

ADVISORY

Wilson Bowden Developments Ltd
Plot Q, Kingsway Business Park
Rochdale
Sustainable Drainage Statement

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Sustainable Drainage Statement

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1. INTRODUCTION

- 1.1 A Sustainable Drainage Statement (SDS) sets out the principles of drainage design for a development and summarises the reasoning behind the chosen design. This includes consideration of national and local guidance, justification of specific flow rates, volumes of attenuation storage, as well as the appropriate level of treatment to be provided to surface water runoff.
- 1.2 This SDS has been produced by BWB Consulting on behalf of Wilson Bowden Developments Ltd in respect of a site located at Plot Q within Kingsway Business Park in Rochdale. The proposed development is a warehouse distribution/production unit with first floor office and core facilities.
- 1.3 A Flood Risk Assessment has been prepared for the site (reference 244498-BWB-ZZ-XX-T-W-0001_FRA) and this SDS accompanies this overarching document.
- 1.4 This SDS is intended to support a full planning application and as such the level of detail included is commensurate and subject to the nature of the proposals.
- 1.5 The location of the site is illustrated within **Figure 1.1** with contextual information provided within **Table 1.1**.

Table 1.1: Site Details

Site Name	Plot Q Kingsway Business Park
Location	Rochdale
NGR (approx.)	SD918124
Application Area (ha)	2.86
Proposed Contributing Area (ha)	2.26
Lead Local Flood Authority	Rochdale Borough Council
Local Planning Authority	Rochdale Borough Council
Sewerage Undertaker	United Utilities
Planning Application Ref.	14/000542/OUT

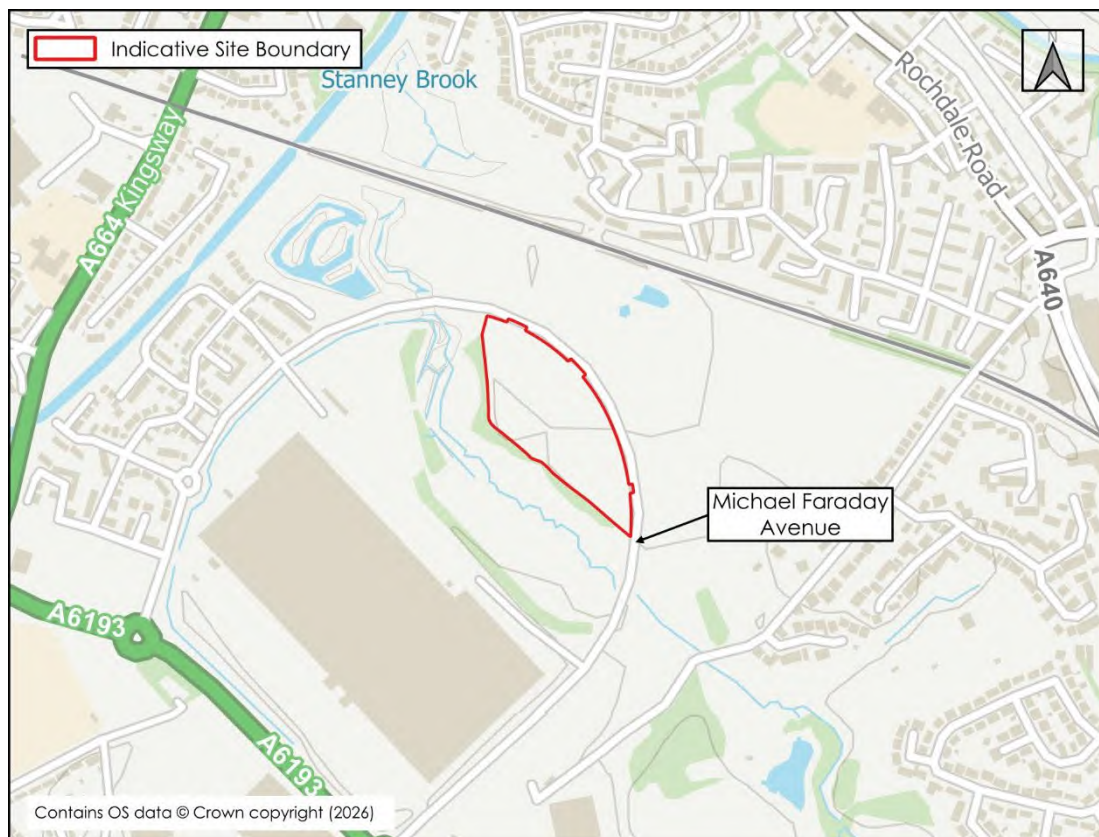


Figure 1.1: Site Location

Sustainable Drainage Guidance

- 1.6 Sustainable Drainage Systems (SuDS) aim to reduce the impact of development by replicating the natural runoff regime in a sustainable, cost effective manner whilst protecting water quality and reducing pollution. The four key objectives of SuDS design are to achieve improvements in water quantity, water quality, amenity provision and biodiversity.
- 1.7 Correspondence with Rochdale Borough Council as the Lead Local Flood Authority and United Utilities (UU) as the Sewerage Undertaker (included within **Appendix 1 and 2**) notes the acceptance of Plot Q's flow rates given on the previously submitted Plan & Modelled Flow Rates as discussed within **Section 3** of this report.
- 1.8 The agreed rates are based upon each plot discharging all flows for storms up to the 1 in 100 year storm without attenuation and with the additional 40% climate change rainfall intensity allowance being accommodated by extra storage on each plot.
- 1.9 The Northwest SuDS pro-forma has been completed and is included within **Appendix 3**.

2. EXISTING CONDITIONS

- 2.1 The site is located within the Kingsway Business Park, approximately 2.2km southeast of Rochdale town centre. The site is bound by Michael Faraday Avenue to the north and east, this road provides access means to the site. The south is bound by dense trees, followed by undeveloped land and Stanney Brook (an Environment Agency designated Main River).
- 2.2 The site comprises greenfield undeveloped land and currently unused.
- 2.3 A topographic survey of the existing site has been undertaken and is included as **Appendix 4**. This shows that the site slopes falling from north to south, situated at approximately 146 m Above Ordnance Datum (m AOD) in the northwest, sloping to 151 m AOD in the northeast. This survey shows that there are no existing drainage features within the site boundary, although there is a ditch present at the boundary between the site and adjacent road. This was not created as a drainage or conveyance feature and does not have any onward connectivity. Runoff is therefore likely considered to infiltrate into the existing ground and surface runoff. During extreme runoff where infiltration potential is exceeded, runoff is expected to flow overland towards Stanney Brook, west of the site.

Kingsway Business Park Drainage Strategy

- 2.4 Plot Q is situated directly south of Michael Faraday Avenue within the wider Kingsway Business Park development. The overall plot was originally split into three distinctive surface water drainage catchments, each served by separate piped systems which have been adopted by UU and ultimately discharge into separate attenuation features.
- 2.5 Plot Q forms a part of Catchment 2 and was subdivided into Plot Q (South), and Plot Q (North). This proposed development of Plot Q comprises of a boundary with a total contributing impermeable area of 2.26ha. In the agreed drainage strategy, the previous agreed allowable impermeable area of Plot Q was 2.12ha, which is the combined total of 1.543ha for Plot Q (North) and 0.581ha for Plot Q (South). Therefore, a pro-rata approach will be utilised to ensure that the previous drainage strategy is adhered to.
- 2.6 Plot Q entirely drains to Pond 2; it is shown to have two existing 600mm diameter surface water stub connections and a 225mm foul water stub connection which connect into existing adopted foul and surface water drainage systems in Michael Faraday Avenue.
- 2.7 The design of the existing sitewide drainage system was carried out by WYG Ltd and was constructed in 1999. It is understood to have been designed to accommodate the 1 in 100-year storm event for all future plots across the business park but not including an allowance for climate change.
- 2.8 Reference should be made to the BWB As Built Drainage Study KBP-BWB-ZZ-XX-RP-CD-0003, which is included in **Appendix 5** in this report. The purpose of the BWB report was to model the existing Catchment 2 drainage network based on the as-built information.

- 2.9 The BWB report concludes that the individual plots within Catchment 2 can discharge into the existing stub connection provided at a flow rate not exceeding the calculated peak discharge rate for the 100-year 15-minute duration storm event.
- 2.10 Much of the site's wider drainage infrastructure for the business park has already been constructed, which acts to serve future plots as developments are brought forward. There are surface water and foul water sewers within Michael Faraday Avenue which are UU assets. These locations are noted on the BWB proposed surface water drainage layout drawing located in **Appendix 6**.

Ground Conditions Summary

- 2.11 A Phase 1 Geo-Environment Assessment was undertaken by BWB Consulting (reference: 244498-BWB-ZZ-XX-T-G-0001_Phase 1 Geo-Environmental Assessment). Intrusive ground investigations were undertaken by BWB Consulting in November 2025. The Groundsure report marks Made Ground in two localised areas near the eastern boundary and southwest perimeter of the site.
- 2.12 Ground investigation works, completed in November 2025, recorded three draft borehole logs (reference: 244498-BWB-ZZ-XX-T-G-0002_Phase 2 Geo-Environmental Assessment). Across the three borehole logs, groundwater seepage was recorded at a range of depths of 0.15m bgl, 0.7 m bgl, 1.5m bgl 2.0m bgl and 2.5m bgl, two boreholes were also recorded as damp at depths of 11.7m bgl and 12.7m bgl. Following subsequent monitoring, groundwater levels were recorded at depths between 1.81m – 12.63m bgl.
- 2.13 British Geological Survey mapping shows the site to be underlain by Pennine Lower Coal Measures Formation (Mudstone, Siltstone and Sandstone). This bedrock geology is designated by the EA as a Secondary A Aquifer; these aquifers comprise permeable layers that can support local water supplies and may form an important source of base flow to rivers.
- 2.14 Superficial deposits of Till (Devensian, Diamicton) are mapped across the east of the site, whilst Glaciofluvial Sheet Deposits (Devensian, Sand and Gravel) are mapped across the west of the site. The Glaciofluvial Sheet Deposits are designated by the EA as a Secondary A Aquifer, whilst the Till Deposits are designated as a Secondary (Undifferentiated) Aquifer.

Existing Runoff Rates

- 2.15 An assessment of the existing surface water runoff rates per hectare has been undertaken and is summarised within **Table 2.1**. Calculations are included within **Appendix 7**.

- 2.16 The runoff rates have been estimated using the IH124 method, with appropriate prorated adjustments for a site of less than 50ha, as recommended in Interim Code of Practice for Sustainable Drainage¹. This was undertaken using the UKSUDS Greenfield Runoff Rate Estimation Tool, which makes the necessary adjustments for small sites automatically.

Table 2.1: Existing Runoff Rate from the Site

Return Period (Yrs.)	Runoff Rate (l/s/ha)
1	0.3
Mean Annual Flow Rate (QBAR)	0.3
30	0.5
100	0.6

Existing Runoff Volume

- 2.17 An assessment of the existing surface water runoff rates from the site has been made for a 1 in 100-year, 6 hour storm.
- 2.18 As the existing site is greenfield, the runoff volume has been calculated using the Pre-development Discharge Volume calculator within Causeway 'Flow' to be 88m³/ha, which, based on a contributing area of 2.26ha, equates to 199m³. The supporting results are included within **Appendix 7**.

¹ The National SUDS Working Group (2004), Interim Code of Practice for Sustainable Drainage

3. SURFACE WATER DRAINAGE STRATEGY

- 3.1 The proposed development consists of a warehouse distribution/production unit with first floor office, core facilities.
- 3.2 The drainage strategy has been carried out with the relevant guidance at the time of producing the initial wider site drainage strategy with relevant national and local planning policies and guidance being adhered to.
- 3.3 The proposed drainage strategy for Plot Q has been formulated based on the sitewide strategy. The proposed approach has been agreed with UU (**Appendix 2**) provided that the on-plot attenuation is provided for the residual volume of runoff for storm events up to and including the 100-year plus 40% climate change.

Drainage Hierarchy

- 3.4 The Planning Policy Guidance² and the SuDS Manual³ identify that surface water runoff from a development should be disposed of as high up the following hierarchy as reasonably practicable:
- i. into the ground (infiltration);
 - ii. to a surface water body;
 - iii. to a surface water sewer, highway drain, or another drainage system;
 - iv. to a combined sewer.
- 3.5 The drainage hierarchy was considered in the wider site drainage strategy, with the aim of managing surface water runoff close to where it falls and to mimic natural drainage as closely as possible.
- 3.6 Due to the shallow groundwater levels recorded on-site, the disposal of surface water via infiltration was not considered.
- 3.7 It is proposed to discharge surface water from the site to Pond 2 via surface water sewers on Michael Faraday Avenue which ultimately discharges to the watercourse Stanney Brook to the north of Kingsway Business Park.

Peak Flow Control

- 3.8 In order to comply with the Non-Statutory Technical Standards for Sustainable Drainage Systems S2-S3⁴, runoff from greenfield developments should not exceed the equivalent greenfield rates for the equivalent return period events.

² Planning Practice Guidance. <http://planningguidance.planningportal.gov.uk/>.

³ The SuDS Manual (C753). CIRIA 2015.

⁴ 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems

- 3.9 As previously stated, the wider infrastructure has been designed and installed to accommodate the 1 in 100-year storm event, with flows being restricted at the downstream attenuation features. The proposed catchment for Plot Q, amongst others, is served by the basin in 'Catchment 2' of the site's wider drainage network. The restricted outflows from the attenuation basin is controlled in such a way that the 1 in 10, 30, 50 and 100-year rainfall events do not exceed that of the predeveloped confirmed discharge rates.
- 3.10 BWB have previously undertaken three site wide drainage assessments across the business park which demonstrate the installed drainage networks and downstream attenuation has been designed for all future developments at the site. A summary note of the findings from the three assessments (ref KBP-BWB-ZZ-XX-RP-CD-0004) is included as **Appendix 8**. A subsequent drawing (ref: KBP-BWB-ZZ-XX-DR-CD-0005) has been produced by BWB Consulting Ltd, this drawing shows the allowed peak flow rate of each plot within their respective catchments (**Appendix 9**). Included within **Appendix 1 & 2** is email correspondence with UU and Rochdale Council showing that they both find this approach acceptable.
- 3.11 Surface water drainage for Catchment 2 flows in a northwestern direction where flows are restricted before discharging to Stanney Brook. Based upon the aforementioned drainage study, the existing sewers and downstream attenuation have capacity to accept a maximum discharge rate from the overall Plot Q of 721.4 l/s.
- 3.12 As noted in **Section 2**, the Plot Q covers the combined plots of Plot Q (North) and Plot Q (South). As such, Plot Q is proposed to drain via two separate drainage networks, with the overall discharge rate that will not exceed the overall acceptable discharge rate of 721.4 l/s.
- 3.13 Following the completion of the on plot hydraulic calculations, the prorated modelled discharge rates for the various return periods are outlined within **Appendix 10**; however, it is noted that the hydraulic calculations are subject to change during the tender design stage. Ultimately, the maximum discharge rate from Plot Q will not exceed the approved rate of 721.4l/s.
- 3.14 Considering the downstream infrastructure restricts flows to the equivalent pre-developed runoff rates, prior to ultimately discharging into Stanney Brook, and proposals do not increase flows above the agreed design, the site is considered to fulfil the necessary peak runoff control criteria.

Attenuation Storage

- 3.15 As previously mentioned, attenuation storage is provided in the wider drainage network in Pond 2. A Causeway (Flow) network model of the proposed surface water drainage network for the proposed development has been produced based upon the drainage strategy presented within **Appendix 6**. Results from the critical storms using the Flood Estimation Handbook (FEH) method are included in **Appendix 10**.
- 3.16 Based on the Causeway (Flow) network model outputs, there is no requirements for on-plot attenuation, other than oversized pipes, with the peak discharge rates not exceeding the maximum allowable rates.

- 3.17 Although as climate change allowance wasn't accounted for in the original strategy, attenuation storage for the 40% climate change event has been provided on-site via the pipe network, this includes a combination of 300mm, 375mm, 600mm and 675mm pipes.
- 3.18 The pipe network shows that there is no flooding during the 1 in 30-year event.
- 3.19 During the 100 year plus climate change scenario, simulations identify approximately 13.1m³ flooding located across SWMH9, SWMH10, SWMH11 & SWMH12, these are located within the dock leveller within the service yard. The docks are approximately 1.2m lower than the building finished floor levels, this is included in the external levels design plan (see **Appendix 11**). Considering this, any flood water will be contained in the dock levellers, for a maximum water depth of 100mm for up to 30 minutes, before draining down into the further drainage system, therefore surface water will be contained on-site.

Runoff Volume Control

- 3.20 Due to the proposed increase in impermeable surfacing post-development, the 1 in 100-year 6-hour storm runoff volume from the site will increase as a result of the proposed development.
- 3.21 However, as the runoff rate from the development has been restricted to a modelled and accepted rate and drains into the sitewide drainage system which was designed with an allowance provided for this development, the runoff volume will be managed in a way that does not adversely impact downstream flood risk. Therefore, provision for long term storage is not required.

Sustainable Drainage Systems

- 3.22 A proposed surface water drainage layout is included as **Appendix 6**.
- 3.23 The site drains via existing connections on Michael Faraday Avenue which drains to Pond 2 within the wider site. One SPEL ESR Full Flow Treatment separator (or similar) has been proposed for the service yard and roof, one SPEL ESR Bypass Separator (or similar) for the carpark and one SPEL ESR Full Flow Treatment separator for the external yard have been proposed. These will provide an appropriate level of treatment to runoff from the site, as demonstrated in **Section 3**.
- 3.24 The roof and service yard are drained via linear drains which connect into the wider piped system then through the SPEL ESR Full Flow Treatment separators and orifice plate chambers before discharging into the existing piped network along Michael Faraday Avenue. The carpark is also drained via linear drains which connect into the wider piped system and through the SPEL ESR Bypass Separator and hydrobrake chamber before discharging into the wider piped network. The external service yard is also drained via linear drains which connect into the wider piped system then through the SPEL ESR Full Flow Treatment separator and orifice plate chamber before discharging into the existing piped network along Michael Faraday Avenue.

- 3.25 Although sufficient treatment is provided on-plot via the full retention and bypass separators, further treatment to surface water is provided by Pond 2 at the downstream end of the sitewide drainage network.

Proprietary Treatment Systems

- 3.26 Various types of proprietary treatment systems are available, although the most common are:
- Bioretention in concrete (or other material) structures – filtration using soil or other materials to support plants.
 - Treatment channels designed to collect and treat water rather than convey.
 - Hydrodynamic or vortex separators using gravity and centrifugal force to separate and collect sediments and litter.
 - Proprietary filtration systems to filter water through filter media.
 - Oil separators designed to separate large volumes of oils, silt, and suspended solids from water.
 - Multi process systems which use multiple treatment processes in series.
- 3.27 The use of additional SuDS has been considered when developing the drainage strategy, **Table 3.1** outlines the feasibility consideration and the reasoning for discounting the inclusion of alternative SuDS.

Table 3.1: SuDS Feasibility

SuDS Feature	Main Site	Comments
Infiltration Basin	X	Not viable due to existing ground conditions, comprising made ground (0.2 – 2.3m bgl), soft to firm clay (0.8 – 3.0m bgl) and dense sands and sandy clays (up to 15.45m bgl). Also, several records of shallow groundwater levels during borehole investigations.
Detention Basin	X	Limited capacity in site boundary, although the site will ultimately discharge into Pond 2, included within the wider site's drainage strategy.
Wetlands / Ponds	X	
Swales	X	Limited capacity for inclusion of swales.
Permeable Paving	x	Permeable block paving in car parking bays is not preferred due to the maintenance costs during the development lifetime and due to the use of HGV's in the service yard.
Geo-cellular Storage	✓	Considered suitable, storage in oversized pipes is suitable as an alternative.

SuDS Feature	Main Site	Comments
Filter Strips/Drains	X	Channel drains proposed instead as these are considered to be more suitable due to the development type.
Bioretention Systems / Rain Gardens	x	No suitable space for rain gardens.
Tree Pits	X	No suitable areas for tree pits.
Green Roofs	X	Green roofs will not be feasible for the proposed development.
Rainwater Harvesting	X	Rainwater harvesting is not considered to be sustainable for the use of this development due to insufficient demand.
Proprietary Treatment Separators	✓	Full retention separators are required for the main service yard and roof and a by-pass separator for the office car parking for treatment purposes.

Residual Risk and Designing for Exceedance

- 3.28 In the event that the capacity of the attenuation storage is exceeded, ground levels are profiled towards the linear drains, service yard and car park (see **Appendix 11**).
- 3.29 It should be noted that if storm events in excess of the 1 in 100-year storm plus 40% climate change or blockages occur, there is a residual risk of flood water arising from the site drainage system. To mitigate this risk the drainage system should have regular maintenance. This is further discussed in **Section 4**.
- 3.30 It is recommended that the final layout uses the proposed road infrastructure to provide drainage exceedance (overland flood flow) routes through the development and towards the pond for events in excess of the capacity of the drainage system.

Water Quality

- 3.31 In accordance with the SuDS Manual a simple index approach to water quality risk management should be undertaken for the Proposed Development. This will be compiled to provide a comprehensive account of the water quality treatment provided by the proposed surface water drainage system.
- 3.32 The SuDS Manual Mitigation Index will be used to assess the treatment levels proposed in relation to the pollution hazard posed from the proposed land use(s). This methodology is adopted to ensure that surface water flows receive adequate treatment through all areas of the site prior to the final outfall.
- 3.33 **Table 3.2** shows the pollution hazard indices for the land use classification(s) that are relevant to the proposed development, as described within Table 26.2 in the SuDS Manual.

Table 3.2: Pollution Hazard Indices for Different Land Use Classifications

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Industrial roofs	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Non-residential car parking with frequent change	Medium	0.7	0.6	0.7
Industrial Service Yards	High	0.8	0.8	0.9

3.34 The SuDS Mitigation Indices that are relevant to the proposed development, as described within Table 26.3 of the SuDS Manual, are outlined in **Table 3.3**.

Table 3.3: SuDS Mitigation Indices

Type of SuDS Component	Mitigation Indices		
	TSS	Metals	Hydrocarbons
Proprietary Treatment Systems (i.e. petrol interceptors)	0.8*	0.6*	0.9*
Site Wide Pond	0.7	0.7	0.5

*Based on SPEL ESR Full Flow Treatment System

3.35 The pollution hazard rating and proposed SuDS Mitigation Index for the site is compared within **Table 3.4**. Where more than one SuDS component is proposed, a factor of 0.5 should be applied to the downstream (i.e secondary and/or tertiary) treatment stages to account for the reduced performance due to reduced inflow concentrations.

Table 3.4: Comparison of Pollution Hazard Rating Against Proposed Mitigation Index

Pollution Type	Pollution Hazard Rating	Proposed Mitigation Index	Sufficient Treatment Provided?
Industrial Roof – Petrol Interceptor & Site Wide Pond			
TSS	0.3	1.3	✓
Metals	0.2	1.1	✓
Hydrocarbons	0.05	1.4	✓
Car Park– Petrol Interceptor & Site Wide Pond			
TSS	0.7	1.3	✓
Metals	0.6	1.1	✓
Hydrocarbons	0.7	1.4	✓
Service Yard / External Yard - Petrol Interceptor & Site Wide Pond			
TSS	0.8	1.3	✓
Metals	0.8	1.1	✓
Hydrocarbons	0.9	1.4	✓

- 3.36 Based on the above assessment, the proposed drainage strategy is considered to provide an appropriate level of treatment to surface water prior to discharge from the wider site.

4. MAINTENANCE

- 4.1 An appropriate maintenance company will be appointed by the ultimate site operator who will be responsible for the maintenance of the proposed drainage system. The sitewide drainage system has been adopted by UU (pipe network) and Rochdale Borough Council (Pond 2).
- 4.2 Requirements for ongoing maintenance of the drainage network should form part of an Operation and Maintenance manual for the site and should be undertaken by the site management. Any specialist or proprietary products that are specified at detailed design should have a manufacturer specific maintenance regime which should be included within the document.
- 4.3 It is envisaged that an Operation and Maintenance manual will be developed at the detailed design stage, but some examples are included below.
- All drainage features should be located in open areas which are readily accessible.
 - Gullies and channel drains should be inspected and de-silted at least once a year, where necessary.
 - Pipes, manholes and silt traps should be inspected and de-silted at least once a year, where necessary.
 - Flow Controls should be inspected every 6 months, litter/debris and silt build up should be removed as necessary.
- 4.4 Typical SuDS maintenance activities and schedules, as taken from the CIRIA SuDS Manual for the relevant SuDS proposed in the development are provided below in **Table 4.1**.

Table 4.1 Maintenance of Proprietary Treatment Systems

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter and debris and inspect for sediment oil and grease.	Six monthly
	Change the filter media	As recommended by the manufacturer
	Remove sediment, oil, grease and floatables.	As necessary – indicated by system inspections or immediately following significant spills
Occasional Maintenance	Replace malfunctioning parts or structures	As required
Monitoring	Inspect for evidence of poor operation	Six monthly

Maintenance Schedule	Required Action	Typical Frequency
	Inspect filter media and establish appropriate replacement frequencies	Six monthly
	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly during first six months of operation then every six months

5. FOUL WATER DRAINAGE

- 5.1 The foul water drainage layout for the plot is shown on BWB Dwg No. 244498-BWB-EXT-XX-D-C-0501 which is included as **Appendix 6**.
- 5.2 It is currently proposed that all foul drainage from the development will discharge to the existing 250 mm diameter foul water sewer in Michael Faraday Avenue.
- 5.3 UU have confirmed that all foul drainage from the proposed development can be discharged to the public sewer at an unrestricted rate (**Appendix 2**).
- 5.4 The type and details of the proposed connection will be agreed with UU at the detailed design stage, and a section 106 sewer connection application will be submitted to UU for approval.

6. BREEAM ASSESSMENT

- 6.1 The proposed development is to be designed with consideration to Building Research Establishment Environmental Assessment Method (BREEAM) standards. Within 'Pol 03 Flood and surface water management'⁵ of the BREEAM criteria, there potential for three credits to be awarded under 'surface water management' for the proposed development.
- 6.2 The proposed development is considered to have potential to achieve the surface water runoff credits (two credits available) on the basis of the sitewide drainage system limiting runoff from the Kingsway Business Park to the existing greenfield rates prior to discharging into Stanney Brook. Furthermore, any flooding from the on-plot drainage system will not result in any flooding to properties.
- 6.3 The proposed development is considered to have potential to achieve the minimising watercourse pollution credit (one credit available) through the inclusion of the proprietary treatment system which will contain the first 5mm of rainfall on-plot to be treated prior to discharge into the wider drainage network. Furthermore, the wide attenuation basin will provide further interception losses and treatment of surface water collected from the on-plot drainage system.
- 6.4 The assessment of the potential for achieving the three surface water management credits have been assessed separately to this SDS report within a submitted BREEAM GN38 form.
- 6.5 The remaining Pol03 'Flood Resilience' credits have been reviewed as part of the accompanying FRA (reference: 244498-BWB-ZZ-XX-T-W-0001_FRA).
- 6.6 The SDS and assessment against the BREEAM criteria have been produced and checked by individuals working within a team specialising in flood risk and drainage.

⁵ BREEAM Knowledge Base. Available at: <https://kb.breeam.com/knowledgebase/flood-resilience/> Last accessed: December 2025.

7. SUMMARY

- 7.1 This statement and supporting appendices demonstrate that the drainage design for the development will comply with the relevant local and national standards, specifically the hierarchy of discharge, runoff rate and volume criterion.
- 7.2 This SDS is intended to support a full planning application and as such the level of detail included is commensurate and subject to the nature of the proposals.

APPENDICES

Appendix 1: Correspondence with Rochdale Borough Council

Hello Rowan,

Thanks for sending comprehensive Drainage Model information and documentation on the Kingsway Industrial Site via large file transfer. I have downloaded them.

I have spent some time reviewing the Drainage Designs which discharge the Kingsway Plots to the ponds, both when new sites are submitted for Planning and also when looking at the overall design done by BWB. I have also looked at the Microdrainage models developed by BWB and saved them on the Rochdale Drainage dept. folder.

As such, I can confirm that, to the best of my knowledge, the plot flow rates given on BWB's Plan and Tables sheet ref. KBP-BWB-ZZ-XX-DR-CD-0005, Rev: P01, dated: 03/07/2023 are suitable for use when additional Kingsway (Milnrow) plots come forward for development. As explained in the BWB documentation:-

- the plot surface water flow rates are based upon each plot discharging all flows for storms up to 1 in 100 year storm events without attenuation, and
- only the additional 40% climate change rainwater allowance needs to be accommodated by extra storage on each plot site.

regards

Stephen McCann

Drainage & Flooding Engineer

Network Improvement/Development/Flooding



 [01706 924606](tel:01706924606)

 [07552 570262](tel:07552570262)

 stephen.mccann@rochdale.gov.uk

Rochdale Borough Council
Floor 2, Number One Riverside
Smith Street, Rochdale, OL16 1XU

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From: Rowan Jobling <Rowan.Jobling@bwbconsulting.com>

Sent: 07 July 2023 16:17

To: seweradoptions@uuplc.co.uk; Stephen McCann <Stephen.McCann@Rochdale.Gov.UK>

Cc: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>; David Gray <David.Gray@bwbconsulting.com>

Subject: Kingsway Site Wide Modelled Flow Rates

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Hi Stephen, Mohammed,

Good to speak with you both.

As discussed, we have now produced the attached drawing which is based on the modelling work that was previously submitted. The flow rates shown on the drawing are the peak rate for the 100yr storm event without climate change and hence any plot coming forward should be restricted to the rate identified on this drawing.

Please could you both review and confirm acceptance of the drawing. If it would help then we are happy to set up a call to run through any queries, please advise on availability if required.

Regards

Rowan Jobling

Senior Engineer | BWB Consulting Limited

5th Floor, Waterfront House, Station Street, Nottingham, NG2 3DQ

M 07384 810148 **W** www.bwbconsulting.com



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Appendix 2: Correspondence with United Utilities

From: seweradoptions@uuplc.co.uk
To: [Rowan Jobling](#)
Subject: RE: Kingsway Site Wide Modelled Flow Rates - UU REF: 04306456
Sent: 20/07/2023 10:23:27

This email originated from outside of our organisation. Please exercise caution with content, links and attachments.

Good morning Rowan,

After reviewing the provided document, drawing number: KBP-BWB-ZZ-XX-DR-CD-0005, Rev: P01, dated: 03/07/2023, prepared by BWB. I confirm that this drawing and table are acceptable to United Utilities to be used as a reference for all future plots.

- The discharge rates stated in the document are the maximum rates that can be accommodated within the adopted surface water network for each plot.
- The flow rates are for storms up to 1 in 100-year storm events without attenuation, where the 40% climate change needs to be accommodated by extra storage on each plot site.

This document is saved on ICS case number: 04306456 with all the related correspondence with LLFA for reference and guidance.

Kind regards,

Mohammed Aljafarawi (He/Him)
Developer Engineer
Developer Services & Metering
Customer Services
M: 07950474499
unitedutilities.com

----- Original Message -----

From: Rowan Jobling [rowan.jobling@bwbconsulting.com]

Sent: 07/07/2023 16:19

To: seweradoptions@uuplc.co.uk

Cc: wastewaterdeveloperservices@uuplc.co.uk

Subject: FW: Kingsway Site Wide Modelled Flow Rates

Hi Mohammed,

Good to speak with you.

As discussed, we have now produced the attached drawing which is based on the modelling work that was previously submitted. The flow rates shown on the drawing are the peak rate for the 100yr storm event without climate change and hence any plot coming forward should be restricted to the rate identified on this drawing.

Please could you both review and confirm acceptance of the drawing. If it would help then we are happy to set up a call to run through any queries, please advise on availability if required.

Regards

Rowan Jobling

Senior Engineer | BWB Consulting Limited

5th Floor, Waterfront House, Station Street, Nottingham, NG2 3DQ

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Appendix 3: NorthWest SuDS Proforma

NORTH WEST SuDS PRO-FORMA

This pro-forma is a requirement for any planning application for major development.

It supports applicants in summarising and confirming how surface water from a development will be managed sustainably under current and future conditions.

Your sustainable drainage system should be designed in accordance with [CIRIA The SuDS Manual C753](#) and any necessary adoption standards.

HOW TO COMPLETE

Blue Box	Instruction/ Question
Orange Box	Evidence Required
White Box	To be completed by Developer / Consultant

1. Complete ALL white boxes
2. Submit this pro-forma to the Local Planning Authority, along with:
 - Sustainable Drainage Strategy
 - Site Specific Flood Risk Assessment (if required)
 - Minimum supporting evidence, as indicated in orange boxes of this pro-forma.

GUIDANCE TO SUPPORT YOU

The pro-forma should be completed in conjunction with ‘Completing your SuDS Pro Forma Guide.’

The pro-forma can be completed using freely available tools such as [Tools for Sustainable Drainage Systems](#) or appropriate industry standard surface water management design software.

SECTION 1. APPLICATION & DEVELOPMENT DETAILS

Planning Application Reference <i>(if available)</i>		
State type of planning application <i>i.e. Pre-application, Outline, Full, Hybrid, Reserved Matters*</i> *Information only required if drainage is to be considered as part of reserved matters application	Full	
Developer(s) Name:	Wilson Bowden Developments	
Consultant(s) Name:	BWB Consulting Ltd	
Development Address <i>(including postcode)</i>	Plot Q, Kingsway Business Park, OL16 4FX	
Development Grid Reference <i>(Eastings/Northings)</i>	391906, 412474	
Total Development Site Area (Ha)	2.86ha	
Drained Area (Ha)* of Development	2.26ha	
Please indicate the flood zone that your development is in. Tick all that apply. <i>Based on the Environment Agency Flood Map for Planning and the relevant Local Authority Strategic Flood Risk Assessment (to identify Flood Zones 3a/3b).</i>	Flood Zone 1 ☒ Flood Zone 2 ☐ Flood Zone 3a ☐ Flood Zone 3b ☐	
What is the surface water risk of the site? Tick all that apply. <i>Based on the Environment Agency Surface Water Flood Map.</i>	High ☐ Medium ☐ Low ☒	
Have you submitted a Site Specific Flood Risk Assessment (FRA)? <i>See separate guidance notes for clarification on when a FRA is required</i>	Yes ☒ No ☐	
Have you submitted a Sustainable Drainage Strategy?	Yes ☒ No ☐	
Does your drainage proposal provide multi-functional benefits via SuDS?	Yes ☒ No ☐	
Expected Lifetime of Development <i>(years)</i> <i>Refer to Planning Practice Guidance "Flood Risk and Coastal Change" Paragraph 026</i>	75 years	
Development Type:		State Proposed Number of Units
Greenfield Site Site is wholly undeveloped, and a new drainage system will be installed	☒	
Previously Developed/ Brownfield Site - Site is already developed, and the <u>entirety</u> of the existing surface water drainage system will be used to serve the new development (evidence must be provided to prove existing surface water drainage system is reusable); OR - Where records of the previously developed system are not available so that the hydraulic characteristics of the system cannot be determined or where the drainage system is not in reasonable working order i.e. broken, blocked or no longer operational for other reasons, then one of the approaches outlined in Section 24.5 of The SuDS Manual (C753) should be adopted.	☐	
Please list any relevant document and or drawing numbers (including revision reference) to support your answers to Section 1.	FRA & SDS	

SECTION 2: IMPERMEABLE AREA AND EXISTING DRAINAGE

	Existing (E)	Proposed (P)	Change (P – E)
State Impermeable Area (Ha)	0	2.26ha	2.26ha
Evidence Required: Plans showing development layout of site with existing and proposed impermeable areas.			☒

Are there existing sewers, watercourses, water bodies, highway drains, soakaways or filter drains on the site?	Yes ☐ No ☒ Don't Know ☐
Evidence Required: Plan(s) showing existing layout to include all: • Watercourses, open and culverted • Water bodies – ponds, swales etc. • Sewers, including manholes • Highway drains, include manholes, gullies etc. • Infiltration features - soakaways, filter drains etc.	☒

Drainage Design <i>Outline planning applications should be able to demonstrate that a suitable drainage system is achievable.</i> <i>All other type of planning application should provide full details or reference to previous planning application where drainage details have been submitted or approved.</i>		
Select which design approach you are taking to manage water quantity (refer to Section 3.3 SuDS Manual)		
Approach 1 – Volume control / Long Term Storage (Technical Standards S2/3, S4/5) <i>The attenuated runoff volume for the 1 in 100 year 6 hour event (plus climate change allowance) is limited to the greenfield runoff volume for the 1 in 100 year 6 hour event, with any additional runoff volume utilising long term storage and either infiltrated or released at 2 l/s/ha</i> <i>The discharge rate for the critical duration 1 in 1 year event is restricted to the 1 in 1 year greenfield runoff rate</i> <i>The discharge rate for the critical duration 1 in 100 year event (plus climate change allowance) is restricted to the 1 in 100 year greenfield runoff rate</i>	☐	
Approach 2 – Qbar (Technical Standards S6) <i>Justification has been provided that the provision of volume control/long term storage is not appropriate and an attenuation only approach is proposed. All events up to the critical duration 1 in 100 year event (plus climate change allowance) are limited to Qbar (1 in 2 year greenfield rate) or 2 l/s/ha, whichever is greater.</i>	☒	
Evidence Required: Plans showing: - Existing flow routes and flood risks - Modified flow routes - Contributing and impermeable areas - Current (if any) and proposed ‘source control’ and ‘management train’ locations of sustainable drainage components (C753 Chapter 7) - Details of drainage ownership - Details of exceedance routes (Technical Standards S9) - Topographic survey - Locations and number of existing and proposed discharge points <i>Note consideration should be given to manage surface water from both impermeable and permeable surfaces (including gardens and verges) likely to enter the drainage system.</i>		☒

Please list any relevant document and or drawing numbers (including revision reference) to support your answers to Section 2.	SDS
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SECTION 3: PEAK RUNOFF RATES – TECHNICAL STANDARDS S2, S3 AND S6 (UNLESS S1 APPLIES)

Rainfall Event	Existing Rate (l/s)	Greenfield Rate (l/s)	Proposed Rate (l/s) <i>Previously developed sites - In line with S3 should be equivalent to Greenfield runoff rates – discuss with LLFA if this is not achievable pre-application</i>
Qbar (Approach 2)	Proposed flow rates have been set to discharge at no greater than the 1 in 100yr event in line with the wider strategy. Downstream controls restrict the entire development to the equivalent greenfield rates on a catchment basis.		
1 in 1 Year Event (Approach 1)			
1 in 30 Year Event			
1 in 100 Year Event* (Approach 1)			
* Total discharge at the 1 in 100 year rate should be restricted to the greenfield runoff volume for the 1 in 100 Year 6 hour event with additional volumes (long-term storage volume) released at a rate no greater than 2 l/s/ha where infiltration is not possible. The climate change allowance should only be applied to the proposed rate and not the existing or greenfield rate.			
Evidence Required: Methodology used to calculate peak runoff rate clearly stated and justified. Impermeable areas plan, supported by topographical survey confirming positive drainage. Hydraulic calculations and details of software used.			☒ ☒ ☒

State the hydraulic method used in your calculations <i>(Refer to Table 24.1 of The SuDS Manual)</i>	IH124
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Please list any relevant document and or drawing numbers (including revision reference) to support your answers to Section 3.	SDS
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SECTION 4: DISCHARGE VOLUME – TECHNICAL STANDARDS S4, S5 AND S6 (UNLESS S1 APPLIES)

Rainfall Event	Existing Volume (m ³)	Greenfield Volume (m ³)	Proposed Volume (m ³)
1 in 100 Year 6 Hour Event (Approach 1)	199	199	Proposed is an increase on existing.
Does the below statement apply to your development proposal? Long term storage is not achievable on this site and, in accordance with S6 of the Non Statutory Technical Standards for SuDS, the surface water discharge rates for events up to and including the 1 in 100 year critical event are limited to Qbar (Approach 2)			Yes ☒ No ☐
Evidence Required: Approach to managing the quantity of surface water leaving the site clearly stated and justified Methodology used to calculate discharge volume clearly stated and justified. Hydraulic calculations and details of software used.			☒ ☒ ☒

Please list any relevant document and or drawing numbers (including revision reference) to support your answers to Section 4.	SDS
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SECTION 5: STORAGE – TECHNICAL STANDARDS S7 AND S8

State climate change allowance used (%)	40
State housing density (houses per ha)	0
State urban creep allowance used (%)	0
Evidence Required: State / used in appropriate industry standard surface water management design software.	☒

State storage volume required (m³) (excluding non-void spaces) <i>Must include an allowance for climate change and urban creep</i>	Sufficient storage provided within proposed sewer network & manholes
Have you incorporated interception into your design? <i>(Refer to Chapter 24 of The SuDS Manual C753)</i> <i>Where possible, infiltration or other techniques are to be used to try and achieve zero discharge to receiving waters for rainfall depths up to 5mm.</i>	Yes ☐ No ☒
Evidence Required: Drainage plans showing location of attenuation and all flow control devices and supporting calculations.	☒

Summarise how storage will be provided for 1 in 30 year event on site. <i>Storage must be designed to ensure that at no flooding occurs onsite in a 1 in 30 year event except in designed areas and no flooding occurs offsite in a 1 in 100 year (plus climate change allowance) event.</i>	Sufficient storage provided within proposed sewer network & manholes
Summarise how storage will be provided for 1 in 100 year (plus climate change) event on site. <i>Where storage above the 1 in 30 year rainfall event is provided in designated areas designed to accommodate excess surface water volumes, plans showing storage locations and surface water depths and supported by calculations used in appropriate industry standard surface water management design software. It is important to run a range of duration events to ensure the worst case condition is found for each drainage element on the site</i>	Sufficient storage provided within proposed sewer network & manholes
Evidence Required: Plans showing size and location of storage and supporting calculations. Where there is controlled flooding, extents and depths must be indicated.	☒

Please list any relevant document and or drawing numbers (including revision reference) to support your answers to Section 5.	SDS
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SECTION 6: WATER QUALITY PROTECTION

Contaminated surface water run-off can have negative impacts on the quality of receiving water bodies. The potential level of contamination will influence final the design of an appropriate treatment train as part of your sustainable drainage system.

Is the proposal site known to be or potentially contaminated?	Yes ☐	No ☒
If the site is contaminated, it should be demonstrated that the sustainable drainage system will not increase the risk of pollution to controlled waters through the mobilisation of contaminants and/or creation of new pollution pathways.		

Confirm the Pollution Hazard Level of the proposed development - Tick ALL that apply		
Refer to Pollution Hazard Indices for different Land Use Classifications in Table 26.2 of The SuDS Manual C753 for further guidance.		
Pollution Hazard Level Tick ALL that apply	Surface water run-off from the proposed development will drain from:	
VERY LOW	☐	Residential roofs
LOW	☒	- Other roofs (typically commercial/industrial roofs) - Individual property driveways, residential car parks, low traffic roads (e.g. cul de sacs, home-zones and general access roads) - Non-residential car parking with infrequent change (e.g. schools, offices) i.e. < 300 traffic movements/day
MEDIUM	☒	- Commercial yard and delivery areas - Non-residential car parking with frequent change (e.g. hospitals, retail) - All roads except low traffic roads and trunk roads/motorways¹
HIGH	☒	- Sites with heavy pollution (e.g. haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites) - Sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured - Industrial sites - Trunk roads and motorways¹

If the development's Pollution Hazard Level is 'Very Low' or 'Low', has the sustainable drainage design been risk assessed and appropriate mitigation measures included?	Yes ☒	No ☐
If the proposed development has a very low or low polluting potential, you should design your sustainable drainage system to include an appropriate treatment train in accordance with The SuDS Manual (C753).		

If the development's Pollution Hazard Level is 'Medium' or 'High', is the application supported by a detailed water quality risk assessment?	Yes ☒	No ☐
- If the proposed development has a high polluting potential, a detailed risk assessment <i>will</i> be required to identify an appropriate SuDS treatment train and ensure compliance with Paragraph 170 of the National Planning Policy Framework. - If the proposed development has a medium polluting potential, a detailed risk assessment <i>may</i> be required depending on the nature, scale and location of the development.		

Has pre-application advice on water quality been obtained from the Environment Agency?	Yes ☐	No ☒
If YES, provide details:		

Please list any relevant document and or drawing numbers (including revision reference) to support your answers to Section 6.	
---	--

¹ Motorways and trunk roads should follow the guidance and risk assessment process set out in Highways Agency (2009).

SECTION 7: DETAILS OF YOUR SUSTAINABLE DRAINAGE SYSTEM

a) Function of your Sustainable Drainage System

Do your proposals store rainwater for later use (as a resource)?	Yes ☐ No ☒
Evidence Required: Please provide a brief sentence in the adjacent white box to describe how this function has been achieved.	
Do your proposals promote source control to manage rainfall close to where it falls? (e.g. promoting natural losses through soakage, infiltration and evapotranspiration)	Yes ☐ No ☒
Evidence Required: Please provide a brief sentence in the adjacent white box to describe how this function has been achieved.	Flows leaving the site will be lower than the allowable rate into the UU network
Please list any relevant document and or drawing numbers (including revision reference) to support your answers to Section 7a.	SDS

b) Hierarchy of Drainage Options – Planning Practice Guidance

The proposed method of discharge are set out within order of priority. Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable.

Proposed method of surface water discharge		Is this proposed?	
Hierarchy Level 1: Into the ground (via infiltration)		Yes ☐ No ☒	
If YES - Evidence Required		If NO – Evidence Required Tick ALL that apply	
☐	A. Completed Infiltration Checklist from The SuDS Manual (C753) Appendix B <i>An editable version of this form is available on SusDrain website.</i>	☒	A. Site investigation to demonstrate that the ground is not free draining. Test results to be provided in accordance with: - The methodology within BRE 365 (2016), OR - Falling head permeability tests BS EN ISO 22282-2: 2012
☐	B. British Geological Survey (BGS) Infiltration SuDS Map	☒	B. NOTE: where an applicant is unable to access a site to undertake testing, e.g. where unable to access a site for an outline application, they can submit a SuDS GeoReport or similar.
☐	C. Infiltration testing to BRE 365 (2016) or falling head permeability tests to BS EN ISO 2228-2: 2012 (optional for outline)	☒	C. Evidence to confirm that infiltration to ground would result in a risk of deterioration to ground water quality.
☐	'Plan B' sustainable drainage plan and statement of approach with an alternative discharge method, in case infiltration proposals are proven not feasible upon further site specific ground investigation e.g. to consider seasonal variations to groundwater.	☒	D. Geotechnical advice from a competent person* which determines that infiltration of water to ground would pose an unacceptable risk of geohazards to the site and/or local area. <i>*Note: Competent person may include a Chartered Engineer, Chartered Geologists, Registered Ground Engineering Professionals (RoGEP).</i>

Proposed method of surface water discharge		Is this proposed?	
Hierarchy Level 2: To a surface water body <i>(select type)</i> NOTE: Consent from LLFA or Permit from Environment Agency may be required – refer to guidance		Yes ☒ No ☐ N/A ☐	
		☒ Main river ☐ Ordinary watercourse	☐ Canal ☐ Other water body
If YES - Evidence Required		If NO – Evidence Required Tick <u>ALL</u> that apply	
☒ Surface water body / watercourse survey and report	☐ Plan showing nearby watercourses and waterbodies AND ☐ Statement providing justification in your Sustainable Drainage Strategy Note: Where third party land is cited as a barrier, you should provide visibility of discussions held to date with the riparian landowner of the waterbody.		

Proposed method of surface water discharge		Is this proposed?	
Hierarchy Level 3: To a surface water sewer or highway drain <i>(select type)</i>		Yes ☒ No ☐ N/A ☐	
		☒ Surface water sewer	☐ Highway drain
If YES - Evidence Required		If NO – Evidence Required Tick <u>ALL</u> that apply	
☒ Written correspondence from Water and Sewerage Company/ Highway Authority regarding proposed connection.	☐ Plan showing nearby sewers and highway drains AND ☐ Statement providing justification in your Sustainable Drainage Strategy		

Proposed method of surface water discharge		Is this proposed?	
Hierarchy Level 4: To combined sewer		Yes ☐ No ☐ N/A ☒	
If YES - Evidence Required		If NO – Evidence Required	
☐ Written correspondence from Water and Sewerage Company	N/A		

Please list any relevant document and or drawing numbers (including revision reference) to support your answers to Section 7b.	
--	--

c) Proposed SuDS Component Types

	Tick ALL that apply				
Within property boundary	☐ Rainwater harvesting	☐ Green/ blue roofs	☐ Pervious pavements [Type: A ☐ B ☐ C ☐	☐ Soakaway	☐ Bio retention systems

	Tick ALL that apply				
Within development site boundary (not property)	☐ Infiltration system [Type: ☐ Surface level ☐ Below ground]		☐ Filter strips	☐ Filter drains	☐ Swales
	☐ Bio retention system	☐ Detention basins	☐ Ponds and wetlands	☒ Attenuation tanks/ Oversized pipes	☒ Other (state below)
	If 'Other' please state: Due to the nature of the development, a separator is proposed to treat flows from the higher risk areas				

Off site (not within the boundary of the proposed development)	Please state: Further treatment, flow and volume control is provided by the downstream attenuation pond prior to discharging into the wider catchment
--	---

I confirm that the above selected components have been designed in accordance with The SuDS Manual (C753).	I confirm ☒
I confirm that the management of flows resulting from rainfall in excess of a 1 in 100 year plus climate change rainfall event, and their exceedance route(s), has been fully considered in order to minimise the risks to people, property (new and existing) and infrastructure.	I confirm ☒

Please list any relevant document and or drawing numbers (including revision reference) to support your answers to Section 7c.	SDS
--	-----

SECTION 8: OPERATION AND MAINTENANCE – TECHNICAL STANDARD S12 AND NATIONAL PLANNING POLICY FRAMEWORK

The applicant is responsible to ensure that ALL components selected in Section 7 can be maintained for the design life of the development. This information is required so the Local Planning Authority can ensure the maintenance and management of the sustainable drainage system. The Local Planning Authority will discuss how this will be secured (e.g. via planning condition or planning obligation).

	Information Provided?
Management Plan	Yes ☒ No ☐
Evidence Required: Plan/ drawing provided to show the position of the different SuDS components with: - Key included to identify any of the adopting bodies that you will be offering your sustainable drainage components for adoption (<i>relates to maintenance and management arrangements below</i>). - Plan/ drawing to identify any areas where certain activities are prohibited, detailing reasons why.	☐
Action plan for accidental pollutant spillages.	☐

	Information Provided?
Maintenance Schedule	Yes ☒ No ☐
Evidence Required: A copy of the maintenance schedule including: Proactive and preventative maintenance Detailing regular, occasional and remedial maintenance activities including recommendations for inspection and monitoring. This should include recommended frequencies, advice on plant/ machinery required and an explanation of the objectives for the maintenance proposed and potential implications of not meeting them. Reactive and corrective maintenance (e.g. product repair and replacement). Including advice on excavations, or similar works, in locations that could affect the SuDS components/ adjacent structures.	☐

	Information Provided?
Maintenance and Management Arrangements	Yes ☒ No ☐
Evidence Required: Evidence of formal agreement with the party responsible for undertaking maintenance. Please select any of the adopting bodies that you will be offering your sustainable drainage components for adoption. Tick all that apply. ☐ Water and Sewerage Company <i>Section 104 agreement (Water Industry Act 1991)</i> ☐ Highway Authority <i>Section 278/38 agreement (Highways Act 1980)</i> ☐ Local Authority Public Open Space <i>[Refer to Local Authority Policy]</i> Please select the arrangement(s) for all non-adopted sustainable drainage components. Tick all that apply. ☐ Management Company ☐ Property Owner <i>(for SuDS components within property boundary only)</i> ☐ Other (please state) 	☐

Please list any relevant document and or drawing numbers (including revision reference) to support your answers to Section 8.	SDS
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DECLARATION AND SUBMISSION

This pro-forma has been completed using evidence from information which has been submitted with the planning application.

The information submitted in the Sustainable Drainage Strategy and site-specific Flood Risk Assessment (FRA), where submitted, is proportionate to the site conditions, flood risks and magnitude of development and I agree that this information can be used as evidence to this sustainable drainage approach.

Submitter Details			
Completed by	T. Webb-Jones	Email Address	tess.webb-jones@ bwbconsulting.com
		Telephone Number(s)	0776512863
Signed off by	APPROVED Matthew.Bailey , 28/05/2026, 14:44:55	Accreditation(s) and/or Qualification(s) of Signatory	Senior Engineer BSc (Hons)
Date (dd/mm/yyyy)	28/05/2026	Company	BWB Consulting Ltd

Client Details			
Name	Darren Clark	Company	Wilson Bowden Developments

Appendix 4: Topographical Survey



- Notes**
1. Do not scale this drawing. All dimensions must be checked/verified on site. If in doubt ask.
 2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
 3. All dimensions in metres unless noted otherwise. All levels in metres unless noted otherwise.
 4. Any discrepancies noted on site are to be reported to the engineer immediately.
 5. No scale factor has been applied to this survey, therefore the OS coordinates are to be treated as arbitrary. Please refer to survey station information below for on site control establishment.
 6. All coordinates and height data relate to OSGB36(15). Control stations are coordinated by means of GPS receiving real time corrections via OS smart net.
 7. All manhole data is collected from ground level therefore discrepancies may occur. More accurate data is only achievable via confined space entry.
 8. OS license number: 100022432

Key Plan



Legend

- OS Buildings**
- Surveyed Buildings
 - Building
 - Wall
 - Kerb Channel Line
 - Top of Kerb
 - Edge of Surface
 - Top of Bank
 - Bottom of Bank
 - Canopy / Overhang
 - Line Marking
 - Centre Line
 - Watercourse
 - Centre Line
 - Barrier
 - Fence
 - Gate
 - Overhead Powerline
 - Overhead Utilities
- Contour Lines**
- Flow direction and pipe diameter
 - Station and Name
 - Monitoring Borehole
 - Tree / Bush / Sailing
 - Area of Vegetation/ Extent of Tree Canopy
 - Hedge
 - Body of Water
 - Body of Water from OS
 - Spot Level
 - Assumed Surface
 - Water Drainage Line
 - Surface Water Drainage Line
- AP** Anchor Point **FBW** Fence Barbed Wire **LB** Litter Bin
BO Back Gully **FCB** Fence Closed Board **LP** Lamp Post
BO Bollard **FCL** Fence Chain Link **MP** Manhole
BS Bus Stop **FEL** Fence Electric **MV** Service Marker
BT British Telecom **FMP** Fence Metal Panel **PS** Fuel Box
C Crest **FMR** Fence Metal Railing **PT** Post
CL Cover Level **FOS** Fence Open Board **RE** Roadside Eye
CMP Cable Marker **FPW** Fence Post & Wire **SP** Sign Post
Post **FSP** Fence Steel Palisade **ST** Stop Tap
CCTV Security Camera **FVM** Fence Wire Mesh **SV** Stop Valve
Cable TV **PFL** Finished Floor Level **TCB** Telephone
FP Flagpole **Coil Box**
OK Drop Kerb **Gas** Gas **THL** Threshold Level
TL Traffic Light
DP Down Pipe **Gy** Gully **TP** Telegraph Post
ELC Electric **HL** Height **TS** Traffic Signal
EP Electricity Post **IC** Inspection Chamber **UTS** Unable to Survey
ER Earth Road **IFL** Internal Floor Level **WL** Water Level
FL Fire Hydrant **IL** Invert Level **WM** Water Meter
FL Floodlight **W** (as a reduced level) **WO** Wash Out

Station Coordinates			
Station Name	Eastings (m)	Northings (m)	Height (m)
KLR3	391959.350	412466.631	150.886
KLR4	391914.916	412557.217	149.889
KLR5	391879.085	412596.623	148.854

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Notes

1. Do not scale this drawing. All dimensions must be checked/verified on site. If in doubt ask.

2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.

3. All dimensions in metres unless noted otherwise. All levels in metres unless noted otherwise.

4. Any discrepancies noted on site are to be reported to the engineer immediately.

5. No scale factor has been applied to this survey, therefore the OS coordinates are to be treated as arbitrary. Please refer to survey station information below for on site control establishment.

6. All coordinates and height data relate to OSGB36(15). Control stations are coordinated by means of GPS receiving real time corrections via OS smart net.

7. All manhole data is collected from ground level therefore discrepancies may occur. More accurate data is only achievable via confined space entry.

8. OS license number: 100022432

Key Plan

Legend

OS Buildings

Surveyed Buildings

Building

Wall

Kerb Channel Line

Top of Kerb

Edge of Surface

Top of Bank

Bottom of Bank

Canopy / Overhang

Line Marking

Centre Line

Watercourse

Centre Line

Barrier

Fence

Gate

Overhead Powerline

Overhead Utilities

Contour Lines

Inspection Chamber

Flow direction and pipe diameter

Station and Name

Monitoring Borehole

Tree / Bush / Shrub

Area of Vegetation / Extent of Tree Canopy

Hedge

Body of Water

Body of Water from OS

Spot Level

Assumed Surface

Water Drainage Line

Surface Water Drainage Line

AP Anchor Point

BO Back Gully

BO Borehole

BS Bus Stop

BT British Telecom

C Canal

CMP Cable Marker

CCTV/Security Camera

CTV Cable TV

DC Drainage

DK Drop Kerb

DP Down Pipe

Elec Electric

EP Electricity Post

FL Floodlight

FBW Fence Barbed Wire

FCB Fence Closed Board

FCL Fence Chain Link

FEL Fence Electric

FMP Fence Metal Panel

C Crest

FMR Fence Metal Railing

FOP Fence Open Panel

FPW Fence Post & Wire

FVM Fence Wire Mesh

FPL Finished Floor Level

FP Flagpole

Gas Gas

OV Gas Valve

Gy Gully

HL Height

IC Inspection Chamber

IPL Internal Floor Level

IL Invert Level

LB Litter Bin

LP Lamp Post

MH Manhole

MV Service Marker

PS Fuel Box

PT Post

RE Roofing Edge

SP Sign Post

SV Stop Valve

TCB Telephone

THL Threshold Level

TL Traffic Light

TP Telegraph Post

TS Traffic Signal

UTS Unable to Survey

WL Water Level

WM Water Meter

WO Wash Out

Station Coordinates

Station Name	Eastings (m)	Northings (m)	Height (m)
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KLR4	391914.916	412557.217	149.889
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P1 29.10.24 First Issue

PQ 88

Rev Date Details of issue / revision

Dwg Rev

Issues & Revisions

Birmingham

| 0121 233 3322

Leeds

| 0113 233 8000

London

| 020 7407 3879

Manchester

| 0161 233 4280

Nottingham

| 0115 924 1100

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Client

Wilson Bowden Developments Ltd

Project Title

Plot P2 + Q

Drawing Title

Existing Site Plan Sheet 2 of 2

Drawn: P Quetch

Reviewed: S Shreeves

BWB Ref: 244497

Date: 29.10.24

Scale: A0: 1:500

Drawing Status

Information

Project - Originator - Zone - Level - Type - Role - Number

Status Rev

244497-BWB-00-02-DR-G-0001 S2 P1



Appendix 5: As Built Drainage Study

Project Name	Kingsway Business Park		
Document Number	KBP-BWB-ZZ-XX-RP-CD-0003	Job Number	NTW2889
Author	M. Bailey	Status	S2
Checked	R. Jobling	Revision	P1
Approved	D. Gray	Date	28-01-2022

Introduction

BWB Consulting Ltd (BWB) has been appointed by Wilson Bowden Developments Ltd (the Client) to undertake a drainage network modelling exercise of the existing surface water drainage networks serving Kingsway Business Park, Rochdale.

The drainage strategy across the site is split into three distinct catchments (as shown on **Figure 1.1**), all served by separate piped systems discharging to separate attenuation features. The existing drainage was constructed in 1999 and is understood to have been designed to accommodate the 1 in 100-year storm event for all future plots across the business park.

This Technical Note is dedicated solely to the drainage network that discharges into "Pond 2" prior to flows being discharged at a restricted rate to Stanney Brook, hereafter referred to as "Catchment 2", which is located within the northern extent of the Kingsway Business Park.

This study aims to model the existing Catchment 2 drainage network (using MicroDrainage 2019.1 software) based on the as-built information. The performance of the network and attenuation pond will be assessed in order to verify the drainage strategies that have been / will be used across the business park and to facilitate the drainage of each individual plot.

This technical note will outline the following:

- The sources of data used to create the network model;
- The design parameters used to create the network model;
- The assumptions used to create the model where information is incomplete/missing;
- The results of key storm simulations; and
- Conclusions and recommendations.

This study has been based upon the most up-to date and readily available information at the time of writing.

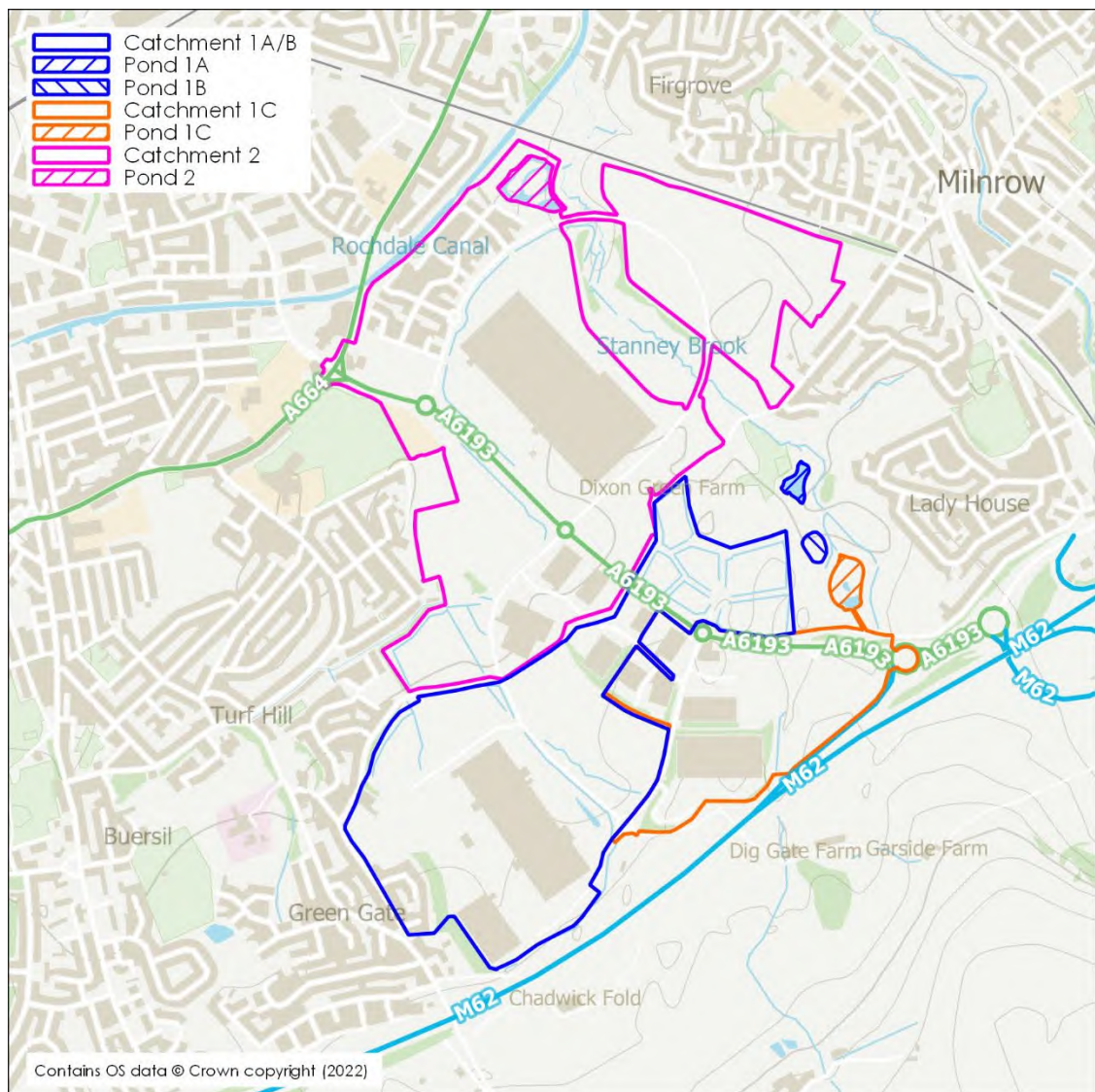


Figure 1.1: Business Park overall indicative catchments and attenuation ponds.

Sources of Information

The following sources on information have been used to recreate/remodel the Catchment 2 drainage network:

- BWB Drainage Adoptions Plan (Sheet 1 of 3; ref: LDH/037/510).
- BWB Drainage Adoptions Plan (Sheet 2 of 3; ref: LDH/037/511).
- White Young Green (WYG) Composite S104 Colourised Drawing Phases 1 and 2 – Flows to Pond 1A (ref: A030095_01-010).
- WYG Pond Area 2 – Flow Control and Outlet from Attenuation Area 2 Cross Section (D-8-003_AB1).
- WYG Attenuation Pond 2 Layout Plan (D-07-001_AB1).
- Kingsway Business Park, Rochdale, United Utilities Adoptable Drainage, Quality File, (dated 29.10.07).
- Kingsway Business Park, Rochdale, Spine / Loop Road (Section 38), Quality File, (dated 29.10.07).
- Kingsway Business Park, Rochdale, United Utilities Adoptable Drainage, Health & Safety File, (dated 29.10.07).
- DLA Architecture Illustrative Masterplan dated 26/04/18 (ref: 2010-095/1826).
- BWB Plot M Sustainable Drainage Statement 'KPM-BWB-ZZ-XX-RP-CD-0001_SDS'.
- BWB Plot N Proposed Surface and Foul Water Drainage Layout Construction Record 'KBP-BWB-HDG-ZN-DR-D-0500'.
- BWB Plot T, JD Sports Extension Drainage Layout Construction Issue 'KBT-BWB-HDG-XX-DR-D-500/505'.

The impermeable areas used within the network model have been taken from the latest Masterplan for the wider Rochdale Business Park provided to BWB (dated 26/04/2018). The source of each contributing impermeable area used within the network model is illustrated on the Assumed Contributing Areas Catchment Plan presented as **Appendix A**.

All highways contributing areas have been assumed to be 100% of the measured area as shown in **Appendix A**.

The contributing areas for plots L, N, O, P1, P2, P3, Q, R, T1, T2, U2, V AND X have been assumed to be 90% of the measured area as shown in **Appendix A**.

The contributing areas for Plots S and U2 have been assumed to be 65% of the measured area as shown in **Appendix A**.

The contributing areas for Plot M have been taken from BWB Sustainable Drainage Statement 'KPM-BWB-ZZ-XX-RP-CD-0001_SDS'. The areas used for Plot M are provided on the contributing areas catchments drawing within **Appendix A**.

Design Parameters & Assumptions

The drainage network model created within this study uses the following parameters:

- All manhole coordinates taken from BWB & WYG S104 Agreement Drawings.
- All manhole cover and invert levels taken from WYG S104 Agreement Drawings, 'UU Adoptions Drainage Quality File' and 'Spine / Loop Road (Section 38) Quality File'. Where 'As-built' cover level information was not available assumed cover levels have been selected using 2020 1m spatial resolution Digital Terrain Model (DTM) Light Detection and Ranging (LiDAR) data.
- Pond 2 has been recreated using information from WYG Attenuation Pond 2 Layout Plan (D-07-001_AB1)*.
- The online flow control structure recreated for the network model has been specified using information from 'Flow Control and Outlet from Attenuation Area 2 Cross Section (D-8-003_AB1)'. See **Figure 1.2**, overleaf for an extract of this control structure.
- The contributing areas for each plot have been directly inputted into the relevant network model node 'stub connection' for each plot as shown on the BWB, WYG S104 Agreement Plans and the Assumed Contributing Areas Plan within **Appendix A**.
- The contributing areas for all highways drainage have either been spread out evenly across the nearest relevant network model nodes that are located within the highways, or where a specific connection into the drainage network is shown on the BWB & WYG S104 Agreement Drawings, as shown within **Appendix A**.
- Network model simulation criteria set to default settings in MicroDrainage 2019.1.
- Simulations have been run for the network model using the 'Seasonal Return Period Wizard' for all storm durations for the 1 in 100-year event on 2.5 second increments with Dynamic Time Step turned off, Dynamic viscous Dampening and Inertia turned on.
- Simulations have been run using both Flood Studies Report (FSR) and Flood Estimation Handbook (FEH) rainfall methodologies.**
 - * The detention basin volumes have been checked by recreating them in AutoCAD Civils 3D Software before being input into the MicroDrainage Network Model. The Pond 2 3D model has included the incorporation of the vole embankments within the centre of the pond.
 - ** Note that the original drainage system was designed using FSR rainfall (as stated within 'Attenuation Ponds Health & Safety File'), however FEH simulations have been ran as a sensitivity test for the recreated network model. The 15-, 30- and 60-minute storms have not been run using FEH rainfall data as it is best practice to exclude these storm events when using FEH data.

The following assumptions have been made during this study:

- Where as-built information was unavailable, the BWB and WYG S104 agreement drawings were used to input information into the MicroDrainage network model.
- The Pond 2 parameters within the network model are based on an area to depth relationship using the basin extents and design levels shown on the WYG Attenuation Pond 2 Layout Plan (D-07-001_AB1). The volumes of each basin have been sense checked using AutoCAD Civil 3D Software before being added to the MicroDrainage Network Model.
- The contributing impermeable areas plan from the original design of the drainage system is unavailable to BWB. Therefore, for this study, the contributing areas have been assumed. The assumed contributing areas used within this study are provided within **Appendix A** and are typically 90% of the plot areas for the commercial / industrial areas, 65% for the residential areas and 100% for the road areas.

The contributing areas for each plot have been directly input into the existing stub connection constructed in anticipation of future development within the business park, as shown in **Appendix A**. This provides a conservative assessment during short-term rainfall events as surface water is directly input into the spine drainage network during each simulation. In reality, once each plot has been developed with their own drainage systems, a 'lag time' would be present where surface water is captured across various parts of individual plot drainage network and reduce the rate of surface water entering the spine drainage network during short-term events.

Additionally, the individual plots within 'Catchment 2' will include on plot attenuation which has not been considered within this study. This provides additional redundancy to the conservative nature of this model during short term storm events.

Any individual modelled plot drainage networks have not been added to the as-built model spine network due to instabilities caused by adding the large networks in the wider spine as-built network model.

Simulation Results

Two simulations have been run for the as-built network model. The simulation parameters are provided within the 'Design Parameters & Assumptions' section of this Technical Note. All simulation calculation outputs are provided within **Appendix B** and are arranged in the following order:

- i. Existing Drainage Network (FSR)
- ii. Existing Drainage Network (FEH)

An extract of the flow control structure for Pond 2 is shown in the WYG "Pond Area 2 – Flow Control and Outlet from Attenuation Area 2 Cross Section" as-built drawing is provided below as **Figure 1.2**. Additionally, the relevant as-built pond and flow control drawings have been enclosed within **Appendix C**.

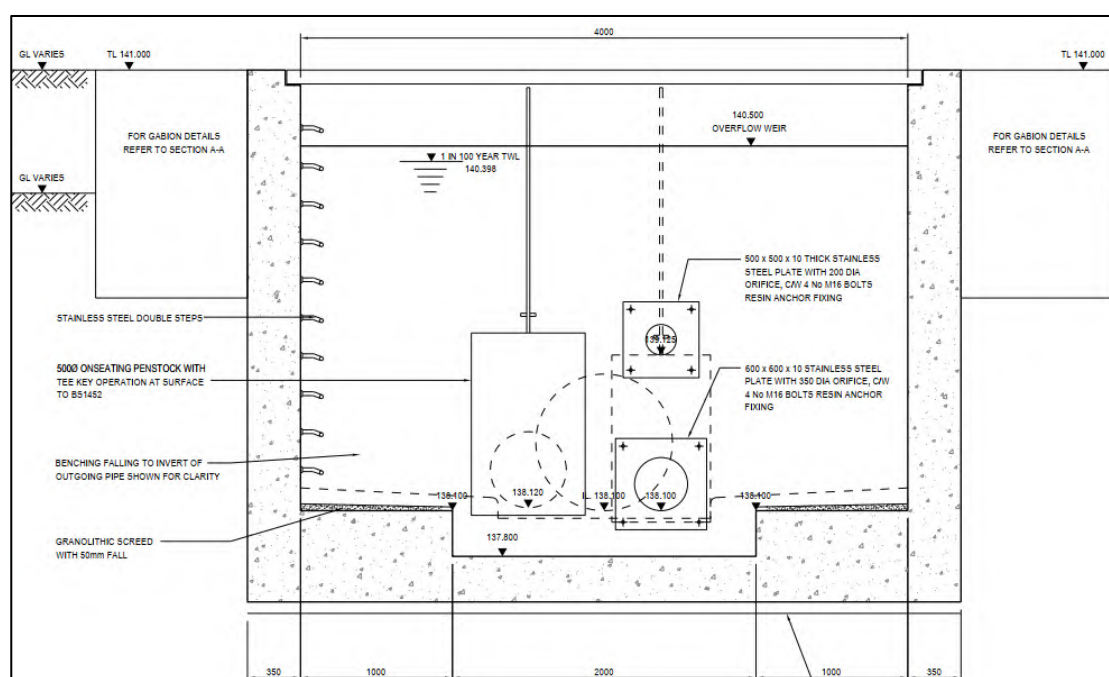


Figure 1.2: Extract of Pond 2 Flow Control structure design (WYG drawing D-8-003_AB1)

An extract of the 1 in 100-year results provided within the 'Attenuation Ponds Health & Safety File' is shown below as **Figure 1.3**. **Figure 1.3** shows the original design maximum outflows, water depths and volumes for 'Ponds 1A/1B, 1C and 2'.

Summary of 1 in 100 year results.

Pond	Critical Duration (min)	Maximum Outflow (l/s)	Maximum Depth (m)	Maximum Volume (m ³)	Permitted Outflow (l/s)
1A/1B	720	304	2.344	10276	292
1C	720	144	0.919	7143	205
2	600	555	2.039	21277	562
Σ		1003			1059

Figure 1.3: Extract of original design results for each attenuation pond in the 1 in 100-year event.

As shown on **Figure 1.3**, the original design criteria for Pond 2 include for a maximum outflow of 555l/s, with an assumed maximum water depth of 2.039m and an assumed maximum storage requirement of 21,277m³.

From a sense check of the ponds using Civils 3D, the maximum Storage volume of Pond 1C is approximately 29,533m³, based on a potential maximum water level of 140.5m Above Ordnance Datum (AOD) (i.e., the top of weir located on the flow control of the pond) to the base level of the pond.

A breakdown of the results for each simulation are provided below. In brief, the overall results of this study show that the pipe network is adequately designed to operate during the 1 in 100-year storm.

Minor flooding of 13.5m³ is shown to occur within Sir Isaac Newton Way (A6193) at manhole S317 during the 1 in 100-year critical storm event. As the critical storm for S317 is the 30-minute winter storm, it is expected that any flooding at S317 will remain within the road corridor for a short period of time before being picked up again by the drainage system as water levels within the network drop.

The results show that the attenuation pond has a maximum discharge rate of 445.5l/s, maximum water depth of 2.17m and maximum water storage volume of 26,565m³. Although there are discrepancies between the original design intent and this modelling exercise, the pond and outflow are operating within the permitted flow rate to Stanney Brook. The larger volume of storage is due to a lower modelled flow rate and accurate modelling of the pond in Civils 3D, however, the maximum water level is lower than the original design intent of 140.398m AOD.

Is it understood that the original design modelling for the drainage network was undertaken in an alternative software to MicroDrainage. Additionally, the network was constructed in 1999. It is anticipated that the rainfall intensity data/methodologies used within drainage modelling software have been updated since the original design model was created. Therefore, it is expected that there would be discrepancies between the results provided within this study and the results from the original design model from which the network was constructed.

Existing Drainage Network (FSR) – Simulation Results

The results from this simulation show that the pipe network is adequately designed to receive flows from Catchment 2 after it is entirely developed. The system will be surcharged during the high intensity short duration storms (i.e., the 15-, 30- and 60-minute storms).

Minor flooding (13.5m³) is shown to occur within Sir Isaac Newton Way at S317, to the east of Plot M. This flooding is expected to remain within the road corridor for a short period of time before being picked up again by the drainage system as water levels within the network drop.

Minor flooding (31m³) is also shown to occur on Plot T at manhole S3T3 during the critical (15-minute) storm. This flood is likely due to the size of the outgoing pipe from this plot and the extent of impermeable area being input into the modelled node of S3T3. The extent of flooding at this node is not unusual for private drainage systems during the 1 in 100-year storm and it is likely that a provision is made within the car parking / service yard on Plot T to temporarily store this storm water during such an event.

It should be noted that in reality the modelled flooded volumes at S317 and S3T3 are likely to be lower than shown within the MicroDrainage network model. This is due to the design of the model directly inputting the total contributing areas of each plot directly into the connection stub nodes. In reality, the contributing areas across the catchment will be split across a vast array of private drainage networks within each plot, which will buffer against the flows within the adopted drainage network during the high intensity short duration storms.

The maximum water level within Pond 2 is shown to be 140.268m AOD, this is 130mm below the original design water level of 140.398. This shows that the pond is functioning well and should be adequate to receive the flows from the entire of Catchment 2 once it has entirely been built out.

Existing Drainage Network (FEH) – Simulation Results

A simulation has been run for the recreated network model with FEH rainfall methodologies, as a sensitivity test for the network. As stated above the original design was modelled using FSR rainfall. Therefore, the FEH results are not representative of the original design standards and should only be used as to ensure that no significant flooding occurs when using this dataset. As FEH rainfall data is considered to be less robust for short storm durations, the 15-, 30- and 60-minute return periods have been excluded from this sensitivity check.

The results from this simulation show that the pipe network is adequately designed to receive flows from Catchment 2 after it is entirely developed. The system will be surcharged during the 1 in 100-year return periods.

The maximum water level within Pond 2 is shown to be 140.272m AOD, this is 126mm below the original design water level of 140.398. This shows that the pond is functioning well and should be adequate to receive the flows from the entire Catchment once it has entirely been built out.

Conclusions and Recommendations

BWB Consulting Ltd (BWB) have been appointed by Wilson Bowden Developments Ltd to undertake a drainage network modelling exercise study of the existing surface water drainage networks serving Kingsway Business Park, Rochdale. This Technical Note focuses on the section of the drainage network that drains into Pond 2 (Catchment 2).

An as-built network model for the existing drainage infrastructure, that was installed within the business park in 1999 and adopted by United Utilities (UU) in November 2012, has been created using the best available information at the time of writing.

A list of the sources of information, design parameters and assumptions used to recreate the existing drainage network are provided within this Technical Note. The network model was created using MicroDrainage 2019.1 using a wide range of sources available to BWB, including: historical drawings, Health and Safety and Quality files.

The network has been modelled to provide a conservative approach to the assessment of the drainage network during short-term rainfall events with flows being input directly into the adopted network and no allowances being made for the on-plot drainage and attenuation.

The results from the modelling study show that the overall pipe network adopted by UU is adequate to convey flows during the 1 in 100-year critical storm event through the catchment with only minor flooding (13m³) within Sir Isaac Newton Way once the development has been entirely built out. The minor flooding occurs during the short term high intensity storm events, which is considered to have been conservatively modelled as part of this study. Additionally, the flooding shown to occur is expected to be contained within the highway carriageway for a short period of time before drainage back into the network as the water levels within the system fall.

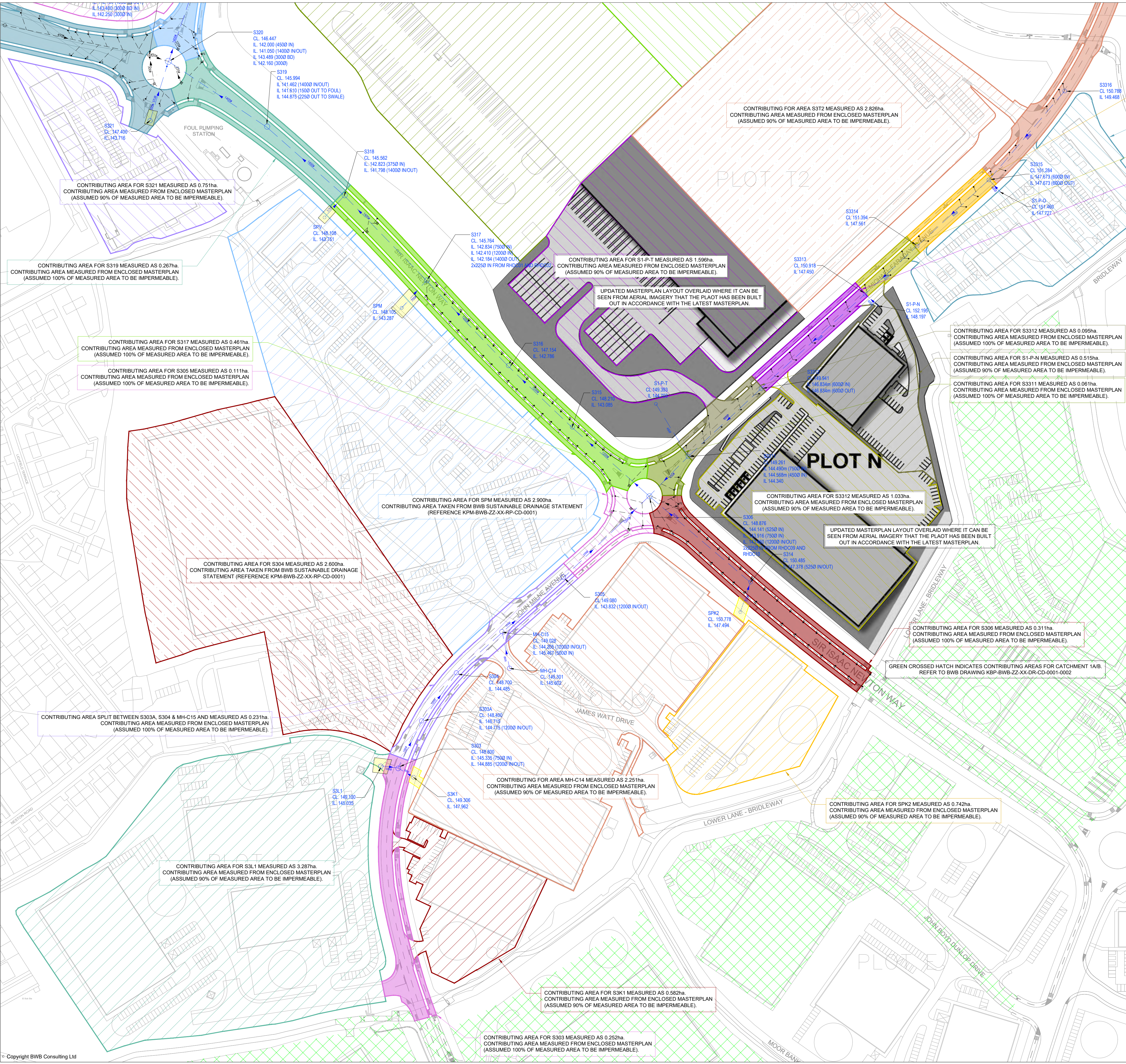
Approximately 31m³ of on plot flooding has been identified during the 1 in 100-year critical storm (15-minute) event. The extent of flooding at this node is not unusual for private drainage systems during the 1 in 100-year storm and is likely the result of the conservative nature of the recreated MicroDrainage network model with respect to short term storms.

The findings show that Pond 2 is able to safely attenuate and discharge flows from 'Catchment 2' with the maximum water level within the pond simulated to be approximately 232mm below the pond's overflow weir crest level.

The findings show that the 'Pond 2' discharges surface water at a lower rate (444.5l/s) that of the original design intent (555l/s).

Overall, based on the information available to BWB, the existing drainage network serving 'Catchment 2' of Kingsway Business Park is considered to be currently operating efficiently and safely and has been sufficiently designed to continue to do so once the entire development has been built out.

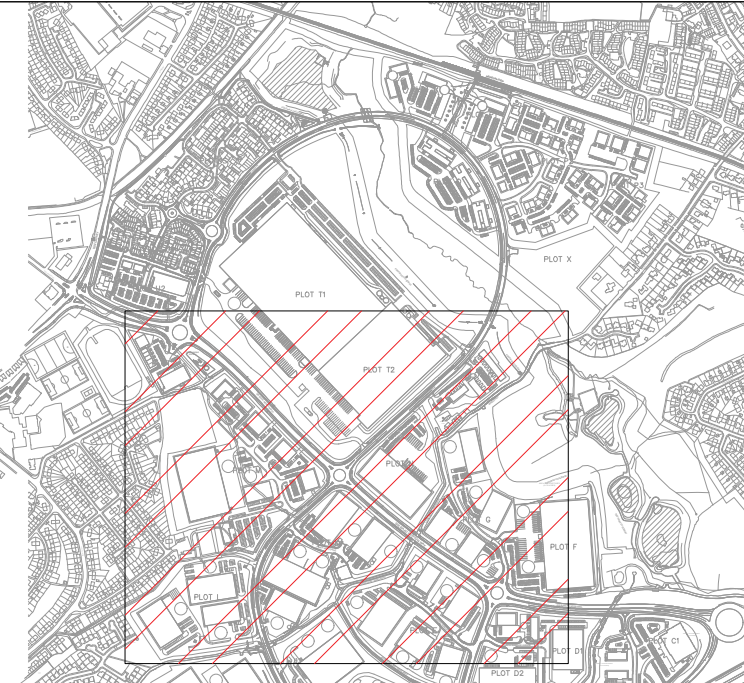
Appendix A – Assumed Contributing Areas Catchments Plan



Notes

1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.
5. This drawing is to be read in conjunction with BWB Technical Note Reference KBP-BWB-ZZ-XX-RP-CD-0002.

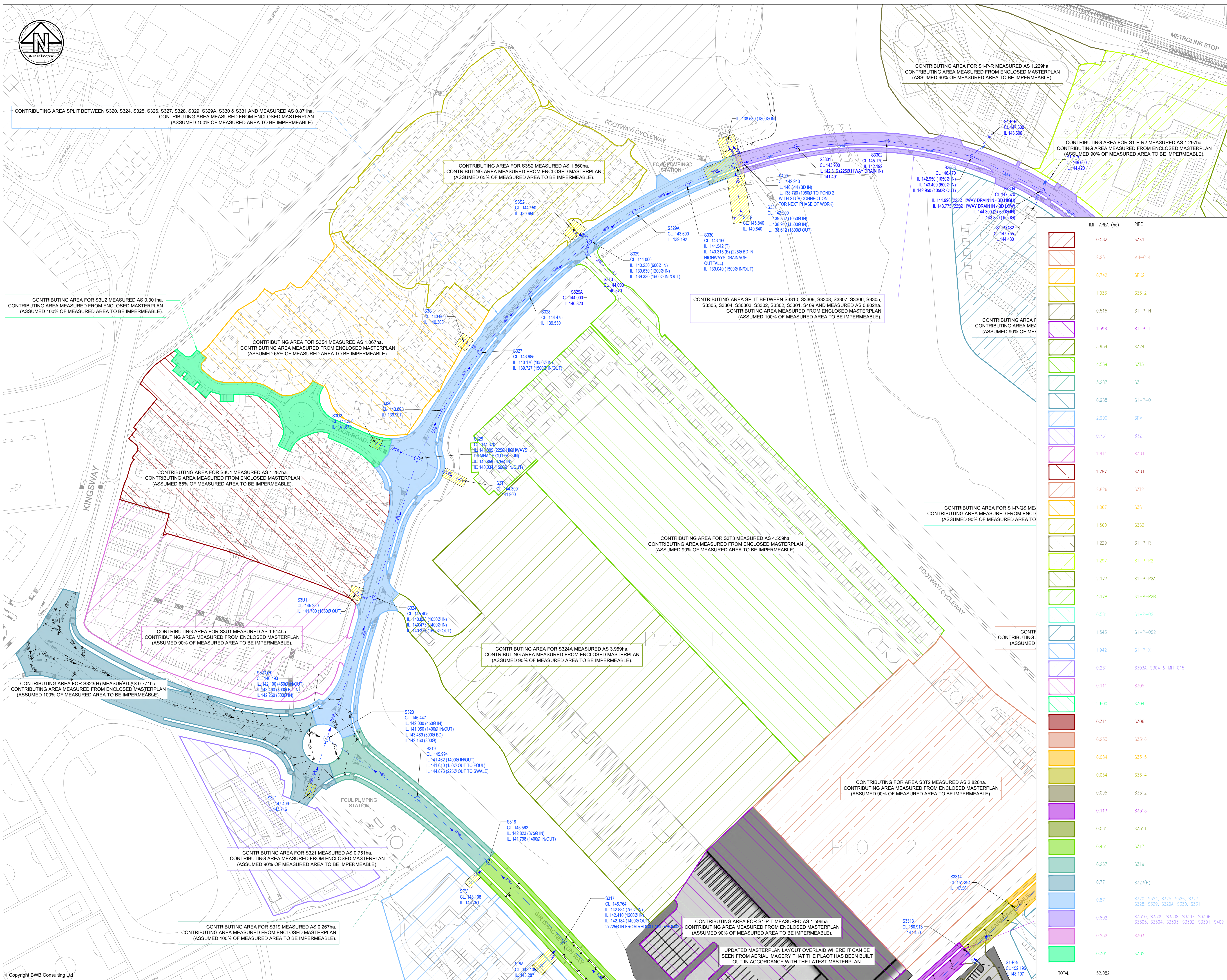
Key Plan (not to scale)



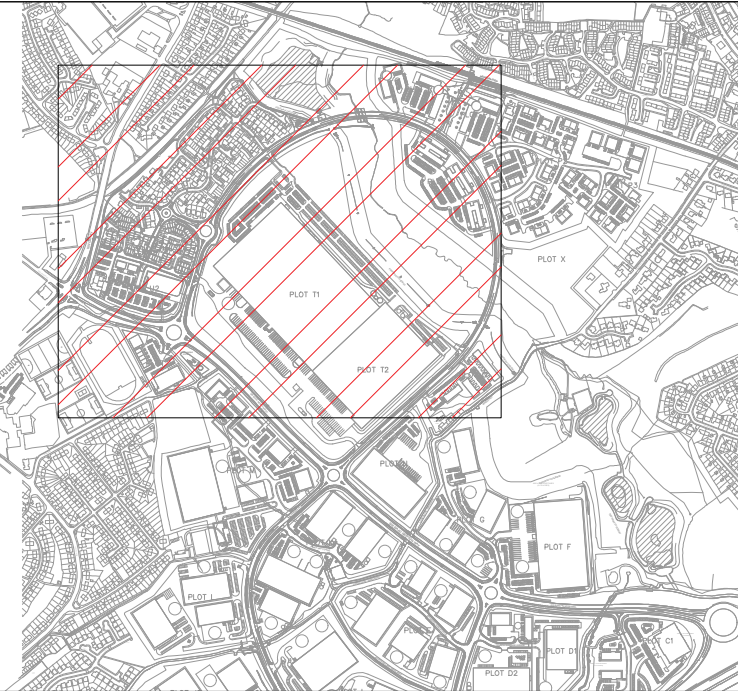
Legend

CONTRIBUTING AREA FOR CATCHMENT 1A/B - REFER TO BWB DRAWING KBP-BWB-ZZ-XX-RP-CD-0001-0002

IMP. AREA (ha)	PIPE
0.582	S3K1
2.251	MH-C14
0.742	SPK2
1.033	S3312
0.515	S1-P-N
1.596	S1-P-T
3.959	S324
4.559	S333
3.287	S3L1
0.988	S1-P-O
2.900	SPM
0.751	S321
1.614	S3U1
1.287	S3U1
2.826	S3T2
1.067	S3S1
1.560	S3S2
1.229	S1-P-R
1.297	S1-P-R2
2.177	S1-P-P2A
4.178	S1-P-P2B
0.581	S1-P-Q5
1.543	S1-P-Q52
1.942	S1-P-X
0.231	S303A, S304 & MH-C15
0.111	S305
2.600	S304
0.311	S306
0.233	S3316
0.084	S3315
0.054	S3314
0.095	S3312
0.113	S3313
0.061	S3311
0.461	S317
0.267	S319
0.771	S323(H)
0.871	S320, S324, S325, S326, S327, S328, S329, S329A, S330, S331
0.802	S3310, S3309, S3308, S3307, S3306, S3305, S3304, S3303, S3302, S3301, S409
0.252	S303
0.301	S3U2
TOTAL	52.082



- Notes**
1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
 2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
 3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
 4. Any discrepancies noted on site are to be reported to the engineer immediately.
 5. This drawing is to be read in conjunction with BWB Technical Note Reference KBP-BWB-ZZ-XX-RP-CD-0002.
- Key Plan (not to scale)**



Legend

IMP. AREA (ha)	PIPE
0.582	S3K1
2.251	MH-C14
0.742	SPK2
1.033	S3312
0.515	S1-P-N
1.596	S1-P-T
3.959	S324
4.559	S3T3
3.287	S3L1
0.988	S1-P-O
2.900	SPM
0.751	S321
1.614	S3U1
1.287	S3U1
2.826	S3T2
1.067	S3S1
1.560	S3S2
1.229	S1-P-R
1.297	S1-P-R2
2.177	S1-P-P2A
4.178	S1-P-P2B
0.581	S1-P-Q5
1.543	S1-P-Q52
1.942	S1-P-X
0.231	S303A, S304 & MH-C15
0.111	S305
2.600	S304
0.311	S306
0.233	S3316
0.084	S3315
0.054	S3314
0.095	S3312
0.113	S3313
0.061	S3311
0.461	S317
0.267	S319
0.771	S323(H)
0.871	S320, S324, S325, S326, S327, S328, S329, S329A, S330, S331
0.802	S3310, S3309, S3308, S3307, S3306, S3305, S3304, S3303, S3302, S3301, S409
0.252	S303
0.301	S3U2
TOTAL	52.082

P1	28.01.22	Preliminary Issue	MB	DG
Rev	Date	Details of issue / revision	Drw	Rev

Issues & Revisions

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Client
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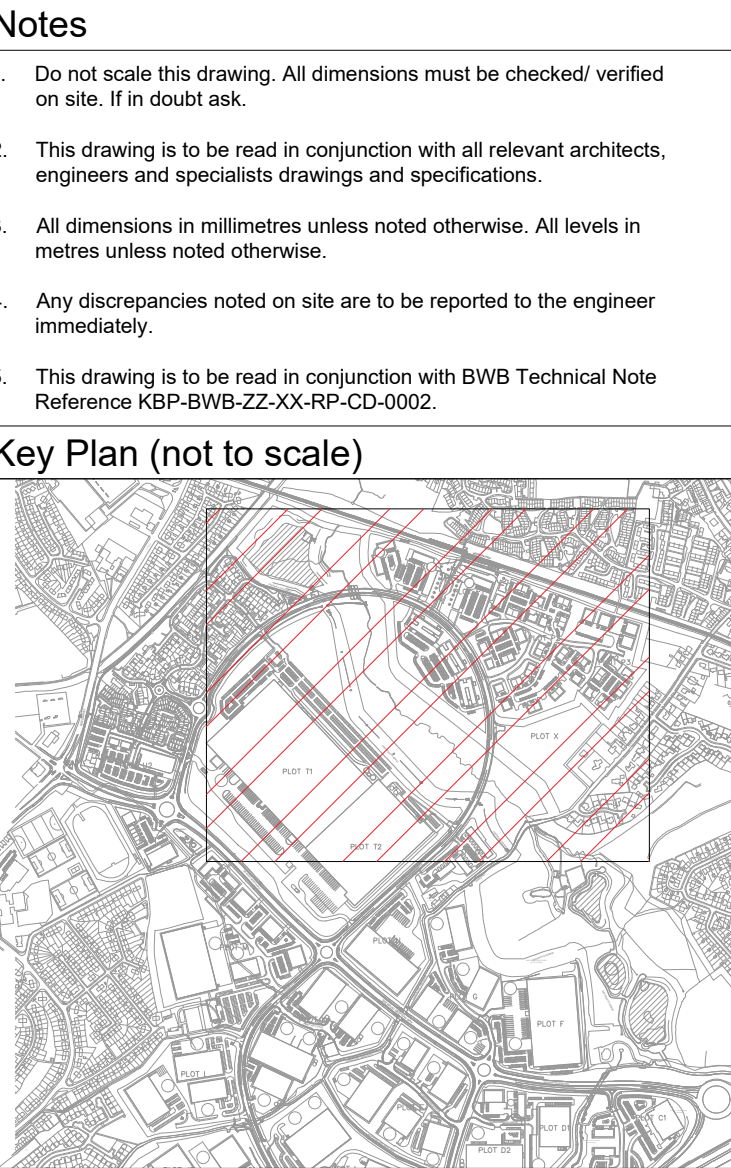
Project Title
KINGSWAY BUSINESS PARK

Drawing Title
CATCHMENT 2 ASSUMED CONTRIBUTING AREAS CATCHMENT PLAN (SHEET 2 OF 3)

Drawn:	M. Bailey	Reviewed:	D. Gray
BWB Ref:	NTW2889	Date:	28.01.22
Scale@A1:	1:1250		

Drawing Status
PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
KBP-BWB-ZZ-XX-DR-CD-0004	S2	P1



1	28.01.22	Preliminary Issue	MB	DG
Rev	Date	Details of issue / revision	Draw	Rev

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☐ Leeds | 0113 233 8000
☐ London | 020 7407 3879
☒ Manchester | 0161 233 4260
☐ Nottingham | 0115 924 1100

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Project Title

KINGSWAY BUSINESS PARK

**CATCHMENT 2 ASSUMED
CONTRIBUTING AREAS
CATCHMENT PLAN
(SHEET 3 OF 3)**

Drawn:	M. Bailey	Reviewed:	D. Gray		
WB Ref:	NTW2889	Date:	28.01.22	Scale@A1:	1:1250
Drawing Status					
PRELIMINARY					
Project - Originator - Zone - Level - Type - Role - Number				Status	Rev
KBP-BWB-ZZ-XX-DR-CD-0004				S2	P1

Appendix B – MicroDrainage Network Model

Time Area Diagram for Existing

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	11.794	4-8	24.082	8-12	14.047	12-16	2.159

Total Area Contributing (ha) = 52.083

Total Pipe Volume (m³) = 2652.438

Existing Network Details for Existing

- Indicates pipe length does not match coordinates

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
E1.000	11.913	0.150	79.4	3.287	5.00	0.0	0.600	o	1200	Pipe/Conduit
E2.000	11.955	2.627	4.6	0.582	5.00	0.0	0.600	o	750	Pipe/Conduit
E1.001	35.859	0.170	210.9	0.252	0.00	0.0	0.600	o	1200	Pipe/Conduit
E1.002	40.155	0.230	174.6	0.077	0.00	0.0	0.600	o	1200	Pipe/Conduit
E1.003	41.606	0.280	148.6	2.677	0.00	0.0	0.600	o	1200	Pipe/Conduit
E3.000	25.330	0.135	187.6	2.251	5.00	0.0	0.600	o	500	Pipe/Conduit
E1.004	55.563	0.373	149.0	0.077	0.00	0.0	0.600	o	1200	Pipe/Conduit
E1.005	80.019	0.372	215.1	0.111	0.00	0.0	0.600	o	1200	Pipe/Conduit
E4.000	21.422	0.116	184.7	0.742	5.00	0.0	0.600	o	525	Pipe/Conduit
E4.001	89.800	3.237	27.7	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit
E5.000	79.103	1.795	44.1	0.233	5.00	0.0	0.600	o	225	Pipe/Conduit
E6.000	11.029	0.054	204.2	0.988	5.00	0.0	0.600	o	600	Pipe/Conduit
E5.001	66.134	0.112	590.5	0.084	0.00	0.0	0.600	o	600	Pipe/Conduit
E5.002	47.917	0.111	431.7	0.054	0.00	0.0	0.600	o	600	Pipe/Conduit
E7.000	12.175	0.697	17.5	0.515	5.00	0.0	0.600	o	600	Pipe/Conduit
E5.003	95.200	0.666	142.9	0.113	0.00	0.0	0.600	o	600	Pipe/Conduit
E5.004	67.417	2.344	28.8	1.128	0.00	0.0	0.600	o	600	Pipe/Conduit
E8.000	41.835	0.135	309.9	1.596	5.00	0.0	0.600	o	450	Pipe/Conduit
E5.005	37.597	0.424	88.7	0.061	0.00	0.0	0.600	o	750	Pipe/Conduit
E1.006	70.186	0.375	187.2	0.311	0.00	0.0	0.600	o	1200	Pipe/Conduit
E1.007	59.982	0.299	200.6	0.000	0.00	0.0	0.600	o	1200	Pipe/Conduit
E1.008	80.002	0.376	212.8	0.000	0.00	0.0	0.600	o	1200	Pipe/Conduit
E9.000	25.299	0.453	55.8	2.900	5.00	0.0	0.600	o	750	Pipe/Conduit
E1.009	80.058	0.386	207.4	0.461	0.00	0.0	0.600	o	1400	Pipe/Conduit
E10.000	20.302	0.928	21.9	0.000	5.00	0.0	0.600	o	375	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
E1.000	145.035	3.287	0.0	4.20	4750.2
E2.000	147.962	0.582	0.0	13.17	5817.3
E1.001	144.885	4.121	0.0	2.57	2909.1
E1.002	144.715	4.198	0.0	2.83	3199.1
E1.003	144.485	6.875	0.0	3.07	3468.8
E3.000	145.602	2.251	0.0	1.58	310.7
E1.004	144.205	9.203	0.0	3.06	3464.5
E1.005	143.832	9.314	0.0	2.55	2880.6
E4.000	147.494	0.742	0.0	1.65	356.1
E4.001	147.378	0.742	0.0	4.26	923.2
E5.000	149.468	0.233	0.0	1.98	78.6
E6.000	147.727	0.988	0.0	1.70	480.7
E5.001	147.673	1.305	0.0	0.99	281.3
E5.002	147.561	1.359	0.0	1.17	329.6
E7.000	148.197	0.515	0.0	5.85	1652.7
E5.003	147.500	1.987	0.0	2.03	575.3
E5.004	146.834	3.115	0.0	4.55	1287.1
E8.000	144.703	1.596	0.0	1.15	182.8
E5.005	144.340	4.772	0.0	2.97	1313.4
E1.006	143.460	15.139	0.0	2.73	3089.2
E1.007	143.085	15.139	0.0	2.64	2983.4
E1.008	142.786	15.139	0.0	2.56	2896.5
E9.000	143.287	2.900	0.0	3.75	1656.4
E1.009	142.184	18.500	0.0	2.85	4389.9
E10.000	143.751	0.000	0.0	3.89	429.5

Existing Network Details for Existing

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
E1.010	70.068	0.336	208.5	0.000	0.00	0.0	0.600	o	1400	Pipe/Conduit
E1.011	80.140	0.412	194.5	0.267	0.00	0.0	0.600	o	1400	Pipe/Conduit
E11.000	42.000	0.227	185.0	0.751	5.00	0.0	0.600	o	300	Pipe/Conduit
E12.000	13.524	0.100	135.2	0.771	5.00	0.0	0.600	o	450	Pipe/Conduit
E1.012	109.739	0.577	190.2	0.087	0.00	0.0	0.600	o	1400	Pipe/Conduit
E13.000	13.351	0.877	15.2	2.901	5.00	0.0	0.600	o	1050	Pipe/Conduit
E1.013	106.625	0.339	314.5	4.046	0.00	0.0	0.600	o	1500	Pipe/Conduit
E14.000	36.067	1.041	34.6	0.000	5.00	0.0	0.600	o	675	Pipe/Conduit
E15.000	32.713	1.011	32.4	0.301	5.00	0.0	0.600	o	675	Pipe/Conduit
E1.014	40.493	0.127	318.8	0.087	0.00	0.0	0.600	o	1500	Pipe/Conduit
E1.015	50.583	0.180	281.0	0.087	0.00	0.0	0.600	o	1500	Pipe/Conduit
E16.000	13.160	0.132	99.7	1.067	5.00	0.0	0.600	o	1050	Pipe/Conduit
E1.016	56.696	0.197	287.8	0.087	0.00	0.0	0.600	o	1500	Pipe/Conduit
E1.017	57.990	0.200	290.0	0.087	0.00	0.0	0.600	o	1500	Pipe/Conduit
E17.000	25.000	0.250	100.0	4.559	5.00	0.0	0.600	o	600	Pipe/Conduit
E17.001	9.000	0.090	100.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit
E18.000	12.736	0.020	636.8	1.560	5.00	0.0	0.600	o	1200	Pipe/Conduit
E1.018	39.976	0.138	289.7	0.087	0.00	0.0	0.600	o	1500	Pipe/Conduit
E1.019	43.686	0.152	287.4	0.087	0.00	0.0	0.600	o	1500	Pipe/Conduit
E1.020	36.994	0.128	289.0	0.087	0.00	0.0	0.600	o	1500	Pipe/Conduit
E19.000	35.519	1.478	24.0	2.826	5.00	0.0	0.600	o	1050	Pipe/Conduit
E1.021	22.240#	0.082	271.2	0.088	0.00	0.0	0.600	o	1800	Pipe/Conduit
E20.000	16.500	0.082	201.2	1.942	5.00	0.0	0.600	o	750	Pipe/Conduit
E20.001	44.135	0.414	106.6	0.073	0.00	0.0	0.600	o	900	Pipe/Conduit
E20.002	40.455	0.382	105.9	0.073	0.00	0.0	0.600	o	900	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
E1.010	141.798	18.500	0.0	2.84	4377.9
E1.011	141.462	18.767	0.0	2.95	4533.7
E11.000	143.716	0.751	0.0	1.15	81.5
E12.000	142.100	0.771	0.0	1.75	277.8
E1.012	141.050	20.376	0.0	2.98	4585.2
E13.000	141.700	2.901	0.0	8.85	7666.5
E1.013	140.373	27.323	0.0	2.41	4264.6
E14.000	141.900	0.000	0.0	4.46	1596.8
E15.000	141.870	0.301	0.0	4.62	1652.4
E1.014	140.034	27.711	0.0	2.40	4235.5
E1.015	139.907	27.798	0.0	2.55	4513.1
E16.000	140.308	1.067	0.0	3.45	2988.9
E1.016	139.727	28.952	0.0	2.52	4459.3
E1.017	139.530	29.039	0.0	2.51	4442.6
E17.000	140.570	4.559	0.0	2.44	688.6
E17.001	140.320	4.559	0.0	2.44	688.6
E18.000	139.650	1.560	0.0	1.48	1668.2
E1.018	139.330	35.245	0.0	2.52	4444.7
E1.019	139.192	35.332	0.0	2.53	4462.4
E1.020	139.040	35.419	0.0	2.52	4449.9
E19.000	140.840	2.826	0.0	7.04	6099.5
E1.021	138.612	38.333	0.0	2.91	7395.7
E20.000	146.382	1.942	0.0	1.97	870.0
E20.001	146.150	2.015	0.0	3.03	1930.5
E20.002	145.736	2.088	0.0	3.04	1936.9

Existing Network Details for Existing

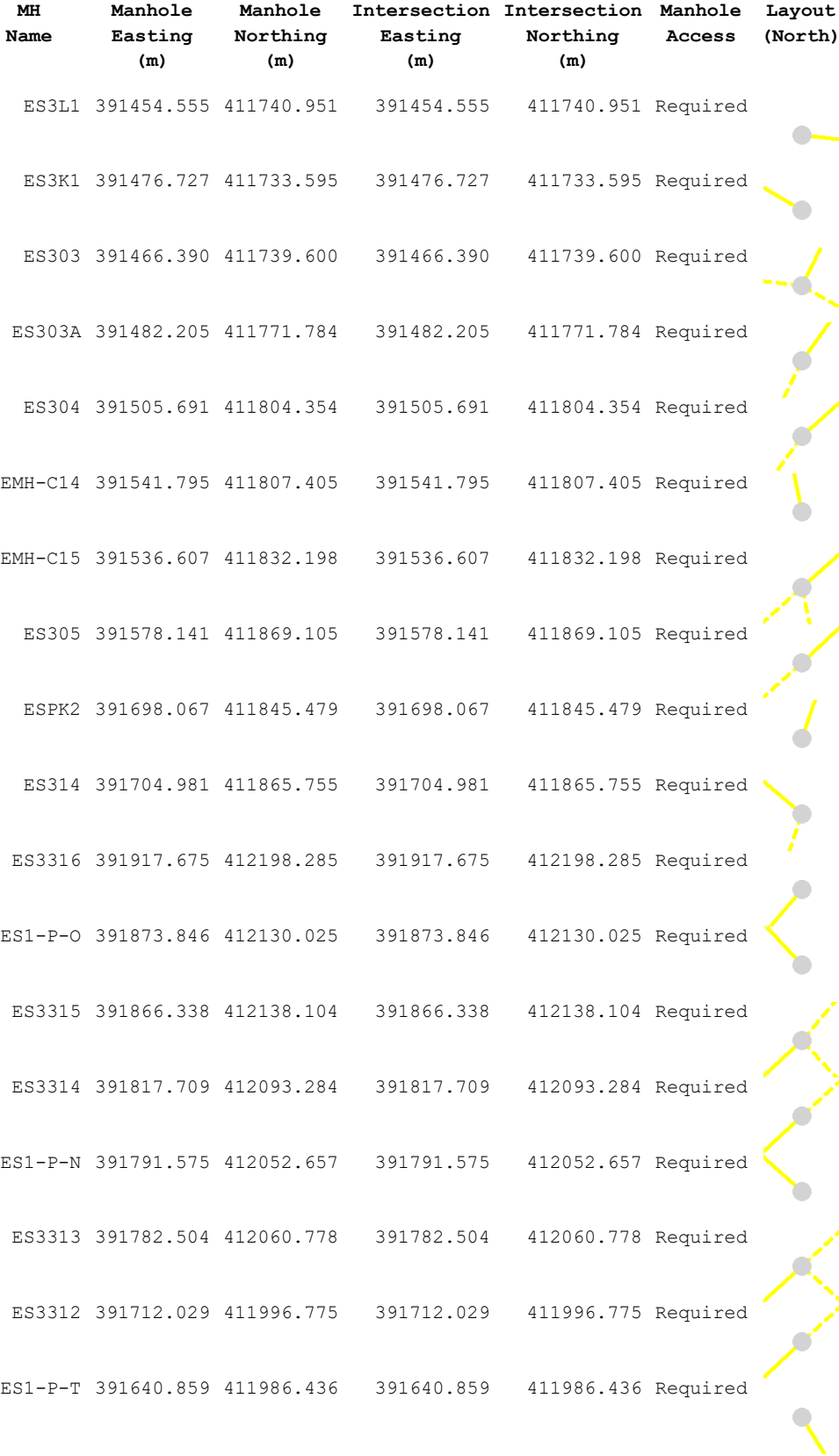
PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type
E21.000	14.500	0.145	100.0	0.581	5.00	0.0	0.600	o	600	Pipe/Conduit
E22.000	22.000	0.220	100.0	4.178	5.00	0.0	0.600	o	600	Pipe/Conduit
E20.003	52.630	0.454	115.9	0.073	0.00	0.0	0.600	o	900	Pipe/Conduit
E23.000	21.000	0.210	100.0	2.177	5.00	0.0	0.600	o	750	Pipe/Conduit
E20.004	52.603	0.190	276.9	0.073	0.00	0.0	0.600	o	1050	Pipe/Conduit
E20.005	46.317	0.165	280.7	0.073	0.00	0.0	0.600	o	1050	Pipe/Conduit
E20.006	52.286	0.545	95.9	0.073	0.00	0.0	0.600	o	1050	Pipe/Conduit
E24.000	12.000	0.120	100.0	1.297	5.00	0.0	0.600	o	600	Pipe/Conduit
E25.000	13.000	0.130	100.0	1.543	5.00	0.0	0.600	o	600	Pipe/Conduit
E20.007	57.210	0.900	63.6	0.073	0.00	0.0	0.600	o	1050	Pipe/Conduit
E26.000	20.000	0.200	100.0	1.229	5.00	0.0	0.600	o	600	Pipe/Conduit
E20.008	63.532	0.758	83.8	0.073	0.00	0.0	0.600	o	1050	Pipe/Conduit
E20.009	67.003	0.701	95.6	0.073	0.00	0.0	0.600	o	1050	Pipe/Conduit
E20.010	41.345	0.847	48.8	0.073	0.00	0.0	0.600	o	1050	Pipe/Conduit
E20.011	22.710#	0.190	119.5	0.073	0.00	0.0	0.600	o	1050	Pipe/Conduit
E1.022	31.625#	0.100	316.3	0.000	0.00	0.0	0.600	o	1050	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
E21.000	145.799	0.581	0.0	2.44	688.6
E22.000	145.874	4.178	0.0	2.44	688.6
E20.003	145.354	6.920	0.0	2.91	1850.9
E23.000	145.260	2.177	0.0	2.80	1236.4
E20.004	144.750	9.170	0.0	2.07	1789.1
E20.005	144.560	9.243	0.0	2.05	1776.7
E20.006	144.395	9.316	0.0	3.52	3047.1
E24.000	144.420	1.297	0.0	2.44	688.6
E25.000	144.430	1.543	0.0	2.44	688.6
E20.007	143.850	12.229	0.0	4.33	3746.0
E26.000	143.600	1.229	0.0	2.44	688.6
E20.008	142.950	13.531	0.0	3.77	3260.8
E20.009	142.192	13.604	0.0	3.53	3052.8
E20.010	141.491	13.677	0.0	4.94	4276.3
E20.011	138.720	13.750	0.0	3.15	2728.7
E1.022	138.100	52.083	0.0	1.93	1673.3

Manhole Schedules for Existing

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
								E21.000	145.654	600	
								E22.000	145.654	600	
ES1-P-P2A	150.000	4.740	Open Manhole	2400	E23.000	145.260	750				
ES3307	150.570	5.820	Open Manhole	2700	E20.004	144.750	1050	E20.003	144.900	900	
								E23.000	145.050	750	
ES3306	149.560	5.000	Open Manhole	2700	E20.005	144.560	1050	E20.004	144.560	1050	
ES3305	148.620	4.225	Open Manhole	2700	E20.006	144.395	1050	E20.005	144.395	1050	
ES1-P-R2	149.000	4.580	Open Manhole	2100	E24.000	144.420	600				
ES1-P-QS2	147.755	3.325	Open Manhole	2100	E25.000	144.430	600				
ES3304	147.570	3.720	Open Manhole	2700	E20.007	143.850	1050	E20.006	143.850	1050	
								E24.000	144.300	600	
								E25.000	144.300	600	
ES1-P-R	147.600	4.000	Open Manhole	2100	E26.000	143.600	600				
ES3303	146.470	3.520	Open Manhole	2700	E20.008	142.950	1050	E20.007	142.950	1050	
								E26.000	143.400	600	
ES3302	145.170	2.978	Open Manhole	2700	E20.009	142.192	1050	E20.008	142.192	1050	
ES3301	143.900	2.409	Open Manhole	2700	E20.010	141.491	1050	E20.009	141.491	1050	
ES409	142.943	4.223	Open Manhole	2700	E20.011	138.720	1050	E20.010	140.644	1050	1924
EPOND 2	140.550	2.450	Open Manhole	5600 x 4000	E1.022	138.100	1050	E1.021	138.530	1800	1180
								E20.011	138.530	1050	430
E	140.450	2.450	Open Manhole	0		OUTFALL		E1.022	138.000	1050	



Manhole Schedules for Existing

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
ES3311	391662.739	411950.779	391662.739	411950.779	Required	
ES306	391636.504	411923.849	391636.504	411923.849	Required	
ES315	391584.329	411970.794	391584.329	411970.794	Required	
ES316	391541.037	412012.311	391541.037	412012.311	Required	
ESPM	391468.761	412051.453	391468.761	412051.453	Required	
ES317	391485.784	412070.168	391485.784	412070.168	Required	
ESPV	391416.478	412112.633	391416.478	412112.633	Required	
ES318	391430.099	412127.688	391430.099	412127.688	Required	
ES319	391377.624	412174.120	391377.624	412174.120	Required	
ES321	391298.351	412178.215	391298.351	412178.215	Required	
ES323 (H)	391297.882	412222.386	391297.882	412222.386	Required	
ES320	391310.784	412218.333	391310.784	412218.333	Required	
ES3U1	391332.996	412324.796	391332.996	412324.796	Required	
ES324	391346.098	412322.234	391346.098	412322.234	Required	
ES3T1	391409.682	412408.348	391409.682	412408.348	Required	
ES3U2	391346.818	412436.112	391346.818	412436.112	Required	
ES325	391377.284	412424.197	391377.284	412424.197	Required	
ES326	391396.227	412459.985	391396.227	412459.985	Required	
ES3S1	391412.715	412510.143	391412.715	412510.143	Required	
ES327	391423.493	412502.591	391423.493	412502.591	Required	
ES328	391460.391	412545.638	391460.391	412545.638	Required	
ES3T3	391522.634	412560.632	391522.634	412560.632	Required	
ES329A	391502.127	412574.931	391502.127	412574.931	Required	
ES3S2	391494.037	412591.462	391494.037	412591.462	Required	
ES329	391504.138	412583.704	391504.138	412583.704	Required	
ES329A	391537.364	412605.931	391537.364	412605.931	Required	
ES330	391576.107	412626.117	391576.107	412626.117	Required	
ES3T2	391615.433	412604.533	391615.433	412604.533	Required	
ES331	391610.513	412639.709	391610.513	412639.709	Required	

Manhole Schedules for Existing

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
ES1-P-X	391983.875	412377.329	391983.875	412377.329	Required	
ES3310	391967.421	412378.562	391967.421	412378.562	Required	
ES3309	391965.020	412422.632	391965.020	412422.632	Required	
ES1-P-QS	391942.916	412456.942	391942.916	412456.942	Required	
ES1-P-P2B	391978.414	412463.282	391978.414	412463.282	Required	
ES3308	391956.442	412462.168	391956.442	412462.168	Required	
ES1-P-P2A	391956.624	412520.000	391956.624	412520.000	Required	
ES3307	391937.521	412511.279	391937.521	412511.279	Required	
ES3306	391910.518	412556.422	391910.518	412556.422	Required	
ES3305	391878.956	412590.320	391878.956	412590.320	Required	
ES1-P-R2	391843.635	412631.794	391843.635	412631.794	Required	
ES1-P-QS2	391831.493	412609.994	391831.493	412609.994	Required	
ES3304	391837.137	412621.705	391837.137	412621.705	Required	
ES1-P-R	391798.718	412661.640	391798.718	412661.640	Required	
ES3303	391785.600	412646.543	391785.600	412646.543	Required	
ES3302	391723.067	412657.763	391723.067	412657.763	Required	
ES3301	391656.181	412653.806	391656.181	412653.806	Required	
ES409	391616.692	412641.560	391616.692	412641.560	Required	
EPOND 2	391551.156	412735.562	391551.156	412735.562	Required	
E	391631.492	412760.413			No Entry	

PIPELINE SCHEDULES for Existing

Upstream Manhole

- Indicates pipe length does not match coordinates

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
E1.000	o	1200	ES3L1	149.100	145.035	2.865	Open Manhole	2700
E2.000	o	750	ES3K1	149.306	147.962	0.594	Open Manhole	2400
E1.001	o	1200	ES303	148.800	144.885	2.715	Open Manhole	2700
E1.002	o	1200	ES303A	148.400	144.715	2.485	Open Manhole	2700
E1.003	o	1200	ES304	148.700	144.485	3.015	Open Manhole	2700
E3.000	o	500	EMH-C14	149.301	145.602	3.199	Open Manhole	1800
E1.004	o	1200	EMH-C15	149.028	144.205	3.623	Open Manhole	2700
E1.005	o	1200	ES305	149.080	143.832	4.048	Open Manhole	2700
E4.000	o	525	ESPK2	150.778	147.494	2.759	Open Manhole	1800
E4.001	o	525	ES314	150.485	147.378	2.582	Open Manhole	2100
E5.000	o	225	ES3316	150.778	149.468	1.085	Open Manhole	1200
E6.000	o	600	ES1-P-O	151.460	147.727	3.133	Open Manhole	2100
E5.001	o	600	ES3315	151.284	147.673	3.011	Open Manhole	2100
E5.002	o	600	ES3314	151.394	147.561	3.233	Open Manhole	2100
E7.000	o	600	ES1-P-N	152.195	148.197	3.398	Open Manhole	2100
E5.003	o	600	ES3313	150.918	147.500	2.818	Open Manhole	2100
E5.004	o	600	ES3312	149.941	146.834	2.507	Open Manhole	2100
E8.000	o	450	ES1-P-T	149.393	144.703	4.240	Open Manhole	1800
E5.005	o	750	ES3311	149.261	144.340	4.171	Open Manhole	2400
E1.006	o	1200	ES306	148.876	143.460	4.216	Open Manhole	3000
E1.007	o	1200	ES315	148.210	143.085	3.925	Open Manhole	2700
E1.008	o	1200	ES316	147.154	142.786	3.168	Open Manhole	2700
E9.000	o	750	ESPM	148.105	143.287	4.068	Open Manhole	2400
E1.009	o	1400	ES317	145.764	142.184	2.180	Open Manhole	3000
E10.000	o	375	ESPV	148.108	143.751	3.982	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
E1.000	11.913	79.4	ES303	148.800	144.885	2.715	Open Manhole	2700
E2.000	11.955	4.6	ES303	148.800	145.335	2.715	Open Manhole	2700
E1.001	35.859	210.9	ES303A	148.400	144.715	2.485	Open Manhole	2700
E1.002	40.155	174.6	ES304	148.700	144.485	3.015	Open Manhole	2700
E1.003	41.606	148.6	EMH-C15	149.028	144.205	3.623	Open Manhole	2700
E3.000	25.330	187.6	EMH-C15	149.028	145.467	3.061	Open Manhole	2700
E1.004	55.563	149.0	ES305	149.080	143.832	4.048	Open Manhole	2700
E1.005	80.019	215.1	ES306	148.876	143.460	4.216	Open Manhole	3000
E4.000	21.422	184.7	ES314	150.485	147.378	2.582	Open Manhole	2100
E4.001	89.800	27.7	ES306	148.876	144.141	4.210	Open Manhole	3000
E5.000	79.103	44.1	ES3315	151.284	147.673	3.386	Open Manhole	2100
E6.000	11.029	204.2	ES3315	151.284	147.673	3.011	Open Manhole	2100
E5.001	66.134	590.5	ES3314	151.394	147.561	3.233	Open Manhole	2100
E5.002	47.917	431.7	ES3313	150.918	147.450	2.868	Open Manhole	2100
E7.000	12.175	17.5	ES3313	150.918	147.500	2.818	Open Manhole	2100
E5.003	95.200	142.9	ES3312	149.941	146.834	2.507	Open Manhole	2100
E5.004	67.417	28.8	ES3311	149.261	144.490	4.171	Open Manhole	2400
E8.000	41.835	309.9	ES3311	149.261	144.568	4.243	Open Manhole	2400
E5.005	37.597	88.7	ES306	148.876	143.916	4.210	Open Manhole	3000
E1.006	70.186	187.2	ES315	148.210	143.085	3.925	Open Manhole	2700
E1.007	59.982	200.6	ES316	147.154	142.786	3.168	Open Manhole	2700
E1.008	80.002	212.8	ES317	145.764	142.410	2.154	Open Manhole	3000
E9.000	25.299	55.8	ES317	145.764	142.834	2.180	Open Manhole	3000
E1.009	80.058	207.4	ES318	145.562	141.798	2.364	Open Manhole	3000
E10.000	20.302	21.9	ES318	145.562	142.823	2.364	Open Manhole	3000

PIPELINE SCHEDULES for Existing

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., (mm)	L*W
E1.010	o	1400	ES318	145.562	141.798	2.364	Open Manhole	3000	
E1.011	o	1400	ES319	145.994	141.462	3.132	Open Manhole	3000	
E11.000	o	300	ES321	147.400	143.716	3.384	Open Manhole	1500	
E12.000	o	450	ES323 (H)	146.493	142.100	3.943	Open Manhole	1800	
E1.012	o	1400	ES320	146.447	141.050	3.997	Open Manhole	3660	
E13.000	o	1050	ES3U1	145.280	141.700	2.530	Open Manhole	2700	
E1.013	o	1500	ES324	145.405	140.373	3.532	Open Manhole	3000	
E14.000	o	675	ES3T1	144.300	141.900	1.725	Open Manhole	2100	
E15.000	o	675	ES3U2	144.250	141.870	1.705	Open Manhole	2100	
E1.014	o	1500	ES325	144.370	140.034	2.836	Open Manhole	3000	
E1.015	o	1500	ES326	143.895	139.907	2.488	Open Manhole	3000	
E16.000	o	1050	ES3S1	143.960	140.308	2.602	Open Manhole	2700	
E1.016	o	1500	ES327	143.985	139.727	2.758	Open Manhole	3000	
E1.017	o	1500	ES328	144.475	139.530	3.445	Open Manhole	3000	
E17.000	o	600	ES3T3	144.000	140.570	2.830	Open Manhole	2100	
E17.001	o	600	ES329A	144.000	140.320	3.080	Open Manhole	2100	
E18.000	o	1200	ES3S2	144.150	139.650	3.300	Open Manhole	2700	
E1.018	o	1500	ES329	144.000	139.330	3.170	Open Manhole	3000	
E1.019	o	1500	ES329A	143.600	139.192	2.908	Open Manhole	3000	
E1.020	o	1500	ES330	143.160	139.040	2.620	Open Manhole	3000	
E19.000	o	1050	ES3T2	145.840	140.840	3.950	Open Manhole	2700	
E1.021	o	1800	ES331	142.900	138.612	2.488	Open Manhole	3660	
E20.000	o	750	ES1-P-X	150.250	146.382	3.118	Open Manhole	2400	
E20.001	o	900	ES3310	149.930	146.150	2.880	Open Manhole	2400	
E20.002	o	900	ES3309	150.720	145.736	4.084	Open Manhole	2400	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., (mm)	L*W
E1.010	70.068	208.5	ES319	145.994	141.462	3.132	Open Manhole	3000	
E1.011	80.140	194.5	ES320	146.447	141.050	3.997	Open Manhole	3660	
E11.000	42.000	185.0	ES320	146.447	143.489	2.658	Open Manhole	3660	
E12.000	13.524	135.2	ES320	146.447	142.000	3.997	Open Manhole	3660	
E1.012	109.739	190.2	ES324	145.405	140.473	3.532	Open Manhole	3000	
E13.000	13.351	15.2	ES324	145.405	140.823	3.532	Open Manhole	3000	
E1.013	106.625	314.5	ES325	144.370	140.034	2.836	Open Manhole	3000	
E14.000	36.067	34.6	ES325	144.370	140.859	2.836	Open Manhole	3000	
E15.000	32.713	32.4	ES325	144.370	140.859	2.836	Open Manhole	3000	
E1.014	40.493	318.8	ES326	143.895	139.907	2.488	Open Manhole	3000	
E1.015	50.583	281.0	ES327	143.985	139.727	2.758	Open Manhole	3000	
E16.000	13.160	99.7	ES327	143.985	140.176	2.759	Open Manhole	3000	
E1.016	56.696	287.8	ES328	144.475	139.530	3.445	Open Manhole	3000	
E1.017	57.990	290.0	ES329	144.000	139.330	3.170	Open Manhole	3000	
E17.000	25.000	100.0	ES329A	144.000	140.320	3.080	Open Manhole	2100	
E17.001	9.000	100.0	ES329	144.000	140.230	3.170	Open Manhole	3000	
E18.000	12.736	636.8	ES329	144.000	139.630	3.170	Open Manhole	3000	
E1.018	39.976	289.7	ES329A	143.600	139.192	2.908	Open Manhole	3000	
E1.019	43.686	287.4	ES330	143.160	139.040	2.620	Open Manhole	3000	
E1.020	36.994	289.0	ES331	142.900	138.912	2.488	Open Manhole	3660	
E19.000	35.519	24.0	ES331	142.900	139.362	2.488	Open Manhole	3660	
E1.021	22.240#	271.2	EPOND 2	140.550	138.530	0.220	Open Manhole	5600 x 4000	
E20.000	16.500	201.2	ES3310	149.930	146.300	2.880	Open Manhole	2400	
E20.001	44.135	106.6	ES3309	150.720	145.736	4.084	Open Manhole	2400	
E20.002	40.455	105.9	ES3308	150.520	145.354	4.266	Open Manhole	2400	

PIPELINE SCHEDULES for Existing

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
E21.000	o	600	ES1-P-QS	150.200	145.799	3.801	Open Manhole	2100
E22.000	o	600	ES1-P-P2B	150.000	145.874	3.526	Open Manhole	2100
E20.003	o	900	ES3308	150.520	145.354	4.266	Open Manhole	2400
E23.000	o	750	ES1-P-P2A	150.000	145.260	3.990	Open Manhole	2400
E20.004	o	1050	ES3307	150.570	144.750	4.770	Open Manhole	2700
E20.005	o	1050	ES3306	149.560	144.560	3.950	Open Manhole	2700
E20.006	o	1050	ES3305	148.620	144.395	3.175	Open Manhole	2700
E24.000	o	600	ES1-P-R2	149.000	144.420	3.980	Open Manhole	2100
E25.000	o	600	ES1-P-QS2	147.755	144.430	2.725	Open Manhole	2100
E20.007	o	1050	ES3304	147.570	143.850	2.670	Open Manhole	2700
E26.000	o	600	ES1-P-R	147.600	143.600	3.400	Open Manhole	2100
E20.008	o	1050	ES3303	146.470	142.950	2.470	Open Manhole	2700
E20.009	o	1050	ES3302	145.170	142.192	1.928	Open Manhole	2700
E20.010	o	1050	ES3301	143.900	141.491	1.359	Open Manhole	2700
E20.011	o	1050	ES409	142.943	138.720	3.173	Open Manhole	2700
E1.022	o	1050	EPOND 2	140.550	138.100	1.400	Open Manhole	5600 x 4000

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
E21.000	14.500	100.0	ES3308	150.520	145.654	4.266	Open Manhole	2400
E22.000	22.000	100.0	ES3308	150.520	145.654	4.266	Open Manhole	2400
E20.003	52.630	115.9	ES3307	150.570	144.900	4.770	Open Manhole	2700
E23.000	21.000	100.0	ES3307	150.570	145.050	4.770	Open Manhole	2700
E20.004	52.603	276.9	ES3306	149.560	144.560	3.950	Open Manhole	2700
E20.005	46.317	280.7	ES3305	148.620	144.395	3.175	Open Manhole	2700
E20.006	52.286	95.9	ES3304	147.570	143.850	2.670	Open Manhole	2700
E24.000	12.000	100.0	ES3304	147.570	144.300	2.670	Open Manhole	2700
E25.000	13.000	100.0	ES3304	147.570	144.300	2.670	Open Manhole	2700
E20.007	57.210	63.6	ES3303	146.470	142.950	2.470	Open Manhole	2700
E26.000	20.000	100.0	ES3303	146.470	143.400	2.470	Open Manhole	2700
E20.008	63.532	83.8	ES3302	145.170	142.192	1.928	Open Manhole	2700
E20.009	67.003	95.6	ES3301	143.900	141.491	1.359	Open Manhole	2700
E20.010	41.345	48.8	ES409	142.943	140.644	1.249	Open Manhole	2700
E20.011	22.710#	119.5	EPOND 2	140.550	138.530	0.970	Open Manhole	5600 x 4000
E1.022	31.625#	316.3	E	140.450	138.000	1.400	Open Manhole	0

BWB Consulting Ltd		Page 13
5th Floor, Waterfront House 35 Station Street Nottingham, NG2 3DQ	Kingsway Business Park Existing SW Network Catchment 2 - FSR	
Date 28/01/2022 File Existing SW Network Model - P1.MDX	Designed by M. Bailey Checked by D. Gray	
Innovyze	Network 2019.1	

Synthetic Rainfall Details

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

BWB Consulting Ltd		Page 14
5th Floor, Waterfront House 35 Station Street Nottingham, NG2 3DQ	Kingsway Business Park Existing SW Network Catchment 2 - FSR	
Date 28/01/2022 File Existing SW Network Model - P1.MDX	Designed by M. Bailey Checked by D. Gray	
Innovyze	Network 2019.1	

Online Controls for Existing

Complex Manhole: EPOND 2, DS/PN: E1.022, Volume (m³): 115.8

Orifice

Diameter (m) 0.350 Discharge Coefficient 0.600 Invert Level (m) 138.100

Orifice

Diameter (m) 0.200 Discharge Coefficient 0.600 Invert Level (m) 139.125

Weir

Discharge Coef 0.544 Width (m) 4.000 Invert Level (m) 140.500

Storage Structures for Existing

Tank or Pond Manhole: EPOND 2, DS/PN: E1.022

Invert Level (m) 138.100

Depth (m) Area (m²)		Depth (m) Area (m²)	
0.000	10550.0	2.450	14420.0

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

Simulation Criteria

Areal Reduction Factor	1.000	Manhole Headloss Coeff (Global)	0.500	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Foul Sewage per hectare (l/s)	0.000	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Additional Flow - % of Total Flow	0.000	Flow per Person per Day (l/per/day)	0.000

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

Synthetic Rainfall Details

Rainfall Model	FSR M5-60 (mm)	19.000	Cv (Summer)	0.750
Region England and Wales	Ratio R	0.268	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter											
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080											
Period(s) (years)	2, 30, 100											
Climate Change (%)	0, 0, 0											

									Water	Surcharged	Flooded	Pipe			
	US/MH		Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Level	Depth	Volume	Flow /	Overflow	Flow	
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	(m)	(m)	(m³)	Cap.	(l/s)	(l/s)	Status
E1.000	ES3L1	15 Winter	2	+0%	100/15 Summer				145.444	-0.791	0.000	0.25		489.1	OK
E2.000	ES3K1	15 Winter	2	+0%					148.052	-0.660	0.000	0.03		86.9	OK
E1.001	ES303	15 Winter	2	+0%	100/15 Summer				145.346	-0.739	0.000	0.31		607.0	OK
E1.002	ES303A	15 Winter	2	+0%	100/15 Summer				145.172	-0.743	0.000	0.31		608.0	OK
E1.003	ES304	15 Winter	2	+0%	100/15 Summer				145.038	-0.647	0.000	0.43		919.9	OK
E3.000	EMH-C14	15 Winter	2	+0%	2/15 Summer				146.182	0.080	0.000	1.31		334.0	SURCHARGED
E1.004	EMH-C15	15 Winter	2	+0%	30/15 Winter				144.807	-0.598	0.000	0.50		1223.7	OK
E1.005	ES305	15 Winter	2	+0%	30/15 Summer				144.445	-0.587	0.000	0.51		1211.7	OK
E4.000	ESPK2	15 Winter	2	+0%					147.734	-0.285	0.000	0.42		109.4	OK
E4.001	ES314	15 Winter	2	+0%					147.503	-0.400	0.000	0.13		110.8	OK
E5.000	ES3316	15 Winter	2	+0%	100/15 Summer				149.575	-0.118	0.000	0.45		34.1	OK
E6.000	ES1-P-O	15 Winter	2	+0%	30/15 Summer				148.084	-0.243	0.000	0.46		144.2	OK
E5.001	ES3315	15 Winter	2	+0%	30/15 Summer				148.062	-0.211	0.000	0.70		177.3	OK
E5.002	ES3314	15 Winter	2	+0%	30/15 Winter				147.909	-0.252	0.000	0.61		174.2	OK
E7.000	ES1-P-N	15 Winter	2	+0%					148.320	-0.477	0.000	0.09		77.1	OK
E5.003	ES3313	15 Winter	2	+0%	100/15 Winter				147.781	-0.319	0.000	0.44		232.8	OK
E5.004	ES3312	15 Winter	2	+0%	100/15 Winter				147.063	-0.371	0.000	0.31		359.6	OK
E8.000	ES1-P-T	15 Winter	2	+0%	2/15 Summer				145.289	0.136	0.000	1.43		233.0	SURCHARGED
E5.005	ES3311	15 Winter	2	+0%	30/15 Summer				144.741	-0.349	0.000	0.55		565.2	OK
E1.006	ES306	15 Winter	2	+0%	30/15 Summer				144.249	-0.411	0.000	0.76		1854.2	OK
E1.007	ES315	15 Winter	2	+0%	30/15 Summer				143.931	-0.354	0.000	0.83		1826.0	OK
E1.008	ES316	15 Winter	2	+0%	30/15 Summer				143.569	-0.417	0.000	0.75		1798.6	OK
E9.000	ESPM	15 Winter	2	+0%	100/15 Winter				143.624	-0.413	0.000	0.41		432.4	OK
E1.009	ES317	15 Winter	2	+0%	30/30 Winter	100/30 Winter			142.940	-0.644	0.000	0.56		1906.7	OK
E10.000	ESPV	360 Winter	2	+0%	100/15 Winter				143.751	-0.375	0.000	0.00		0.0	OK
E1.010	ES318	15 Winter	2	+0%	30/30 Winter				142.581	-0.617	0.000	0.60		1884.7	OK
E1.011	ES319	15 Winter	2	+0%	30/30 Winter				142.196	-0.666	0.000	0.54		1877.6	OK
E11.000	ES321	15 Winter	2	+0%	2/15 Summer				144.244	0.228	0.000	1.42		107.7	SURCHARGED
E12.000	ES323 (H)	15 Winter	2	+0%	30/15 Summer				142.366	-0.184	0.000	0.64		114.8	OK
E1.012	ES320	30 Winter	2	+0%	30/30 Summer				141.745	-0.705	0.000	0.49		1904.7	OK
E13.000	ES3U1	15 Winter	2	+0%	30/30 Winter				141.973	-0.777	0.000	0.15		432.5	OK
E1.013	ES324	30 Winter	2	+0%	30/30 Summer				141.233	-0.640	0.000	0.62		2210.2	OK
E14.000	ES3T1	360 Winter	2	+0%	100/15 Winter				141.900	-0.675	0.000	0.00		0.0	OK
E15.000	ES3U2	15 Winter	2	+0%	100/15 Winter				141.952	-0.593	0.000	0.04		45.0	OK
E1.014	ES325	30 Winter	2	+0%	30/15 Winter				141.026	-0.508	0.000	0.77		2216.6	OK
E1.015	ES326	30 Winter	2	+0%	30/15 Winter				140.834	-0.573	0.000	0.68		2214.4	OK
E16.000	ES3S1	30 Winter	2	+0%	30/30 Summer				140.678	-0.680	0.000	0.09		131.7	OK
E1.016	ES327	30 Winter	2	+0%	30/15 Winter				140.673	-0.554	0.000	0.68		2242.0	OK
E1.017	ES328	30 Winter	2	+0%	30/15 Winter				140.505	-0.525	0.000	0.68		2242.3	OK
E17.000	ES3T3	15 Winter	2	+0%	2/15 Summer	100/15 Summer			141.626	0.456	0.000	1.26		632.8	SURCHARGED
E17.001	ES329A	15 Winter	2	+0%	2/15 Summer				141.211	0.291	0.000	1.82		632.3	SURCHARGED
E18.000	ES3S2	30 Winter	2	+0%	30/15 Winter				140.350	-0.500	0.000	0.32		186.7	OK
E1.018	ES329	30 Winter	2	+0%	30/15 Winter				140.348	-0.482	0.000	0.80		2403.2	OK
E1.019	ES329A	30 Winter	2	+0%	30/15 Winter				140.211	-0.481	0.000	0.78		2404.9	OK
E1.020	ES330	30 Winter	2	+0%	30/15 Winter				140.073	-0.467	0.000	0.82		2406.7	OK
E19.000	ES3T2	15 Winter	2	+0%					141.075	-0.815	0.000	0.11		422.6	OK
E1.021	ES331	60 Winter	2	+0%	100/30 Summer				139.669	-0.743	0.000	0.65		2509.6	OK
E20.000	ES1-P-X	15 Winter	2	+0%	30/15 Summer				146.759	-0.373	0.000	0.49		288.4	OK
E20.001	ES3310	15 Winter	2	+0%	30/15 Summer				146.428	-0.622	0.000	0.21		297.7	OK
E20.002	ES3309	15 Winter	2	+0%	30/15 Summer				146.022	-0.614	0.000	0.22		305.9	OK
E21.000	ES1-P-QS	15 Winter	2	+0%	30/15 Summer				145.993	-0.406	0.000	0.23		86.7	OK
E22.000	ES1-P-P2B	15 Winter	2	+0%	2/15 Summer				146.635	0.161	0.000	1.33		624.7	SURCHARGED
E20.003	ES3308	15 Winter	2	+0%	30/15 Summer				145.894	-0.360	0.000	0.66		1001.9	OK
E23.000	ES1-P-P2A	15 Winter	2	+0%	30/15 Summer				145.617	-0.393	0.000	0.45		324.2	OK
E20.004	ES3307	15 Winter	2	+0%	30/15 Summer				145.551	-0.249	0.000	0.92		1295.5	OK
E20.005	ES3306	15 Winter	2	+0%	30/15 Summer				145.363	-0.247	0.000	0.93		1277.7	OK
E20.006	ES3305	15 Winter	2	+0%	100/15 Summer				144.960	-0.485	0.000	0.56		1261.8	OK
E24.000	ES1-P-R2	15 Winter	2	+0%	30/15 Winter				144.744	-0.276	0.000	0.56		193.1	OK
E25.000	ES1-P-QS2	15 Winter	2	+0%	30/15 Summer				144.782	-0.248	0.000	0.63		228.9	OK
E20.007	ES3304	15 Winter	2	+0%	100/15 Summer				144.393	-0.507	0.000	0.53		1543.4	OK
E26.000	ES1-P-R	15 Winter	2	+0%	100/15 Summer				143.869	-0.331	0.000	0.41		183.2	OK
E20.008	ES3303	15 Winter	2	+0%	30/15 Winter				143.550	-0.450	0.000	0.62		1657.9	OK
E20.009	ES3302	15 Winter	2	+0%	30/15 Winter				142.817	-0.425	0.000	0.66		1665.2	OK
E20.010	ES3301	15 Winter	2	+0%	100/15 Winter				142.071	-0.470	0.000	0.59		1669.0	OK
E20.011	ES409	15 Winter	2	+0%	2/15 Summer				139.828	0.058	0.000	1.19		1670.1	SURCHARGED
E1.022	EPOND 2	1440 Winter	2	+0%	2/720 Winter				139.199	0.049	0.000	0.21		248.4	SURCHARGED

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

PN	US/MH Name	Level Exceeded
E1.000	ES3L1	
E2.000	ES3K1	
E1.001	ES303	
E1.002	ES303A	
E1.003	ES304	
E3.000	EMH-C14	
E1.004	EMH-C15	
E1.005	ES305	
E4.000	ESPK2	
E4.001	ES314	
E5.000	ES3316	
E6.000	ES1-P-O	
E5.001	ES3315	
E5.002	ES3314	
E7.000	ES1-P-N	
E5.003	ES3313	
E5.004	ES3312	
E8.000	ES1-P-T	
E5.005	ES3311	
E1.006	ES306	
E1.007	ES315	
E1.008	ES316	
E9.000	ESPM	
E1.009	ES317	1
E10.000	ESPV	
E1.010	ES318	
E1.011	ES319	
E11.000	ES321	
E12.000	ES323 (H)	
E1.012	ES320	
E13.000	ES3U1	
E1.013	ES324	
E14.000	ES3T1	
E15.000	ES3U2	
E1.014	ES325	
E1.015	ES326	
E16.000	ES3S1	
E1.016	ES327	
E1.017	ES328	
E17.000	ES3T3	4
E17.001	ES329A	
E18.000	ES3S2	
E1.018	ES329	
E1.019	ES329A	
E1.020	ES330	
E19.000	ES3T2	
E1.021	ES331	
E20.000	ES1-P-X	
E20.001	ES3310	
E20.002	ES3309	
E21.000	ES1-P-QS	
E22.000	ES1-P-P2B	
E20.003	ES3308	
E23.000	ES1-P-P2A	
E20.004	ES3307	
E20.005	ES3306	
E20.006	ES3305	
E24.000	ES1-P-R2	
E25.000	ES1-P-QS2	
E20.007	ES3304	
E26.000	ES1-P-R	
E20.008	ES3303	
E20.009	ES3302	
E20.010	ES3301	
E20.011	ES409	
E1.022	EPOND 2	

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.268 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 0

Water Surcharged Flooded Pipe															
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status
E1.000	ES3L1	15 Winter	30	+0%	100/15 Summer				145.719	-0.516	0.000	0.47		924.3	OK
E2.000	ES3K1	15 Winter	30	+0%					148.087	-0.625	0.000	0.06		164.1	OK
E1.001	ES303	15 Winter	30	+0%	100/15 Summer				145.697	-0.388	0.000	0.59		1150.3	OK
E1.002	ES303A	15 Winter	30	+0%	100/15 Summer				145.649	-0.266	0.000	0.58		1148.5	OK
E1.003	ES304	15 Winter	30	+0%	100/15 Summer				145.608	-0.077	0.000	0.80		1697.6	OK
E3.000	EMH-C14	15 Winter	30	+0%	2/15 Summer				146.761	0.659	0.000	2.44		623.3	SURCHARGED
E1.004	EMH-C15	15 Winter	30	+0%	30/15 Winter				145.521	0.116	0.000	0.88		2166.1	SURCHARGED
E1.005	ES305	15 Winter	30	+0%	30/15 Summer				145.361	0.329	0.000	0.80		1906.5	SURCHARGED
E4.000	ESPK2	15 Winter	30	+0%					147.855	-0.164	0.000	0.79		206.6	OK
E4.001	ES314	15 Winter	30	+0%					147.553	-0.350	0.000	0.24		207.8	OK
E5.000	ES3316	15 Winter	30	+0%	100/15 Summer				149.648	-0.045	0.000	0.84		64.0	OK
E6.000	ES1-P-O	15 Winter	30	+0%	30/15 Summer				148.415	0.088	0.000	0.89		276.0	SURCHARGED
E5.001	ES3315	15 Winter	30	+0%	30/15 Summer				148.369	0.096	0.000	1.31		333.7	SURCHARGED
E5.002	ES3314	15 Winter	30	+0%	30/15 Winter				148.174	0.013	0.000	1.11		320.1	SURCHARGED
E7.000	ES1-P-N	15 Winter	30	+0%					148.365	-0.432	0.000	0.17		145.5	OK
E5.003	ES3313	15 Winter	30	+0%	100/15 Winter				147.914	-0.186	0.000	0.80		427.1	OK
E5.004	ES3312	15 Winter	30	+0%	100/15 Winter				147.157	-0.277	0.000	0.56		648.0	OK
E8.000	ES1-P-T	15 Winter	30	+0%	2/15 Summer				146.002	0.849	0.000	2.63		429.0	SURCHARGED
E5.005	ES3311	15 Winter	30	+0%	30/15 Summer				145.502	0.412	0.000	0.98		994.3	SURCHARGED
E1.006	ES306	15 Winter	30	+0%	30/15 Summer				145.184	0.524	0.000	1.24		3032.4	SURCHARGED
E1.007	ES315	15 Winter	30	+0%	30/15 Summer				144.678	0.393	0.000	1.34		2945.1	SURCHARGED
E1.008	ES316	15 Winter	30	+0%	30/15 Summer				144.121	0.135	0.000	1.20		2887.3	SURCHARGED
E9.000	ESPM	15 Winter	30	+0%	100/15 Winter				143.791	-0.246	0.000	0.77		816.3	OK
E1.009	ES317	30 Winter	30	+0%	30/30 Winter	100/30 Winter			143.608	0.024	0.000	0.91		3075.9	SURCHARGED
E10.000	ESPV	360 Winter	30	+0%	100/15 Winter				143.751	-0.375	0.000	0.00		0.0	OK
E1.010	ES318	30 Winter	30	+0%	30/30 Winter				143.368	0.170	0.000	0.91		2873.1	SURCHARGED
E1.011	ES319	30 Winter	30	+0%	30/30 Winter				143.148	0.286	0.000	0.80		2795.2	SURCHARGED
E11.000	ES321	15 Winter	30	+0%	2/15 Summer				145.299	1.283	0.000	2.57		195.2	SURCHARGED
E12.000	ES323 (H)	30 Winter	30	+0%	30/15 Summer				142.993	0.443	0.000	1.00		178.2	SURCHARGED
E1.012	ES320	30 Winter	30	+0%	30/30 Summer				142.910	0.460	0.000	0.74		2878.9	SURCHARGED
E13.000	ES3U1	30 Winter	30	+0%	30/30 Winter				142.875	0.125	0.000	0.24		681.5	SURCHARGED
E1.013	ES324	30 Winter	30	+0%	30/30 Summer				142.596	0.723	0.000	0.93		3304.7	SURCHARGED
E14.000	ES3T1	30 Winter	30	+0%	100/15 Winter				142.296	-0.279	0.000	0.00		5.0	OK
E15.000	ES3U2	30 Winter	30	+0%	100/15 Winter				142.303	-0.242	0.000	0.06		70.7	OK
E1.014	ES325	30 Winter	30	+0%	30/15 Winter				142.296	0.762	0.000	1.16		3327.6	SURCHARGED
E1.015	ES326	60 Winter	30	+0%	30/15 Winter				142.127	0.720	0.000	0.98		3193.2	SURCHARGED
E16.000	ES361	60 Winter	30	+0%	30/30 Summer				141.959	0.601	0.000	0.11		161.1	SURCHARGED
E1.016	ES327	60 Winter	30	+0%	30/15 Winter				141.954	0.727	0.000	1.00		3284.8	SURCHARGED
E1.017	ES328	60 Winter	30	+0%	30/15 Winter				141.757	0.727	0.000	1.00		3292.5	SURCHARGED
E17.000	ES3T3	15 Winter	30	+0%	2/15 Summer	100/15 Summer			143.321	2.151	0.000	2.22		1111.0	SURCHARGED
E17.001	ES329A	15 Winter	30	+0%	2/15 Summer				142.045	1.125	0.000	3.21		1114.0	SURCHARGED
E18.000	ES362	60 Winter	30	+0%	30/15 Winter				141.564	0.714	0.000	0.41		239.0	SURCHARGED
E1.018	ES329	60 Winter	30	+0%	30/15 Winter				141.559	0.729	0.000	1.28		3866.7	SURCHARGED
E1.019	ES329A	60 Winter	30	+0%	30/15 Winter				141.177	0.485	0.000	1.25		3870.7	SURCHARGED
E1.020	ES330	60 Winter	30	+0%	30/15 Winter				140.796	0.256	0.000	1.31		3875.4	SURCHARGED
E19.000	ES3T2	15 Winter	30	+0%					141.170	-0.720	0.000	0.21		798.7	OK
E1.021	ES331	30 Winter	30	+0%	100/30 Summer				140.412	0.000	0.000	1.05		4051.1	OK
E20.000	ES1-P-X	15 Winter	30	+0%	30/15 Summer				147.281	0.149	0.000	0.93		544.5	SURCHARGED
E20.001	ES3310	15 Winter	30	+0%	30/15 Summer				147.209	0.159	0.000	0.37		533.2	SURCHARGED
E20.002	ES3309	15 Winter	30	+0%	30/15 Summer				146.974	0.338	0.000	0.33		465.9	SURCHARGED
E21.000	ES1-P-QS	15 Winter	30	+0%	30/15 Summer				146.861	0.462	0.000	0.34		131.2	SURCHARGED
E22.000	ES1-P-P2B	15 Winter	30	+0%	2/15 Summer				147.852	1.378	0.000	2.23		1049.2	SURCHARGED
E20.003	ES3308	15 Winter	30	+0%	30/15 Summer				146.801	0.547	0.000	1.02		1555.0	SURCHARGED
E23.000	ES1-P-P2A	15 Winter	30	+0%	30/15 Summer				146.409	0.399	0.000	0.78		559.3	SURCHARGED
E20.004	ES3307	15 Winter	30	+0%	30/15 Summer				146.310	0.510	0.000	1.47		2060.3	SURCHARGED
E20.005	ES3306	15 Winter	30	+0%	30/15 Summer				145.849	0.239	0.000	1.49		2054.2	SURCHARGED
E20.006	ES3305	15 Winter	30	+0%	100/15 Summer				145.177	-0.268	0.000	0.91		2051.2	OK
E24.000	ES1-P-R2	15 Winter	30	+0%	30/15 Winter				145.023	0.003	0.000	1.02		354.2	SURCHARGED
E25.000	ES1-P-QS2	15 Winter	30	+0%	30/15 Summer				145.067	0.037	0.000	1.20		434.3	SURCHARGED
E20.007	ES3304	15 Winter	30	+0%	100/15 Summer				144.682	-0.218	0.000	0.88		2575.6	OK
E26.000	ES1-P-R	15 Winter	30	+0%	100/15 Summer				144.073	-0.127	0.000	0.77		345.8	OK
E20.008	ES3303	15 Winter	30	+0%	30/15 Winter				144.020	0.020	0.000	1.00		2670.7	SURCHARGED
E20.009	ES3302	15 Winter	30	+0%	30/15 Winter				143.269	0.027	0.000	1.05		2663.1	SURCHARGED
E20.010	ES3301	15 Winter	30	+0%	100/15 Winter				142.297	-0.244	0.000	0.95		2670.5	OK
E20.011	ES409	15 Winter	30	+0%	2/15 Summer				140.295	0.525	0.000	1.90		2671.9	SURCHARGED
E1.022	EPOND 2	960 Winter	30	+0%	2/720 Winter				139.864	0.714	0.000	0.33		388.3	SURCHARGED

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

PN	US/MH Name	Level Exceeded
E1.000	ES3L1	
E2.000	ES3K1	
E1.001	ES303	
E1.002	ES303A	
E1.003	ES304	
E3.000	EMH-C14	
E1.004	EMH-C15	
E1.005	ES305	
E4.000	ESPK2	
E4.001	ES314	
E5.000	ES3316	
E6.000	ES1-P-O	
E5.001	ES3315	
E5.002	ES3314	
E7.000	ES1-P-N	
E5.003	ES3313	
E5.004	ES3312	
E8.000	ES1-P-T	
E5.005	ES3311	
E1.006	ES306	
E1.007	ES315	
E1.008	ES316	
E9.000	ESPM	
E1.009	ES317	1
E10.000	ESPV	
E1.010	ES318	
E1.011	ES319	
E11.000	ES321	
E12.000	ES323 (H)	
E1.012	ES320	
E13.000	ES3U1	
E1.013	ES324	
E14.000	ES3T1	
E15.000	ES3U2	
E1.014	ES325	
E1.015	ES326	
E16.000	ES3S1	
E1.016	ES327	
E1.017	ES328	
E17.000	ES3T3	4
E17.001	ES329A	
E18.000	ES3S2	
E1.018	ES329	
E1.019	ES329A	
E1.020	ES330	
E19.000	ES3T2	
E1.021	ES331	
E20.000	ES1-P-X	
E20.001	ES3310	
E20.002	ES3309	
E21.000	ES1-P-QS	
E22.000	ES1-P-P2B	
E20.003	ES3308	
E23.000	ES1-P-P2A	
E20.004	ES3307	
E20.005	ES3306	
E20.006	ES3305	
E24.000	ES1-P-R2	
E25.000	ES1-P-QS2	
E20.007	ES3304	
E26.000	ES1-P-R	
E20.008	ES3303	
E20.009	ES3302	
E20.010	ES3301	
E20.011	ES409	
E1.022	EPOND 2	

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.268 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Status
									Level (m)	Depth (m)	Volume (m³)			Flow (l/s)	
E1.000	ES3L1	30 Winter	100	+0%	100/15 Summer				148.251	2.016	0.000	0.50		983.4	SURCHARGED
E2.000	ES3K1	15 Winter	100	+0%					148.108	-0.604	0.000	0.08		211.5	OK
E1.001	ES303	30 Winter	100	+0%	100/15 Summer				147.671	1.586	0.000	0.61		1206.6	SURCHARGED
E1.002	ES303A	30 Winter	100	+0%	100/15 Summer				147.528	1.613	0.000	0.57		1126.5	SURCHARGED
E1.003	ES304	30 Winter	100	+0%	100/15 Summer				147.463	1.778	0.000	0.79		1677.6	SURCHARGED
E3.000	EMH-C14	30 Winter	100	+0%	2/15 Summer				147.665	1.563	0.000	2.65		676.3	SURCHARGED
E1.004	EMH-C15	30 Winter	100	+0%	30/15 Winter				147.418	2.013	0.000	0.86		2112.0	SURCHARGED
E1.005	ES305	30 Winter	100	+0%	30/15 Summer				147.314	2.282	0.000	0.83		1997.3	SURCHARGED
E4.000	ESPK2	15 Winter	100	+0%					147.999	-0.020	0.000	1.00		261.3	OK
E4.001	ES314	15 Winter	100	+0%					147.575	-0.328	0.000	0.30		260.8	OK
E5.000	ES3316	15 Winter	100	+0%	100/15 Summer				150.121	0.428	0.000	0.91		69.8	SURCHARGED
E6.000	ES1-P-O	15 Winter	100	+0%	30/15 Summer				148.662	0.335	0.000	1.11		345.7	SURCHARGED
E5.001	ES3315	15 Winter	100	+0%	30/15 Summer				148.600	0.327	0.000	1.62		410.9	SURCHARGED
E5.002	ES3314	30 Winter	100	+0%	30/15 Winter				148.393	0.232	0.000	1.32		378.8	SURCHARGED
E7.000	ES1-P-N	15 Winter	100	+0%					148.390	-0.407	0.000	0.22		187.7	OK
E5.003	ES3313	30 Winter	100	+0%	100/15 Winter				148.310	0.210	0.000	0.98		521.8	SURCHARGED
E5.004	ES3312	30 Winter	100	+0%	100/15 Winter				148.000	0.566	0.000	0.68		791.6	SURCHARGED
E8.000	ES1-P-T	30 Winter	100	+0%	2/15 Summer				147.812	2.659	0.000	2.62		427.4	SURCHARGED
E5.005	ES3311	30 Winter	100	+0%	30/15 Summer				147.420	2.330	0.000	1.11		1132.0	SURCHARGED
E1.006	ES306	30 Winter	100	+0%	30/15 Summer				147.154	2.494	0.000	1.34		3283.7	SURCHARGED
E1.007	ES315	30 Winter	100	+0%	30/15 Summer				146.712	2.427	0.000	1.44		3158.4	SURCHARGED
E1.008	ES316	30 Winter	100	+0%	30/15 Summer				146.248	2.262	0.000	1.26		3029.5	SURCHARGED
E9.000	ESPM	30 Winter	100	+0%	100/15 Winter				145.997	1.960	0.000	0.84		888.5	SURCHARGED
E1.009	ES317	30 Winter	100	+0%	30/30 Winter	100/30 Winter			145.776	2.192	13.308	1.01		3410.8	FLOOD
E10.000	ESPV	30 Winter	100	+0%	100/15 Winter				145.509	1.383	0.000	0.03		9.6	SURCHARGED
E1.010	ES318	30 Winter	100	+0%	30/30 Winter				145.508	2.310	0.000	1.03		3271.5	FLOOD RISK
E1.011	ES319	30 Winter	100	+0%	30/30 Winter				145.220	2.358	0.000	0.92		3216.9	SURCHARGED
E11.000	ES321	15 Winter	100	+0%	2/15 Summer				146.168	2.152	0.000	3.22		244.4	SURCHARGED
E12.000	ES323 (H)	30 Winter	100	+0%	30/15 Summer				144.975	2.425	0.000	1.33		236.6	SURCHARGED
E1.012	ES320	30 Winter	100	+0%	30/30 Summer				144.913	2.463	0.000	0.86		3348.8	SURCHARGED
E13.000	ES3U1	30 Winter	100	+0%	30/30 Winter				144.719	1.969	0.000	0.31		888.7	SURCHARGED
E1.013	ES324	30 Winter	100	+0%	30/30 Summer				144.507	2.634	0.000	1.17		4147.8	SURCHARGED
E14.000	ES3T1	30 Winter	100	+0%	100/15 Winter				144.066	1.491	0.000	0.01		19.3	FLOOD RISK
E15.000	ES3U2	30 Winter	100	+0%	100/15 Winter				144.071	1.526	0.000	0.07		92.2	FLOOD RISK
E1.014	ES325	30 Winter	100	+0%	30/15 Winter				144.064	2.530	0.000	1.44		4147.6	SURCHARGED
E1.015	ES326	30 Winter	100	+0%	30/15 Winter				143.638	2.231	0.000	1.27		4133.8	FLOOD RISK
E16.000	ES3S1	30 Winter	100	+0%	30/30 Summer				143.209	1.851	0.000	0.20		278.3	SURCHARGED
E1.016	ES327	30 Winter	100	+0%	30/15 Winter				143.204	1.977	0.000	1.28		4226.7	SURCHARGED
E1.017	ES328	30 Winter	100	+0%	30/15 Winter				142.744	1.714	0.000	1.28		4221.9	SURCHARGED
E17.000	ES3T3	15 Winter	100	+0%	2/15 Summer	100/15 Summer			144.031	2.861	31.204	2.53		1267.7	FLOOD
E17.001	ES329A	30 Winter	100	+0%	2/15 Summer				143.087	2.167	0.000	3.36		1166.1	SURCHARGED
E18.000	ES3S2	60 Winter	100	+0%	30/15 Winter				142.313	1.463	0.000	0.54		314.2	SURCHARGED
E1.018	ES329	60 Winter	100	+0%	30/15 Winter				142.306	1.476	0.000	1.65		4962.1	SURCHARGED
E1.019	ES329A	60 Winter	100	+0%	30/15 Winter				141.676	0.984	0.000	1.61		4972.9	SURCHARGED
E1.020	ES330	60 Winter	100	+0%	30/15 Winter				141.044	0.504	0.000	1.69		4976.8	SURCHARGED
E19.000	ES3T2	15 Winter	100	+0%					141.216	-0.674	0.000	0.28		1029.5	OK
E1.021	ES331	30 Winter	100	+0%	100/30 Summer				140.499	0.087	0.000	1.35		5217.8	SURCHARGED
E20.000	ES1-P-X	15 Winter	100	+0%	30/15 Summer				148.392	1.260	0.000	1.01		589.5	SURCHARGED
E20.001	ES3310	15 Winter	100	+0%	30/15 Summer				148.336	1.286	0.000	0.39		562.4	SURCHARGED
E20.002	ES3309	15 Winter	100	+0%	30/15 Summer				148.131	1.495	0.000	0.39		537.2	SURCHARGED
E21.000	ES1-P-QS	15 Winter	100	+0%	30/15 Summer				148.006	1.607	0.000	0.43		163.0	SURCHARGED
E22.000	ES1-P-P2B	15 Winter	100	+0%	2/15 Summer				149.242	2.768	0.000	2.64		1240.5	SURCHARGED
E20.003	ES3308	15 Winter	100	+0%	30/15 Summer				147.933	1.679	0.000	1.26		1908.8	SURCHARGED
E23.000	ES1-P-P2A	15 Winter	100	+0%	30/15 Summer				147.386	1.376	0.000	0.97		697.0	SURCHARGED
E20.004	ES3307	15 Winter	100	+0%	30/15 Summer				147.293	1.493	0.000	1.78		2501.3	SURCHARGED
E20.005	ES3306	15 Winter	100	+0%	30/15 Summer				146.727	1.117	0.000	1.78		2451.1	SURCHARGED
E20.006	ES3305	15 Winter	100	+0%	100/15 Summer				146.173	0.728	0.000	1.07		2427.2	SURCHARGED
E24.000	ES1-P-R2	15 Winter	100	+0%	30/15 Winter				145.632	0.612	0.000	1.36		470.9	SURCHARGED
E25.000	ES1-P-QS2	15 Winter	100	+0%	30/15 Summer				145.641	0.611	0.000	1.55		558.4	SURCHARGED
E20.007	ES3304	15 Winter	100	+0%	100/15 Summer				145.582	0.682	0.000	1.02		2975.8	SURCHARGED
E26.000	ES1-P-R	15 Winter	100	+0%	100/15 Summer				144.791	0.591	0.000	0.99		441.8	SURCHARGED
E20.008	ES3303	15 Winter	100	+0%	30/15 Winter				144.646	0.646	0.000	1.17		3138.7	SURCHARGED
E20.009	ES3302	15 Winter	100	+0%	30/15 Winter				143.693	0.451	0.000	1.22		3095.5	SURCHARGED
E20.010	ES3301	15 Winter	100	+0%	100/15 Winter				142.664	0.123	0.000	1.09		3070.9	SURCHARGED
E20.011	ES409	15 Winter	100	+0%	2/15 Summer				140.548	0.778	0.000	2.19		3072.8	SURCHARGED
E1.022	EPOND 2	960 Winter	100	+0%	2/720 Winter				140.268	1.118	0.000	0.37		445.5	FLOOD RISK

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

PN	US/MH Name	Level Exceeded
E1.000	ES3L1	
E2.000	ES3K1	
E1.001	ES303	
E1.002	ES303A	
E1.003	ES304	
E3.000	EMH-C14	
E1.004	EMH-C15	
E1.005	ES305	
E4.000	ESPK2	
E4.001	ES314	
E5.000	ES3316	
E6.000	ES1-P-O	
E5.001	ES3315	
E5.002	ES3314	
E7.000	ES1-P-N	
E5.003	ES3313	
E5.004	ES3312	
E8.000	ES1-P-T	
E5.005	ES3311	
E1.006	ES306	
E1.007	ES315	
E1.008	ES316	
E9.000	ESPM	
E1.009	ES317	1
E10.000	ESPV	
E1.010	ES318	
E1.011	ES319	
E11.000	ES321	
E12.000	ES323 (H)	
E1.012	ES320	
E13.000	ES3U1	
E1.013	ES324	
E14.000	ES3T1	
E15.000	ES3U2	
E1.014	ES325	
E1.015	ES326	
E16.000	ES3S1	
E1.016	ES327	
E1.017	ES328	
E17.000	ES3T3	4
E17.001	ES329A	
E18.000	ES3S2	
E1.018	ES329	
E1.019	ES329A	
E1.020	ES330	
E19.000	ES3T2	
E1.021	ES331	
E20.000	ES1-P-X	
E20.001	ES3310	
E20.002	ES3309	
E21.000	ES1-P-QS	
E22.000	ES1-P-P2B	
E20.003	ES3308	
E23.000	ES1-P-P2A	
E20.004	ES3307	
E20.005	ES3306	
E20.006	ES3305	
E24.000	ES1-P-R2	
E25.000	ES1-P-QS2	
E20.007	ES3304	
E26.000	ES1-P-R	
E20.008	ES3303	
E20.009	ES3302	
E20.010	ES3301	
E20.011	ES409	
E1.022	EPOND 2	

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

Simulation Criteria

Areal Reduction Factor	1.000	Manhole Headloss Coeff (Global)	0.500	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Foul Sewage per hectare (l/s)	0.000	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Additional Flow - % of Total Flow	0.000	Flow per Person per Day (l/per/day)	0.000

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

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Catchment
FEH Rainfall Version	2013	Cv (Summer)	0.750
Site Location	GB 391450 411950 SD 91450 11950	Cv (Winter)	0.840

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

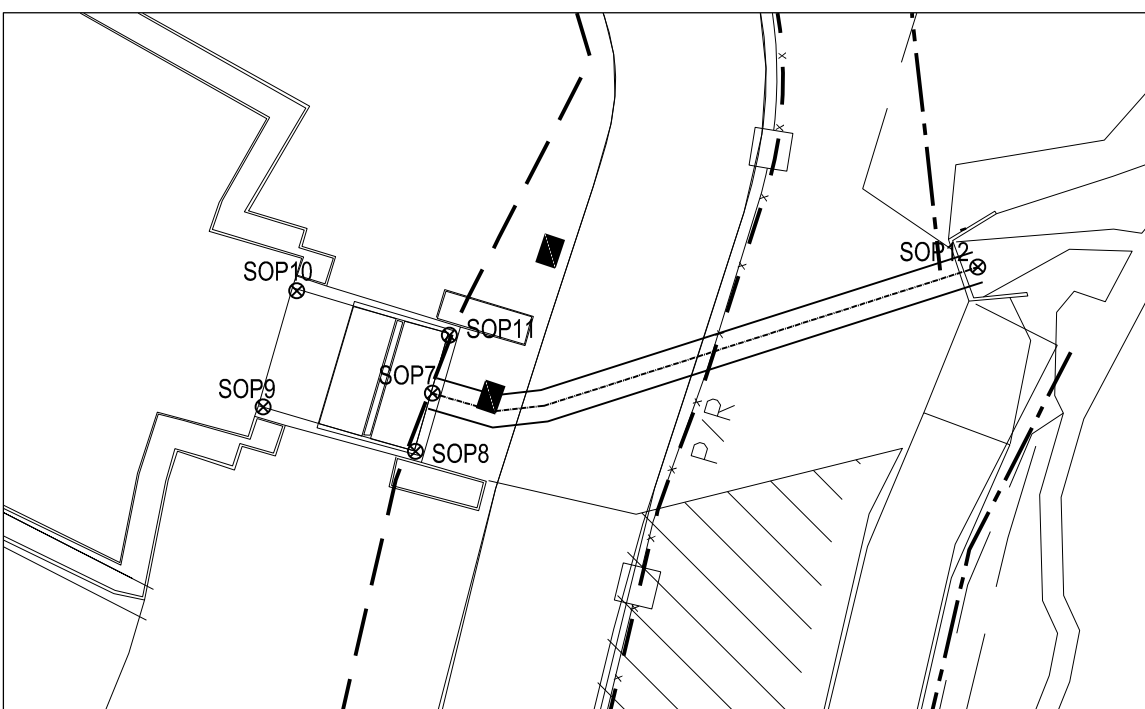
Profile(s)	Summer and Winter
Duration(s) (mins)	120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Period(s) (years)	100
Climate Change (%)	0

										Water	Surcharged	Flooded	Pipe				
	US/MH			Return	Climate	First (X)		First (Y)	First (Z)	Overflow	Level	Depth	Volume	Flow /	Overflow	Flow	
PN	Name	Storm	Period	Change		Surcharge		Flood	Overflow	Act.	(m)	(m)	(m³)	Cap.	(l/s)	(l/s)	Status
E1.000	ES3L1	120	Summer	100	+0%						145.585	-0.650	0.000	0.33		645.0	OK
E2.000	ES3K1	120	Summer	100	+0%						148.064	-0.648	0.000	0.04		114.2	OK
E1.001	ES303	120	Summer	100	+0%						145.569	-0.516	0.000	0.41		808.2	OK
E1.002	ES303A	120	Summer	100	+0%						145.530	-0.385	0.000	0.42		819.1	OK
E1.003	ES304	120	Summer	100	+0%						145.474	-0.211	0.000	0.62		1315.8	OK
E3.000	EMH-C14	120	Summer	100	+0%	100/120	Summer				146.345	0.243	0.000	1.72		440.1	SURCHARGED
E1.004	EMH-C15	120	Summer	100	+0%						145.383	-0.022	0.000	0.70		1708.3	OK
E1.005	ES305	120	Summer	100	+0%	100/120	Summer				145.196	0.164	0.000	0.69		1643.1	SURCHARGED
E4.000	ESPK2	120	Summer	100	+0%						147.774	-0.245	0.000	0.56		145.5	OK
E4.001	ES314	120	Summer	100	+0%						147.522	-0.381	0.000	0.17		145.1	OK
E5.000	ES3316	120	Summer	100	+0%						149.593	-0.100	0.000	0.59		45.5	OK
E6.000	ES1-P-O	120	Summer	100	+0%						148.186	-0.141	0.000	0.62		192.8	OK
E5.001	ES3315	120	Summer	100	+0%						148.159	-0.114	0.000	0.98		250.0	OK
E5.002	ES3314	120	Summer	100	+0%						148.004	-0.157	0.000	0.89		256.9	OK
E7.000	ES1-P-N	120	Summer	100	+0%						148.335	-0.462	0.000	0.12		101.0	OK
E5.003	ES3313	120	Summer	100	+0%						147.868	-0.232	0.000	0.69		367.3	OK
E5.004	ES3312	120	Summer	100	+0%						147.131	-0.303	0.000	0.49		570.2	OK
E8.000	ES1-P-T	120	Summer	100	+0%	100/120	Summer				145.547	0.394	0.000	1.90		310.2	SURCHARGED
E5.005	ES3311	120	Summer	100	+0%	100/120	Summer				145.336	0.246	0.000	0.84		857.7	SURCHARGED
E1.006	ES306	120	Summer	100	+0%	100/120	Summer				145.130	0.470	0.000	1.08		2639.0	SURCHARGED
E1.007	ES315	120	Summer	100	+0%	100/120	Summer				144.901	0.616	0.000	1.18		2579.1	SURCHARGED
E1.008	ES316	120	Summer	100	+0%	100/120	Summer				144.674	0.688	0.000	1.00		2418.7	SURCHARGED
E9.000	ESPM	120	Summer	100	+0%	100/120	Summer				144.624	0.587	0.000	0.54		569.0	SURCHARGED
E1.009	ES317	120	Summer	100	+0%	100/120	Summer				144.405	0.821	0.000	0.82		2793.0	SURCHARGED
E10.000	ESPV	120	Summer	100	+0%	100/120	Summer				144.217	0.091	0.000	0.01		4.5	SURCHARGED
E1.010	ES318	120	Summer	100	+0%	100/120	Summer				144.212	1.014	0.000	0.84		2665.9	SURCHARGED
E1.011	ES319	120	Summer	100	+0%	100/120	Summer				144.042	1.180	0.000	0.76		2660.5	SURCHARGED
E11.000	ES321	120	Summer	100	+0%	100/120	Summer				144.606	0.590	0.000	1.91		144.9	SURCHARGED
E12.000	ES323 (H)	120	Summer	100	+0%	100/120	Summer				143.951	1.401	0.000	0.85		151.3	SURCHARGED
E1.012	ES320	120	Summer	100	+0%	100/120	Summer				143.846	1.396	0.000	0.72		2786.5	SURCHARGED
E13.000	ES3U1	120	Summer	100	+0%	100/120	Summer				143.871	1.121	0.000	0.20		565.0	SURCHARGED
E1.013	ES324	120	Summer	100	+0%	100/120	Summer				143.557	1.684	0.000	1.00		3543.5	SURCHARGED
E14.000	ES3T1	120	Summer	100	+0%	100/120	Summer				143.228	0.653	0.000	0.01		10.6	SURCHARGED
E15.000	ES3U2	120	Summer	100	+0%	100/120	Summer				143.234	0.689	0.000	0.05		59.0	SURCHARGED
E1.014	ES325	120	Summer	100	+0%	100/120	Summer				143.229	1.695	0.000	1.24		3576.1	SURCHARGED
E1.015	ES326	120	Summer	100	+0%	100/120	Summer				142.904	1.497	0.000	1.10		3578.0	SURCHARGED
E16.000	ES3S1	120	Summer	100	+0%	100/120	Summer				142.582	1.224	0.000	0.15		206.5	SURCHARGED
E1.016	ES327	120	Summer	100	+0%	100/120	Summer				142.577	1.350	0.000	1.12		3690.7	SURCHARGED
E1.017	ES328	120	Summer	100	+0%	100/120	Summer				142.227	1.197	0.000	1.12		3695.6	SURCHARGED
E17.000	ES3T3	120	Summer	100	+0%	100/120	Summer				142.752	1.582	0.000	1.61		807.8	SURCHARGED
E17.001	ES329A	120	Summer	100	+0%	100/120	Summer				142.280	1.360	0.000	2.30		796.8	SURCHARGED
E18.000	ES3S2	120	Summer	100	+0%	100/120	Summer				141.885	1.035	0.000	0.49		285.2	SURCHARGED
E1.018	ES329	120	Summer	100	+0%	100/120	Summer				141.879	1.049	0.000	1.45		4370.1	SURCHARGED
E1.019	ES329A	120	Summer	100	+0%	100/120	Summer				141.392	0.700	0.000	1.41		4378.6	SURCHARGED
E1.020	ES330	120	Summer	100	+0%	100/120	Summer				140.903	0.363	0.000	1.49		4387.3	SURCHARGED
E19.000	ES3T2	120	Summer	100	+0%						141.108	-0.782	0.000	0.15		554.4	OK
E1.021	ES331	120	Winter	100	+0%						140.412	0.000	0.000	1.18		4579.6	OK
E20.000	ES1-P-X	120	Summer	100	+0%						146.824	-0.308	0.000	0.65		381.1	OK
E20.001	ES3310	120	Summer	100	+0%						146.482	-0.568	0.000	0.27		395.2	OK
E20.002	ES3309	120	Summer	100	+0%						146.375	-0.261	0.000	0.27		381.3	OK
E21.000	ES1-P-QS	120	Summer	100	+0%	100/120	Summer				146.427	0.028	0.000	0.27		103.4	SURCHARGED
E22.000	ES1-P-P2B	120	Summer	100	+0%	100/120	Summer				146.900	0.426	0.000	1.73		814.2	SURCHARGED
E20.003	ES3308	120	Summer	100	+0%	100/120	Summer				146.293	0.039	0.000	0.83		1257.5	SURCHARGED
E23.000	ES1-P-P2A	120	Summer	100	+0%	100/120	Summer				146.132	0.122	0.000	0.57		411.6	SURCHARGED
E20.004	ES3307	120	Summer	100	+0%	100/120	Summer				145.981	0.181	0.000	1.18		1654.1	SURCHARGED
E20.005	ES3306	120	Summer	100	+0%	100/120	Summer				145.689	0.079	0.000	1.21		1666.4	SURCHARGED
E20.006	ES3305	120	Summer	100	+0%						145.070	-0.375	0.000	0.74		1674.8	OK
E24.000	ES1-P-R2	120	Summer	100	+0%						144.803	-0.217	0.000	0.73		254.5	OK
E25.000	ES1-P-QS2	120	Summer	100	+0%						144.852	-0.178	0.000	0.84		302.8	OK
E20.007	ES3304	120	Summer	100	+0%						144.528	-0.372	0.000	0.74		2168.6	OK
E26.000	ES1-P-R	120	Summer	100	+0%						143.913	-0.287	0.000	0.54		241.1	OK
E20.008	ES3303	120	Summer	100	+0%						143.723	-0.277	0.000	0.89		2385.2	OK
E20.009	ES3302	120	Summer	100	+0%						142.999	-0.243	0.000	0.95		2397.6	OK
E20.010	ES3301	120	Summer	100	+0%						142.238	-0.303	0.000	0.85		2404.6	OK
E20.011	ES409	960	Winter	100	+0%	100/120	Summer				140.278	0.508	0.000	0.33		470.8	SURCHARGED
E1.022	EPOND 2	960	Winter	100	+0%	100/120	Summer				140.272	1.122	0.000	0.37		446.1	FLOOD RISK

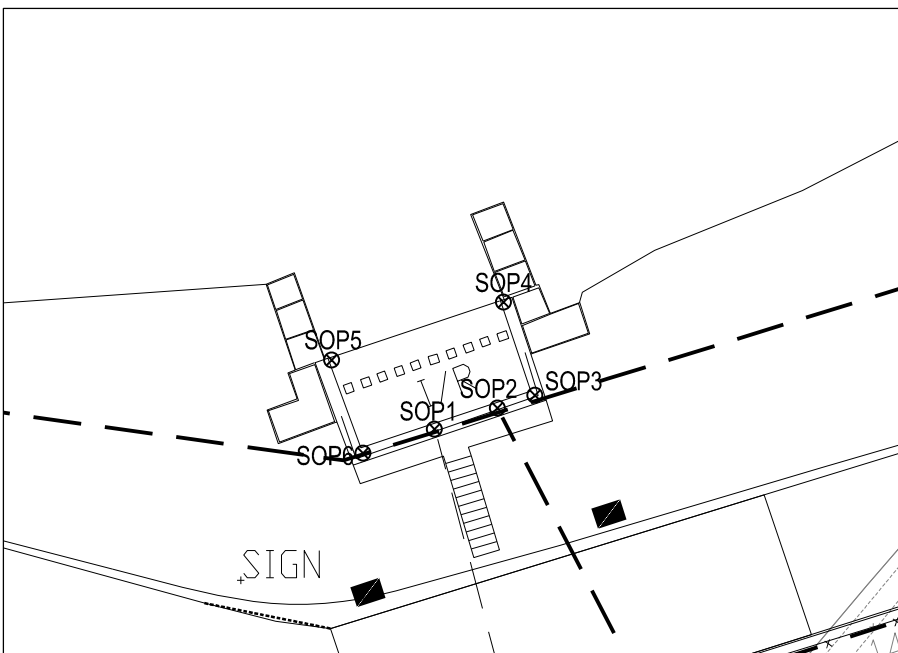
100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Existing

PN	US/MH Name	Level Exceeded
E1.000	ES3L1	
E2.000	ES3K1	
E1.001	ES303	
E1.002	ES303A	
E1.003	ES304	
E3.000	EMH-C14	
E1.004	EMH-C15	
E1.005	ES305	
E4.000	ESPK2	
E4.001	ES314	
E5.000	ES3316	
E6.000	ES1-P-O	
E5.001	ES3315	
E5.002	ES3314	
E7.000	ES1-P-N	
E5.003	ES3313	
E5.004	ES3312	
E8.000	ES1-P-T	
E5.005	ES3311	
E1.006	ES306	
E1.007	ES315	
E1.008	ES316	
E9.000	ESPM	
E1.009	ES317	
E10.000	ESPV	
E1.010	ES318	
E1.011	ES319	
E11.000	ES321	
E12.000	ES323 (H)	
E1.012	ES320	
E13.000	ES3U1	
E1.013	ES324	
E14.000	ES3T1	
E15.000	ES3U2	
E1.014	ES325	
E1.015	ES326	
E16.000	ES3S1	
E1.016	ES327	
E1.017	ES328	
E17.000	ES3T3	
E17.001	ES329A	
E18.000	ES3S2	
E1.018	ES329	
E1.019	ES329A	
E1.020	ES330	
E19.000	ES3T2	
E1.021	ES331	
E20.000	ES1-P-X	
E20.001	ES3310	
E20.002	ES3309	
E21.000	ES1-P-QS	
E22.000	ES1-P-P2B	
E20.003	ES3308	
E23.000	ES1-P-P2A	
E20.004	ES3307	
E20.005	ES3306	
E20.006	ES3305	
E24.000	ES1-P-R2	
E25.000	ES1-P-QS2	
E20.007	ES3304	
E26.000	ES1-P-R	
E20.008	ES3303	
E20.009	ES3302	
E20.010	ES3301	
E20.011	ES409	
E1.022	EPOND 2	

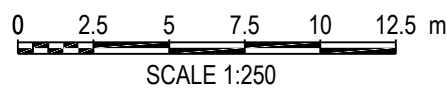
Appendix C – As-built drawings of Ponds and Flow Control



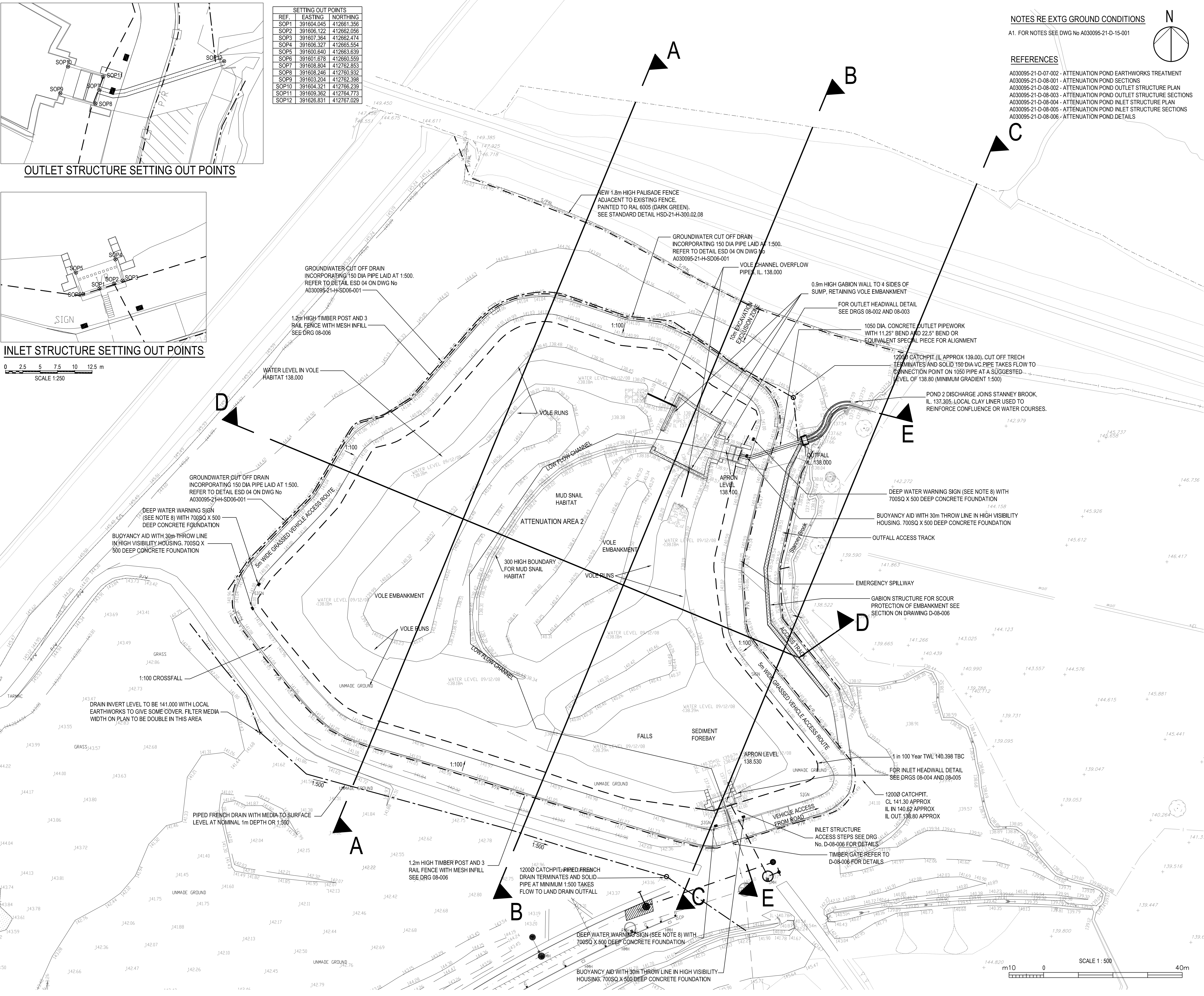
OUTLET STRUCTURE SETTING OUT POINTS



INLET STRUCTURE SETTING OUT POINTS



SETTING OUT POINTS		
REF.	EASTING	NORTHING
SOP1	391604.045	412661.366
SOP2	391606.122	412662.056
SOP3	391607.364	412662.474
SOP4	391606.327	412665.554
SOP5	391600.640	412663.639
SOP6	391601.678	412660.559
SOP7	391608.804	412762.853
SOP8	391608.246	412760.932
SOP9	391603.204	412762.398
SOP10	391604.321	412766.239
SOP11	391609.362	412764.773
SOP12	391626.831	412767.029



NOTES RE EXTG GROUND CONDITIONS

A1. FOR NOTES SEE DWG No A030095-21-D-15-001

REFERENCES

A030095-21-D-07-002 - ATTENUATION POND EARTHWORKS TREATMENT
A030095-21-D-08-001 - ATTENUATION POND SECTIONS
A030095-21-D-08-002 - ATTENUATION POND OUTLET STRUCTURE PLAN
A030095-21-D-08-003 - ATTENUATION POND OUTLET STRUCTURE SECTIONS
A030095-21-D-08-004 - ATTENUATION POND INLET STRUCTURE PLAN
A030095-21-D-08-005 - ATTENUATION POND INLET STRUCTURE SECTIONS
A030095-21-D-08-006 - ATTENUATION POND DETAILS

NOTES

- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER PROJECT DRAWINGS AND THE SPECIFICATION.
- THE SURVEY INFORMATION AND FINISHED AS BUILT INFORMATION OF THE PHASE ONE WORKS USED IN PREPARATION OF THIS AND ALL OTHER WYG DRAWINGS IS NOT WARRANTED. IT WILL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THAT ALL EXISTING INFORMATION PROVIDED IS ACCURATE AND CORRECT. ANY ERRORS SHALL BE REPORTED TO THE PROJECT MANAGER PRIOR TO COMMENCEMENT OF WORKS.
- ALL PROPOSED MANHOLE COVER LEVELS ARE APPROXIMATE ONLY. FINAL COVER LEVELS SHALL TIE IN WITH FINISHED SURFACE LEVELS.
- CONTRACTOR IS TO CONFIRM LOCATIONS AND LEVELS OF EXISTING CULVERTS AND PIPES PRIOR TO START OF WORKS.
- CONTRACTOR SHALL REFER TO RISK ASSESSMENTS IN HEALTH AND SAFETY PLAN PRIOR TO BEGINNING WORKS.
- FOR ACCESS TRACKS AND RAMPS SEE DETAIL AND NOTE ON DRAWING No. D-08-006.
- ALL WORKS TO ADHERE TO ALL RELEVANT CDM REGULATIONS, PROJECT RELATED CDM DOCUMENTATION AND HEALTH AND SAFETY RISK ASSESSMENTS.
- 'DEEP WATER' WARNING SIGN TO BE COMPLIANT WITH BS-5499
- POND PERIMETER FENCE TO BE SET AT 0.5m OFFSET FROM TOP OF EMBANKMENT UNLESS INDICATED OTHERWISE.
- ATTENUATION POND 2 TO PROVIDE STORAGE VOLUME OF 21,277m³.
- 10m EXCLUSION ZONE REQUIRED BY NETWORK RAIL TO ENSURE THAT EMBANKMENT REMAINS UNDISTURBED. NEW PALISADE FENCE TO BE ERECTED POND SIDE OF THE EXISTING NETWORK RAIL FENCE WHICH IS TO BE LEFT UNDISTURBED.
- BUOYANCY AID TO BE RING TYPE LIFEBOUJ, 450mm INTERNAL DIA, 750mm EXTERNAL DIA, POLYETHYLENE OUTER STRUCTURE FILLED WITH POLYURETHANE FOAM. THROW LINE TO BE FLOATING POLYPROPYLENE 8mm DIA. TO MEET E.C. DIRECTIVE 96/98 FOR MARINE EQUIPMENT.

IMPORTANT CDM / H&S NOTE

THE DESIGNERS WOULD DRAW THE READERS ATTENTION TO THE KEY OPERATION, MAINTENANCE AND DEMOLITION HEALTH AND SAFETY RISKS DETAILED IN THE RELEVANT HEALTH AND SAFETY FILES FOR THIS ELEMENT OF THE PROJECT

THE "AS BUILT" INFORMATION CONTAINED WITHIN THIS DRAWING HAS BEEN PROVIDED BY: PRINCIPAL CONTRACTOR

Carillon Regional Civil Engineering
Gateway House
1 Old Hall Road
Wirral International Business Park
Bromborough
Wirral
CH62 3NX Tel: 0151 3466000



AND REPRESENTS AN AS BUILT RECORD OF THE WORKS CARRIED OUT FOR:

KINGSWAY PHASE 2
ROCHDALE

VERIFIED AS A TRUE RECORD BY THE ABOVE CONTRACTORS REPRESENTATIVES

NAME	DATE	CONTRACT ROLE	SIGNED
J. TREE	OCT 09	PROJECT MANAGER	J.T.
T. AISYMONITT	OCT 09	AGENT	T.A.

THE AS BUILT INFORMATION PROVIDED BY THE ABOVE COMPANY IS NOT WARRANTED BY WYG.

AB1	AS BUILT ISSUE	BY	CHK	APP	DATE
REV	DESCRIPTION				

Wilson Bowden Developments
Forest Business Park
Cartwright Way
Bardon Hill
Leicestershire
LE67 1UB
Tel: 01530 276 276

Wilson Bowden
Developments

Kingsway
Gateway to England's Northwest

ARNDAL COURT
HEADINGLEY
LEEDS
LS6 2UJ



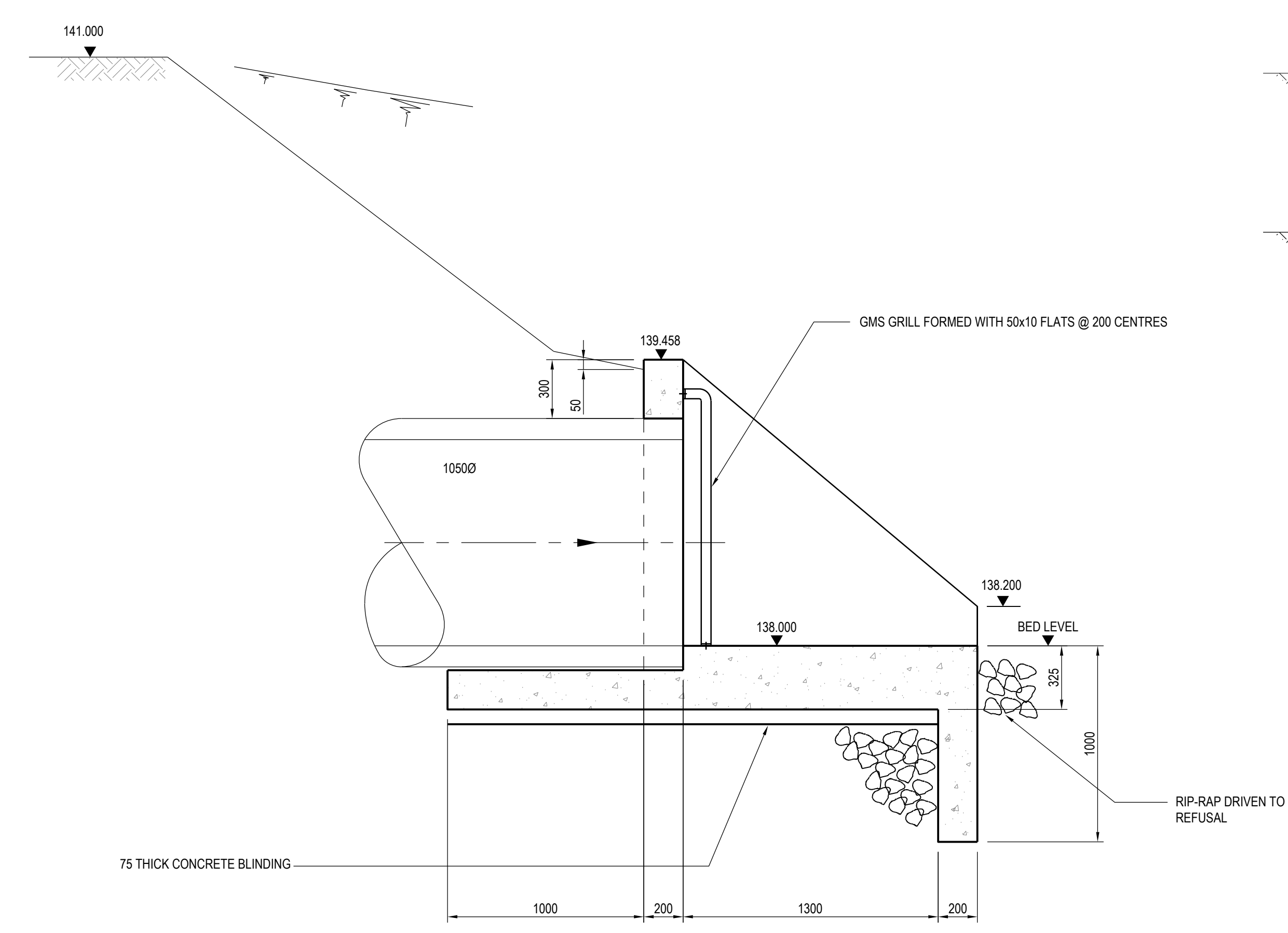
TEL: +44 (0)113 278 7111
FAX: +44 (0)113 278 3487
e-mail: leeds@wyg.com

Project:

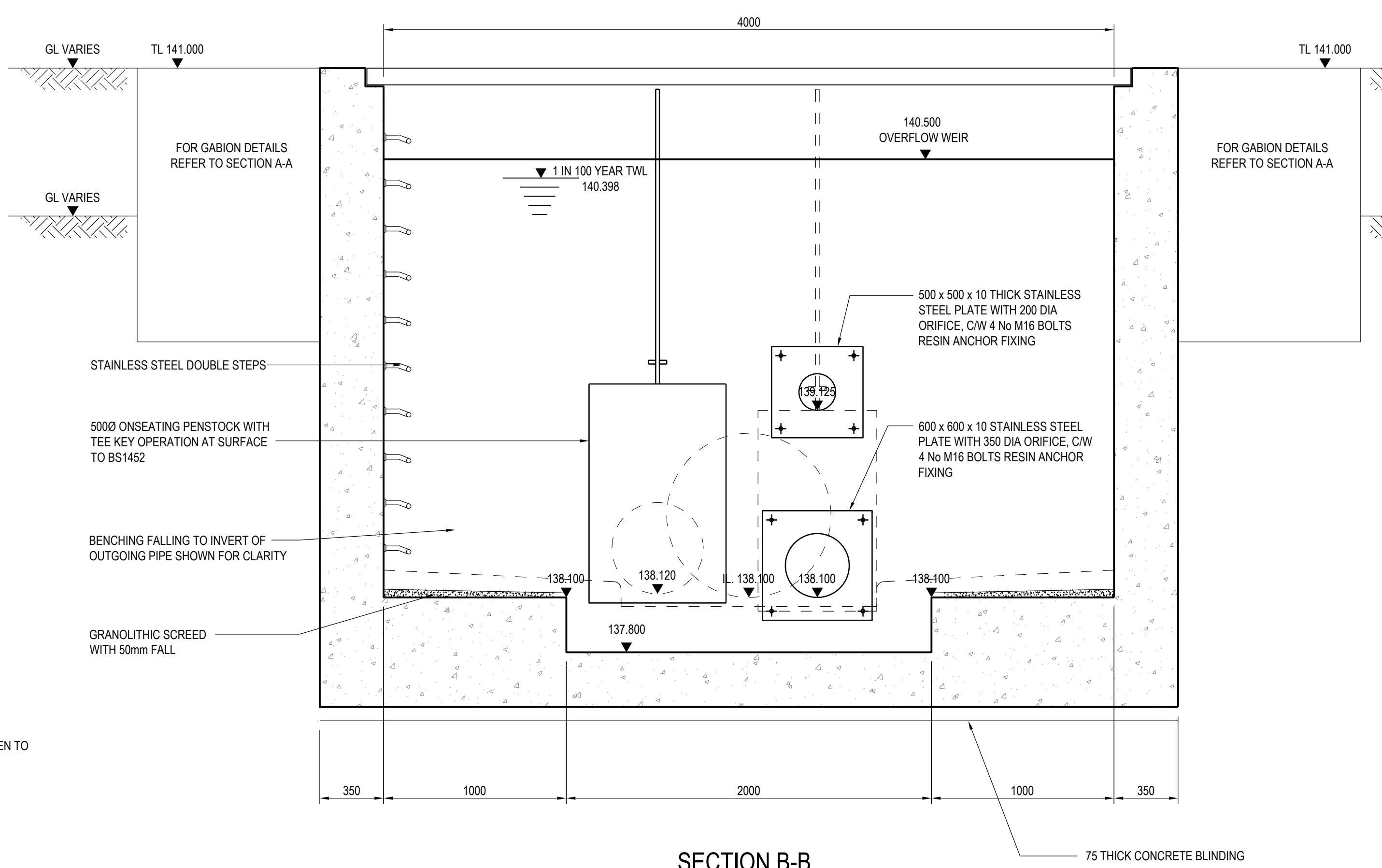
KINGSWAY PHASE 2
ROCHDALE

Drawing Title:
ATTENUATION POND 2
LAYOUT PLAN

Scale @	A1	Drawn	Date	Checked	Date	Approved	Date
1:500	NGP	07.07.06	GSG	24.07.06	KAO	24.07.06	
Project No.	Office	Type	Drawing No.	Revision			
A030095	21	D	07-001	AB1			



POND 2 OUTFALL TO STANNEY BROOK



SECTION B-B

- DO NOT SCALE: CONTRACTOR TO CHECK ALL DIMENSIONS AND REPORT ANY OMISSIONS OR ERRORS
- NOTES**
- FOR NOTES AND PLAN ON OUTLET STRUCTURE SEE DRAWING D-08-002
 - IMPERMEABLE MEMBRANE USED SHOULD BE NON-WOVEN, MINIMUM MASS PER UNIT OF 200g/m², PERMEABILITY <5x10⁻¹¹, MINIMUM TENSILE MEAN PEAK STRENGTH OF 10kN/m, CBR PUNCTURE RESISTANCE OF 190 ON & MINIMUM LIFE EXPECTANCY OF ABOUT 50 YEARS.

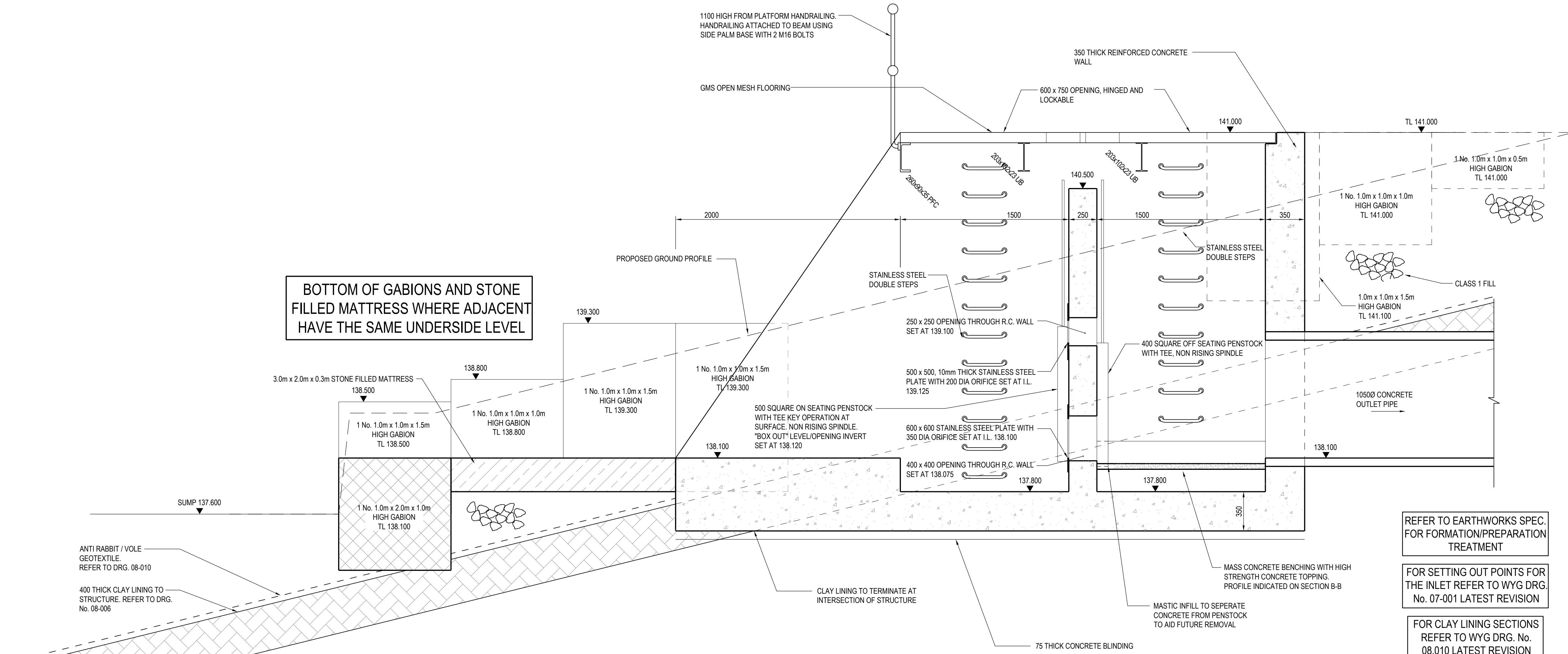
NOTES RE EXTG GROUND CONDITIONS

A1. FOR NOTES SEE DWG No A030095-21-D-15-001

- LEGEND**
- 3.0 x 2.0 x 0.3m STONE FILLED MATTRESS
 - GABION BASKETS - SIZES VARY
 - MIN. 400 THICK LINING

IMPORTANT CDM / H&S NOTE

THE DESIGNERS WOULD DRAW THE READERS ATTENTION TO THE KEY OPERATION, MAINTENANCE AND DEMOLITION HEALTH AND SAFETY RISKS DETAILED IN THE RELEVANT HEALTH AND SAFETY FILES FOR THIS ELEMENT OF THE PROJECT



SECTION A-A

THE "AS BUILT" INFORMATION CONTAINED WITHIN THIS DRAWING HAS BEEN PROVIDED BY: PRINCIPAL CONTRACTOR
Carillon Regional Civil Engineering
Gateway House
1 Old Hall Road
Wirral International Business Park
Bromborough
Wirral
CH62 3NX Tel: 0151 3466000



AND REPRESENTS AN AS BUILT RECORD OF THE WORKS CARRIED OUT FOR:
**KINGSWAY PHASE 2
ROCHDALE**

VERIFIED AS A TRUE RECORD BY THE ABOVE CONTRACTORS REPRESENTATIVES

NAME	DATE	CONTRACT ROLE	SIGNED
J.TREE	OCT 09	PROJECT MANAGER	J.T.
T.AJSYMONTT	OCT 09	AGENT	T.A.

THE AS BUILT INFORMATION PROVIDED BY THE ABOVE COMPANY IS NOT WARRANTED BY WYG.

REV	DESCRIPTION	BY	CHK	APP	DATE
AB1	AS BUILT ISSUE				

Wilson Bowden Developments
Forest Business Park
Cartwright Way
Bardon Hill
Leicestershire
LE67 1UB
Tel: 01530 276 276

WB
Wilson Bowden
Developments

Kingsway
Gateway to England's Northwest

ARNDAL COURT
HEADINGLEY
LEEDS
LS6 2UJ

wyg

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FAX: +44 (0)113 278 3487
e-mail: leeds@wyg.com

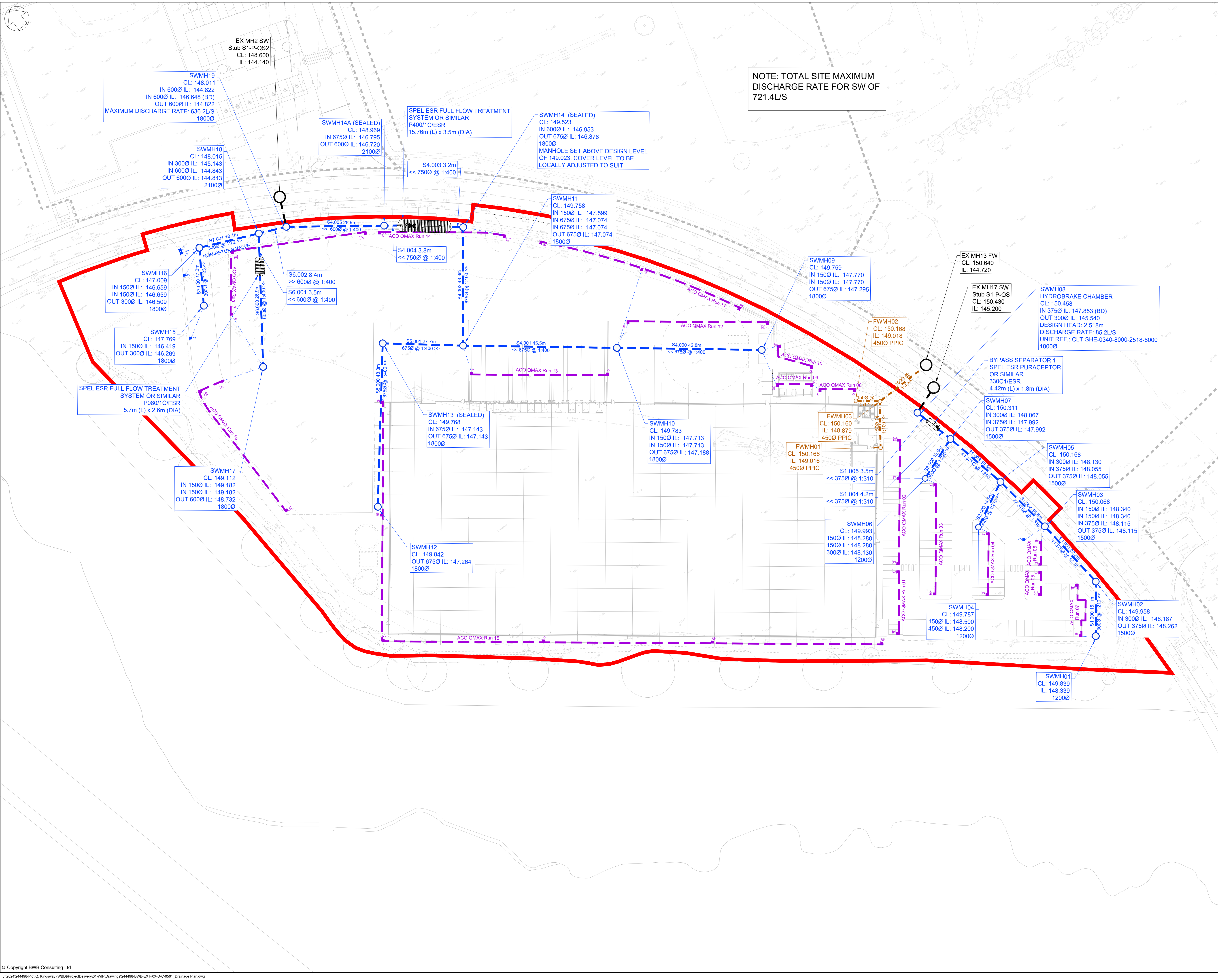
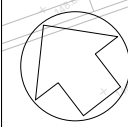
Project:
**KINGSWAY PHASE 2
ROCHDALE**

Drawing Title:
**POND AREA 2 - FLOW CONTROL AND OUTLET
FROM ATTENUATION AREA 2**

CROSS SECTION

Scale @ A1 1:20	Drawn HKS	Date SEPT 2006	Checked JAS	Date 05.09.06	Approved KAO	Date 05.09.06
Project No. A030095	Office 21	Type D	Drawing No. 08-003		Revision AB1	

Appendix 6: Proposed Surface Water Drainage Layout



- Notes**
- Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
 - This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
 - All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
 - Any discrepancies noted on site are to be reported to the engineer immediately.
 - Drainage Survey information taken from the following SOLUM drawing references
SS-13191-PLOT-R-KINGSWAY-ROCHDALE-MHCARDS-CCTV-R0
SS-12380-PLOT-R-KINGSWAY-ROCHDALE-MHCARDS-CCTV-A1-R1

- Key**
- Site Planning Boundary
 - Proposed Surface Water Drainage
 - Proposed Foul Water Drainage
 - Existing Surface Water Drainage
 - Existing Foul Water Drainage
 - Proposed ACO QMax Linear Drain
 - Proposed Bypass Separator
 - Proposed Gully
 - Proposed Rodding Eye
 - Proposed Outfall

P02	28.05.26	Planning Site Boundary Updated	RL	BS
P01	14.01.26	Preliminary Issue	SR	BS
Rev	Date	Details of issue / revision	Drw	Rev

Issues & Revisions

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☐ Leeds | 0113 233 8000
☐ London | 020 7407 3879
☒ Manchester | 0161 233 4260
☐ Nottingham | 0115 924 1100
www.bwbconsulting.com

Client

**Wilson Bowden
Developments & Rochdale
Borough Council**

Project Title

**Kingsway Business Park
Plot Q**

Drawing Title

**Proposed Surface and Foul
Water Drainage Layout**

Drawn:	S. Raja	Reviewed:	B. Sherburn
BWB Ref:	244498	Date:	Dec 25
Scale@A1:	1:500		

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
244498-BWB-EXT-XX-D-C-0501	S3	P02

Appendix 7: Existing Runoff Rate and Volume Calculations

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Project details

Date	08/01/2026
Calculated by	TWJ
Reference	
Model version	2.2.2

Location

Site name	Kingsway Plot Q
Site location	



Site easting (British National Grid)	391844
Site northing (British National Grid)	412515

Site details

Total site area (ha)	1	ha
----------------------	--------------------------------	----

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MORE INFO

Greenfield runoff

Method

Method	IH124
--------	-------

IH124

	<u>My value</u>		<u>Map value</u>
SAAR (mm)	1163	mm	1163
How should SPR be derived?	WRAP soil type		
WRAP soil type	1		1
SPR	0.1		
QBar (IH124) (l/s)	0.3	l/s	

Growth curve factors

	<u>My value</u>		<u>Map value</u>
Hydrological region	10		10
1 year growth factor	0.87		
2 year growth factor	0.93		
10 year growth factor	1.38		
30 year growth factor	1.7		
100 year growth factor	2.08		
200 year growth factor	2.37		

Results

Method	IH124	
Flow rate 1 year (l/s)	0.3	l/s
Flow rate 2 year (l/s)	0.3	l/s
Flow rate 10 years (l/s)	0.4	l/s
Flow rate 30 years (l/s)	0.5	l/s
Flow rate 100 years (l/s)	0.6	l/s
Flow rate 200 years (l/s)	0.7	l/s

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent ‘zero’ figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

Disclaimer

This report was produced using the Greenfield runoff rate estimation tool (2.2.2) developed by HR Wallingford and available at uksuds.com (<https://www.uksubs.com/>). The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at uksuds.com/terms-conditions (<https://www.uksubs.com/terms-conditions>). The outputs from this tool have been used to estimate Greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, Centre for Ecology and Hydrology, Wallingford Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

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Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
Rainfall Events	Singular	Drain Down Time (mins)	240
FSR Region	England and Wales	Additional Storage (m ³ /ha)	20.0
M5-60 (mm)	20.000	Starting Level (m)	
Ratio-R	0.400	Check Discharge Rate(s)	x
Summer CV	0.750	Check Discharge Volume	✓
Winter CV	0.840	100 year 360 minute (m ³)	88
Analysis Speed	Normal		

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	0	0	0

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)	1.000	Storm Duration (mins)	360
Soil Index	1	Betterment (%)	0
SPR	0.10	PR	0.141
CWI	125.408	Runoff Volume (m ³)	88

Appendix 8: Drainage Summary Note

Project	Kingsway Business Park		
Document Number	KBP-BWB-ZZ-XX-RP-CD-0004	BWB Ref	NTW2889
Author	David Gray	Status	S2
Checked	Matthew Bailey	Revision	P1
Approved	Rowan Jobling	Date	15.07.2022

Summary of Surface Water Sewer Modelling

- 1.1. This Technical Note provides a summary of the detailed hydraulic modelling exercises undertaken to date on the surface water sewers that serve the Kingsway Business Park.
- 1.2. The drainage strategy across the business park is split into three distinct catchments (as shown on **Figure 1.1** below).

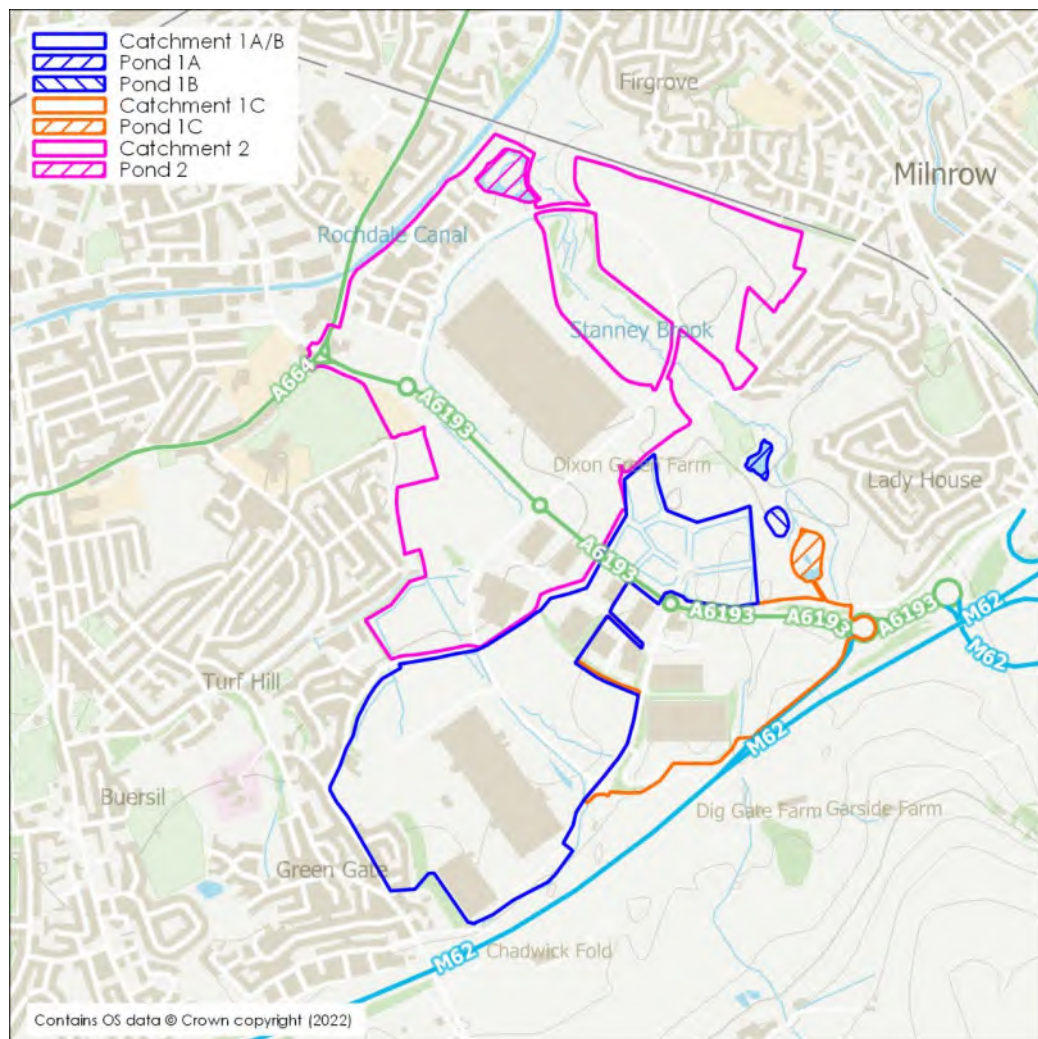


Figure 1.1: Business Park overall indicative catchments and attenuation ponds

- 1.3. Each drainage catchment is served by separate piped systems discharging to separate attenuation features. The existing drainage was constructed in 1999 and the hydraulic modelling exercises have shown that the surface water sewers have been designed to accommodate the 1 in 100-year storm event with no allowance for climate change for all plots across the business park.
- 1.4. Detailed hydraulic modelling and drawings for each drainage catchment are covered by individual reports, as listed below:
- Catchment 1A/1B – Report reference KBP-BWB-ZZ_XX-RP-CD-0001
 - Catchment 1C – Report reference KBP-BWB-ZZ_XX-RP-CD-0002
 - Catchment 2 – Report reference KBP-BWB-ZZ_XX-RP-CD-0003
- 1.5. **Table 1.1** (below) lists which Drainage catchment each development plot discharges to:

Table 1.1: Drainage Catchment Split per Plot

Drainage Catchment	Development Plots
1A/B	E (West), F, G, I, J1, J2, W
1C	C1, D1, D2, D3, D4, E(East), H
2	K, L, M, N, O, P1, P2, P3, Q, R, S, T1, T2, U1, U2, V, X

Design Parameters and Assumptions

- 1.6. The design parameters and assumptions used for each catchment vary depending on the level of information that was available at the time of the modelling work. Catchment specific information is stated in each report and key parameters are listed below:
- Impermeable areas generally taken as 90% for industrial areas and 65% for residential areas
 - Impermeable areas for roads taken as 100%
 - Where plots have been constructed, a more detailed estimate of impermeable area has been used based on the detailed drainage design
 - Network model simulation criteria set to default settings in MicroDrainage 2019.1.
 - Simulations have been run for the network model using the 'Seasonal Return Period Wizard' for all storm durations for the 1 in 100-year event on 2.5 second increments with Dynamic Time Step turned off, Dynamic Viscous Dampening and Inertia turned on.

- Simulations have been run using both Flood Studies Report (FSR) and Flood Estimation Handbook (FEH) rainfall methodologies.
- The detention basin volumes have been checked by recreating them in AutoCAD Civils 3D Software before being input into the MicroDrainage Network Model.
- Note that the original drainage system was designed using FSR rainfall (as stated within 'Attenuation Ponds Health & Safety File'), however FEH simulations have been ran as a sensitivity test for the recreated network model.

Summary of findings from Catchment 1A/1B

- 1.7. The report and modelling results were reviewed and accepted by United Utilities and Rochdale Borough Council (correspondence contained within **Appendix A**)
- 1.8. A summary of the findings from the as-built drainage study is below:
 - The pipe network operates well for all modelled storm events up to and including the 1 in 100-year with minimal surcharging.
 - The maximum water level in the pond was higher than the original Section 104 design and is predicted to overtop the weir wall once all plots within the catchment have been developed.
 - The peak flow rate from Pond 1A/1B is shown to be lower than the consented flows to the Stanney Brook.
 - Several options were investigated to remedy the overtopping of the weir wall. The option suggested in the drainage study report was to raise the weir wall by 200mm which solved the overtopping issue.
 - In subsequent conversations and meetings with Rochdale Borough Council's drainage engineer, Stephen McCann, it was agreed that the existing orifice plate flow control would be replaced with a larger diameter orifice plate. This option lowers the anticipated maximum water level within the pond to below the weir level while maintaining peak flows below the consented flows.
 - During a site visit, it was observed that the flow control could be liable to becoming blocked with vegetation and litter. To lower the risk of future blockages, it has also been agreed to install a debris screen over the flow control.

Summary of findings from Catchment 1C

- 1.9. The report was issued to United Utilities and Rochdale Borough Council
- 1.10. A summary of the findings from the as-built drainage study is below:
- The pipe network operates well for all modelled storm events up to and including the 1 in 100-year with minimal surcharging.
 - The maximum modelled water level within Pond 1C is below the original design level and peak flows are shown to be below the consented flow rate.
 - The drainage forming catchment 1C is considered to be operating efficiently, safely and in line with the original design.

Summary of findings from Catchment 2

- 1.11. The report and modelling results have been reviewed and accepted by Rochdale Borough Council (correspondence contained within **Appendix A**)
- 1.12. Untitled Utilities have reviewed the report and commented on some minor flooding located within Sir Isaac Newton Way. This was discussed with United Utilities who were happy with the explanation and had no further concerns (correspondence contained within **Appendix A**).
- 1.13. A summary of the findings from the as-built drainage study is below:
- The pipe network operates well for all modelled storm events up to and including the 1 in 100-year with one area of minimal flooding within Sir Isaac Newton Way.
 - The flooding was in the short duration, high intensity rainfall event and would be expected to pond within the road corridor for a short time before draining back into the sewer network once the peak storm has passed.
 - The flooding in the sewer network is unrelated to water levels in Pond 2.
 - The maximum modelled water level within Pond 2 is below the original design level and peak flows are shown to be below the consented flow rate.
 - The drainage forming catchment 2 is considered to be operating efficiently, safely and in line with the original design.

Appendix A

Correspondence with United Utilities and Rochdale Borough Council

David Gray

From: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Sent: 19 August 2021 20:36
To: David Gray; Rowan Jobling; Iqbal Rassool; Wastewater Developer Services
Cc: Matthew Bailey; Stephen McCann; Ward, David; John Copestake; Brennan, Adam; Walker, Jillian
Subject: GENQ 4200041062 Kingsway Business Park, Rochdale OL16 4JN

This email originated from outside of our organisation. Please exercise caution with content, links and attachments.

Good evening all and thank you for taking my call earlier David,

Firstly I would like to thank bwb for pulling together the modelling report, it has certainly helped clarify matters. Following a conversation between myself and Stephen McCann at the Lead Local Flood Authority we are now in a position to accept the proposed modelling report essentially as a drainage masterplan for the Business Park moving forward. However, we would request that this is subject to the provision of the mdx. Microdrainage model files being provided to Stephen at the Council for review against the modelling report to ensure its accuracy.

Once reviewed and the Lead Local Flood Authority are happy with the model outputs we will both be providing comments on the individual plots/below planning applications in turn:

DC/21/2987 – 21/00881/REM

DC/21/3213 – 21/01039/DOC

DC/21/3492 – 21/01041/DOC

As a point of note, we understand that there are a number of concerns the Lead Local Flood Authority have about Plot J2 which should be addressed but this sits outside United Utilities remit to comment.

I am on annual leave from tomorrow until Tuesday 24th August and for further information in my absence, I would suggest that Stephen McCann or David Gray would be best pace to answer any queries but I hope that this brings everyone together onto the same page.

Kind regards,



Robert Brenton
Developer Engineer
Developer Services & Metering
Customer Services
M: 07880299827
unitedutilities.com

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David Gray

From: Stephen McCann <Stephen.McCann@Rochdale.Gov.UK>
Sent: 16 November 2021 17:07
To: David Gray; john.ruckledge@environment-agency.gov.uk; Darren Clark; Tracy Hibbert; Gerard Proudman; Michael Cummings
Subject: Kingsway park pond 1A - minor change of orifice plate on outlet to Stanney Brook.

This email originated from outside of our organisation. Please exercise caution with content, links and attachments.

To All

The matter of the capacity and flow discharge from the Kingsway Park Drainage Ponds to Stanney brook was raised when BWB submitted Drainage Details for Planning Applications for the latest Kingsway Plots G, I and J2. When BWB ran the drainage model with the new plots being developed it was realised that the pond would just overtop in a 1 in 100 year storm including climate change allowance of 40%. Although this is a rare event, it was deemed necessary to avoid the overtopping. David Gray looked at options and came up with a simple but effective proposal:-

- to change the low level orifice plate in the outlet weir wall (to Stanney Brook) from 200 to 226mm dia.

This does not require major works and will fulfil the original agreed discharge flow rate to Stanney Brook. It will also and keep water levels under the crest of the weir wall, and maintain a minimum of 300mm freeboard within the pond.

Therefore, I am suggesting that David Gray now organises the replacement of the orifice plate. In terms of installation, BWB will need to arrange to do this when water levels are low and obtain access through the gates. I have advised David that he can contact Michael Cummings to arrange access?

There is an email trail below.

Any comments / queries – please address them to David and myself.

I can forward the diagram of the location of the orifice plate – upon request.

regards

Stephen McCann

Drainage & Flooding Engineer

Highways, Property & Strategic Housing



☎ 01706 924606

📠 07552 570262

✉ stephen.mccann@rochdale.gov.uk

Rochdale Borough Council
Floor 2, Number One Riverside
Smith Street, Rochdale, OL16 1XU

From: David Gray <David.Gray@bwbconsulting.com>

Sent: 07 November 2021 16:30

To: Stephen McCann <Stephen.McCann@Rochdale.Gov.UK>

Cc: Iqbal Rassool <Iqbal.Rassool@bwbconsulting.com>; Peter Davies <Peter.Davies@bwbconsulting.com>; Darren Clark <Darren.Clark@gleeds.com>; Davies, Nick <nick.davies@wilsonbowden.co.uk>; Ellis, Dave <dave.ellis@wilsonbowden.co.uk>; Henson, Henry <henry.henson@wilsonbowden.co.uk>

Subject: RE: Kingsway - Question to EA re. Weir Wall to Stanney Brook

Hi Steve,

Following our discussion last week on the weir wall at Kingsway after reviewing John's email below, I have remodelled the outflow orifice so that the proposed flows are closer to the consented flows of 304 l/sec. The modified orifice is 226mm diameter (upsized from 200mm) with the higher orifice remaining as 250mm. This seems like an eminently sensible resolution.

This does lower water levels within the basin to just below the existing weir wall as shown in the extracts from Microdrainage below. The existing weir is set at 148.25m, the modelled water level is shown to be 148.231m and the flow is 303.4 l/sec.

From previous conversations, you suggested that you would be happy with the original situation, however John's email suggests that the outflow from the pond needs to stay within the consented discharge, which we understand to be 304 l/sec. In this situation, who makes the final decision on the acceptable flow rates? At the Outlet from Pond 1A, Stanney Brook is classed as Ordinary Watercourse so falls under the remit of the LLFA so I would think that myself as LLFA Officer can approve this modification to the orifice plate. Stanney Brook changes to 'Main River' after crossing Buckley Hill lane.

The revised hydraulic modelling shows that altering the orifice does lower the estimated water levels to just below the existing weir wall while keeping within the 304 l/sec flow rate, would this proposal be acceptable to RBC?

I understand that RBC are responsible for maintenance of the pond, are you able to confirm if this extends to the outfall structure as well? If not, are you able to confirm who is responsible for the outfall structure? I understand that Environment received monies from the Developer and now maintain the pond and structures. The managers are Tracy Hibbert and Gerard Proudman who have been cc'd to this email.

I am happy to run through the revised modelling and discuss with yourself this week and agree the best way forward.

Kind Regards

David Gray

Principal Engineer | BWB Consulting Limited

5th Floor, Waterfront House, Station Street, Nottingham, NG2 3DQ
M 07437 015 337 T 0115 924 1100

David Gray

From: Stephen McCann <Stephen.McCann@Rochdale.Gov.UK>
Sent: 22 April 2022 15:52
To: David Gray
Subject: FW: Drainage Consultation Ref: 22/00373/FUL Plot M Kingsway
Attachments: Drainage Consultation 22-00373 FUL.docx

This email originated from outside of our organisation. Please exercise caution with content, links and attachments.

Hi David,

For your ref. see appended and below.

Thanks v much for sending all the extra info this morning. The complexity of the mdx models is beyond my familiarity with using MicroDrainage but your explanations filled in the gaps so I have been able to be confident in 'approving' the proposals.

regards

Stephen McCann

Drainage & Flooding Engineer
Highways, Property & Strategic Housing



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✉ stephen.mccann@rochdale.gov.uk

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From: Stephen McCann
Sent: 22 April 2022 15:50
To: Michael Doyle <Michael.Doyle@Rochdale.Gov.UK>; 'Mohammed.Aljafarawi@uuplc.co.uk' <Mohammed.Aljafarawi@uuplc.co.uk>
Subject: Drainage Consultation Ref: 22/00373/FUL Plot M Kingsway

Hello Michael (Principal Planning Officer) and Mohammed (UU Engineer),

Kingsway Hydraulic Modelling, Catchment 2 - 4200045304

I have written my consultation, appended.

The two MicroDrainage Models, which Mohammed asked me to look at are pretty complex. I've talked to David Gray of BWB a couple of times about this and he's shown me the models in online Teams Screenshare and he has provided details to satisfy me that the system is well designed.

Mohammed, feel free to ring me to discuss OR you can ask David Gray. There are quite large flows coming off Plot M into the adopted Michael Faraday Ave sewer, but this was originally planned as such.

regards

Stephen McCann

Drainage & Flooding Engineer

Highways, Property & Strategic Housing



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Rochdale Borough Council

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David Gray

From: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Sent: 11 February 2022 09:49
To: David Gray; 'Stephen McCann'
Cc: Wastewater Developer Services; Francis Comyn; 'Darren.Clark@gleeds.com'
Subject: MicroDrainage- pde 4200045304 Plot M Kingsway Business Park Rochdale OL16 4UG
Attachments: Existing SW Network Model - P1.MDX

This email originated from outside of our organisation. Please exercise caution with content, links and attachments.

Good Morning David,

Thanks for the prompt response. I am happy with your explanation, I don't have any further concerns. I would like to receive a modelling results confirmation to proceed.

Stephen,

Could you run the model as you did for catchment 1A as a sense check? Then provide confirmation of this results please.

Kind regards,



Mohammed Aljafarawi
Developer Engineer
Developer Services & Metering
Customer Services
Email: Mohammed.Aljafarawi@uuplc.co.uk
M: 07950474499
unitedutilities.com

From: David Gray
Sent: 10 February 2022 14:38
To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>; 'Stephen McCann' <>
Cc: Francis Comyn <>; Darren Clark <>; Davies, Nick <nick.davies@wilsonbowden.co.uk>
Subject: RE: Kingsway Hydraulic Modelling, Catchment 2 - 4200045304

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Mohammed, Steve,

Please find attached the MDX for Network 2 (Plot M catchment) file as mentioned in the email below.

Mohammed, the flooding occurs in the sewers located quite some way from Pond 2 and is not affected by the water level within Pond 2 or the flow rate from Pond 2.

As shown in the extract below, the flooding occurs at MH S317 in the short duration (30 min) / high intensity rainfall event and is due to the flow rate exceeding the capacity of the pipe for a short duration. Based on

the volume shown in the hydraulic model, any flooding would be entirely contained within Sir Isaac Newton Water and drain back down into the system once the peak storm has passed. This is standard practice for designing drainage systems.

In reality, surface water drainage features (gullies, slot drains, kerb drains) are not designed generally designed a much lower storm event, typically the 5 year storm. So although the model shows flooding in the 100 year storm, the water would not have drained into the sewers in the first instance. The surface water would pond on the road surface as the capacities of the road gullies would have been exceeded before the capacity of the sewers.

1.006	S306	30 minute 100 year Winte	148.876	147.154	2.494	0.000	1.34	
1.007	S315	30 minute 100 year Winte	148.210	146.712	2.427	0.000	1.44	
1.008	S316	30 minute 100 year Winte	147.154	146.248	2.262	0.000	1.26	
9.000	SPM	30 minute 100 year Winte	148.105	145.997	1.960	0.000	0.84	
1.009	S317	30 minute 100 year Winte	145.764	145.776	2.192	13.308	1.01	
10.000	SPV	30 minute 100 year Winte	148.108	145.509	1.383	0.000	0.03	
1.010	S318	30 minute 100 year Winte	145.562	145.508	2.310	0.000	1.03	

If it would be beneficial, I would be happy to attend a Teams meeting to discuss this in more detail and answer any other queries you may have.

Kind Regards

David Gray

Principal Engineer | BWB Consulting Limited

5th Floor, Waterfront House, Station Street, Nottingham, NG2 3DQ

M 07437 015 337 **T** 0115 924 1100

From: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>

Sent: 10 February 2022 13:46

To: 'Stephen McCann' <Stephen.McCann@Rochdale.Gov.UK>; David Gray <David.Gray@bwbconsulting.com>

Cc: Francis Comyn <Francis.Comyn@Rochdale.Gov.UK>

Subject: RE: Kingsway Hydraulic Modelling, Catchment 2 - 4200045304

This email originated from outside of our organisation. Please exercise caution with content, links and attachments.

Good afternoon Stephen,

Thanks for your email, I had this morning a conversation with my colleague Robert, I understand that previously both of you deals with Catchment 1A/B (blue in the below picture).

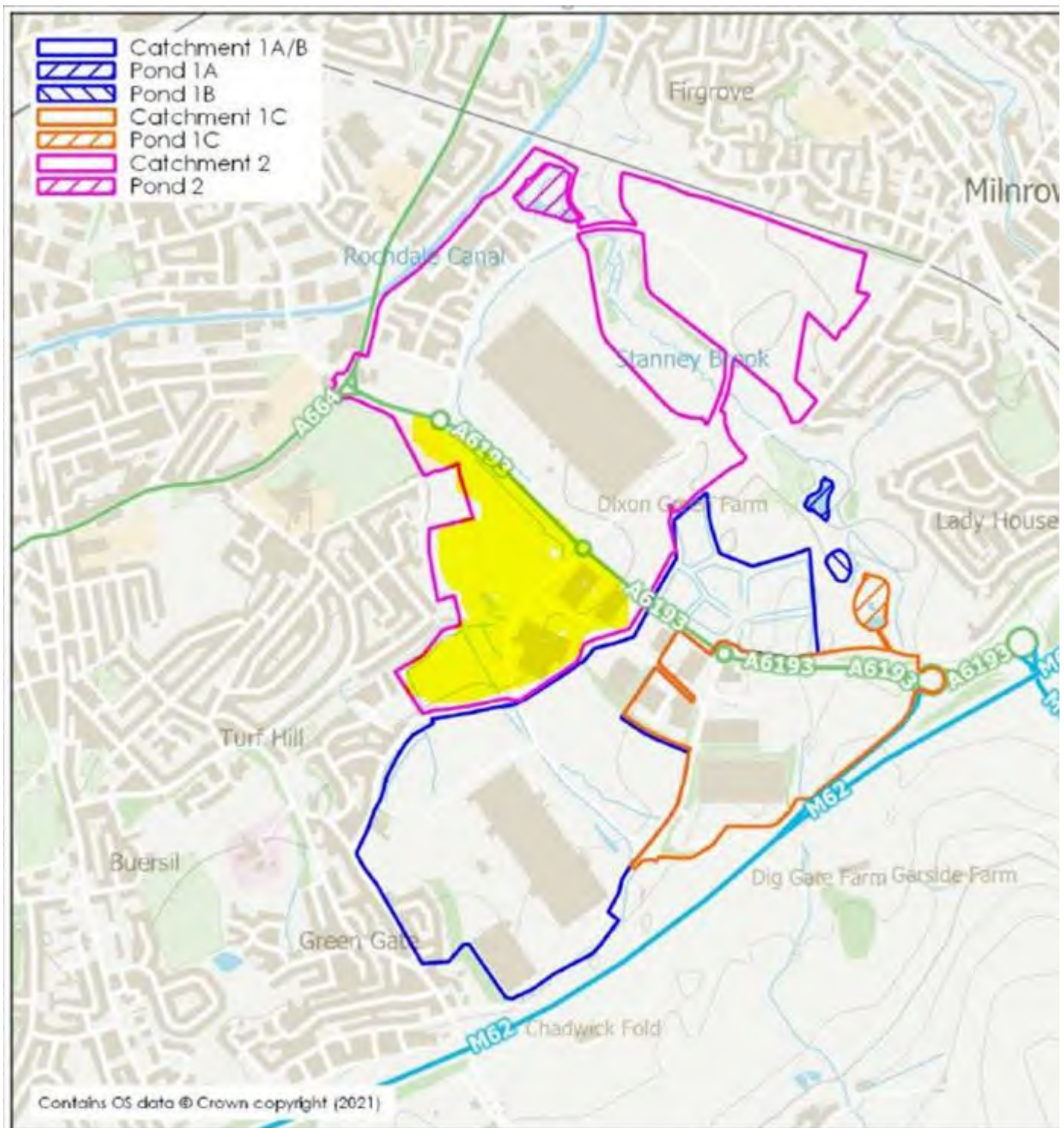


Figure 1.1: Business Park overall indicative catchments and attenuation ponds.

Currently, we are dealing with catchment 2 (pink colour), the developer contact our team regarding plot M (highlighted in yellow).

The provided modelling of catchment 2 has been done in line with previous model of catchment 1A. Previously 1A showed issues at the pond but the sewer network was fine.

Where catchment 2 model shows the pond is fine but the sewer network has a small amount of flooding (13m³) within Sir Isaac Newton Way.

Also, the developer stated in the document no: KBP-BWB-ZZ-XX-RP-CD-0003, that the 'Pond 2' discharges surface water at a lower rate (444.5l/s) that of the original design intent (555l/s).

Could the developer provide the mdx. file to Stephen to run the model as you did for catchment 1A as a sense check.

Stephen, could you then provide confirmation of this results please.

Finally, whilst we have no problems with the proposal in principle...as there is a small amount of flooding on the sewer network, we request that this is investigated as there may be some remedial work to be done at the pond again as it does not appear to be passing forward the flow to the watercourse as it was originally designed to.

Kind regards,



Mohammed Aljafarawi
Developer Engineer
Developer Services & Metering
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Email: Mohammed.Aljafarawi@uuplc.co.uk
M: 07950474499
unitedutilities.com

From: Stephen McCann [<mailto:Stephen.McCann@Rochdale.Gov.UK>]
Sent: 09 February 2022 15:30
To: Aljafarawi, Mohammed <Mohammed.Aljafarawi@uuplc.co.uk>
Cc: Francis Comyn <Francis.Comyn@Rochdale.Gov.UK>; 'David Gray' <David.Gray@bwbconsulting.com>
Subject: RE: Kingsway Hydraulic Modelling, Catchment 2 - 4200045304

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Hello Mohammed,

With reference to your email below, the LLFA part of the Council, myself and Francis Comyn, are aware of the upgrade proposals to the Kingsway park pond 1A, as proposed by BWB - on behalf of the Kingsway Business park developers (Wilson Bowden, Homes England, & Rochdale Development Agency?).

I have recently done a site walkover with David Gray of BWB to discuss the options. As LLFA we agree that the upgrades, which should include a better trash screen on one of the ponds and an increased orifice plate are appropriate.

The previous UU consultee, Robert Brenton (UU) was involved in looking at the Kingsway Drainage Masterplan; he may be able to update you as he has recently dealt with several recent Kingsway Business park plot planning applications.

regards

Stephen McCann
Drainage & Flooding Engineer
Highways, Property & Strategic Housing



 01706 924606



07552 570262



stephen.mccann@rochdale.gov.uk

From: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Sent: 09 February 2022 13:00
To: 'David Gray' <David.Gray@bwbcconsulting.com>
Cc: Stephen McCann <Stephen.McCann@Rochdale.Gov.UK>; Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: Kingsway Hydraulic Modelling, Catchment 2 - 4200045304
Good afternoon,

Thanks for providing the report.

After reviewing the site it would appear that the drainage infrastructure was installed around the year 2000 with agreement from the Rochdale council who acted as our agent at the time.

It would appear that the previously agreed drainage strategy was to freely drain the development areas through the large-diameter adopted sewers to the pond.

The pond appears to have been designed to act as storage to contain storm events up to the 1 in 100 years storm event, and the outfall to the pond was constructed to control flows into the watercourse.

Unfortunately, legislation has changed since the surface water strategy was agreed upon and the system was installed. We must therefore speak to the LLFA to ensure that the previously agreed strategy is still acceptable.

The LLFA will have to decide whether they are happy with the current arrangement where the drainage system, attenuation pond and outfall/flow control (350mm + 200mm ORIFICE plates) has already been constructed and is operational. **OR** whether they would like to restrict and attenuate flow on site in line with the latest legislation/guidance.

- Please contact the LLFA to agree on a way forward and let me know what their position is.
- If the LLFA are willing to accept the previously agreed strategy, could you please highlight the contributing area from the proposed development and the associated pipe length in the submitted Micro Drainage calculations so that the discharge rate from the proposed parcel can be confirmed?

If we can be of any further assistance please don't hesitate to contact us further.

Kind regards,



Mohammed Aljafarawi

Developer Engineer
Developer Services & Metering
Customer Services

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M: 07950474499

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Appendix 9: Site Wide Catchment Plan & Modelled Flow Rates

CATCHMENT 1A/1B

For further details refer to BWB Technical Note, Ref: KBP-BWB-ZZ-XX-RP-CD-0001

Plot	Microdrainage Manhole Reference	Pipe Number	Impermeable Area (ha)	Peak Flow (l/s)	Critical Storm
E (West)	S1PE	10.000	1.530	577.7	15 min
F/G	S1PG1	11.000	5.500	1995.9	15 min
I	S1PI2	9.000	5.348	1847.4	15 min
J1	Plot J1 - Asda	2.000	13.550	513.4	240 min
J2 - Unit 1	Plot J2 - Unit 1	7.000	3.546	452.0	30 min
J2 - Unit 2	Plot J2 - Unit 2	6.000	3.546	340.0	15 min
W	PlotW	4.000	0.716	264.6	15 min

CATCHMENT 1C

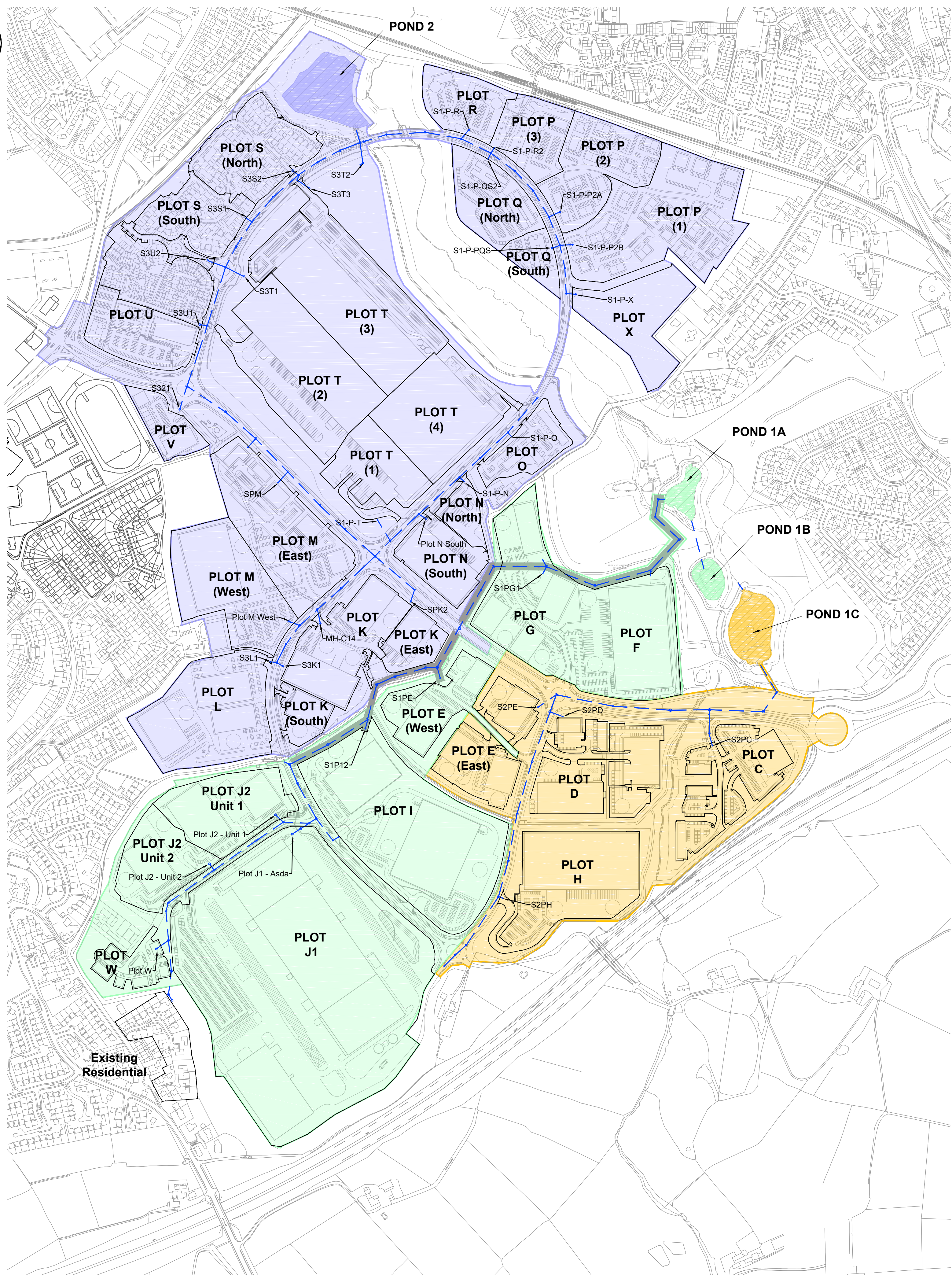
For further details refer to BWB Technical Note, Ref: KBP-BWB-ZZ-XX-RP-CD-0002

Plot	Microdrainage Manhole Reference	Pipe Number	Impermeable Area (ha)	Peak Flow (l/s)	Critical Storm
C	S2PC	7.000	2.010	662.5	15 min
D	S2PD	5.000	2.656	955.7	
E (East)	S2PE	6.000	1.790	567.8	
H	S2PH	3.000	3.196	1153.7	

CATCHMENT 2

For further details refer to BWB Technical Note, Ref: KBP-BWB-ZZ-XX-RP-CD-0003

Plot	Microdrainage Manhole Reference	Pipe Number	Impermeable Area (ha)	Peak Flow (l/s)	Critical Storm
K	MH-C14	4.000	2.251	788.6	15 min
K (South)	S3K1	2.000	0.582	211.5	
K (East)	SPK2	5.000	0.742	261.3	
L	S3L1	1.000	3.287	1175.5	
M (West)	Plot M West	3.000	2.677	947.7	
M (East)	SPM	11.000	2.900	1040.5	
N (North)	S1-P-N	8.000	0.515	187.7	
N (South)	Plot N South	9.000	1.125	368.9	
O	S1-P-O	7.000	0.988	345.7	
P (1)	S1-P-P2B	24.000	4.178	1240.5	
P (2)	S1-P-P2A	25.000	2.177	697.0	
P (3)	S1-P-R2	26.000	1.297	470.9	
Q (South)	S1-P-QS	23.000	0.581	163.0	
Q (North)	S1-P-QS2	27.000	1.543	558.4	
R	S1-P-R	28.000	1.229	441.8	
S (South)	S3S1	18.000	1.067	363.8	
S (North)	S3S2	20.000	1.560	525.4	
T (1)	S1-P-T	10.000	1.596	493.4	
T (2)	S3T1	16.000	3.959	1385.6	
T (3)	S3T3	19.000	4.559	1265.8	
T (4)	S2T2	21.000	2.826	1029.5	
U	S3U1	15.000	2.901	1055.0	
V	S321	13.000	0.751	244.4	
X	S1-P-X	22.000	1.942	589.5	



1. Do not scale this drawing. All dimensions must be checked/ verified on site. If it doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.
5. Drawing to be read in conjunction with the BWB MicroDrainage calculations for each of the Catchments.
6. Flow rates described within the tables are the maximum modelled flow rates based on the 100yr return period, FSR rainfall model. Further details regarding methodology can be found in the supporting BWB Technical Notes.
7. Proposed discharge rates for each plot to be developed are subject to agreement from United Utilities and the Lead Local Flood Authority.
8. Additional flows are present within each of the systems, associated with the highway drainage.
9. Plot boundaries based on the Masterplan at the time of production.

 Catchment 1A/B
 Catchment 1C
 Catchment 2
 Plot Boundaries

P01	03.07.23	Preliminary Issue	LR	RJ
Rev	Date	Details of issue / revision	Drw	Rev

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Client

**WILSON BOWDEN
DEVELOPMENTS LTD**

Project Title

**KINGSWAY BUSINESS
PARK**

Drawing Title

SITE WIDE CATCHMENT PLAN & MODELLED FLOW RATES

Drawn: L. Ream		Reviewed: R. Jobling	
BWB Ref: NTW 2889	Date: 03.07.23	Scale@A1: 1:4000	
Drawing Status			
PRELIMINARY			
Project - Originator - Zone - Level - Type - Role - Number			Status Rev
KBP-BWB-ZZ-XX-DR-CD-0005			S2 P01

Appendix 10: Causeway (Flow) Results

Design Settings

Rainfall Methodology	FEH-22	Maximum Time of Concentration (mins)	30.00	Preferred Cover Depth (m)	1.200
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0	Include Intermediate Ground	x
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00	Enforce best practice design rules	x
CV	0.750	Connection Type	Level Soffits		
Time of Entry (mins)	5.00	Minimum Backdrop Height (m)	0.200		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
SWMH9	0.165	5.00	149.795	1800	391922.299	412498.750	2.500	147.295
SWMH10	0.110	5.00	149.783	1800	391888.732	412525.387	2.595	147.188
SWMH11	0.588	5.00	149.758	1800	391853.129	412553.639	2.684	147.074
SWMH12	0.563	5.00	149.842	1800	391804.057	412531.265	2.578	147.264
SWMH13	0.000	5.00	149.768	1800	391834.711	412568.686	2.625	147.143
SWMH14	0.169	5.00	149.523	1800	391874.521	412581.391	2.645	146.878
Separator 2	0.000	5.00	148.965	1800	391865.262	412588.887	2.143	146.822
SWMH14A (FC)	0.000	5.00	148.969	1800	391856.293	412596.003	2.249	146.720
SWMH15	0.030	5.00	147.769	1800	391799.611	412609.782	1.500	146.269
SWMH16	0.012	5.00	147.009	2100	391809.022	412624.171	1.500	145.509
SWMH17	0.330	5.00	149.112	1800	391802.437	412584.739	4.070	145.042
Separator 3	0.000	5.00	148.732	1800	391819.949	412609.062	3.865	144.867
SWMH18 (FC)	0.000	5.00	148.015	1800	391825.523	412616.803	3.172	144.843
SWMH19	0.000	5.00	148.011	1800	391833.157	412613.394	3.189	144.822
EX MH2 (OUT)	0.000	5.00	148.600	2100	391837.011	412621.585	4.460	144.140
EX MH17 (OUT)			150.430	1800	391955.764	412458.911	5.230	145.200
SWMH8 (HB)			150.458	1800	391947.429	412455.959	4.918	145.540
SWMH7			150.311	1800	391950.447	412443.852	2.319	147.992
SWMH6	0.080	5.00	149.993	1800	391937.390	412439.162	1.863	148.130
SWMH5			150.168	1800	391954.404	412424.780	2.113	148.055
SWMH4	0.041	5.00	149.787	1800	391941.053	412418.123	1.587	148.200
SWMH3	0.092	5.00	150.068	1800	391956.760	412406.340	1.953	148.115
SWMH2			149.958	1800	391958.713	412384.214	1.771	148.187
SWMH1	0.082	5.00	149.839	1800	391948.877	412371.428	1.500	148.339

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
Seporator 01			150.379	1800	391949.013	412450.243	2.518	147.861

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
4.000	SWMH9	SWMH10	42.852	0.600	147.295	147.188	0.107	400.5	675	5.55	50.0
4.001	SWMH10	SWMH11	45.451	0.600	147.188	147.074	0.114	398.7	675	6.13	50.0
5.000	SWMH12	SWMH13	48.334	0.600	147.264	147.143	0.121	399.5	675	5.62	50.0
5.001	SWMH13	SWMH11	27.704	0.600	147.143	147.074	0.069	401.5	675	5.97	50.0
4.002	SWMH11	SWMH14	48.334	0.600	147.074	146.953	0.121	399.5	675	6.75	50.0
4.003	SWMH14	Separator 2	22.338	0.600	146.878	146.822	0.056	398.9	750	7.01	50.0
4.004	Separator 2	SWMH14A (FC)	10.980	0.600	146.822	146.795	0.027	406.7	750	7.14	50.0
4.005	SWMH14A (FC)	SWMH19	28.943	0.600	146.720	146.648	0.072	402.0	600	7.54	50.0
7.0000	SWMH15	SWMH16	17.193	0.600	146.269	145.509	0.760	22.6	300	5.09	50.0
7.001	SWMH16	SWMH18 (FC)	26.432	0.600	145.509	145.143	0.366	72.2	300	5.32	50.0
6.000	SWMH17	Separator 3	29.971	0.600	145.042	144.967	0.075	399.6	600	5.41	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
4.000	1.303	466.3	22.4	1.825	1.920	0.165	0.0	99	0.686
4.001	1.306	467.4	37.3	1.920	2.009	0.275	0.0	128	0.797
5.000	1.305	466.9	76.3	1.903	1.950	0.563	0.0	183	0.973
5.001	1.301	465.7	76.3	1.950	2.009	0.563	0.0	183	0.971
4.002	1.305	466.9	193.3	2.009	1.895	1.426	0.0	302	1.246
4.003	1.395	616.1	216.2	1.895	1.393	1.595	0.0	306	1.277
4.004	1.381	610.2	216.2	1.393	1.424	1.595	0.0	307	1.268
4.005	1.208	341.6	216.2	1.649	0.763	1.595	0.0	347	1.275
7.0000	3.319	234.6	4.1	1.200	1.200	0.030	0.0	27	1.280
7.001	1.852	130.9	5.7	1.200	2.572	0.042	0.0	42	0.941
6.000	1.212	342.6	44.7	3.470	3.165	0.330	0.0	145	0.848

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
6.001	Separator 3	SWMH18 (FC)	9.539	0.600	144.867	144.843	0.024	397.5	600	5.54	50.0
6.002	SWMH18 (FC)	SWMH19	8.361	0.600	144.843	144.822	0.021	398.1	600	5.66	50.0
4.006	SWMH19	EX MH2 (OUT)	9.052	0.600	144.822	144.140	0.682	13.3	600	7.57	50.0
1.006	SWMH8 (HB)	EX MH17 (OUT)	8.842	0.600	145.540	145.200	0.340	26.0	450	6.51	50.0
1.005	Seporator 01	SWMH8 (HB)	5.931	0.600	147.861	147.842	0.019	312.2	375	6.48	50.0
1.004	SWMH7	Seporator 01	6.550	0.600	147.992	147.971	0.021	311.9	375	6.39	50.0
3.000	SWMH6	SWMH7	13.874	0.600	148.130	148.067	0.063	220.2	300	5.22	50.0
1.003	SWMH5	SWMH7	19.478	0.600	148.055	147.992	0.063	309.2	375	6.23	50.0
2.000	SWMH4	SWMH5	14.919	0.600	148.200	148.130	0.070	213.1	300	5.23	50.0
1.002	SWMH3	SWMH5	18.590	0.600	148.115	148.055	0.060	309.8	375	5.91	50.0
1.001	SWMH2	SWMH3	22.219	0.600	148.187	148.115	0.072	308.6	375	5.61	50.0
1.000	SWMH1	SWMH2	16.132	0.600	148.339	148.262	0.077	209.5	300	5.25	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
6.001	1.215	343.5	44.7	3.265	2.572	0.330	0.0	145	0.851
6.002	1.214	343.2	50.4	2.572	2.589	0.372	0.0	154	0.878
4.006	6.706	1896.2	266.6	2.589	3.860	1.967	0.0	150	4.804
1.006	3.999	635.9	40.0	4.468	4.780	0.295	0.0	75	2.266
1.005	1.020	112.6	40.0	2.143	2.241	0.295	0.0	154	0.936
1.004	1.020	112.7	40.0	1.944	2.033	0.295	0.0	154	0.937
3.000	1.055	74.6	10.8	1.563	1.944	0.080	0.0	77	0.759
1.003	1.025	113.2	29.1	1.738	1.944	0.215	0.0	129	0.863
2.000	1.073	75.8	5.6	1.287	1.738	0.041	0.0	55	0.633
1.002	1.024	113.1	23.6	1.578	1.738	0.174	0.0	115	0.813
1.001	1.026	113.3	11.1	1.396	1.578	0.082	0.0	79	0.659
1.000	1.082	76.5	11.1	1.200	1.396	0.082	0.0	77	0.778

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
4.000	42.852	400.5	675	Circular	149.795	147.295	1.825	149.783	147.188	1.920
4.001	45.451	398.7	675	Circular	149.783	147.188	1.920	149.758	147.074	2.009
5.000	48.334	399.5	675	Circular	149.842	147.264	1.903	149.768	147.143	1.950
5.001	27.704	401.5	675	Circular	149.768	147.143	1.950	149.758	147.074	2.009
4.002	48.334	399.5	675	Circular	149.758	147.074	2.009	149.523	146.953	1.895
4.003	22.338	398.9	750	Circular	149.523	146.878	1.895	148.965	146.822	1.393
4.004	10.980	406.7	750	Circular	148.965	146.822	1.393	148.969	146.795	1.424
4.005	28.943	402.0	600	Circular	148.969	146.720	1.649	148.011	146.648	0.763
7.0000	17.193	22.6	300	Circular	147.769	146.269	1.200	147.009	145.509	1.200
7.001	26.432	72.2	300	Circular	147.009	145.509	1.200	148.015	145.143	2.572
6.000	29.971	399.6	600	Circular	149.112	145.042	3.470	148.732	144.967	3.165
6.001	9.539	397.5	600	Circular	148.732	144.867	3.265	148.015	144.843	2.572
6.002	8.361	398.1	600	Circular	148.015	144.843	2.572	148.011	144.822	2.589
4.006	9.052	13.3	600	Circular	148.011	144.822	2.589	148.600	144.140	3.860
1.006	8.842	26.0	450	Circular	150.458	145.540	4.468	150.430	145.200	4.780

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
4.000	SWMH9	1800	Manhole	Adoptable	SWMH10	1800	Manhole	Adoptable
4.001	SWMH10	1800	Manhole	Adoptable	SWMH11	1800	Manhole	Adoptable
5.000	SWMH12	1800	Manhole	Adoptable	SWMH13	1800	Sealed Manhole	Adoptable
5.001	SWMH13	1800	Sealed Manhole	Adoptable	SWMH11	1800	Manhole	Adoptable
4.002	SWMH11	1800	Manhole	Adoptable	SWMH14	1800	Sealed Manhole	Adoptable
4.003	SWMH14	1800	Sealed Manhole	Adoptable	Separator 2	1800	Sealed Manhole	Adoptable
4.004	Separator 2	1800	Sealed Manhole	Adoptable	SWMH14A (FC)	1800	Sealed Manhole	Adoptable
4.005	SWMH14A (FC)	1800	Sealed Manhole	Adoptable	SWMH19	1800	Manhole	Adoptable
7.0000	SWMH15	1800	Manhole	Adoptable	SWMH16	2100	Manhole	Adoptable
7.001	SWMH16	2100	Manhole	Adoptable	SWMH18 (FC)	1800	Manhole	Adoptable
6.000	SWMH17	1800	Manhole	Adoptable	Separator 3	1800	Manhole	Adoptable
6.001	Separator 3	1800	Manhole	Adoptable	SWMH18 (FC)	1800	Manhole	Adoptable
6.002	SWMH18 (FC)	1800	Manhole	Adoptable	SWMH19	1800	Manhole	Adoptable
4.006	SWMH19	1800	Manhole	Adoptable	EX MH2 (OUT)	2100	Manhole	Adoptable
1.006	SWMH8 (HB)	1800	Manhole	Adoptable	EX MH17 (OUT)	1800	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.005	5.931	312.2	375	Circular	150.379	147.861	2.143	150.458	147.842	2.241
1.004	6.550	311.9	375	Circular	150.311	147.992	1.944	150.379	147.971	2.033
3.000	13.874	220.2	300	Circular	149.993	148.130	1.563	150.311	148.067	1.944
1.003	19.478	309.2	375	Circular	150.168	148.055	1.738	150.311	147.992	1.944
2.000	14.919	213.1	300	Circular	149.787	148.200	1.287	150.168	148.130	1.738
1.002	18.590	309.8	375	Circular	150.068	148.115	1.578	150.168	148.055	1.738
1.001	22.219	308.6	375	Circular	149.958	148.187	1.396	150.068	148.115	1.578
1.000	16.132	209.5	300	Circular	149.839	148.339	1.200	149.958	148.262	1.396

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.005	Seporator 01	1800	Manhole	Adoptable	SWMH8 (HB)	1800	Manhole	Adoptable
1.004	SWMH7	1800	Manhole	Adoptable	Seporator 01	1800	Manhole	Adoptable
3.000	SWMH6	1800	Manhole	Adoptable	SWMH7	1800	Manhole	Adoptable
1.003	SWMH5	1800	Manhole	Adoptable	SWMH7	1800	Manhole	Adoptable
2.000	SWMH4	1800	Manhole	Adoptable	SWMH5	1800	Manhole	Adoptable
1.002	SWMH3	1800	Manhole	Adoptable	SWMH5	1800	Manhole	Adoptable
1.001	SWMH2	1800	Manhole	Adoptable	SWMH3	1800	Manhole	Adoptable
1.000	SWMH1	1800	Manhole	Adoptable	SWMH2	1800	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SWMH9	391922.299	412498.750	149.795	2.500	1800				
						0	4.000	147.295	675

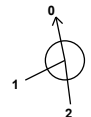
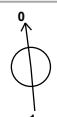
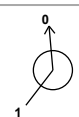
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SWMH10	391888.732	412525.387	149.783	2.595	1800	 0 1	4.000	147.188	675
SWMH11	391853.129	412553.639	149.758	2.684	1800	 1 0 2 0	1 5.001 2 4.001	147.074 147.074	675 675
SWMH12	391804.057	412531.265	149.842	2.578	1800	 0	0 5.000	147.264	675
SWMH13	391834.711	412568.686	149.768	2.625	1800	 1 0 0 0	1 5.000 0 5.001	147.143 147.143	675 675
SWMH14	391874.521	412581.391	149.523	2.645	1800	 0 1 1 0	1 4.002 0 4.003	146.953 146.878	675 750
Separator 2	391865.262	412588.887	148.965	2.143	1800	 0 1 1 0	1 4.003 0 4.004	146.822 146.822	750 750
SWMH14A (FC)	391856.293	412596.003	148.969	2.249	1800	 0 1 1 0	1 4.004 0 4.005	146.795 146.720	750 600
SWMH15	391799.611	412609.782	147.769	1.500	1800	 0	0 7.0000	146.269	300

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SWMH16	391809.022	412624.171	147.009	1.500	2100	 1	7.0000	145.509	300
						0	7.001	145.509	300
SWMH17	391802.437	412584.739	149.112	4.070	1800	 0	6.000	145.042	600
Separator 3	391819.949	412609.062	148.732	3.865	1800	 1	6.000	144.967	600
						0	6.001	144.867	600
SWMH18 (FC)	391825.523	412616.803	148.015	3.172	1800	 1	7.001	145.143	300
						2	6.001	144.843	600
						0	6.002	144.843	600
SWMH19	391833.157	412613.394	148.011	3.189	1800	 1	6.002	144.822	600
						2	4.005	146.648	600
						0	4.006	144.822	600
EX MH2 (OUT)	391837.011	412621.585	148.600	4.460	2100	 1	4.006	144.140	600
EX MH17 (OUT)	391955.764	412458.911	150.430	5.230	1800	 1	1.006	145.200	450
SWMH8 (HB)	391947.429	412455.959	150.458	4.918	1800	 1	1.005	147.842	375
						0	1.006	145.540	450

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
SWMH7	391950.447	412443.852	150.311	2.319	1800		1	3.000	148.067	300
							2	1.003	147.992	375
							0	1.004	147.992	375
SWMH6	391937.390	412439.162	149.993	1.863	1800		0	3.000	148.130	300
SWMH5	391954.404	412424.780	150.168	2.113	1800		1	2.000	148.130	300
							2	1.002	148.055	375
							0	1.003	148.055	375
SWMH4	391941.053	412418.123	149.787	1.587	1800		0	2.000	148.200	300
SWMH3	391956.760	412406.340	150.068	1.953	1800		1	1.001	148.115	375
							0	1.002	148.115	375
SWMH2	391958.713	412384.214	149.958	1.771	1800		1	1.000	148.262	300
							0	1.001	148.187	375
SWMH1	391948.877	412371.428	149.839	1.500	1800		0	1.000	148.339	300
							0	1.004	147.971	375
Separator 01	391949.013	412450.243	150.379	2.518	1800		1	1.004	147.971	375
							0	1.005	147.861	375

Simulation Settings

Rainfall Methodology	FEH-22	Winter CV	0.840	Drain Down Time (mins)	240	Check Discharge Rate(s)	x
Rainfall Events	Singular	Analysis Speed	Detailed	Additional Storage (m ³ /ha)	20.0	Check Discharge Volume	x
Summer CV	0.750	Skip Steady State	x	Starting Level (m)			

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440 | 2160

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0	100	0	0	0
2	0	0	0	100	40	0	0
30	0	0	0				

Node SWMH14A (FC) Online Orifice Control

Flap Valve	x	Invert Level (m)	146.720	Design Flow (l/s)	505.0	Discharge Coefficient	0.600
Replaces Downstream Link	x	Design Depth (m)	2.249	Diameter (m)	0.411		

Node SWMH16 Online Orifice Control

Flap Valve	✓	Invert Level (m)	145.509	Design Flow (l/s)	1000.0	Discharge Coefficient	0.600
Replaces Downstream Link	x	Design Depth (m)	1.800	Diameter (m)	0.627		

Node SWMH18 (FC) Online Orifice Control

Flap Valve	x	Invert Level (m)	144.843	Design Flow (l/s)	155.0	Discharge Coefficient	0.600
Replaces Downstream Link	x	Design Depth (m)	3.172	Diameter (m)	0.205		

Node SWMH8 (HB) Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	145.540	Product Number	CTL-SHE-0340-8000-2518-8000
Design Depth (m)	2.518	Min Outlet Diameter (m)	0.375
Design Flow (l/s)	80.0	Min Node Diameter (mm)	0

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.93%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SWMH9	11	147.369	0.074	12.8	0.2858	0.0000	OK
15 minute winter	SWMH10	12	147.291	0.103	20.6	0.3500	0.0000	OK
15 minute winter	SWMH11	12	147.285	0.211	98.9	1.4622	0.0000	OK
15 minute winter	SWMH12	10	147.404	0.140	43.6	0.9648	0.0000	OK
15 minute winter	SWMH13	12	147.299	0.156	43.1	0.3958	0.0000	OK
15 minute winter	SWMH14	13	147.123	0.245	105.7	0.9372	0.0000	OK
15 minute winter	Separator 2	13	147.100	0.278	104.3	0.7072	0.0000	OK
15 minute winter	SWMH14A (FC)	13	147.084	0.364	101.2	0.9267	0.0000	OK
15 minute winter	SWMH15	10	146.290	0.021	2.3	0.0617	0.0000	OK
15 minute winter	SWMH16	11	145.545	0.036	3.2	0.1301	0.0000	OK
15 minute winter	SWMH17	10	145.153	0.111	25.6	0.4622	0.0000	OK
15 minute winter	Separator 3	12	145.060	0.193	24.9	0.4902	0.0000	OK
15 minute winter	SWMH18 (FC)	12	145.058	0.214	27.6	0.5459	0.0000	OK
15 minute winter	SWMH19	13	144.941	0.119	124.6	0.3023	0.0000	OK
15 minute winter	EX MH2 (OUT)	13	144.243	0.103	125.4	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SWMH9	4.000	SWMH10	12.3	0.504	0.026	1.1563	
15 minute winter	SWMH10	4.001	SWMH11	18.2	0.326	0.039	2.9447	
15 minute winter	SWMH11	4.002	SWMH14	95.5	1.076	0.205	4.2915	
15 minute winter	SWMH12	5.000	SWMH13	43.1	0.807	0.092	2.7374	
15 minute winter	SWMH13	5.001	SWMH11	40.9	0.523	0.088	2.1782	
15 minute winter	SWMH14	4.003	Separator 2	104.3	0.855	0.169	3.0515	
15 minute winter	Separator 2	4.004	SWMH14A (FC)	101.2	0.801	0.166	1.6729	
15 minute winter	SWMH14A (FC)	4.005	SWMH19	101.7	1.104	0.298	2.6681	
15 minute winter	SWMH15	7.0000	SWMH16	2.3	0.717	0.010	0.0589	
15 minute winter	SWMH16	7.001	SWMH18 (FC)	3.1	0.772	0.023	0.1046	
15 minute winter	SWMH17	6.000	Separator 3	24.9	0.757	0.073	0.9879	
15 minute winter	Separator 3	6.001	SWMH18 (FC)	24.5	0.476	0.071	0.8031	
15 minute winter	SWMH18 (FC)	6.002	SWMH19	26.5	0.708	0.077	0.3361	
15 minute winter	SWMH19	4.006	EX MH2 (OUT)	125.4	3.517	0.066	0.3230	70.2

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.93%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	EX MH17 (OUT)	12	145.256	0.056	21.3	0.0000	0.0000	OK
15 minute winter	SWMH8 (HB)	12	145.751	0.211	21.4	0.5377	0.0000	OK
15 minute winter	SWMH7	12	148.109	0.117	21.4	0.2985	0.0000	OK
15 minute winter	SWMH6	10	148.189	0.059	6.2	0.2011	0.0000	OK
15 minute winter	SWMH5	11	148.152	0.097	15.9	0.2461	0.0000	OK
15 minute winter	SWMH4	11	148.242	0.042	3.2	0.1283	0.0000	OK
15 minute winter	SWMH3	11	148.203	0.088	12.9	0.3068	0.0000	OK
15 minute winter	SWMH2	11	148.246	0.059	6.2	0.1492	0.0000	OK
15 minute winter	SWMH1	11	148.398	0.059	6.4	0.2145	0.0000	OK
15 minute winter	Seporator 01	12	147.979	0.118	21.3	0.3002	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SWMH8 (HB)	1.006	EX MH17 (OUT)	21.3	1.795	0.033	0.1049	10.5
15 minute winter	SWMH7	1.004	Seporator 01	21.3	0.786	0.189	0.1778	
15 minute winter	SWMH6	3.000	SWMH7	6.0	0.629	0.080	0.1319	
15 minute winter	SWMH5	1.003	SWMH7	15.6	0.603	0.138	0.5048	
15 minute winter	SWMH4	2.000	SWMH5	3.1	0.527	0.041	0.0873	
15 minute winter	SWMH3	1.002	SWMH5	12.8	0.609	0.113	0.3912	
15 minute winter	SWMH2	1.001	SWMH3	6.2	0.407	0.054	0.3399	
15 minute winter	SWMH1	1.000	SWMH2	6.2	0.648	0.081	0.1538	
15 minute winter	Seporator 01	1.005	SWMH8 (HB)	21.4	0.785	0.190	0.1619	

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.74%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SWMH9	11	147.386	0.091	19.7	0.3511	0.0000	OK
15 minute winter	SWMH10	12	147.353	0.165	32.1	0.5603	0.0000	OK
15 minute winter	SWMH11	12	147.344	0.270	151.8	1.8697	0.0000	OK
15 minute winter	SWMH12	10	147.438	0.174	67.2	1.2036	0.0000	OK
15 minute winter	SWMH13	12	147.355	0.212	65.9	0.5387	0.0000	OK
15 minute winter	SWMH14	13	147.222	0.344	162.6	1.3160	0.0000	OK
15 minute winter	Separator 2	13	147.205	0.383	153.8	0.9735	0.0000	OK
15 minute winter	SWMH14A (FC)	13	147.191	0.471	151.4	1.1975	0.0000	OK
15 minute winter	SWMH15	10	146.295	0.026	3.6	0.0758	0.0000	OK
15 minute winter	SWMH16	11	145.555	0.046	4.9	0.1671	0.0000	OK
15 minute winter	SWMH17	10	145.182	0.140	39.5	0.5842	0.0000	OK
15 minute winter	Separator 3	12	145.161	0.294	38.5	0.7472	0.0000	OK
15 minute winter	SWMH18 (FC)	12	145.159	0.316	37.8	0.8041	0.0000	OK
15 minute winter	SWMH19	13	144.971	0.149	185.1	0.3800	0.0000	OK
15 minute winter	EX MH2 (OUT)	13	144.264	0.124	185.1	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SWMH9	4.000	SWMH10	19.0	0.559	0.041	2.0125	
15 minute winter	SWMH10	4.001	SWMH11	30.4	0.348	0.065	4.5607	
15 minute winter	SWMH11	4.002	SWMH14	146.8	1.163	0.314	6.2692	
15 minute winter	SWMH12	5.000	SWMH13	65.9	0.857	0.141	3.9613	
15 minute winter	SWMH13	5.001	SWMH11	63.0	0.566	0.135	3.1689	
15 minute winter	SWMH14	4.003	Separator 2	153.8	0.890	0.250	4.7224	
15 minute winter	Separator 2	4.004	SWMH14A (FC)	151.4	0.809	0.248	2.5318	
15 minute winter	SWMH14A (FC)	4.005	SWMH19	150.1	1.234	0.440	3.5298	
15 minute winter	SWMH15	7.0000	SWMH16	3.5	0.780	0.015	0.0832	
15 minute winter	SWMH16	7.001	SWMH18 (FC)	4.8	0.886	0.037	0.1443	
15 minute winter	SWMH17	6.000	Separator 3	38.5	0.801	0.112	1.8402	
15 minute winter	Separator 3	6.001	SWMH18 (FC)	32.9	0.524	0.096	1.3709	
15 minute winter	SWMH18 (FC)	6.002	SWMH19	35.7	0.786	0.104	0.4562	
15 minute winter	SWMH19	4.006	EX MH2 (OUT)	185.1	3.840	0.098	0.4374	108.1

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.74%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	EX MH17 (OUT)	12	145.269	0.069	33.2	0.0000	0.0000	OK
15 minute winter	SWMH8 (HB)	12	145.811	0.271	33.1	0.6897	0.0000	OK
15 minute winter	SWMH7	11	148.141	0.149	33.4	0.3781	0.0000	OK
15 minute winter	SWMH6	10	148.204	0.074	9.6	0.2533	0.0000	OK
15 minute winter	SWMH5	11	148.181	0.126	24.7	0.3212	0.0000	OK
15 minute winter	SWMH4	10	148.252	0.052	4.9	0.1587	0.0000	OK
15 minute winter	SWMH3	11	148.228	0.112	20.0	0.3921	0.0000	OK
15 minute winter	SWMH2	11	148.259	0.072	9.5	0.1843	0.0000	OK
15 minute winter	SWMH1	10	148.413	0.074	9.8	0.2685	0.0000	OK
15 minute winter	Seporator 01	12	148.010	0.149	32.9	0.3798	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SWMH8 (HB)	1.006	EX MH17 (OUT)	33.2	2.021	0.052	0.1452	16.3
15 minute winter	SWMH7	1.004	Seporator 01	32.9	0.884	0.292	0.2440	
15 minute winter	SWMH6	3.000	SWMH7	9.3	0.707	0.124	0.1858	
15 minute winter	SWMH5	1.003	SWMH7	24.2	0.663	0.214	0.7122	
15 minute winter	SWMH4	2.000	SWMH5	4.7	0.590	0.062	0.1198	
15 minute winter	SWMH3	1.002	SWMH5	19.9	0.664	0.176	0.5603	
15 minute winter	SWMH2	1.001	SWMH3	9.5	0.452	0.084	0.4735	
15 minute winter	SWMH1	1.000	SWMH2	9.5	0.731	0.124	0.2096	
15 minute winter	Seporator 01	1.005	SWMH8 (HB)	33.1	0.884	0.294	0.2224	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.92%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SWMH9	13	147.755	0.460	51.9	1.7783	0.0000	OK
15 minute winter	SWMH10	14	147.766	0.578	69.8	1.9609	0.0000	OK
15 minute winter	SWMH11	13	147.759	0.685	342.6	4.7426	0.0000	SURCHARGED
15 minute winter	SWMH12	13	147.779	0.515	177.2	3.5579	0.0000	OK
15 minute winter	SWMH13	13	147.757	0.614	165.1	1.5614	0.0000	OK
15 minute winter	SWMH14	13	147.732	0.854	336.9	3.2635	0.0000	SURCHARGED
15 minute winter	Separator 2	13	147.716	0.894	271.5	2.2756	0.0000	SURCHARGED
15 minute winter	SWMH14A (FC)	13	147.703	0.983	266.8	2.5023	0.0000	SURCHARGED
15 minute winter	SWMH15	10	146.310	0.041	9.5	0.1201	0.0000	OK
15 minute winter	SWMH16	13	145.690	0.181	13.2	0.6546	0.0000	OK
15 minute winter	SWMH17	13	145.694	0.652	103.9	2.7179	0.0000	SURCHARGED
15 minute winter	Separator 3	13	145.697	0.830	80.3	2.1111	0.0000	SURCHARGED
15 minute winter	SWMH18 (FC)	13	145.696	0.853	81.1	2.1714	0.0000	SURCHARGED
15 minute winter	SWMH19	13	145.037	0.215	336.7	0.5479	0.0000	OK
15 minute winter	EX MH2 (OUT)	13	144.307	0.167	335.8	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SWMH9	4.000	SWMH10	43.0	0.609	0.092	12.5019	
15 minute summer	SWMH10	4.001	SWMH11	74.0	0.387	0.158	14.1906	
15 minute summer	SWMH11	4.002	SWMH14	296.8	1.231	0.636	16.9055	
15 minute winter	SWMH12	5.000	SWMH13	165.1	0.948	0.354	15.2933	
15 minute winter	SWMH13	5.001	SWMH11	141.1	0.593	0.303	9.6650	
15 minute summer	SWMH14	4.003	Separator 2	275.6	0.918	0.447	9.8314	
15 minute winter	Separator 2	4.004	SWMH14A (FC)	266.8	0.828	0.437	4.8325	
15 minute winter	SWMH14A (FC)	4.005	SWMH19	266.9	1.457	0.781	5.2950	
15 minute winter	SWMH15	7.0000	SWMH16	9.4	0.939	0.040	0.4162	
15 minute winter	SWMH16	7.001	SWMH18 (FC)	16.9	0.901	0.129	1.5147	
15 minute winter	SWMH17	6.000	Separator 3	80.3	0.834	0.234	8.4421	
15 minute winter	Separator 3	6.001	SWMH18 (FC)	81.1	0.622	0.236	2.6869	
15 minute winter	SWMH18 (FC)	6.002	SWMH19	69.8	0.825	0.203	0.7707	
15 minute winter	SWMH19	4.006	EX MH2 (OUT)	335.8	4.346	0.177	0.7017	285.4

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.92%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	EX MH17 (OUT)	13	145.306	0.106	79.9	0.0000	0.0000	OK
15 minute winter	SWMH8 (HB)	13	146.366	0.826	85.0	2.1017	0.0000	SURCHARGED
15 minute winter	SWMH7	11	148.248	0.255	85.9	0.6501	0.0000	OK
15 minute winter	SWMH6	11	148.266	0.136	25.2	0.4623	0.0000	OK
15 minute winter	SWMH5	11	148.290	0.235	63.0	0.5979	0.0000	OK
15 minute winter	SWMH4	11	148.294	0.093	12.9	0.2861	0.0000	OK
15 minute winter	SWMH3	11	148.325	0.210	52.5	0.7327	0.0000	OK
15 minute winter	SWMH2	11	148.336	0.149	25.2	0.3790	0.0000	OK
15 minute winter	SWMH1	10	148.465	0.126	25.8	0.4568	0.0000	OK
15 minute winter	Seporator 01	11	148.116	0.255	85.3	0.6487	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SWMH8 (HB)	1.006	EX MH17 (OUT)	79.9	2.516	0.126	0.2813	42.7
15 minute winter	SWMH7	1.004	Seporator 01	85.3	1.175	0.757	0.4748	
15 minute winter	SWMH6	3.000	SWMH7	24.3	0.787	0.326	0.5219	
15 minute winter	SWMH5	1.003	SWMH7	62.2	0.820	0.549	1.4861	
15 minute winter	SWMH4	2.000	SWMH5	12.3	0.629	0.162	0.4243	
15 minute winter	SWMH3	1.002	SWMH5	51.8	0.765	0.458	1.2655	
15 minute winter	SWMH2	1.001	SWMH3	24.9	0.486	0.220	1.1581	
15 minute winter	SWMH1	1.000	SWMH2	25.2	0.947	0.329	0.4304	
15 minute winter	Seporator 01	1.005	SWMH8 (HB)	85.0	1.176	0.755	0.4288	

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.94%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	SWMH9	21	148.517	1.222	54.2	4.7234	0.0000	SURCHARGED
15 minute winter	SWMH10	13	148.495	1.307	108.4	4.4324	0.0000	SURCHARGED
15 minute winter	SWMH11	13	148.498	1.424	401.2	9.8617	0.0000	SURCHARGED
15 minute winter	SWMH12	13	148.529	1.265	223.4	8.7420	0.0000	SURCHARGED
30 minute winter	SWMH13	21	148.504	1.361	156.4	3.4648	0.0000	SURCHARGED
15 minute winter	SWMH14	13	148.412	1.534	385.7	5.8640	0.0000	SURCHARGED
15 minute winter	Separator 2	13	148.383	1.561	375.1	3.9734	0.0000	SURCHARGED
15 minute winter	SWMH14A (FC)	13	148.359	1.639	371.5	4.1701	0.0000	SURCHARGED
15 minute winter	SWMH15	10	146.315	0.045	11.9	0.1339	0.0000	OK
30 minute winter	SWMH16	21	146.075	0.566	13.8	2.0518	0.0000	SURCHARGED
15 minute winter	SWMH17	13	146.112	1.070	131.0	4.4567	0.0000	SURCHARGED
15 minute winter	Separator 3	13	146.095	1.228	100.1	3.1262	0.0000	SURCHARGED
15 minute winter	SWMH18 (FC)	13	146.090	1.247	99.1	3.1726	0.0000	SURCHARGED
15 minute winter	SWMH19	13	145.086	0.264	461.2	0.6724	0.0000	OK
15 minute winter	EX MH2 (OUT)	13	144.337	0.197	461.0	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SWMH9	4.000	SWMH10	48.7	0.599	0.104	15.2972	
15 minute winter	SWMH10	4.001	SWMH11	95.3	0.377	0.204	16.2250	
30 minute winter	SWMH11	4.002	SWMH14	343.3	1.161	0.735	17.2542	
15 minute summer	SWMH12	5.000	SWMH13	193.8	0.987	0.415	17.2542	
15 minute winter	SWMH13	5.001	SWMH11	162.6	0.593	0.349	9.8897	
30 minute winter	SWMH14	4.003	Separator 2	376.1	0.855	0.610	9.8314	
30 minute winter	Separator 2	4.004	SWMH14A (FC)	374.5	0.851	0.614	4.8325	
15 minute winter	SWMH14A (FC)	4.005	SWMH19	373.8	1.630	1.094	6.5868	
15 minute winter	SWMH15	7.0000	SWMH16	11.8	0.985	0.050	0.6554	
15 minute summer	SWMH16	7.001	SWMH18 (FC)	-30.0	0.888	-0.229	1.8613	
15 minute summer	SWMH17	6.000	Separator 3	115.2	0.843	0.336	8.4421	
15 minute summer	Separator 3	6.001	SWMH18 (FC)	109.8	0.636	0.320	2.6869	
15 minute winter	SWMH18 (FC)	6.002	SWMH19	87.4	0.874	0.255	0.9976	
15 minute winter	SWMH19	4.006	EX MH2 (OUT)	461.0	4.621	0.243	0.9055	360.2

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.94%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	EX MH17 (OUT)	25	145.306	0.106	80.0	0.0000	0.0000	OK
15 minute winter	SWMH8 (HB)	14	148.178	2.638	105.9	6.7148	0.0000	SURCHARGED
15 minute winter	SWMH7	11	148.285	0.293	107.1	0.7448	0.0000	OK
15 minute winter	SWMH6	11	148.299	0.169	31.8	0.5737	0.0000	OK
15 minute winter	SWMH5	11	148.333	0.278	79.0	0.7070	0.0000	OK
15 minute winter	SWMH4	11	148.336	0.136	16.3	0.4168	0.0000	OK
15 minute winter	SWMH3	11	148.367	0.252	66.1	0.8777	0.0000	OK
15 minute winter	SWMH2	11	148.376	0.189	31.9	0.4800	0.0000	OK
15 minute winter	SWMH1	10	148.483	0.144	32.6	0.5246	0.0000	OK
15 minute winter	Seporator 01	14	148.200	0.339	106.2	0.8628	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	SWMH8 (HB)	1.006	EX MH17 (OUT)	80.0	2.518	0.126	0.2815	67.5
15 minute winter	SWMH7	1.004	Seporator 01	106.2	1.269	0.943	0.5461	
15 minute winter	SWMH6	3.000	SWMH7	30.4	0.801	0.407	0.6625	
15 minute winter	SWMH5	1.003	SWMH7	77.8	0.868	0.687	1.7514	
15 minute winter	SWMH4	2.000	SWMH5	14.5	0.633	0.191	0.6099	
15 minute winter	SWMH3	1.002	SWMH5	64.5	0.798	0.571	1.5447	
15 minute winter	SWMH2	1.001	SWMH3	31.1	0.484	0.275	1.4901	
15 minute winter	SWMH1	1.000	SWMH2	31.9	1.004	0.416	0.5136	
15 minute winter	Seporator 01	1.005	SWMH8 (HB)	105.9	1.270	0.941	0.6202	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.80%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SWMH9	12	149.795	2.500	91.7	9.6625	0.1306	FLOOD
15 minute winter	SWMH10	12	149.783	2.595	199.7	8.8022	1.8763	FLOOD
30 minute winter	SWMH11	20	149.758	2.684	585.7	18.5894	10.9482	FLOOD
15 minute winter	SWMH12	12	149.842	2.578	312.8	17.8191	0.1235	FLOOD
15 minute winter	SWMH13	12	149.768	2.625	243.3	6.7745	0.0000	FLOOD RISK
15 minute winter	SWMH14	12	149.523	2.645	606.6	10.5506	0.0000	FLOOD RISK
15 minute summer	Separator 2	12	148.965	2.143	506.6	6.6573	0.0000	FLOOD RISK
15 minute summer	SWMH14A (FC)	12	148.969	2.249	498.8	6.7947	0.0000	FLOOD RISK
30 minute winter	SWMH15	23	146.782	0.513	19.7	1.5102	0.0000	SURCHARGED
30 minute winter	SWMH16	23	146.763	1.254	19.6	4.5461	0.0000	FLOOD RISK
15 minute winter	SWMH17	13	147.042	2.000	183.3	8.3339	0.0000	SURCHARGED
15 minute winter	Separator 3	13	147.038	2.171	163.8	5.5262	0.0000	SURCHARGED
15 minute winter	SWMH18 (FC)	13	147.033	2.190	137.4	5.5732	0.0000	SURCHARGED
15 minute winter	SWMH19	12	145.151	0.329	634.0	0.8370	0.0000	OK
15 minute winter	EX MH2 (OUT)	12	144.374	0.233	633.5	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	SWMH9	4.000	SWMH10	98.6	0.503	0.211	15.2972	
15 minute winter	SWMH10	4.001	SWMH11	-142.0	-0.398	-0.304	16.2250	
15 minute winter	SWMH11	4.002	SWMH14	512.6	1.436	1.098	17.2542	
15 minute summer	SWMH12	5.000	SWMH13	246.2	1.013	0.527	17.2542	
15 minute winter	SWMH13	5.001	SWMH11	253.6	0.710	0.544	9.8897	
30 minute winter	SWMH14	4.003	Separator 2	531.7	1.208	0.863	9.8314	
30 minute winter	Separator 2	4.004	SWMH14A (FC)	517.0	1.175	0.847	4.8325	
15 minute winter	SWMH14A (FC)	4.005	SWMH19	515.8	1.874	1.510	7.5052	
15 minute summer	SWMH15	7.0000	SWMH16	25.5	1.045	0.109	0.9586	
15 minute winter	SWMH16	7.001	SWMH18 (FC)	39.5	0.955	0.301	1.8613	
15 minute winter	SWMH17	6.000	Separator 3	163.8	0.839	0.478	8.4421	
15 minute summer	Separator 3	6.001	SWMH18 (FC)	140.0	0.594	0.408	2.6869	
15 minute winter	SWMH18 (FC)	6.002	SWMH19	119.8	0.956	0.349	1.3235	
15 minute winter	SWMH19	4.006	EX MH2 (OUT)	633.5	4.889	0.334	1.1744	491.1

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.80%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	EX MH17 (OUT)	14	145.310	0.110	85.4	0.0000	0.0000	OK
15 minute winter	SWMH8 (HB)	14	148.545	3.005	131.1	7.6465	0.0000	SURCHARGED
15 minute winter	SWMH7	13	148.601	0.609	137.5	1.5508	0.0000	SURCHARGED
15 minute winter	SWMH6	13	148.609	0.479	44.5	1.6294	0.0000	SURCHARGED
15 minute winter	SWMH5	13	148.635	0.580	102.2	1.4749	0.0000	SURCHARGED
15 minute winter	SWMH4	13	148.642	0.442	22.8	1.3525	0.0000	SURCHARGED
15 minute winter	SWMH3	13	148.647	0.532	88.7	1.8555	0.0000	SURCHARGED
15 minute winter	SWMH2	13	148.651	0.464	44.1	1.1804	0.0000	SURCHARGED
15 minute winter	SWMH1	13	148.667	0.328	45.6	1.1917	0.0000	SURCHARGED
15 minute winter	Seporator 01	13	148.571	0.710	133.4	1.8058	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SWMH8 (HB)	1.006	EX MH17 (OUT)	85.4	2.555	0.134	0.2958	74.8
15 minute summer	SWMH7	1.004	Seporator 01	138.9	1.373	1.232	0.7224	
15 minute winter	SWMH6	3.000	SWMH7	41.2	0.797	0.553	0.9770	
15 minute summer	SWMH5	1.003	SWMH7	99.7	0.930	0.881	2.1484	
15 minute summer	SWMH4	2.000	SWMH5	19.6	0.638	0.259	1.0506	
15 minute winter	SWMH3	1.002	SWMH5	83.1	0.837	0.735	2.0504	
15 minute winter	SWMH2	1.001	SWMH3	39.3	0.481	0.347	2.4507	
15 minute winter	SWMH1	1.000	SWMH2	44.1	1.050	0.577	1.1360	
30 minute summer	Seporator 01	1.005	SWMH8 (HB)	132.1	1.381	1.172	0.6542	

Appendix 11: Proposed Levels Design



- ### Notes
1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
 2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
 3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
 4. Any discrepancies noted on site are to be reported to the engineer immediately.
 5. It is assumed that the building will have 150mm threshold to the south and west and level access to the north and east, subject to confirmation.
 6. Proposed levels provided are for bottom of kerb.
 7. Levels strategy is based off a BWB Consulting Ltd topographical survey 244497-BWB-00-01-DR-G-0001 dated 29/10/24.
 8. Plot boundaries and building and external works footprints shown on this drawing are indicative only, based on the DLA architecture drawing reference KBPQ-DLA-QS-XX-DR-A-99002 and KBPQ-DLA-QS-XX-DR-A-99052 dated 09/01/2026
 9. Drawing to be read in conjunction with the BWB planning set of drawings.

- ### Key
- Site Planning Boundary
 - Major Contour (0.5m Interval)
 - Minor Contour (0.1m Interval)
 - × 44.361m Proposed Level
 - × (Ex)44.202m Existing Level

P03	28.05.26	Planning Site Boundary Updated	RL	BS
P02	14.01.26	Drawing split into Plot Q1 and Q2	SR	BS
P01	12.12.26	Issued for Planning	SR	BS
Rev	Date	Details of issue / revision	Drw	Rev

Issues & Revisions



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Client

Wilson Bowden Developments

Project Title

Kingsway Business Park Plot Q

Drawing Title

External Levels Design

Drawn:	S. Raja	Reviewed:	B. Sherburn
BWB Ref:	244498	Date:	Dec 25
Scale@A1:	1:500		

Drawing Status

For Planning Issue

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
244498-BWB-EXT-XX-D-C-0101	S3	P03

