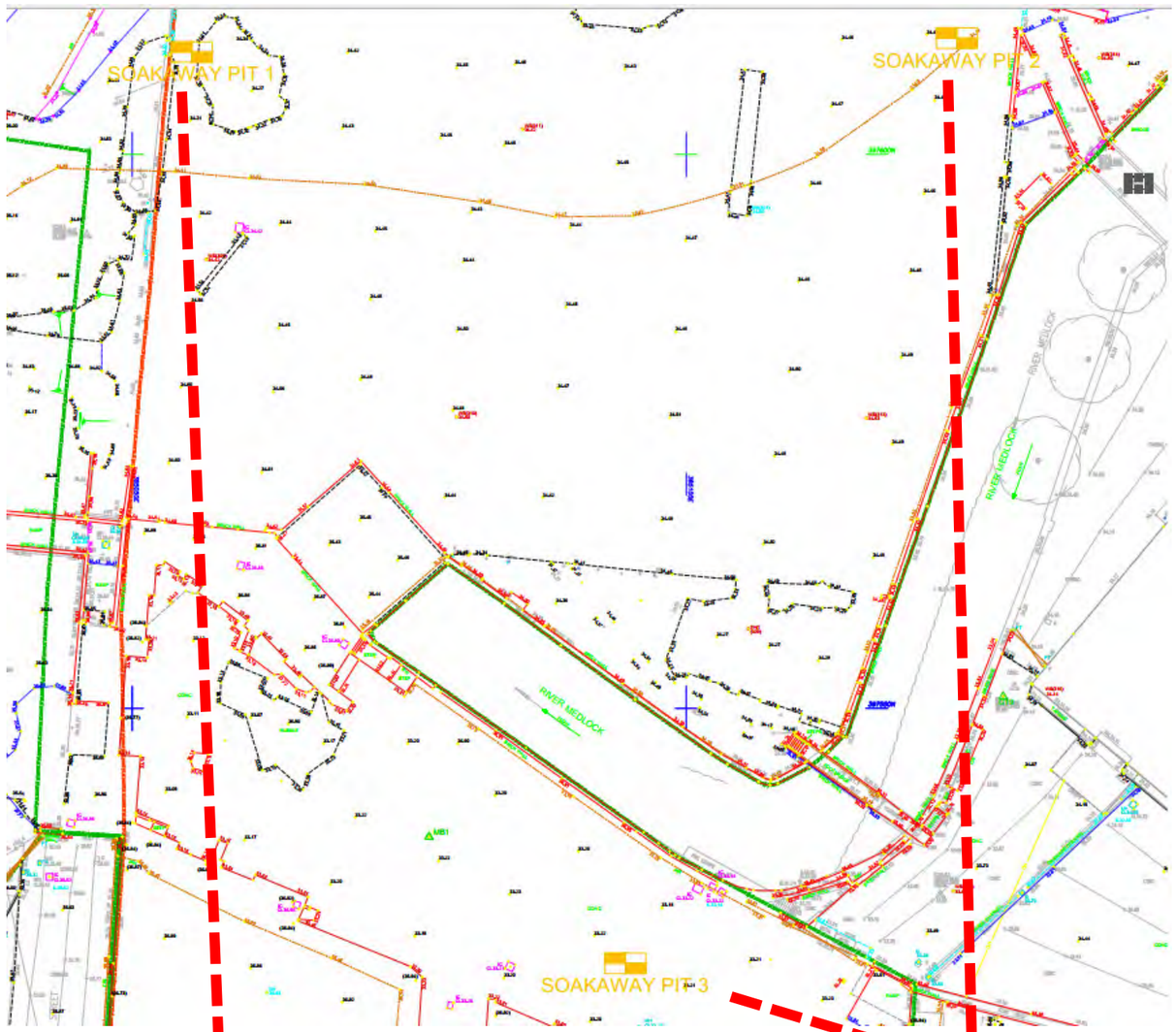
Alex Smiles

Earth Sciences Director

Enc: Drawing 4153 SOAK101 Soakaway test location plan

Soakaway test pit results & photographs

Chemical Testing Results



Sketch Notes

1) Soakaway pits to be completed in accordance with BRE 365 guidance document.

2) Soil samples for leachate testing to be completed from two locations in each pit and tested for a range of determinands including Heavy Metals, PAH and TPHCWG.

3) Soakaway pit to be formed to anticipated invert level of proposed rain gardens. Any below ground structures encountered to be grubbed up and broken out and backfilled as appropriate.







JOB NO	4153	SKETCH NO	SOAK101	DRAWN BY AS 19 11 2020
PROJECT TITLE	Mayfield Park, Manchester	SKETCH TITLE	Proposed Soakway Test Locations	

Mayfield Park Soakaway Test Results

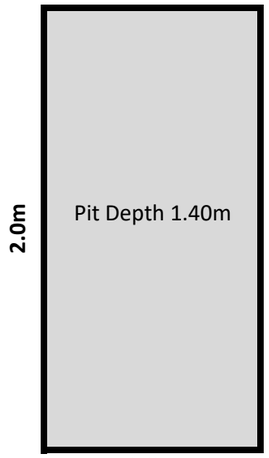
Collated by : RMG
Reviewed by : AS
04/12/2020

Soakaway Test Pit 1 (SA1)

Resting Water Level (mbgl)

SA1	Test 1	Test 2	Test 3
Start	0.55	0.52	0.56
5 sec	0.63	0.59	0.57
10 sec	0.71	0.66	0.61
15 sec	0.8	0.74	0.66
20 sec	0.88	0.83	0.69
30 sec	0.95	0.91	0.72
1 min	1.08	1.03	0.81
2 min	1.15	1.11	0.86
3 min	1.18	1.17	0.93
4 min	1.2		0.98
5 min	END	1.22	1.04
10 min			1.16
15 min			1.22
30 min			END

Pit Dimensions



Photograph of Test Pit



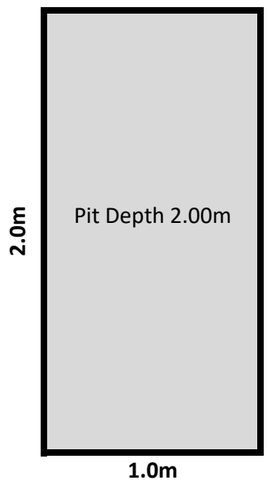
Soil sample obtained for leachate analysis in pit at depth of 1.25m

Soakaway Test Pit 2 (SA2)

Resting Water Level (mbgl)

SA2	Test 1	Test 2	Test 3
Start	0.9	0.95	0.9
5 sec	1	1.02	0.95
10 sec	1.08	1.09	0.99
15 sec	1.16	1.13	1.04
20 sec	1.25	1.2	1.098
30 sec	1.3	1.26	1.11
1 min	1.65	1.6	1.15
2 min	1.79	1.71	1.2
3 min	1.9	1.8	1.37
4 min		1.88	1.52
5 min	1.94	END	1.6
10 min			1.7
15 min			1.79
20 min			1.85
30 min			1.9

Pit Dimensions



Photograph of Test Pit



Soil sample obtained for leachate analysis in pit at depth of 1.95m

Mayfield Park Soakaway Test Results

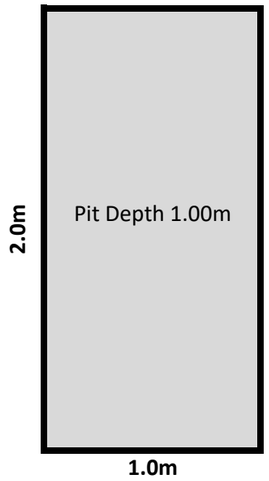
Collated by : RMG
Reviewed by : AS
04/12/2020

Soakaway Test Pit 3 (SA3)

Resting Water Level (mbgl)

SA3	Test 1	Test 2	Test 3
Start	0.1	0.12	0.1
5 sec	0.12	0.14	0.11
10 sec	0.13	0.15	0.12
15 sec	0.14	0.15	0.13
20 sec	0.15	0.16	0.14
30 sec	0.16	0.17	0.15
1 min	0.19	0.18	0.19
2 min	0.26	0.24	0.25
3 min	0.31	0.28	0.29
4 min	0.33	0.32	0.31
5 min	0.35	0.34	0.33
10 min	0.42	0.4	0.39
15 min	0.44	0.43	0.42
20 min	0.48	0.46	0.46
30 min	0.57	0.54	0.55
40 min	0.62	0.58	0.57
50 min	0.71	0.66	0.63
60 min	0.76	0.72	0.7
90 min	0.89	0.87	0.85

Pit Dimensions



Photograph of Test Pit



Soil sample obtained for leachate analysis in pit at depth of 1.00m

envirolab
Units 7 & 8 Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 20/10261
Issue Number: 1 **Date:** 08 December, 2020

Client: ROCP LIMITED
Commercial Wharf 6 Commercial Street
Castlefield
Manchester
M15 4PZ

Project Manager: Elizabeth Stewart/Liam Daley
Project Name: Mayfield
Project Ref: 4153
Order No: 1603
Date Samples Received: 27/11/20
Date Instructions Received: 01/12/20
Date Analysis Completed: 07/12/20

Prepared by:

Melanie Marshall
Laboratory Coordinator

Approved by:

Holly Neary-King
Client Services Supervisor

Envirolab Job Number: 20/10261

Client Project Name: Mayfield

Client Project Ref: 4153

Lab Sample ID	20/10261/1	20/10261/2	20/10261/3	20/10261/4	20/10261/5			Units	Limit of Detection	Method ref
Client Sample No	1	2		2	3					
Client Sample ID	SA1	SA2	SA3	Riverbed 2	Riverbed 3					
Depth to Top	1.25	1.95	1.00							
Depth To Bottom										
Date Sampled	25-Nov-20	25-Nov-20	25-Nov-20	25-Nov-20	25-Nov-20					
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES					
Sample Matrix Code	4AB	4ABE	4A	4E	4A					
% Stones >10mm$_A$	<0.1	15.6	9.7	<0.1	<0.1			% w/w	0.1	A-T-044
pH$_D$$^{M\#}$	8.84	8.74	9.47	8.07	8.33			pH	0.01	A-T-031s
Sulphate BRE (water sol 2:1)$_D$$^{M\#}$	123	996	88	<10	12			mg/l	10	A-T-026s
Cyanide (total)$_A$$^{M\#}$	2	<1	<1	4	<1			mg/kg	1	A-T-042sTCN
Phenols - Total by HPLC$_A$	<0.2	<0.2	<0.2	<0.2	<0.2			mg/kg	0.2	A-T-050s
Fraction of organic carbon$_D$$^{\#}$	0.0702	0.0171	0.0010	0.0120	0.0015			N/A	0.0003	A-T-032 FOC
Antimony$_D$	<5	<5	<5	<5	<5			mg/kg	5	A-T-024s
Arsenic$_D$$^{M\#}$	44	101	<1	2	2			mg/kg	1	A-T-024s
Barium$_D$	397	148	29	82	86			mg/kg	1	A-T-024s
Beryllium$_D$$^{\#}$	1.8	1.6	<0.5	<0.5	<0.5			mg/kg	0.5	A-T-024s
Boron (water soluble)$_D$	<1.0	<1.0	<1.0	<1.0	<1.0			mg/kg	1	A-T-027s
Cadmium$_D$$^{M\#}$	1.2	0.8	<0.5	0.7	<0.5			mg/kg	0.5	A-T-024s
Copper$_D$$^{M\#}$	134	68	5	36	10			mg/kg	1	A-T-024s
Chromium$_D$$^{M\#}$	24	20	4	9	6			mg/kg	1	A-T-024s
Chromium (hexavalent)$_D$	<1	<1	<1	<1	<1			mg/kg	1	A-T-040s
Chromium (trivalent)	24	20	4	9	6			mg/kg	1	Calc
Lead$_D$$^{M\#}$	846	219	16	70	79			mg/kg	1	A-T-024s
Mercury$_D$	1.65	0.82	<0.17	<0.17	<0.17			mg/kg	0.17	A-T-024s
Molybdenum$_D$$^{M\#}$	3	5	<1	<1	<1			mg/kg	1	A-T-024s
Nickel$_D$$^{M\#}$	27	23	3	11	8			mg/kg	1	A-T-024s
Selenium$_D$$^{M\#}$	1	2	<1	<1	<1			mg/kg	1	A-T-024s
Vanadium$_D$$^{M\#}$	31	29	5	10	8			mg/kg	1	A-T-024s
Zinc$_D$$^{M\#}$	226	126	48	95	62			mg/kg	5	A-T-024s
Leachate Prep BS EN 12457-1 (2:1) (3 no)$_A$	*	*	*	-	-					A-T-001
pH (leachable)$_A$$^{\#}$	8.54	7.86	10.61	-	-			pH	0.01	A-T-031w
Sulphate (leachable)$_A$$^{\#}$	105	894	132	-	-			mg/l	1	A-T-026w
DOC (leachable)$_A$$^{\#}$	2.8	0.5	0.8	-	-			mg/l	0.2	A-T-032w
Antimony (leachable)$_A$$^{\#}$	7	6	2	-	-			µg/l	1	A-T-025w
Arsenic (leachable)$_A$$^{\#}$	28	20	9	-	-			µg/l	1	A-T-025w
Boron (leachable)$_A$$^{\#}$	49	45	37	-	-			µg/l	10	A-T-025w
Barium (leachable)$_A$$^{\#}$	38	71	11	-	-			µg/l	1	A-T-025w
Beryllium (leachable)$_A$$^{\#}$	<1	<1	<1	-	-			µg/l	1	A-T-025w
Cadmium (leachable)$_A$$^{\#}$	<1	<1	<1	-	-			µg/l	1	A-T-025w

Envirolab Job Number: 20/10261

Client Project Name: Mayfield

Client Project Ref: 4153

Lab Sample ID	20/10261/1	20/10261/2	20/10261/3	20/10261/4	20/10261/5			Units	Limit of Detection	Method ref
Client Sample No	1	2		2	3					
Client Sample ID	SA1	SA2	SA3	Riverbed 2	Riverbed 3					
Depth to Top	1.25	1.95	1.00							
Depth To Bottom										
Date Sampled	25-Nov-20	25-Nov-20	25-Nov-20	25-Nov-20	25-Nov-20					
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES					
Sample Matrix Code	4AB	4ABE	4A	4E	4A					
Copper (leachable)$_{A}^{\#}$	6	1	4	-	-			µg/l	1	A-T-025w
Chromium (leachable)$_{A}^{\#}$	19	4	6	-	-			µg/l	1	A-T-025w
Chromium (hexavalent) (leachable)$_{A}$	<0.05	<0.05	<0.05	-	-			mg/l	0.05	A-T-040w
Chromium (trivalent) (10:1 leachable)	<0.05	<0.05	<0.05	-	-			mg/l	0.05	Calc
Mercury (leachable)$_{A}^{\#}$	<0.1	<0.1	<0.1	-	-			µg/l	0.1	A-T-025w
Molybdenum (leachable)$_{A}^{\#}$	9	16	6	-	-			µg/l	1	A-T-025w
Nickel (leachable)$_{A}^{\#}$	<1	<1	<1	-	-			µg/l	1	A-T-025w
Selenium (leachable)$_{A}^{\#}$	<1	1	<1	-	-			µg/l	1	A-T-025w
Vanadium (leachable)$_{A}^{\#}$	6	6	59	-	-			µg/l	1	A-T-025w
Zinc (leachable)$_{A}^{\#}$	2	4	1	-	-			µg/l	1	A-T-025w
1,2,4-Trimethylbenzene (leachable)$_{A}$	<1	<1	<1	-	-			µg/l	1	A-T-006w
Isopropylbenzene (leachable)$_{A}$	<1	<1	<1	-	-			µg/l	1	A-T-006w
n-propylbenzene (leachable)$_{A}$	<1	<1	<1	-	-			µg/l	1	A-T-006w
Styrene (leachable)$_{A}$	<1	<1	<1	-	-			µg/l	1	A-T-006w
Carbon Disulphide (leachable)$_{A}$	<1	<1	<1	-	-			µg/l	1	A-T-006w
Hexachlorobutadiene (leachable)$_{A}$	<1	<1	<1	-	-			µg/l	1	A-T-006w

Envirolab Job Number: 20/10261

Client Project Name: Mayfield

Client Project Ref: 4153

Lab Sample ID	20/10261/1	20/10261/2	20/10261/3	20/10261/4	20/10261/5			Units	Limit of Detection	Method ref
Client Sample No	1	2		2	3					
Client Sample ID	SA1	SA2	SA3	Riverbed 2	Riverbed 3					
Depth to Top	1.25	1.95	1.00							
Depth To Bottom										
Date Sampled	25-Nov-20	25-Nov-20	25-Nov-20	25-Nov-20	25-Nov-20					
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES					
Sample Matrix Code	4AB	4ABE	4A	4E	4A					
Asbestos in Soil (inc. matrix)										
Asbestos in soil$_{D}^{\#}$	Chrysotile	NAD	-	-	-					A-T-045
Asbestos Matrix (microscope)$_{D}$	Loose Fibres	-	-	-	-					A-T-045
Asbestos ACM - Suitable for Water Absorption Test?$_{D}$	N/A	N/A	-	-	-					A-T-045
Asbestos in Soil Quantification % (Hand Picking & Weighing)										
Asbestos in soil % composition (hand picking and weighing)$_{D}$	<0.001	-	-	-	-			% w/w	0.001	A-T-054

Envirolab Job Number: 20/10261

Client Project Name: Mayfield

Client Project Ref: 4153

Lab Sample ID	20/10261/1	20/10261/2	20/10261/3	20/10261/4	20/10261/5			Units	Limit of Detection	Method ref
Client Sample No	1	2		2	3					
Client Sample ID	SA1	SA2	SA3	Riverbed 2	Riverbed 3					
Depth to Top	1.25	1.95	1.00							
Depth To Bottom										
Date Sampled	25-Nov-20	25-Nov-20	25-Nov-20	25-Nov-20	25-Nov-20					
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES					
Sample Matrix Code	4AB	4ABE	4A	4E	4A					
PAH-16MS										
Acenaphthene$_{A}^{M\#}$	0.08	0.06	0.03	0.03	<0.01			mg/kg	0.01	A-T-019s
Acenaphthylene$_{A}^{M\#}$	0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	0.01	A-T-019s
Anthracene$_{A}^{M\#}$	0.12	0.06	<0.02	0.05	<0.02			mg/kg	0.02	A-T-019s
Benzo(a)anthracene$_{A}^{M\#}$	0.48	0.21	0.07	0.23	<0.04			mg/kg	0.04	A-T-019s
Benzo(a)pyrene$_{A}^{M\#}$	0.37	0.23	0.07	0.25	<0.04			mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene$_{A}^{M\#}$	0.42	0.25	0.08	0.29	<0.05			mg/kg	0.05	A-T-019s
Benzo(ghi)perylene$_{A}^{M\#}$	0.22	0.16	<0.05	0.17	<0.05			mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene$_{A}^{M\#}$	0.13	0.09	<0.07	0.11	<0.07			mg/kg	0.07	A-T-019s
Chrysene$_{A}^{M\#}$	0.48	0.28	0.10	0.28	<0.06			mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene$_{A}^{M\#}$	0.05	<0.04	<0.04	<0.04	<0.04			mg/kg	0.04	A-T-019s
Fluoranthene$_{A}^{M\#}$	0.91	0.51	0.17	0.42	<0.08			mg/kg	0.08	A-T-019s
Fluorene$_{A}^{M\#}$	0.06	0.04	<0.01	0.02	<0.01			mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene$_{A}^{M\#}$	0.24	0.17	0.05	0.19	<0.03			mg/kg	0.03	A-T-019s
Naphthalene $_{A}^{M\#}$	0.18	0.05	<0.03	<0.03	<0.03			mg/kg	0.03	A-T-019s
Phenanthrene$_{A}^{M\#}$	0.77	0.37	0.19	0.24	<0.03			mg/kg	0.03	A-T-019s
Pyrene$_{A}^{M\#}$	0.90	0.50	0.17	0.41	<0.07			mg/kg	0.07	A-T-019s
Total PAH-16MS$_{A}^{M\#}$	5.42	2.98	0.93	2.69	<0.08			mg/kg	0.01	A-T-019s

Envirolab Job Number: 20/10261

Client Project Name: Mayfield

Client Project Ref: 4153

Lab Sample ID	20/10261/1	20/10261/2	20/10261/3	20/10261/4	20/10261/5			Units	Limit of Detection	Method ref
Client Sample No	1	2		2	3					
Client Sample ID	SA1	SA2	SA3	Riverbed 2	Riverbed 3					
Depth to Top	1.25	1.95	1.00							
Depth To Bottom										
Date Sampled	25-Nov-20	25-Nov-20	25-Nov-20	25-Nov-20	25-Nov-20					
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES					
Sample Matrix Code	4AB	4ABE	4A	4E	4A					
PAH 16MS (leachable)										
Acenaphthene (leachable)$_A$	<0.02	<0.02	<0.02	-	-			µg/l	0.02	A-T-019w
Acenaphthylene (leachable)$_A$	<0.02	<0.02	<0.02	-	-			µg/l	0.02	A-T-019w
Anthracene (leachable)$_A$	<0.02	<0.02	<0.02	-	-			µg/l	0.02	A-T-019w
Benzo(a)anthracene (leachable)$_A$	<0.02	<0.02	<0.02	-	-			µg/l	0.02	A-T-019w
Benzo(a)pyrene (leachable) $_A$	<0.02	<0.02	<0.02	-	-			µg/l	0.02	A-T-019w
Benzo(b)fluoranthene (leachable)$_A$	<0.02	<0.02	<0.02	-	-			µg/l	0.02	A-T-019w
Benzo(ghi)perylene (leachable)$_A$	<0.02	<0.02	<0.02	-	-			µg/l	0.02	A-T-019w
Benzo(k)fluoranthene (leachable)$_A$	<0.02	<0.02	<0.02	-	-			µg/l	0.02	A-T-019w
Chrysene (leachable)$_A$	<0.02	<0.02	<0.02	-	-			µg/l	0.02	A-T-019w
Dibenzo(ah)anthracene (leachable)$_A$	<0.02	<0.02	<0.02	-	-			µg/l	0.02	A-T-019w
Fluoranthene (leachable)$_A$	<0.02	<0.02	<0.02	-	-			µg/l	0.02	A-T-019w
Fluorene (leachable)$_A$	0.09	0.08	<0.02	-	-			µg/l	0.02	A-T-019w
Indeno(123-cd)pyrene (leachable)$_A$	<0.02	<0.02	<0.02	-	-			µg/l	0.02	A-T-019w
Naphthalene (leachable) $_A$	<0.02	<0.02	<0.02	-	-			µg/l	0.02	A-T-019w
Phenanthrene (leachable)$_A$	<0.02	<0.02	<0.02	-	-			µg/l	0.02	A-T-019w
Pyrene (leachable)$_A$	<0.02	<0.02	<0.02	-	-			µg/l	0.02	A-T-019w
Total PAH 16MS (leachable)$_A$	0.09	0.08	<0.02	-	-			µg/l	0.02	A-T-019w

Envirolab Job Number: 20/10261

Client Project Name: Mayfield

Client Project Ref: 4153

Lab Sample ID	20/10261/1	20/10261/2	20/10261/3	20/10261/4	20/10261/5			Units	Limit of Detection	Method ref
Client Sample No	1	2		2	3					
Client Sample ID	SA1	SA2	SA3	Riverbed 2	Riverbed 3					
Depth to Top	1.25	1.95	1.00							
Depth To Bottom										
Date Sampled	25-Nov-20	25-Nov-20	25-Nov-20	25-Nov-20	25-Nov-20					
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES					
Sample Matrix Code	4AB	4ABE	4A	4E	4A					
Speciated PCB-EC7 & WHO12 (leachable)										
PCB BZ 28 (leachable)$_A$	<0.002	<0.002	<0.002	-	-			µg/l	0.002	A-T-004w
PCB BZ 52 (leachable)$_A$	<0.002	<0.002	<0.002	-	-			µg/l	0.002	A-T-004w
PCB BZ 101 (leachable)$_A$	<0.002	<0.002	<0.002	-	-			µg/l	0.002	A-T-004w
PCB BZ 118 (leachable)$_A$	<0.002	<0.002	<0.002	-	-			µg/l	0.002	A-T-004w
PCB BZ 138 (leachable)$_A$	<0.002	<0.002	<0.002	-	-			µg/l	0.002	A-T-004w
PCB BZ 153 (leachable)$_A$	<0.002	<0.002	<0.002	-	-			µg/l	0.002	A-T-004w
PCB BZ 180 (leachable)$_A$	<0.002	<0.002	<0.002	-	-			µg/l	0.002	A-T-004w
PCB BZ 77 (leachable)$_A$	<0.002	<0.002	<0.002	-	-			µg/l	0.002	A-T-004w
PCB BZ 81 (leachable)$_A$	<0.002	<0.002	<0.002	-	-			µg/l	0.002	A-T-004w
PCB BZ 105 (leachable)$_A$	<0.002	<0.002	<0.002	-	-			µg/l	0.002	A-T-004w
PCB BZ 114 (leachable)$_A$	<0.002	<0.002	<0.002	-	-			µg/l	0.002	A-T-004w
PCB BZ 123 (leachable)$_A$	<0.002	<0.002	<0.002	-	-			µg/l	0.002	A-T-004w
PCB BZ 126 (leachable)$_A$	<0.002	<0.002	<0.002	-	-			µg/l	0.002	A-T-004w
PCB BZ 156 (leachable)$_A$	<0.002	<0.002	<0.002	-	-			µg/l	0.002	A-T-004w
PCB BZ 157 (leachable)$_A$	<0.002	<0.002	<0.002	-	-			µg/l	0.002	A-T-004w
PCB BZ 167 (leachable)$_A$	<0.002	<0.002	<0.002	-	-			µg/l	0.002	A-T-004w
PCB BZ 169 (leachable)$_A$	<0.002	<0.002	<0.002	-	-			µg/l	0.002	A-T-004w
PCB BZ 189 (leachable)$_A$	<0.002	<0.002	<0.002	-	-			µg/l	0.002	A-T-004w
Total Speciated PCB-EC7 & WHO12 (leachable)$_A$	<0.002	<0.002	<0.002	-	-			µg/l	0.002	A-T-004w

Envirolab Job Number: 20/10261

Client Project Name: Mayfield

Client Project Ref: 4153

Lab Sample ID	20/10261/1	20/10261/2	20/10261/3	20/10261/4	20/10261/5			Units	Limit of Detection	Method ref
Client Sample No	1	2		2	3					
Client Sample ID	SA1	SA2	SA3	Riverbed 2	Riverbed 3					
Depth to Top	1.25	1.95	1.00							
Depth To Bottom										
Date Sampled	25-Nov-20	25-Nov-20	25-Nov-20	25-Nov-20	25-Nov-20					
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES					
Sample Matrix Code	4AB	4ABE	4A	4E	4A					
TPH UKCWG (leachable)										
Ali >C5-C6 (leachable)$_A$	<1	<1	<1	-	-			µg/l	1	A-T-022w
Ali >C6-C8 (leachable)$_A$	<1	<1	<1	-	-			µg/l	1	A-T-022w
Ali >C8-C10 (leachable)$_A$	<10	<10	<10	-	-			µg/l	10	A-T-055w
Ali >C10-C12 (leachable)$_A$	<10	<10	<10	-	-			µg/l	10	A-T-055w
Ali >C12-C16 (leachable)$_A$	<10	<10	<10	-	-			µg/l	10	A-T-055w
Ali >C16-C21 (leachable)$_A$	<10	<10	<10	-	-			µg/l	10	A-T-055w
Ali >C21-C35 (leachable)$_A$	<20	<20	<20	-	-			µg/l	20	A-T-055w
Ali >C35-C44 (leachable)$_A$	<10	<10	<10	-	-			µg/l	10	A-T-055w
Total Aliphatics (leachable)$_A$	<20	<20	<20	-	-			µg/l	10	A-T-055w
Aro >C5-C7 (leachable)$_A$	<1	<1	<1	-	-			µg/l	1	A-T-022w
Aro >C7-C8 (leachable)$_A$	<1	<1	<1	-	-			µg/l	1	A-T-022w
Aro >C8-C10 (leachable)$_A$	<10	<10	<10	-	-			µg/l	10	A-T-055w
Aro >C10-C12 (leachable)$_A$	<10	<10	<10	-	-			µg/l	10	A-T-055w
Aro >C12-C16 (leachable)$_A$	<10	<10	<10	-	-			µg/l	10	A-T-055w
Aro >C16-C21 (leachable)$_A$	<10	<10	<10	-	-			µg/l	10	A-T-055w
Aro >C35-C44 (leachable)$_A$	<10	<10	<10	-	-			µg/l	10	A-T-055w
Total Aromatics (leachable) GCxGC$_A$	<20	<20	<20	-	-			µg/l	20	A-T-055w
TPH (Ali & Aro >C5-C44) (leachable)$_A$	<20	<20	<20	-	-			µg/l	20	A-T-055w
BTEX - Benzene (leachable)$_A$	<1	<1	<1	-	-			µg/l	1	A-T-022w
BTEX - Toluene (leachable)$_A$	<1	<1	<1	-	-			µg/l	1	A-T-022w
BTEX - Ethyl Benzene (leachable)$_A$	<1	<1	<1	-	-			µg/l	1	A-T-022w
BTEX - o Xylene (leachable)$_A$	<1	<1	<1	-	-			µg/l	1	A-T-022w
BTEX - m & p Xylene (leachable)$_A$	<1	<1	<1	-	-			µg/l	1	A-T-022w
MTBE (leachable)$_A$	<1	<1	<1	-	-			µg/l	1	A-T-022w
Aro >C21-C35 (leachable)$_A$	<20	<20	<20	-	-			µg/l	20	A-T-055w

Envirolab Job Number: 20/10261

Client Project Name: Mayfield

Client Project Ref: 4153

Lab Sample ID	20/10261/1	20/10261/2	20/10261/3	20/10261/4	20/10261/5			Units	Limit of Detection	Method ref
Client Sample No	1	2		2	3					
Client Sample ID	SA1	SA2	SA3	Riverbed 2	Riverbed 3					
Depth to Top	1.25	1.95	1.00							
Depth To Bottom										
Date Sampled	25-Nov-20	25-Nov-20	25-Nov-20	25-Nov-20	25-Nov-20					
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES					
Sample Matrix Code	4AB	4ABE	4A	4E	4A					
TPH UKCWG										
Ali >C5-C6$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	0.01	A-T-022s
Ali >C6-C8$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	0.01	A-T-022s
Ali >C8-C10$_A$	<1	<1	<1	<1	<1			mg/kg	1	A-T-055s
Ali >C10-C12$_A^{M\#}$	<1	<1	<1	<1	<1			mg/kg	1	A-T-055s
Ali >C12-C16$_A^{M\#}$	<1	<1	<1	1	<1			mg/kg	1	A-T-055s
Ali >C16-C21$_A^{M\#}$	1	1	<1	2	<1			mg/kg	1	A-T-055s
Ali >C21-C35$_A^{M\#}$	14	7	13	20	2			mg/kg	1	A-T-055s
Ali >C35-C44$_A$	2	2	2	6	<1			mg/kg	1	A-T-055s
Total Aliphatics$_A$	18	10	15	30	2			mg/kg	1	A-T-055s
Aro >C5-C7$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	0.01	A-T-022s
Aro >C7-C8$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	0.01	A-T-022s
Aro >C8-C10$_A$	2	2	<1	2	<1			mg/kg	1	A-T-055s
Aro >C10-C12$_A$	1	<1	<1	1	<1			mg/kg	1	A-T-055s
Aro >C12-C16$_A$	4	3	<1	5	<1			mg/kg	1	A-T-055s
Aro >C16-C21$_A^{M\#}$	14	10	3	26	<1			mg/kg	1	A-T-055s
Aro >C21-C35$_A^{M\#}$	48	39	8	86	4			mg/kg	1	A-T-055s
Aro >C35-C44$_A$	2	1	<1	5	<1			mg/kg	1	A-T-055s
Total Aromatics$_A$	72	55	14	125	4			mg/kg	1	A-T-055s
TPH (Ali & Aro >C5-C44)$_A$	90	65	29	155	6			mg/kg	1	A-T-055s
BTEX - Benzene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	0.01	A-T-022s
BTEX - Toluene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	0.01	A-T-022s
BTEX - m & p Xylene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	0.01	A-T-022s
BTEX - o Xylene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	0.01	A-T-022s
MTBE$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	0.01	A-T-022s

REPORT NOTES

General
This report shall not be reproduced, except in full, without written approval from Envirolab.
The results reported herein relate only to the material supplied to the laboratory.
The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.
Analytical results reflect the quality of the sample at the time of analysis only.
Opinions and interpretations expressed are outside the scope of our accreditation.
If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.
A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.
The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:
All results are reported as dry weight (<40°C).
For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.
For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any “A” subscripts
All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:
Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:
Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:
Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.
Stones etc. are not removed from the sample prior to analysis.
Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:
1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.
Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.
Secondary Matrix Codes:
A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

Key:
IS indicates Insufficient Sample for analysis.
US indicates Unsuitable Sample for analysis.
NDP indicates No Determination Possible.
NAD indicates No Asbestos Detected.
N/A indicates Not Applicable.
Superscript # indicates method accredited to ISO 17025.
Superscript "M" indicates method accredited to MCERTS.
Subscript "A" indicates analysis performed on the sample as received.
Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

Envirolab Deviating Samples Report

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Client: ROCP LIMITED, Commercial Wharf 6 Commercial Street, Castlefield, Manchester, M15 4PZ

Project: Mayfield

Clients Project No: 4153

Project No: 20/10261

Date Received: 01/12/2020 (am)

Cool Box Temperatures (°C): 10.4

NO DEVIATIONS IDENTIFIED

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

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