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ENVIRONMENT

Kirklees Council
New Woodley School and College
Huddersfield
Sustainable Drainage Statement

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New Woodley School and College Huddersfield
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 attenuated storage, as well as the appropriate level of treatment to be provided to surface water runoff.

1.2 This SDS is intended to support a full planning application for the construction of a Special Educational Needs and Disability (SEND) school facility. The removal of existing buildings on site is covered by a separate Prior Approval application. The SEND school will be located within the existing building footprint. The level of detail included is commensurate and subject to the nature of the proposals. A proposed site development plan is included as **Appendix 1.**

1.3 Within the application area, the existing pre-school car park, in the north of the site, and MUGAs are to be retained. The surface water drainage system in place for the pre-school car park and MUGAs are proposed to be retained as existing, with the exception of any remedial works that are identified prior to the redevelopment of the site.

1.4 A Flood Risk Assessment (FRA) has been prepared for the site by LK Consult Ltd (reference: FRA 22 1180 – R0).

1.5 The location of the site is illustrated within **Figure 1.1**, with contextual information provided within **Table 1.1**.

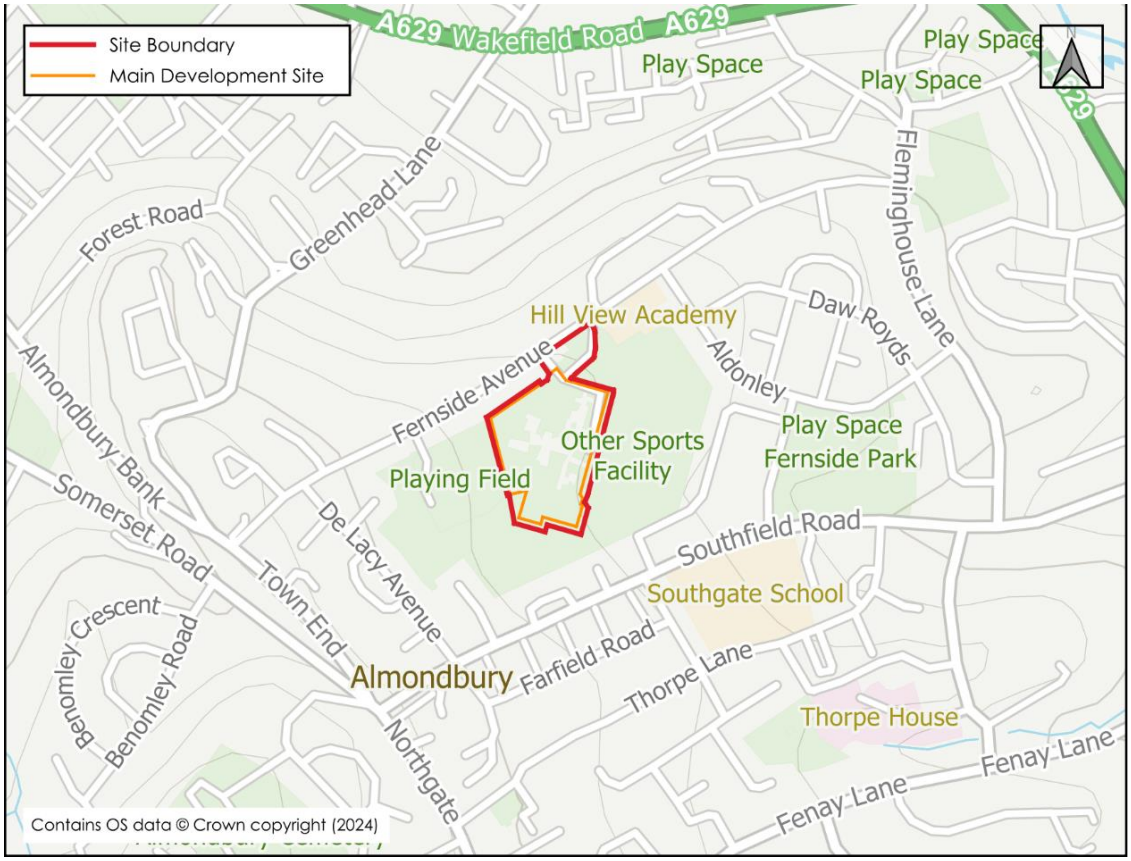


Figure 1.1: Site Location

Table 1.1: Site Details

Site Name	Future Woodley School and College
Location	Huddersfield
NGR (approx.)	416950, 415860
Application Site Area (ha)	Approx. 3.76
Main Development Area (ha)	Approx. 2.80
Development Type	Education
Lead Local Flood Authority	Kirklees Council
Local Planning Authority	Kirklees Council
Sewerage Undertaker	Yorkshire Water

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 This SDS has been produced with reference to the following local and national SuDS guidance:

- West Yorkshire Combined Authority (WYCA) SuDS Guidance[1];
- The DEFRA Non-Statutory Technical Standards for SuDS[2];
- The CIRIA SuDS Manual[3]; and
- The National Planning Policy Framework[4] and relevant Flood Risk Planning Practice Guidance[5];

1.8 The site is located within the Aire and Calder Management Catchment within the Humber River Basin District. Table 2 from the EA's 'Flood risk assessments: climate change allowances', included as **Table 1.2**, shows the anticipated changes in peak rainfall intensity for the site.

Table 1.2: Aire and Calder Management Catchment Peak Rainfall Allowances

Aire and Calder Management Catchment Allowance	Total Potential Change Anticipated for the '2050s' (Lifetime up to 2060)	Total Potential Change Anticipated for the '2070s' (2061 to 2125)
1 in 30-Year Rainfall Event		
Upper End	35%	40%
Central	20%	25%
1 in 100-Year Rainfall Event		
Upper End	40%	45%
Central	25%	30%

1.9 The proposed development is anticipated to have a lifespan of up to 80 years; therefore the 2070's epoch upper end allowance will be used to assess the impacts of climate change for the proposed surface water drainage strategy.

[1] West Yorkshire Combined Authority SuDS Guidance (Various Councils, no date). Available from [last accessed: 23.05.2024] - https://www.kirklees.gov.uk/beta/flooding-and-drainage/pdf/sustainable-urban-drainage.pdf
[2] 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems
[3] The SuDS Manual (CIRIA, 2015)
[4] Revised National Planning Policy Framework, Ministry of Housing, Communities & Local Government, amended 2021.
[5] Planning Practice Guidance: https://www.gov.uk/government/collections/planning-practice-guidance

1.10 Based on the above guidance, an allowance of 45% will be applied to the 1 in 100-year return period within the drainage calculations. There will also be an allowance of 40% applied to the 1 in 30 year return period.

1.11 The proposed development is for a school and, therefore, an allowance for urban creep has not been included within the impermeable area calculations.

2. EXISTING CONDITIONS

2.1 The existing site is brownfield, formerly Almondbury Community School and Sports Centre.

2.2 The site is bound to the north by Fernside Avenue, to the east and south by playing fields with residential development beyond, and to the west by residential buildings and Almondbury Cricket Club.

2.3 The FRA prepared for the site by LK Consult Ltd (reference: FRA 22 1180 – R0) identifies the site to be at low to very low risk of flooding from all sources.

2.4 A topographical and utility survey (**Appendix 2**) shows existing levels within the site to generally fall from west to east; with levels falling from approximately 139.0m Above Ordnance Datum (AOD) at the western site boundary to circa 128.0m AOD at the north eastern and south eastern site boundaries.

2.5 Yorkshire Water sewer records (**Appendix 3**) show no public sewerage assets to be located within the site. A 300mm diameter combined water sewer is shown to be located within Fernside Avenue, adjacent to the north site access. There is also a 300mm diameter surface water and a 300mm diameter combined water sewer located approximately 140m south east of the site within the playing fields.

2.6 The existing 300mm diameter surface water public sewer to the south east of the site appears to drain towards a landscaped area of "The Homestead (Home for the Elderly)" approximately 185m to the east of the application site, where the sewer is no longer mapped. It is understood that this sewer drains into an unmapped culverted watercourse. The combined water sewer to the east of the site joins a wider combined water public sewer network which conveys flows onwards to the east.

2.7 The utility survey (**Appendix 2**) identifies an existing private surface water and combined water drainage system servicing the pre-school and associated car park in the north of the site, which discharges to the 300mm diameter combined public sewer located within Fernside Avenue. The existing school site and sports centre are shown to be served by an existing private surface and combined water sewer system, which discharges into the existing 300mm diameter combined public sewer located within the playing fields approximately 140m to the east of the application site boundary.

2.8 British Geological Survey (BGS) online mapping indicates that the majority of the site is underlain by Greenmoor Rock (Sandstone), with Pennine Lower Coal Measures Formation (Mudstone, Siltstone and Sandstone) located at the far northern and southeastern site boundaries. There are no superficial deposits recorded on BGS to be located within the site.

2.9 A Phase 2 ground investigation has been undertaken by LK Group in March 2023 (reference: LK 22 1679-B1-GI) and confirms the ground conditions within the site to generally comprise of Made Ground to generally less than 1m below ground level (bgl) underlain by weathered mudstone and sandstone, with soft to firm clay encountered in localised areas.

2.10 No groundwater was encountered during the ground investigations and two soakaway test locations were assessed in accordance with BRE365 Digest Guidance. The results of the soakaways tests are summarised in **Table 2.1**, with relevant extracts from the ground investigation report included as **Appendix 4**.

Table 2.1: Summary of soakaway tests extracted from LK Group Ground Investigation

Trial Pit	Test No.	Strata at Test Level	Soil infiltration rate (m/s)
SA101	1*	Weathered Mudstone	3.34×10^{-6}
SA102	1	Weathered Mudstone	1.56×10^{-4}
	2		1.20×10^{-4}
	3		8.71×10^{-5}

* Test data extrapolated

2.11 Based on the above information, the existing drainage regime is anticipated to consist of two drainage catchments served by private positive drainage systems discharging flows from the site to the surrounding public sewer networks.

2.12 The northern portion of the site (i.e., existing pre-school and associated car parking) is served by a private drainage system which outfalls to the public sewer network in Fernside Avenue. This part of the site is to be retained as existing and, therefore, this part of the site will be excluded from the assessment within this SDS report.

2.13 The rest of the site (hereafter referred to as "main development site") is served by a private drainage system which outfalls to the public sewer network to the east of the site. The main development site area is illustrated on **Figure 1.1**.

2.14 The soft landscaping areas within the site will either drain via infiltration or, where infiltration is not occurring within the site, onto the surrounding areas served by the existing drainage systems.

Existing Runoff Rates

2.15 The northern portion of the application site, which drains to the public sewer located within Fernside Avenue, is to be retained as existing; therefore, this area has not been assessed to compare the pre- and post-development runoff rates and volumes.

2.16 For the main development site (2.80ha) which drains to the east, approximately 1.83ha of this area has been identified as impermeable and positively draining to the east, with the remaining 0.97ha consisting of soft landscaping.

2.17 A drawing of the existing impermeable and permeable surfacing types within the main development site, and an assessment of the existing and proposed runoff rate for the main development site is presented within **Appendix 5**. The existing runoff rates discharging from the site have been calculated using the Modified Rational Method, summarised within **Table 2.2**.

2.18 The existing discharge rate leaving the site via the 300mm diameter combined public water sewer will be limited by the pipe capacity and, therefore, this has been used to calculate the existing runoff rate. The calculations are included as **Appendix 5** and **Table 2.2**. Due to limited information regarding the downstream invert levels of the 300mm diameter combined water public sewer, it has been assumed that the receiving sewer has been laid at the minimum self-cleansing gradient of 1:240. If further survey works confirm that the receiving sewer is set at different gradient, the existing runoff rate calculation should be revised to reflect the more accurate assessment of the downstream capacity of the receiving public sewer.

Table 2.2: Existing Runoff Rates from the Site

Return Period (Yrs.)	Average Rainfall Intensity (mm/hr)	Runoff Rate from Impermeable Surfaces (l/s)	Existing Discharge Rate from the Site (l/s)
1	56.5	280.7	71.3*
2	130.1	645.9	71.3*
30	163.2	810.4	71.3*
100	228.5	1134.5	71.3*

*Flow leaving the site limited by pipe capacity

2.19 Therefore, the existing pipe capacity controls the current discharge rate of the site for all storm events.

Existing Runoff Volume

2.20 As previously discussed, the northern portion of the site draining to the public sewer network within Fernside Avenue has been excluded from the existing runoff rate and volume calculations.

2.21 An assessment of the existing surface water runoff rates from the main development site (2.80ha) has been made for a 1 in 100-year, 6 hour storm. As the main development area is both impermeable and permeable, calculations for each surface type has been undertaken and added together.

2.22 The runoff volume from the permeable (0.97ha) areas of the main development site has been calculated using the Source Control module within Micro Drainage to be approximately **145m³**. The supporting calculation is presented within **Appendix 6**.

2.23 The runoff volume from the impermeable (1.83ha) has been calculated using an average rainfall intensity of 11.267mm/hr as calculated using FEH rainfall data within Micro Drainage, and multiplied by the impermeable area, as described within **Figure 2.1**. The 100-year, 6 hour rainfall profile is presented within **Appendix 6**.

Av. Rainfall (m/hr) x 6 (hours) x Impermeable Area (m^2) = Runoff Volume (m^3)
0.011267 x 6 x 18,300 = 1,235m^3

Figure 2.1: 1 in 100-Year, 6 Hour Runoff Volume (Pre-Development)

2.24 Based on the above calculations, the total runoff volume from the existing main development site during the 1 in 100-year 6-hour storm is approximately **1,380m^3**.

3. SURFACE WATER DRAINAGE STRATEGY

3.1 A Proposed Outline Levels Strategy and Proposed Drainage Layout are presented as **Appendix 7**, with the supporting drainage modelling calculations presented within **Appendix 8**.

3.2 Based on the proposed development plan (**Appendix 1**), the impermeable area for the main development site is measured as 1.93ha which results in a 5.5% increase in impermeable surfacing compared to the existing impermeable area (1.83ha).

Drainage Hierarchy

3.3 The Planning Policy Guidance[6] and the SuDS Manual[7] 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.

3.4 The aim of this is approach is to manage surface water runoff close to where it falls and mimic natural drainage as closely as possible.

Infiltration

3.5 The infiltration testing undertaken within the site identified that one out of the two test locations had a suitable infiltration potential for soakaway drainage systems. Due to the variable infiltration potential and extent of made ground across the site, the use of soakaway drainage system to manage the surface water runoff from the entire development is considered to be unsuitable.

3.6 Furthermore, due to the existing topography of the site and surrounding land to the east, if a significant portion of the site were to be drained via a single soakaway structure close to the east site boundary, there is a risk reemergence of uncontrolled surface water offsite to the east as levels fall within the playing fields.

Surface Water Body

3.7 There are no surface water bodies located within the vicinity of the site that can be drained to via gravity without crossing third-party land. Therefore, alternative means of surface water disposal have been considered to present a deliverable solution that does not rely on agreements with third parties.

[6] Planning Practice Guidance. http://planningguidance.planningportal.gov.uk/.
[7] The SuDS Manual (C753). CIRIA 2015.

Surface Water Sewer

3.8 A pre-planning enquiry with Yorkshire Water (**Appendix 3**) initially confirmed that a surface water connection from the proposed development site to the existing 300mm diameter public surface water sewer located to the south east of the main development site would be acceptable at a maximum discharge rate of 3.5l/s.

3.9 The CCTV records and utility survey (**Appendix 3**) indicate that there is an existing network of field drains serving the playing fields to the east of the site currently draining to the 300mm diameter surface water public sewer. Based on the existing field drainage and unknown capacity of the downstream culverted watercourse, it is considered that the existing 300mm diameter surface water public sewer may have limited capacity available to serve the proposed redevelopment.

Combined sewer

3.10 Due to potential downstream capacity constraints of the existing surface water public sewer, it is proposed to maintain the existing regime of draining to the existing combined public sewer currently serving the main development site. Further consultation with Yorkshire Water (**Appendix 3**) confirmed that the sewerage undertaker would accept the existing combined water outfall from the site to be retained at a reduced discharge rate of 49.9l/s, which is a 30% betterment on the existing assumed maximum capacity of the downstream receiving public sewer network.

3.11 Therefore, it is proposed to discharge surface water from the main development site to the 300mm diameter combined public sewer located to the south east of the site, at a maximum discharge rate of 49.9l/s.

3.12 The connection to the existing combined public sewer will be made via the existing private outfall pipe currently serving the site. A CCTV survey, undertaken by Mapmatic Surveys in February 2023 (reference: 5475CCTV-01), confirmed the existing positive outfall from the site, although some remedial works are recommended to be undertaken on the existing outfall pipe to be retained.

3.13 Correspondence with the Lead Local Flood Authority (LLFA, **Appendix 9**) has confirmed that they would accept the proposed discharge of surface water to the existing 300mm diameter combined public sewer at a maximum discharge rate of 49.9l/s.

Peak Flow Control

3.14 In order to comply with the relevant local and nation SuDS guidance for the site, and the correspondence undertaken with the LLFA and Yorkshire Water, it is proposed that the maximum discharge rate of surface water from the proposed development will be limited to 49.9l/s for all events up to and including the 1 in 100-year + 45% critical storm event, as summarised within **Table 3.1**.

Table 3.1: Existing & Proposed Runoff Rates

Return Period (Yr.)	Existing Runoff Rate (l/s)	Proposed Discharge Rate (l/s)
1	71.3*	49.9
QBAR	71.3*	
30	71.3*	
100	71.3*	
100 + 45%	-	

* Flow leaving the site limited by pipe capacity

3.15 The proposed maximum discharge rate of 49.9l/s provides a 30% betterment on the assumed maximum capacity of the downstream receiving public sewer network.

3.16 Further survey investigation may identify that the downstream sewer may have additional capacity to receive flows from the proposed development site. If the downstream sewer is identified to have additional capacity to receive flows, then the maximum discharge rate from the proposed development may increase to 146.0l/s (i.e., 30% betterment on the existing 1 in 1-year runoff rate of 208.7l/s), subject to agreement with the LLFA and Yorkshire Water.

Modelling of Proposed Drainage System

3.17 A MicroDrainage network model of the proposed surface water drainage network for the main development has been produced based upon the Drainage Strategy presented within **Appendix 7**. Results from the critical storms using both Flood Studies Report (FSR) and Flood Estimation Handbook (FEH) rainfall methodologies are included within **Appendix 10.**

3.18 The pipe network has been designed to operate within the FSR rainfall model (as per standard requirements), demonstrating that there is no flooding up to the 1 in 30-year (+40%) critical storm event. Minor, temporary flooding (2.95m^3) is shown to occur within the car parking area during the 1 in 100-year +45% critical storm. This minor flooding will be temporarily stored within the car parking bays before draining back into the drainage network as water levels within the system fall.

3.19 The model has also been run under FEH rainfall conditions and show no flooding of the attenuation tank in all events up to and including the 1 in 100-year plus 45% climate change event. This demonstrates that the storage features are adequately designed. The proposed discharge rates do not exceed 49.9l/s for both FSR and FEH simulations.

3.20 The proposed contributing area within the modelled drainage network has been measured from the proposed development masterplan, presented within **Appendix 1**.

3.21 Based upon the Micro Drainage network model outputs, the maximum storage volume required across the proposed development during the 1 in 100-year plus 45% climate change critical storm event is approximately 953m^3.

Runoff Volume Control

3.22 An assessment of the post-development runoff volumes has been undertaken using the same methodology as the pre-development assessment for the main development area (2.80ha) using the post-development impermeable (1.93ha) and permeable (0.87ha) areas.

3.23 The post-development runoff volume from the permeable areas (0.87ha) of the site have been calculated using Microdrainage Source Control Module as approximately **130m³**. The supporting calculations is presented within **Appendix 6**.

3.24 The runoff volume from the post-development impermeable areas (1.93ha) has been calculated using an average rainfall intensity of 11.267mm/hr as calculated using FEH rainfall data within Micro Drainage, and multiplied by the impermeable area, as described within **Figure 2.1**. The 100-year, 6 hour rainfall profile is presented within **Appendix 6**.

Av. Rainfall (m/hr) x 6 (hours) x Impermeable Area (m^2) = Runoff Volume (m^3)

0.011267 x 6 x 19,300 = 1,305m^3

Figure 3.1: 1 in 100-Year, 6 Hour Runoff Volume (Post-Development)

3.25 Based on the above calculations, the total post-development runoff volume from the main development site during the 1 in 100-year 6-hour storm is calculated to be approximately **1,435m³.**

3.26 The calculated existing and post-development runoff volumes are compared within **Table 3.2**.

Table 3.2: Runoff Volume Comparison

Existing Volume (m^3)	Proposed Volume (m^3)	Difference (m^3)
1,380	1,435	+55

3.27 Based on the above comparison, there is anticipated to be an increase in runoff volume of 55m³ during the 1 in 100-year 6-hour storm. However, it is proposed that the site will discharge surface water at a 30% betterment to the existing 1 in 1-year return period for all events up to and including the 1 in 100-year + 45% critical storm. Therefore, this additional volume of water will be discharged from the development at a rate which does not adversely impact flood risk.

3.28 As such the relevant local and national guidance on surface water runoff control has been met and there is no requirement for long-term storage within the site.

Sustainable Drainage Systems

3.29 Surface water from the proposed development will be collected from the proposed development via a combination of rainwater downpipes, gullys, linear channel drains, kerb drains and swales. Surface water will then be conveyed via a below ground pipe network into an underground attenuation tank. Flows from the attenuation tank will be discharged via a vortex flow control, restricted to a maximum rate of 49.9l/s, into the existing 300mm diameter combined public sewer, located approximately 140m to the southeast of the site.

3.30 Prior to storage within the attenuation tank, surface water collected from the proposed car parking and student drop off areas will be routed through a Class 1 bypass oil separator.

3.31 Rainwater collected from the building roofs and the external paved walking areas are considered to be very low risk from a pollution hazard perspective. Therefore, these areas will be treated by catchpits and sump units at the point of collection.

3.32 The inclusion of swales within the proposed development layout will slow down the rate at which surface water enters the drainage system and also provide additional treatment. The swales should be appropriately planted to provide additional treatment and amenity benefits within the development.

3.33 The use of swales is limited to the car park as there are specific reservations of their use within the student areas for health and safety purposes, as outlined by the Client below:

"Kirklees Council are advocates for sustainable design and wish for the future Woodley School and College to be environmentally friendly and socially responsible. The advantages of swales are understood, but Kirklees feel that swales are an unsuitable drainage method within the school playground or minibus drop off areas.

Whilst the swales, for the future Woodley School and College are not designed to hold water, standing water up to roughly 300mm could be present for a short period of time in an extreme rainfall event - until the water has sufficient time to drain. Any increase in depth would be new situation to the students, as they would not have previous experience of these conditions. People with complex autism are not deterred by weather events and will choose to be outside during extreme rainfall. Free movement in the outside environment of the new school, for the students, is encouraged – thus why the fence lines, secure gates and planting plan are well considered and designed to encourage independence in a safe environment.

This means swales within the school playground or minibus drop off areas would introduce a complex and unique risk to students. Whilst the chances of an incident would be low, a potential risk of drowning exists due to the students' comfort at being outside in rainfall and the school design encouraging safe freedom of movement for the cohort. The proposal of swales to the school playground and minibus drop off zone is not a manageable risk."

Residual Risk and Designing for Exceedance

3.34 In the event that the capacity of the attenuation is exceeded, flood water will be directed away from buildings and pool within the car parking areas. Significant excess flow would leave the site via the east site boundary in accordance with the existing overland flow conditions at the site.

4. MAINTENANCE

4.1 A management company will be appointed to maintain the drainage system and SuDS features, including vegetation maintenance, trash screen clearing and regular outfall inspections. The site operator will ultimately be responsible for ensuring that the maintenance of the drainage system is upheld.

4.2 Requirements for ongoing maintenance of the drainage network should form part of the 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 for the site will be produced at the tender design stage; however, general maintenance recommendations for the SuDS proposed within the site, as informed by the CIRIA SuDS Manual[8], is provided within Table 4.1, Table 4.2 and Table 4.3.

Table 4.1: The SuDS Manual Typical Maintenance Schedule for Attenuation Tanks

Maintenance Schedule	Typical Frequency	Required Action
Regular Maintenance	Monthly for 3 months, then annually	• Inspect and identify any areas that are not operating correctly. If required, take remedial action.
	Monthly	• Inspect and identify any areas that are not operating correctly. If required, take remedial action.
	Annually	• For systems where rainfall infiltrates into the tank from above, check surface or filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.
	Annually, or as required	• Remove sediment from pre-treatment structures and/or internal forebays.
Remedial Actions	As required	• Repair/rehabilitate inlets, outlet, overflows and vents.
Remedial Action	Annually	• Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed.
	Every 5 years or as required	• Survey inside of tank for sediment build-up and remove if necessary

[8] The SuDS Manual (CIRIA, 2015)

Table 4.2: The SuDS Manual Typical Maintenance Schedule for Swales

Maintenance Schedule	Typical Frequency	Required Action
Regular Maintenance	Monthly	• Inspect inlets, outlets and overflows for blockages, and clear if required.
	Monthly (or as required)	• Remove litter and debris; and • Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours.
	Monthly (during growing season), or as required	• Cut grass – to retain grass height within specified design range.
	Monthly for first year then as required	• Manage other vegetation and remove nuisance plants.
	Monthly for 6 months, quarterly for 2 years, then half yearly	• Inspect vegetation coverage.
	Half yearly	• Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies.
Occasional Maintenance	As required or if bare soil is exposed over > 10% of the swale treatment area	• Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required.
Remedial Action	As required	• Repair erosion or other damage by re-turfing or reseeding; • Relevel uneven surfaces and reinstate design levels; • Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface; • Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip; and • Remove and dispose of oils or petrol residues using safe standard practices.

Table 4.3: The SuDS Manual Typical Maintenance Schedule for Oil Separators

Maintenance Schedule	Typical Frequency	Required Action
Routine Maintenance	Six monthly	• Remove litter and debris and inspect for sediment, oil and grease accumulation.
	As recommended by manufacturer	• Change the filter media.
	As necessary – indicated by system inspections or immediately following significant spill	• Remove sediment, oil, grease and floatables.
Remedial Actions	As required	• Replace malfunctioning parts or structures.
Monitoring	Six monthly	• Inspect for evidence of poor operation; and • Inspect filter media and establish appropriate replacement frequencies.
	Monthly during first half year of operation, then every six months	• Inspect sediment accumulation rates and establish appropriate removal frequencies.

5. FOUL WATER DRAINAGE

5.1 Foul water will be managed separately to surface water within the development.

5.2 Foul flows are proposed to be discharged at an unrestricted rate downstream from the surface water vortex flow control at the east site boundary where the foul flows will utilise the existing outfall to the 300mm diameter combined public sewer to the south east of the site.

5.3 Correspondence with Yorkshire Water (**Appendix 3**) confirms that the flow flows from the development can discharge into the 300mm diameter combined public sewer system to the east of the site.

5.4 Foul water from kitchens and/or food preparation areas of any restaurants and/or canteens must pass through a fat and grease trap prior to leaving the site.

5.5 A proposed foul drainage layout is presented on the Proposed Drainage Layout within **Appendix 7**.

6. SUMMARY

6.1 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.

6.2 This SDS is intended to support an full planning application and as such the level of detail included is commensurate and subject to the nature of the proposals.

6.3 The northern region of the site containing the private pre-school and associated car parking is proposed to be retained as existing; therefore, the SDS focuses on the remaining areas of the site (i.e., the "Main Development Area").

Table 6.1: Sustainable Drainage Statement Summary

		Existing Site	Proposed Development
Site Area (Ha)		Approx. 3.76	
Main Development Area (ha)		Approx. 2.80	
Impermeable Area (Ha)		1.83	1.93
Outfall Location		Combined Public Sewer	Combined Public Sewer
Peak Runoff Rate (l/s)	**1 in 1-Year**	71.3*	49.9
	1 in 30-Year	71.3*	
	1 in 100-Year	71.3*	
	1 in 100-Year + 45%	-	
Runoff Volume (100yr RP 6 hour Storm)		1,380m^3	1,435m^3
Volume Control		-	Discharge rate limited to a 30% betterment on the existing 1 in 1-year runoff rate for all events up to the 1 in 100-year + 45% return period
Proposed Storage Volume		-	953m^3
Flow Control Type		-	Vortex
SuDS Features		-	Class 1 Oil Bypass Separator Swales
Maintenance Responsibility		-	Management Company

* Flow leaving the site limited by pipe capacity

APPENDICES

Appendix 1: Proposed Development Plan



KEY CONTINUED

- (A) **Main Visitor Entrance**
  Direct pedestrian route through visitor car park to main reception.
- (B) **Visitor Car Park (Total Bays: 30 Bays)**
  - 24no. Car Parking Bays
  - 3no. Accessible Parking Bays (Incuding 1 EV Charging Point)
  - 3no. EV Parking Bays
- (C) **Staff Garden**
  Staff breakout space incorporating seating / tables and planting to buffer the car park.
- (D) **Staff Car Park (Total Bays: 120 excluding mini bus bays)**
  -111 Standard Parking Bays
  - 2no. Mini Bus Parking Bays
  - 3no. Accessible Parking Bays
  - 6no. Standard EV Bays
- (E) **Student Drop-Off / External Play**
  Informal drop-off loop for 30no. vehicles, designed to be utilised as soft and hard external play when not in use as a drop-off space. This is secured via fence and gates from the staff car park and gives direct access into the courtyard.
- (F) **6no.Existing MUGA Courts**
  Courts to be retained and resurfaced as required. 1no. Court to be used for fixed play equipment.
- (G) **Proposed Woodland Buffer Planting**
  Woodland whip buffer planting to be planted around the outside of the school boundary to mitigate overlooking.
- (H) **Forest School**
  Fenced off forest school play space set across the western side of the site incorporating the existing slopes as well as flat plateaus and winding footpath routes.
- (I) **Fixed Play Equipment including Swings**
- (J) **KS1 / 2 External Play Space**
  Fenced hard play associated with each classroom.
- (K) **Bin store (Location TBC)**
  Capacity for 8no. eurobins (as per existing number)
- (L) **External Courtyard**
- (M) **KS3 / 4 External Play Space**
  Fenced hard play associated with each classroom.
- (N) **Forest Hub**
  Existing Forest School classroom relocated. Horticultural garden including raised beds and greenhouse adjacent.
- (O) **Chickens**
  Secure fenced area.
- (P) **Seating Terraces**
  Terraced seating making key level changes usable.
- (Q) **Potential Substation Location**
- (R) **Existing Main Entrance**
  Entrance road widened with new gates and fenceline as required.
- (S) **Proposed Main Entrance**
  Gates and secondary secure line.
- (T) **Fire Pit**
- (U) **Water Feature**
- (V) **10no. Covered Cycle Spaces**
- (W) **Sports Equipment Storage**
- (X) **Existing Pre-School Demolished and replaced with grass. Existing parking retained.**
- (Y) **Covered outdoor dining area**
- (Z) **Covered seating area**
- (AA) **Signage Board**
- (BB) **Area identified as potential petting zoo location**
- (CC) **Post 16 External garden space**
- (DD) **Swale**
  Refer to drainage plan by others for details.
- (EE) **Existing playing field retained**

Note

1. Do not scale from this drawing
2. To be read in conjunction with Project Risk Register REF: XXX
3. To be read in conjunction with all other Landscape Architect's drawings

KEY

Site Planning Boundary

ID	RISK	MITIGATION	DATE MITIGATED

RESIDUAL PROJECT RISKS

DATE	REV	DESCRIPTION OF REVISION	DRAWN BY	APPROVED BY
17/06/2024	P04	Issued for Planning.	MM	RS
18/04/2024	P03	Updated as per email NP (17.04.2024)	AT	RS

REVISIONS

STATUS
S2 - *For Planning*

ares LANDSCAPE ARCHITECTS
Ares Landscape Architects LTD
Gatecrasher,
51 Eyre Lane
Sheffield
S1 4RB
t: 0114 276 2000
e: hello@aresdesign.co.uk
w: aresdesign.co.uk

CLIENT :
Kirklees Council

PROJECT TITLE :
Woodley School and College

DRAWING TITLE :
Landscape Illustrative Masterplan

DRAWING SCALE :	DRAWN BY :	DRAWN DATE :
1:500	AT	19/01/2023
PAPER SIZE :	APPROVED BY :	ALA PROJECT CODE:
A1	RS	ALA 823

DRAWING NUMBER :	STATUS :	REVISION :
22315-ALA-00-XX-DR-L-0001	S2	P04

Appendix 2: Topographical and Utility Survey

GENERAL NOTES

1. Do not scale.

2. This drawing is to be read in conjunction with all other relevant drawings.

3. Should there be any discrepancy between details indicated on this drawing and those indicated on other drawings the Engineer should be informed PRIOR to construction on site.

4. Until technical approval has been obtained from the relevant Authorities it should be understood that all drawings issued are preliminary and NOT for construction. Should the contractor start site work prior to approval been given, it is entirely at his own risk.

5. All dimensions shown are in millimetres unless noted otherwise.

6. This drawing is based on MAPMATIC Drawing Number, 5475-001 Rev 3, dated 04.03.2024.

7. All survey information is provided by the surveying company and HSP cannot accept any liability for any discrepancies there in. All survey information to be verified on site by contractor. Should discrepancies be identified, HSP to be notified immediately.

KEY

FL:	Floor level
CL:	Ceiling level
SusCL:	Suspended ceiling level
U/S:	Underside level
SHL:	Sill height level
HHL:	Head height level
SPR:	Spring Point
	Heater / radiator
	Ground light
	Door / sliding door
	Inspection cover
	Building line
	Beam
	Window
	Dimension

ABBREVIATION KEY

AR	Assumed Route	PTG	Pipe to Ground	Av	Air valve
BD	Base Bend	PTS	Pipe to Surface	Bg	Back gully
BD	Backdrop	RE	Rodding Eye	BH	Borehole
BL	Bed Level	RWP	Rainwater Pipe	BM	Benchmark
CL	Cover Level	SV	Stop Valve	Boll	Bollard
CR	Cable Riser	SVP	Soil Vent Pipe	Bs	Bus stop
DP	Down Pipe	TE	Trapped Exit	BT	British Telecom
EOT	End of Trace	TFR	Taken From Records	Bg	Back Gully
EP	Electricity Pole	TP	Telegraph Pole	CL	Cover Level
FH	Fire Hydrant	UTF	Unable to Find	CBX	Control box
G	Gully	UTL	Unable to Lift	CPS	Concrete paving slab
GV	Gas Valve	UTS	Unable to Survey	CTV	Cable TV cover
HOR	Head of Run	UTT	Unable to Trace	Elc	Electric cover
HL	High Level	VP	Vent Pipe	Ep	Electricity post
IC	Inspection Chamber	WL	Water Level	Er	Earth rod
IL	Invert Level	WM	Water Meter	Fh	Fire hydrant
MH	Manhole	WO	Wash Out Valve	Fs	Flagstaff
PR	Pipe Riser	D	Depth		
G	Girth circumference	Sv	Stop valve		
Gy	Gully	TCB	Telephone call box		
HL	Height	TTL	Tree top level		
IC	Inspection cover	THL	Threshold level		
IFL	Internal floor level	TCB	Telephone call box		
IL	Invert level	TL	Traffic light		
Lb	Letter box	THL	Threshold level		
Lp	Lamp Post	Tp	Telegraph post		
MG	Multigirth	Ts	Traffic signal		
MH	Manhole	TT	Tactile paving		
Mkr	Marker post	Twl	Top of wall level		
NVP	No visible pipes	UTL	Unable to lift		
Pinv	Pipe invert	WL	Water level		
Pb	Post box	Wm	Water meter		
Re	Rodding eye	Wo	Wash out		
Sp	Sign post				
St	Stop tap				

Ordnance Survey information is provided for a guide only.
OS BUILDING OUTLINE
OS DETAIL

Road		Verge Grass	
Drop Kerb		Verge	
Verge Tarmac		Tops	
Verge Concrete		Bottoms	

KEY FOR UNDERGROUND SERVICES

Foul water	
Surface water	
Other	
Gas	GAS
Electric	E
Telephone	BT
Cable TV	CATV
Unidentified	U
Water	W
Closed Circuit TV	CCTV
Communications	COM
Heating Pipe	HP
Empty Duct	ED
Fibre Optics	FO
Vents	V
Pipe	PIPE
Traffic Signal	TS
Gauge Lines	G
Vapor Recovery	VT
Offsets	O
Fuel	F

Where chamber extents are significantly greater than the cover size, their approximate extents are shown thus;

Station	Easting (m)	Northing (m)	Level (m)
S1	416906.387	415903.391	132.921
S1A	416923.892	415940.963	131.236
S1B	416895.463	415967.836	130.195
S2	416969.716	415944.575	129.668
S3	416997.226	415893.507	130.809
S4	416981.910	415795.937	130.848
S5	416965.917	415734.086	130.360
S6	416906.012	415754.445	132.609
M1	417048.122	415681.870	123.442

REV	BY	DATE	DETAILS	CKD
P01	IA	19.03.24	First revision	MK

STATUS: S2 - INFORMATION

CLIENT: Frank Shaw Associates

PROJECT: Almondbury. Heckmondwike

TITLE: Topographical & Utility Survey

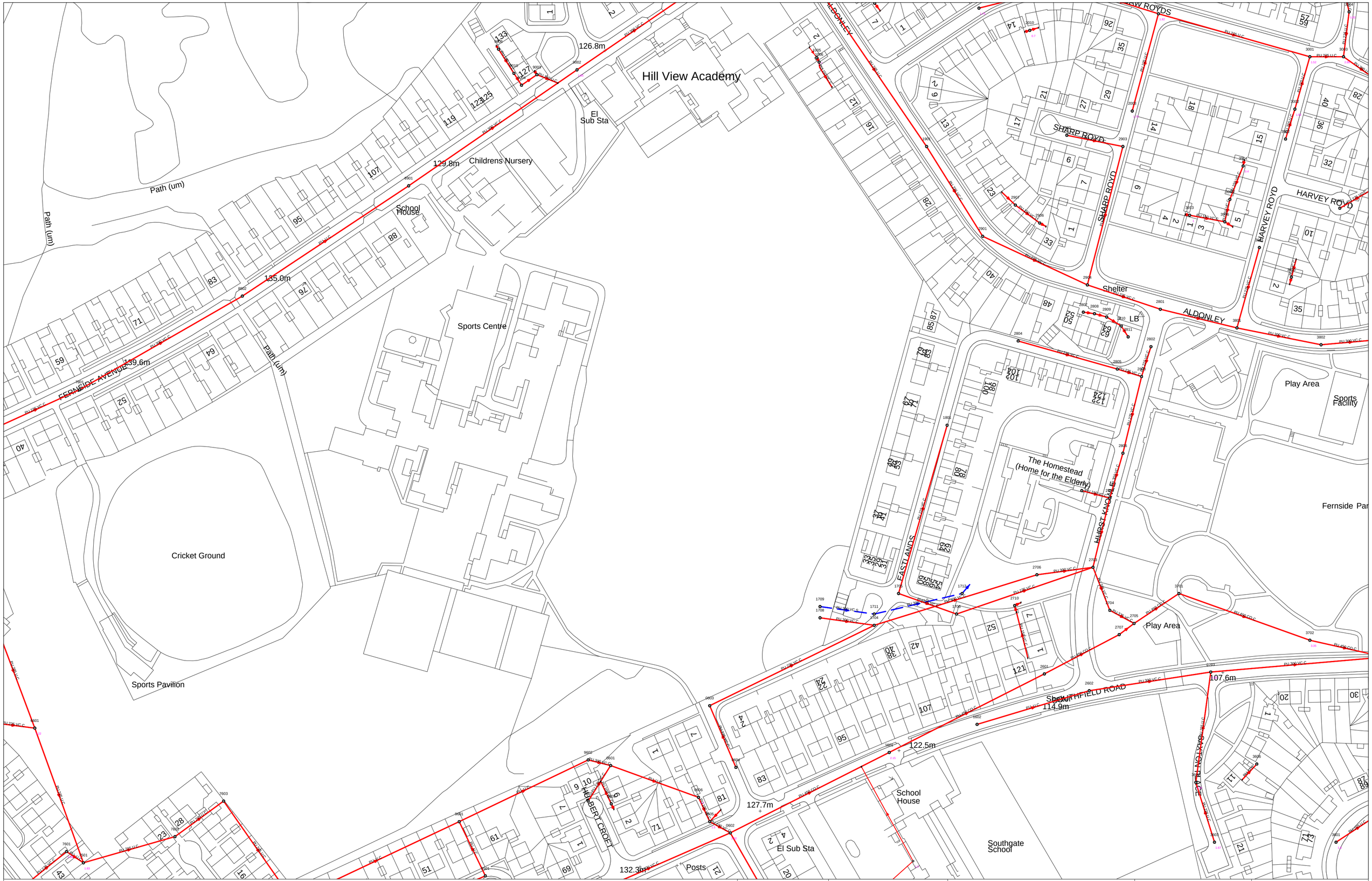
hsp consulting
Lawrence House, 6 Meadowbank Way, Eastwood, Nottingham, NG16 3SB
Tel: 01773 535555
www.hspconsulting.com

SCALE	PROJECT NO.	SHEET SIZE A0
1:500	C4202	

DATE	DRAWN	CHECKED
19.03.24	IA	MK

DRAWING NO. C4202-HSP-00-00-DR-G-5100 REV P01

Appendix 3: Yorkshire Water Sewer Records and Correspondence



416874 : 415715	Map Name : SE1615NE	Title	Partial Key
YorkshireWater	Yorkshire Water, PO Box 500, Halifax Road, Bradford BD6 2LZ Contact Name : YorMap Advisor C ROBERTS Contact Tel : 87 2582	Notes	Foul Sewer = F Combined Sewer = C Surface Water Sewer = SW Trade Sewer = TD Partially Separate = PS
		(Ody) COPYRIGHT STATEMENTS: Reproduced by permission of Ordnance Survey on behalf of HMSO © Crown copyright and database 2014. All rights reserved Ordnance Survey Licence number 100022432	Date Req : 17/01/2024, 10:55:38
			Source : Sewer Network Enquiry

This plan is furnished as a general guide only and no warranty as to its correctness is given or implied. This plan must not be relied upon in the event of excavations or other works made in the vicinity of public sewers. No house or property connections are shown.

Date Gen : 17/01/2024, 10:55:58

UPN: Undefined Originator: C ROBERTS, YorMap, 87 2582

YorkshireWater

Mr H Watts
BWB Consulting Ltd
Unit 2 Whitehall Waterfront
2 Riverside Way
Whitehall Road
Leeds
LS1 4EH

Yorkshire Water Services
Developer Services
Pre-Development Team
PO BOX 52
Bradford
BD3 7AY

Tel: 0345 120 8482

Email:

Your Ref:
Our Ref: A000078

For telephone enquiries ring:
Chris Roberts on 0345 120 8482

17th January 2024

Dear Mr H Watts,

Almondbury Send School, Land off Fernside Avenue, Huddersfield, HD5 8PQ - Pre-planning Enquiry V356377

Thank you for your recent enquiry and remittance. Our official VAT receipt has been sent to you under separate cover. Please find enclosed a complimentary extract from the Statutory Sewer Map which indicates the recorded position of the public sewers. Please note that as of October 2011 and the private to public sewer transfer, there are many uncharted Yorkshire Water assets currently not shown on our records.

The following comments reflect our view, with regard to the public sewer network only, based on a 'desk top' study of the site and are valid for a maximum period of twelve months:

Existing Infrastructure

There is a 300 mm diameter public surface water sewer recorded crossing the site. No buildings, or other obstructions, are to be erected within 3 (three) metres is required at each side of the sewer centre-line, no trees planted within 5 (five) metres of this public sewer. It may not be acceptable to raise or lower ground levels over the sewer, nor to restrict access to the manholes on the sewer.

There is a 300 mm diameter public combined water sewer recorded crossing the site. No buildings, or other obstructions, are to be erected within 3 (three) metres is required at each side of the sewer centre-line, no trees planted within 5 (five) metres of this public sewer. It may not be acceptable to raise or lower ground levels over the sewer, nor to restrict access to the manholes on the sewer.

If you wish to have this sewer diverted under Section 185 of the Water Industry Act 1991 an application should be made in writing. To discuss this matter, please telephone 0345 120 84 82.

Foul Water

Development of the site should take place with separate systems for foul and surface water drainage. The separate systems should extend to the points of discharge to be agreed.

Foul water domestic waste can discharge to the 300 mm diameter public combined sewer recorded in the southeastern corner of the site.

Foul water from kitchens and/or food preparation areas of any restaurants and/or canteens etc. must pass through a fat and grease trap of adequate design before any discharge to the public sewer network.

Yorkshire Water's Trade Effluent team must be consulted in respect of any proposed trade effluent discharge to the public sewer. Please visit - https://www.yorkshirewater.com/business/trade-effluent/

Surface Water

As discharge to soakaways and watercourses have been discounted, curtilage surface water may discharge to the 300 mm diameter public surface water sewer recorded in the southeastern corner of the site.

The surface water discharge from the site to be restricted to not greater than 3.5 (three point five) litres/second. This permission is not an acceptance in respect to any planning conditions imposed under the Grant of Planning Permission.

Surface water run-off from communal parking (greater than 800 sq metres or more than 50 car parking spaces) and hardstanding must pass through an oil, petrol and grit interceptor/separator of adequate design before any discharge to the public sewer network. Roof water should not pass through the traditional 'stage' or full retention type of interceptor/separator. It is good drainage practice for any interceptor/separator to be located upstream of any on-site balancing, storage or other means of flow attenuation that may be required.

Please note further restrictions on surface water disposal from the site may be imposed by other parties. You are strongly advised to seek advice/comments from the Environment Agency/Land Drainage Authority/Internal Drainage Board, with regard to surface water disposal from the site.

Other Observations

Any new connection to an existing public sewer will require the prior approval of Yorkshire Water. You may apply on line or obtain an application form from our website - https://www.yorkshirewater.com/developers/sewerage/sewerage-connections/

Under the provisions of section 111 of the Water Industry Act 1991 it is unlawful to pass into any public sewer (or into any drain or private sewer communicating with the public sewer network) any items likely to cause damage to the public sewer network interfere with the free flow of its contents or affect the treatment and disposal of its contents. Amongst other things this includes fat, oil, nappies, bandages, syringes, medicines, sanitary towels and incontinence pants. Contravention of the provisions of section 111 is a criminal offence.

All the above comments are based upon the information and records available at the present time and is subject to formal planning approval agreement. The information contained in this letter together with that shown on any extract from the Statutory Sewer Map that may be enclosed is believed to be correct and is supplied in good faith.

YorkshireWater

Please note that capacity in the public sewer network is not reserved for specific future development. It is used up on a 'first come, first served' basis. You should visit the site and establish the line and level of any public sewers affecting your proposals before the commencement of any design work.

Yours sincerely

Chris Roberts
Development Services Technician

Matthew Bailey

From: Technical Sewerage
Sent: 27 February 2024 11:32
To: Harrison Watts
Subject: RE: Almondbury Send School, Land off Fernside Avenue, Huddersfield, HD5 8PQ - Pre-planning Enquiry V356377

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

Dear Mr Watts,

Thank you for the additional information.

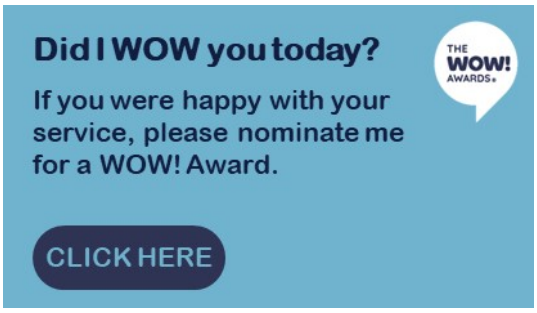
I will agree to the proposed surface water discharge rate of 49.9 l/s max to the 300 mm combined public sewer to the south east of the site.

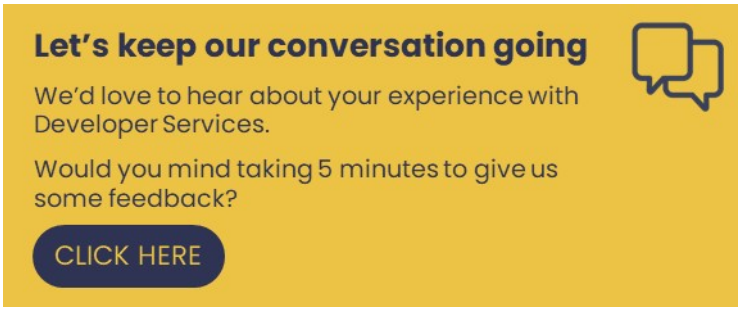
Kind Regards

YorkshireWater

Chris Roberts
Pre-Development Technician
Developer Services
Tel: 0345 1 20 84 82

*******Please note we have 10 working days to respond to email enquiries*******





From: Harrison Watts
Sent: Tuesday, February 13, 2024 12:57 PM

To: Technical Sewerage
Cc: Kristen Jones
Subject: RE: Almondbury Send School, Land off Fernside Avenue, Huddersfield, HD5 8PQ - Pre-planning Enquiry V356377

You don't often get email from harrison.watts@bwbconsulting.com. Learn why this is important

WARNING - EXTERNAL SOURCE
This email has been sent from an account outside of the Kelda Group network and could be a phishing email.
Please **THINK** before clicking links or opening any attachments.
If you suspect that this email is suspicious please report it to the Cyber Security Team using the "Report Message" button.

Good Morning Chris,

As discussed, see the attached CCTV survey information conducted by HSP Consulting on 13.01.23. Please refer to page 312 for details on the current combined sewer joining the existing school to the larger network.

Also attached is an existing and proposed discharge rate drawing detailing our calculations for the proposed site discharge rates. If you could please review and provide comments that would be much appreciated.

Please let me know if you require any further information.

Kind regards

Harrison Watts BEng (Hons)
Graduate Engineer - Transport & Infrastructure Design | BWB Consulting Limited

Whitehall Waterfront, 2 Riverside Way, Leeds , LS1 4EH
W www.bwbconsulting.com



From: Technical Sewerage
Sent: Monday, January 22, 2024 3:42 PM
To: Harrison Watts
Subject: RE: Almondbury Send School, Land off Fernside Avenue, Huddersfield, HD5 8PQ - Pre-planning Enquiry V356377

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

Hi Harrison,

We do not accept greenfield rates into our sewers. What we do offer if there are no other options for surface water for greenfield areas is the minimum adoptable rate which is 3.5 l/s max.

If you can evidence like you mention positive connectivity of brownfield areas to the public sewer network for surface water please use the below guidance and provide me further evidence. Estimate of brownfield areas are not acceptable.

If other methods of surface water disposal are not viable and subject to providing satisfactory evidence as to why they have been discounted, curtilage surface water discharges to the public sewer will be restricted to the level of run-off - i.e. same rate of discharge - to that from the existing use of the site less a 30% reduction in the existing discharge. Any discharge of surface water from the site should discharge to similar points of connection to that of the existing use of the site. You will need to demonstrate positive drainage, based on a 1 in 1 year storm, to the public sewer to Yorkshire Water by means of investigation and calculation carried out at your expense.

To do this, Yorkshire Water requires to see existing and proposed drainage layouts with pipe sizes, gradients, gullies, downpipes and connection points, measured impermeable areas of the present and proposed use of the site, along with the calculations that show the existing and proposed discharge rate from the site to the public sewer.

As per Part H3 of the Building Regulations 2010, surface water should in the first instance always discharge to a surface water sewer over a combined unless evidence of why this cannot happen be provided.

Kind Regards

YorkshireWater

Chris Roberts
Pre-Development Technician
Developer Services
Tel: 0345 1 20 84 82

*****Please note we have 10 working days to respond to email enquiries*****

Did I WOW you today?

If you were happy with your service, please nominate me for a WOW! Award.

THE WOW! AWARDS

CLICK HERE

Let's keep our conversation going

We'd love to hear about your experience with Developer Services.

Would you mind taking 5 minutes to give us some feedback?

CLICK HERE

From: Harrison Watts
Sent: 18 January 2024 16:47
To: Technical Sewerage
Subject: RE: Almondbury Send School, Land off Fernside Avenue, Huddersfield, HD5 8PQ - Pre-planning Enquiry V356377

WARNING - EXTERNAL SOURCE
This email has been sent from an account outside of the Kelda Group network and could be a phishing email.
Please **THINK** before clicking links or opening any attachments.
If you suspect that this email is suspicious please report it to the Cyber Security Team using the "Report Message" button.

Good afternoon Chris,

Thank you for your response.

Please could you confirm the rationale behind the 3.5 l/s discharge rate? This discharge rate is less than greenfield so some verification on this would be great.

Current CCTV records indicate both foul and surface water are currently discharging into the combined sewer. Can the proposed surface water discharge only to the public surface water or can the surface water discharge be split between the combined and public surface water sewer?

Kind regard

Harrison Watts BEng (Hons)
Graduate Engineer - Transport & Infrastructure Design | BWB Consulting Limited

Whitehall Waterfront, 2 Riverside Way, Leeds , LS1 4EH
W www.bwbconsulting.com



From: Technical Sewerage
Sent: Wednesday, January 17, 2024 11:23 AM
To: Harrison Watts
Subject: Almondbury Send School, Land off Fernside Avenue, Huddersfield, HD5 8PQ - Pre-planning Enquiry V356377

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

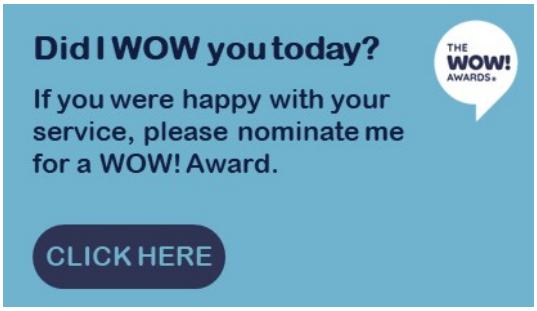
Dear Mr Watts,

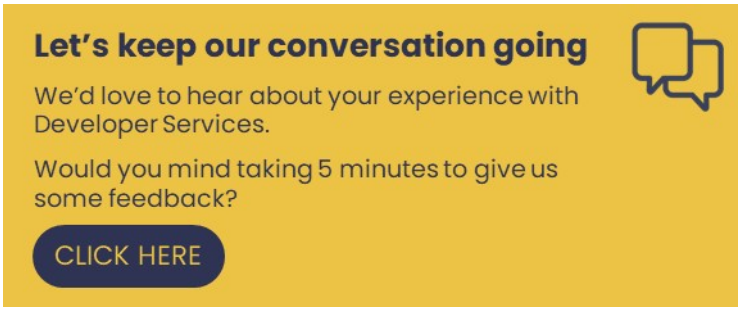
Please find my response attached.

Kind Regards

Chris Roberts
Pre-Development Technician
Developer Services
Tel: 0345 1 20 84 82

*******Please note we have 10 working days to respond to email enquiries*******





From: Harrison Watts
Sent: 22 December 2023 12:16
To: Technical Sewerage
Cc: Kristen Jones
Subject: Pre-planning sewerage enquiry - Almondbury Send School, Huddersfield

WARNING - EXTERNAL SOURCE
This email has been sent from an account outside of the Kelda Group network and could be a phishing email.
Please **THINK** before clicking links or opening any attachments.
If you suspect that this email is suspicious please report it to the Cyber Security Team using the "Report Message" button.

Good morning,

Please find below, the attached we-transfer link for a pre-planning sewerage enquiry for Almondbury Send School, Huddersfield.

Note, the below link will expire on the 29th of December.
https://we.tl/t-EvvBy6APia

The link includes the following information to support the enquiry:

- Proposed site masterplan (823-ALA-00-XX-DR-L-0001_Illustrative Masterplan_P01)
- Existing site plan (823-BWB-VTO-XX-DR-D-0001-S2-P01_Existing Site Plan)
- Evidence of existing connection to public sewer (823-BWB-VTO-XX-DR-D-0001-S2-P01_Existing Site Plan, C4202-HSP-00-00-DR--C-501 - CCTV Drainage Survey)
- Topographical Survey (C4202-HSP-00-00-DR--C-501 - CCTV Drainage Survey)
- Site Location Plan (823-BWB-VTO-XX-DR-D-0002-S2-P01_Site Location Plan)
- CCTV Survey Report (5475CCTV-01)
- Flood Risk Assessment (FRA 22 1180 Almondbury SEND School R0)

Please note, the justification for the method of discharge can be found on page 14 of the Flood Risk Assessment report.

If you require any further information please do not hesitate to contact me .

Kind regards

Harrison Watts BEng (Hons)
Graduate Engineer - Transport & Infrastructure Design | BWB Consulting Limited

Whitehall Waterfront, 2 Riverside Way, Leeds , LS1 4EH
W www.bwbconsulting.com

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Registered Office: 5th Floor, Waterfront House, Station Street, Nottingham, NG2 3DQ
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Appendix 4: Ground Investigation Extracts

ALMONDBURY SEND SCHOOL

PHASE 2 GEO-ENVIRONMENTAL EXPLORATORY INVESTIGATION, RISK ASSESSMENT AND REMEDIATION STRATEGY

Job Number: LKC 22 1679
Date: 31st May 2023
Client: Wilde Consulting Engineers



INCREASING LAND VALUE

LK GROUP

LK Consult

Document Verification

Site Address	Almondbury SEND School, Fernside Avenue, Huddersfield, HD5 8PG		
Report Title	Phase 2 Geo-Environmental Exploratory Investigation, Risk Assessment and Remediation Strategy		
Job Number	LKC 22 1679	**Document Ref.**	LKC 22 1679-B1-GI Almondbury SEND School
Date Issued	31st May 2023	**Report Version**	R0
Prepared By	Rachel Wylie	**Reviewed By**	Colin Crompton

Revision Record			
Revision No.	**Date**	**Nature of Revision**	**Approved By**
R1	26/06/2023	Update following client comments.	

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This report has been prepared by LK Consult (LKC) who have exercised such professional skill, care and diligence as may reasonably be expected of a properly qualified and competent consultant, experienced in preparing reports of a similar scope.

However, to the extent that the report is based or relies upon information contained in records, reports or other materials provided to LKC, which have not been independently produced or verified, LKC gives no warranty, representation or assurance as to the accuracy or completeness of such information.

This report is issued on the condition that LKC will not be held liable for any loss arising from ground conditions between sampling points (i.e. boreholes/trial pits/hand augers/surface samples) which have not been shown by the sampling points or related testing carried out during the investigation, nor for any loss arising from conditions below the maximum depth of the investigation. Opinions on such conditions, where given, are for general guidance only.

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Those using this information in subsequent assessments or evaluations do so at their own risk.

EXECUTIVE SUMMARY

Site Details

Site Location:	South of Fernside Avenue and to the south-west of Aldonley, Site Location Almondbury. Centred at approximate National Grid Reference 417000E 415830N.
Site Area:	8.09Ha (full site area). Proposed re-development area is c. 2.6Ha
Current Land Use:	Vacant school buildings and sports hall, with swimming pool currently in use. External areas include playing fields, hardstood car parks and hardstood sports pitches.
Proposed Development:	Secondary school with soft landscaping.
Purpose of Report:	Exploratory Contamination and Geotechnical Assessment.

Preliminary Risk Assessment

PRA Details:	Undertaken by LKC in February 2023.
History:	Onsite: Agricultural / pasture fields, unreferenced buildings, anti-aircraft facility, Almondbury High School. Surrounding Area: Electricity sub-station, paddling pool, pond.
Geology / Hydrogeology:	Greenmoor Rock (Sandstone). Small area of Pennine Lower Coal Measures Formation (mudstone, siltstone and sandstone) in the south of site close to the southern site boundary. 1 fault in east of the site, striking northwest-southeast with a downthrow to the northeast. (Secondary A Aquifer).
Mining:	Consultants mining report shows no risk from shallow mining.
Relevant Environmental Setting:	Secondary A Aquifer below site. Not within Source Protection Zone.
Preliminary Conceptual Model: PL=Pollutant Linkage	PL1 Direct Contact (Human Health): Moderate Risk (ACM, heavy metals, hydrocarbons, PCBs). PL2 Inhalation of Vapours: Moderate/Low Risk (volatile contaminants). PL3 Gas: Moderate/ Low Risk (hazardous and ground gas). PL4 Controlled waters: Moderate/Low Risk (mobile contaminants). PL5 Water Pipelines: Moderate/Low Risk (organic contaminants).
Recommendations:	Site Investigation was recommended to further assess PL1, PL2, PL4 and PL5.

Ground Investigation Work Undertaken

Date of Investigation:	25th to 28th March 2023
Intrusive Investigation Work Undertaken:	27no. window sample boreholes (WS101-WS127). 2no. mechanically excavated trial pits (SA101-SA102). 6no. hand dug pits (HD101-HD105).
Monitoring Wells:	Installed in WS102, WS103, WS108, WS116 and WS120.
Soil Sampling with leachinge tests:	16no. samples tested for metals, speciated PAHs, pH, sulphate, asbestos and SOM. 6no. samples tested for metals, speciated PAHs, cyanide, pH, sulphate, asbestos, phenol, TPHCWG, BTEX, SOM and waste acceptance criteria. 6no. soil samples tested for leachable metals, speciated PAHs, pH, sulphate and hardness. 1no. sample tested for metals, speciated PAHs, cyanide, pH, sulphate, asbestos, phenol, TPHCWG, BTEX, PCBs and SOM. 2no. samples tested for pH and sulphate.
Monitoring:	2no. groundwater monitoring visits.
Insitu and Laboratory Geotechnical Testing:	SPTs, pocket penetrometer.
Other Work:	Infiltration tests in 2no. locations.

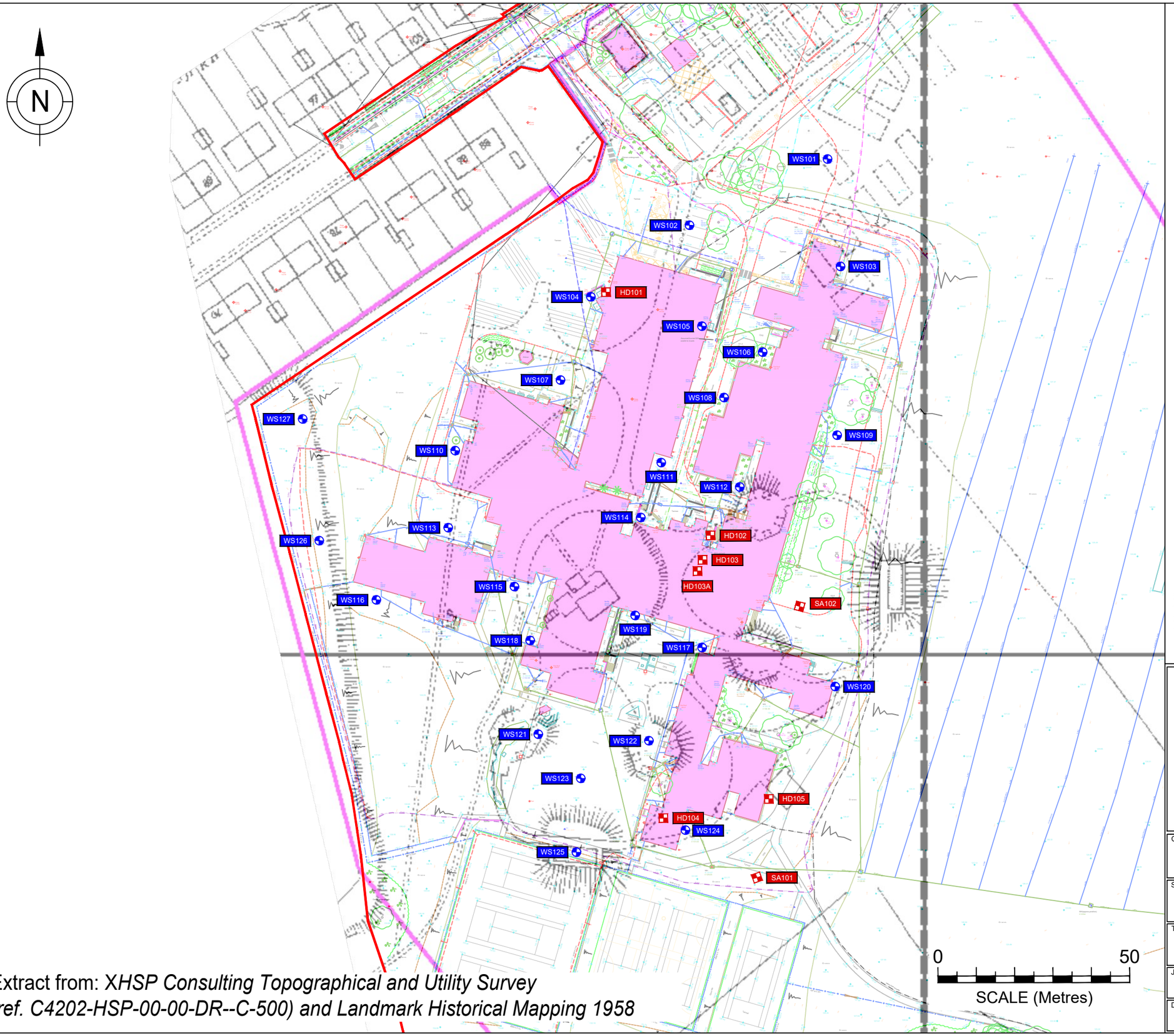
Ground Conditions and Geotechnical Assessment

General Ground conditions	Allowable Bearing Pressure	Anticipated Foundation Type	Other Considerations
Made Ground (including ash and clinker) to generally less than 1mbgl. Deeper areas of made ground localised around the site. Soft to firm consistency clay encountered in localised areas. Some with organic inclusions. Bedrock comprised weathered mudstone and sandstone. No groundwater encountered.	600kN/m^2 assumed in weathered bedrock	Pads founded on bedrock.	Further ground investigation once site is cleared. Assessment of the extent / depth of basement, ducts Consider extent and thickness of localised red shale deposits. Temporary supports of excavations may be required. Detailed design should be carried out by structural engineer. Concrete Requirements DS1-AC-1s over most of the site. Localised areas require DS-2 AC-1s and DS-3 AC-1s.

Contamination Risk Assessment

The table below shows a summary of the risk assessments undertaken for each pollutant linkage, the revised conceptual model and recommendation for either remediation and / or further investigation.

Pollutant Linkage		Risk	Recommendations
1	Contaminants posing a risk to future site users via dermal contact, ingestion and inhalation (of soil, dust and fibres).	**Moderate (localised)**	- ACM (chrysotile) identified in made ground localised to the west of site. - Elevated PAHs in the made ground localised to the centre of site. - **Recommendations:** Remediation may be required in soft landscaping areas.
		Low	- No elevated heavy metals, PCBs and petroleum hydrocarbons identified across the site. - **Recommendations:** No remediation required.
2	Volatile contaminants posing a risk to future site users via the inhalation of vapours.	**Low**	- No elevated volatile contaminants across the site. - **Recommendation:** No remediation required.
3	Gas posing a risk to buildings and future site users via the migration of gas into building causing explosion and asphyxiation.	**Low**	- No significant made ground identified on site. Low TOC/SOM. - **Recommendation:** No remediation required.
4	Mobile contamination posing a risk to controlled waters via the migration through permeable strata.	**Low**	- No elevated contaminants identified in groundwater. - **Recommendations:** No remediation required.
5	Organic contaminants posing a risk to water pipes.	**Low**	- Elevated hydrocarbons identified but not at pipeline depth. - **Recommendations:** Water pipeline risk assessment to be completed.



Extract from: X*HSP Consulting Topographical and Utility Survey (ref. C4202-HSP-00-00-DR--C-500) and Landmark Historical Mapping 1958*

KEY

- Site Boundary
- Window Sample Borehole (WS)
- Trial Pit (TP)

NOTE:

HD = Hand Dug Trial Pit
SA = Soakaway Trial Pit
TP = Mechanical Excavated Trial Pit

Sampling Locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing includes information provided to LK Consult Ltd by others, LK Consult Ltd gives no warranty, representation or assurance as to the accuracy of such information.

LK CONSULT LIMITED

Client:	Wilde Consulting Engineers
Site:	Almondbury SEND School
Title:	Sampling Location Plan

Job No.:	Scale (See Scale Bar):	Figure:	Revision:
LKC 22 1679	1:1000 @ A3	2	

Drawn By:	Checked By:	Drawn:
CC	RW	May 2023

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Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com

Site	Trial Pit Number
Almondbury SEND School	SA101

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Machine excavated to 1.70mbgl.	2.00m x 0.70m x 1.70m	131.32	Wilde Consulting Engineers	LKC 22 1679
	Location	**Dates**	**Engineer**	**Sheet**
	416956.9 E 415741.3 N	28/04/2023	LKC	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	MADE GROUND: Dark brown sandy SILT with occasional rootlets and brick fragments. Sand is fine to medium.		
0.30-0.40	ES			131.02	0.30 (0.10)	MADE GROUND: Tarmacadam.		
0.40-0.70	ES PID=<0.1ppm			130.92	0.40 (0.30)	MADE GROUND: Dark grey gravelly CLAY with occasional ash and coal fragments. Gravel is fine to medium, subangular to subrounded of mudstone and sandstone.		
1.00-1.70	B			130.62	0.70 (1.00)	Brown sandy silty GRAVEL of mudstone and sandstone (weathered bedrock). Gravel is fine to coarse, subangular to angular.		
				129.62	1.70	Terminated at 1.70m		



Remarks

Pit was dry and stable.
Soakaway test carried out within pit see separate sheet with same reference for test details (ref. SA101).

Scale (approx)	Logged By	Figure No.
1:20	RW	LKC 22 1679.SA101

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Site	Trial Pit Number
Almondbury SEND School	SA102

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Machine excavated to 1.70mbgl.	2.00m x 0.70m x 1.70m	131.02	Wilde Consulting Engineers	LKC 22 1679
	Location	**Dates**	**Engineer**	**Sheet**
	416968.8 E 415813.3 N	28/04/2023	LKC	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.40	ES PID=<0.1ppm				(0.30)	MADE GROUND: Dark brown sandy SILT with occasional rootlets and brick fragments. Sand is fine to medium.		
				130.72	0.30			
0.40-0.70 0.40-1.70	ES PID=<0.1ppm B				(1.40)	Brown sandy GRAVEL of mudstone and sandstone (weathered bedrock). Gravel is fine to coarse, subangular to angular.		
				129.32	1.70	Terminated at 1.70m		



Remarks

Pit was dry and stable.
Soakaway test carried out within pit see separate sheet with same reference for test details (ref. SA102).

Scale (approx)	Logged By	Figure No.
1:20	RW	LKC 22 1679.SA102

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Soakaway Test (BRE Digest 365)

Site : Almondbury SEND School

Client : Wilde Consulting Engineers

Engineer : LKC

Job Number LKC 22 1679

Sheet 1 / 2

Location	Date	Level	Location
SA101	27/04/2023		

Pit Width (m)	0.70
Pit Depth (m)	1.70
Pit Length (m)	2.00

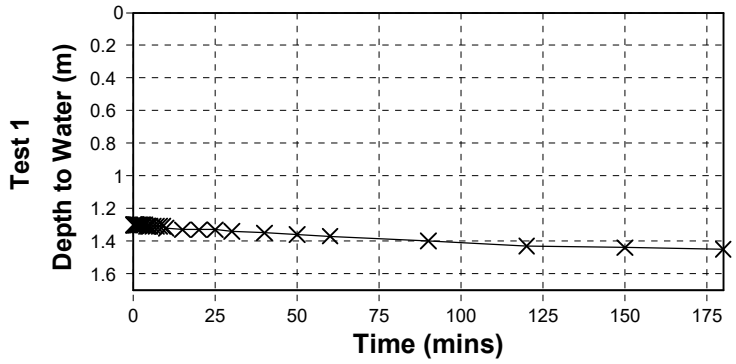
Soil type at test level	Weathered bedrock.
Groundwater	None
Drain discharge depth	None
Sidewall stability	Stable
Stone filled or open pit	Open pit

	1
Effective depth (m)	0.40
Volume outflowing between 75% & 25% (m3)	0.28
Mean surface area through which outflow occurs (m2)	2.48
Time for outflow between 75% & 25% (min)	548.60
SOIL INFILTRATION RATE (ms-1), f	3.43E-6

Remarks

Test data extrapolated.

Elapsed time (hh:mm:ss)	Depth to Water Test 1
00:00:00	1.30
00:00:05	1.30
00:00:10	1.30
00:00:20	1.30
00:00:30	1.30
00:00:40	1.30
00:00:50	1.30
00:01:00	1.30
00:01:30	1.30
00:02:00	1.30
00:02:30	1.30
00:03:00	1.30
00:03:30	1.30
00:04:00	1.31
00:04:30	1.31
00:05:00	1.31
00:06:00	1.31
00:07:00	1.31
00:08:00	1.31
00:09:00	1.31
00:10:00	1.32
00:15:00	1.33
00:20:00	1.33
00:25:00	1.33
00:30:00	1.34
00:40:00	1.35
00:50:00	1.36
01:00:00	1.37
01:30:00	1.40
02:00:00	1.43
02:30:00	1.44
03:00:00	1.45



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Soakaway Test (BRE Digest 365)

Site : Almondbury SEND School

Client : Wilde Consulting Engineers

Engineer : LKC

Job Number LKC 22 1679

Sheet 2 / 2

Location	Date	Level	Location
SA102	01/05/2023		

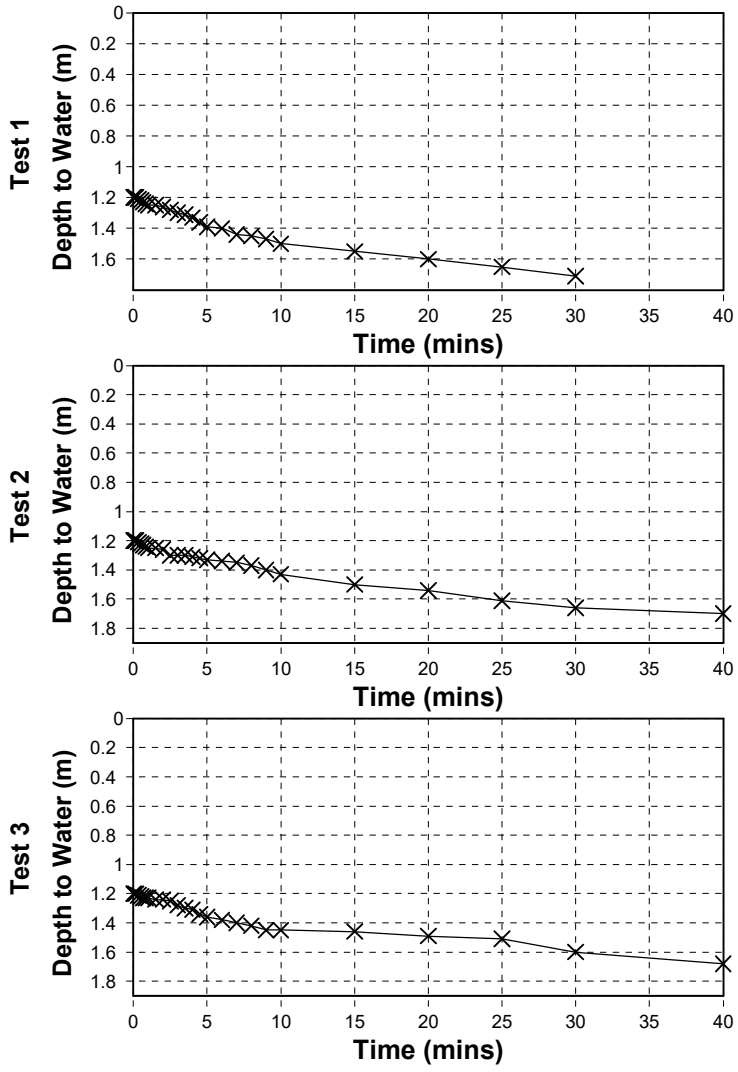
Pit Width (m)	0.70
Pit Depth (m)	1.70
Pit Length (m)	2.00

Soil type at test level	Weathered bedrock.
Groundwater	None
Drain discharge depth	None
Sidewall stability	Stable
Stone filled or open pit	Open pit

	1	2	3
Effective depth (m)	0.50	0.50	0.50
Volume outflowing between 75% & 25% (m3)	0.35	0.35	0.35
Mean surface area through which outflow occurs (m2)	2.75	2.75	2.75
Time for outflow between 75% & 25% (min)	13.62	17.75	24.36
SOIL INFILTRATION RATE (ms-1), f	1.56E-4	1.20E-4	8.71E-5

Remarks

Elapsed time (hh:mm:ss)	Depth to Water Test 1	Depth to Water Test 2	Depth to Water Test 3
00:00:00	1.20	1.20	1.20
00:00:05	1.20	1.20	1.20
00:00:10	1.20	1.20	1.20
00:00:20	1.21	1.21	1.21
00:00:30	1.22	1.22	1.22
00:00:40	1.23	1.23	1.23
00:00:50	1.24	1.24	1.23
00:01:00	1.25	1.25	1.23
00:01:30	1.25	1.25	1.24
00:02:00	1.26	1.26	1.24
00:02:30	1.28	1.30	1.25
00:03:00	1.30	1.30	1.28
00:03:30	1.31	1.30	1.30
00:04:00	1.33	1.31	1.31
00:04:30	1.36	1.32	1.34
00:05:00	1.39	1.33	1.36
00:06:00	1.40	1.34	1.38
00:07:00	1.44	1.35	1.40
00:08:00	1.45	1.37	1.42
00:09:00	1.47	1.40	1.45
00:10:00	1.50	1.43	1.45
00:15:00	1.55	1.50	1.46
00:20:00	1.60	1.54	1.49
00:25:00	1.65	1.61	1.51
00:30:00	1.71	1.66	1.60
00:40:00		1.70	1.68



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Appendix 5: Existing and Proposed Runoff Rates Assessment

Land drain arrangement to be left as existing

Combined sewers currently utilised to discharge flows from site

Combined sewer connection to carriageway manhole MH61

Existing Brownfield Discharge Rates

Existing School - Area within Red Boundary

Site Area = 2.8ha
Impermeable Area = 1.83ha
Permeable Area = 0.96ha

Refer to the adjacent plan for detailed Impermeable/Permeable areas breakdown.

Existing Brownfield Discharge rates were calculated utilising 'The Modified Rational Method'. Refer to 22170-BWB-EXT-XX-CA-0001_SW Assessment for full calculation sheet.

See below results:

Existing Brownfield 1 in 1 year discharge rate = 280.7 l/s

Proposed Brownfield 1 in 1 year discharge rate (Including 30% betterment from existing conditions) = 196.5 l/s

Please refer to the below Note for a continued proposed discharge rate rationale which considers a reduced discharge rate in line with the capacity of the existing outgoing pipe from the site.

Proposed Discharge Rate
A discharge rate for the new development of **49.9 l/s** is proposed via the combined sewer into MH61.

Note
Discharge from MH61 will be limited in accordance with the outgoing pipe diameter and gradient.

The outgoing pipe diameter from MH61 is 300mm. No gradients are available for the outgoing pipe so assuming the pipe is laid at minimum gradient (1:240), the pipe capacity can be approximated at 71.3 l/. If the outgoing pipe is laid steeper than 1:240 then capacity would increase respectively.

Providing a 30% betterment on the assumed existing outgoing pipe capacitiy would result in a proposed site discharge rate of **49.9 l/s**.

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. CCTV Survey 'C4202-HSP-00-00-DR-C-501' conducted by HSP consulting.

Legend

- Impermeable Area
- Permeable Area
- Site Boundary
- Combined Sewer

Rev	Date	Details of issue / revision	Drw	Rev
P01	13.02.24	Preliminary Issue	HW	KJ

Issues & Revisions

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Client
Kirklees Council

Woodley School and College
Communication • Independence • Achievement

Project Title
Future Woodley School and College

Drawing Title
Existing and Proposed Discharge Rates

Drawn:	H.Watts		Reviewed:	K.Jones	
BWB Ref:	22315	Date:	Feb 24	Scale@A1:	1:500

Drawing Status
For Information

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
22315-BWB-XX-XX-D-C-0505	S2	P01

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Appendix 6: MicroDrainage Greenfield Runoff Volume Calculations and Rainfall Profiles

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TRANSPORT AND INFRASTRUCTURE

Kirklees Council
Woodley School and College
Huddersfield

Surface Water Drainage Design

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Project Number:	221770
Project Name:	Woodley School and College
Client:	Kirklees Council
Document Title:	Surface Water Drainage Design
Phase / Unit Reference:	Entire Site
Revision:	P01
Stage:	Due Diligence
Prepared by:	H.Watts
Date:	02/02/2024
Checked by:	K.Jones
Date:	Date
Authorised by:	K.Jones
Date:	02/02.2024
File Ref:	221770-BWB-DDG-XX-CA-D-0001-SW Assessment

Project Number:	221770	Page:	1
Project Name:	Woodley School and College	Rev.:	P01
		Stage:	Due Diligence
Plot Reference / Zone:	Entire Site	Date:	02/02.2024
Client:	Kirklees Council	Prepared by:	H.Watts
File Ref:	221770-BWB-DDG-XX-CA-D-0001-SW Assessment	Checked by:	K.Jones
Document Title:	Surface Water Drainage Design	Authorised by:	K.Jones

Pre-development Peak Runoff Rate

The site is currently considered as Brown Field land and is known / understood to discharge offsite.

To provide a betterment to the receiving drainage system a reduction in brownfield runoff rates has been allowed.

The allowance made for this reduction is : **30** %

The WALLINGFORD PROCEDURE Volume 4 'The Modified Rational Method ' has been used to assess the existing and proposed discharge rates.

Using The Rational formula:

Qp = CiA

Where:

Qp	=	discharge rate
C	=	Coefficient where C = Cv (volumetric coefficient) x Cr (routing coefficient) - formula 7.19
i	=	rainfall intensity (mm/hr)
i	=	mean rainfall intensity (mm/hr)
A	=	Area (ha) drained hard surfaces

Total site area	At	=	**2.801** ha
Existing impermeable area	Ai	=	**1.831** ha
Existing unsurfaced area	Au	=	**0.969** ha

For Qp in l/s (litres per second) apply 0.36 to formula

$$Qp = \frac{CiA}{0.36}$$

or

$$Qp = 2.78CiA$$

Determine C:

C = Cv x Cr

Cv = 0.75

Cr = 1.3

Therefore: **C = 0.75 x 1.3 = 0.975**

Existing Peak Flow Rates:

Storm Event					Coefficient C		Rainfall intensity i		Impermeable Area Ai
1 year	Qp	=	2.78	x	0.975	x	56.5	x	1.8314
	Qp	**=**	**280.7**	**l/s**					
30 year	Qp	=	2.78	x	0.975	x	130.1	x	1.8314
	Qp	**=**	**645.9**	**l/s**					
100 year	Qp	=	2.78	x	0.975	x	163.2	x	1.8314
	Qp	**=**	**810.4**	**l/s**					
100 year plus 30% CC	Qp	=	2.78	x	0.975	x	228.5	x	1.8314
	Qp	**=**	**1134.5**	**l/s**					

Proposed Peak Flow Rates:

Storm Event	Existing Peak Flow (Qp l/s)		Reduction (%)		Proposed Peak Flow (Qpp l/s)
1 year	280.7	x	30	=	196.5
30 year	645.9	x	30	=	452.1
100 year	810.4	x	30	=	567.3
100 year plus 30% CC	1134.5	x	30	=	794.2

Consultancy | Environment | Infrastructure | Buildings

BWB

Job Number: 221770	**Calc number: 1**		**Rev: 1**
Project: Future Woodley School & College		**Date: 30.05.24**	**Prepared by: MPB**
Title: Pipe Full Flow			**Authorised by: LR**

Colebrook-White Formula

$$V = -2\left(2gDS\right)^{0.5} \log\left(\frac{k}{3.7D} + \frac{2.5\nu}{D\left(2gDS\right)^{0.5}}\right)$$

k = Colebrook-White roughness coefficient, in metres

V = velocity, in metres per second

D = circular cross-section pipe, inside diameter, in metres

S = slope, in metres per metre

ν = kinematic viscosity of water, in square metres per second.

g =	Gravity		9.81 m/s^2
n =	kinematic viscosity of water		1.141E-06 m^2/s
k =	Colebrook-White roughness	= 0.600 mm	= 6.000E-04 m
D =	Inside diameter	= 300 mm	= 0.300 m
S =	Slope, in metres per metre		0.417%
=	(Hydraulic Gradient)		1: 240

Discharge:

Q = V x A

V= 1.01 m/s

A = 0.071 m^2

Q = 0.071 m^3/s = 71.3 l/s

Greenfield Runoff Volume

FEH Data

Return Period (years)	100
Storm Duration (mins)	360
FEH Rainfall Version	2013
Site Location	GB 417600 415750 SE 17600 15750
Data Type	Catchment
Areal Reduction Factor	1.00
Area (ha)	0.970
SAAR (mm)	842
CWI	119.376
SPR Host	9.780
URBEXT (1990)	0.2537

Results

Percentage Runoff (%)	21.86
Greenfield Runoff Volume (m^3)	143.363

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Greenfield Runoff Volume

FEH Data

Return Period (years)	100
Storm Duration (mins)	360
FEH Rainfall Version	2013
Site Location	GB 417600 415750 SE 17600 15750
Data Type	Catchment
Areal Reduction Factor	1.00
Area (ha)	0.870
SAAR (mm)	842
CWI	119.376
SPR Host	9.780
URBEXT (1990)	0.2537

Results

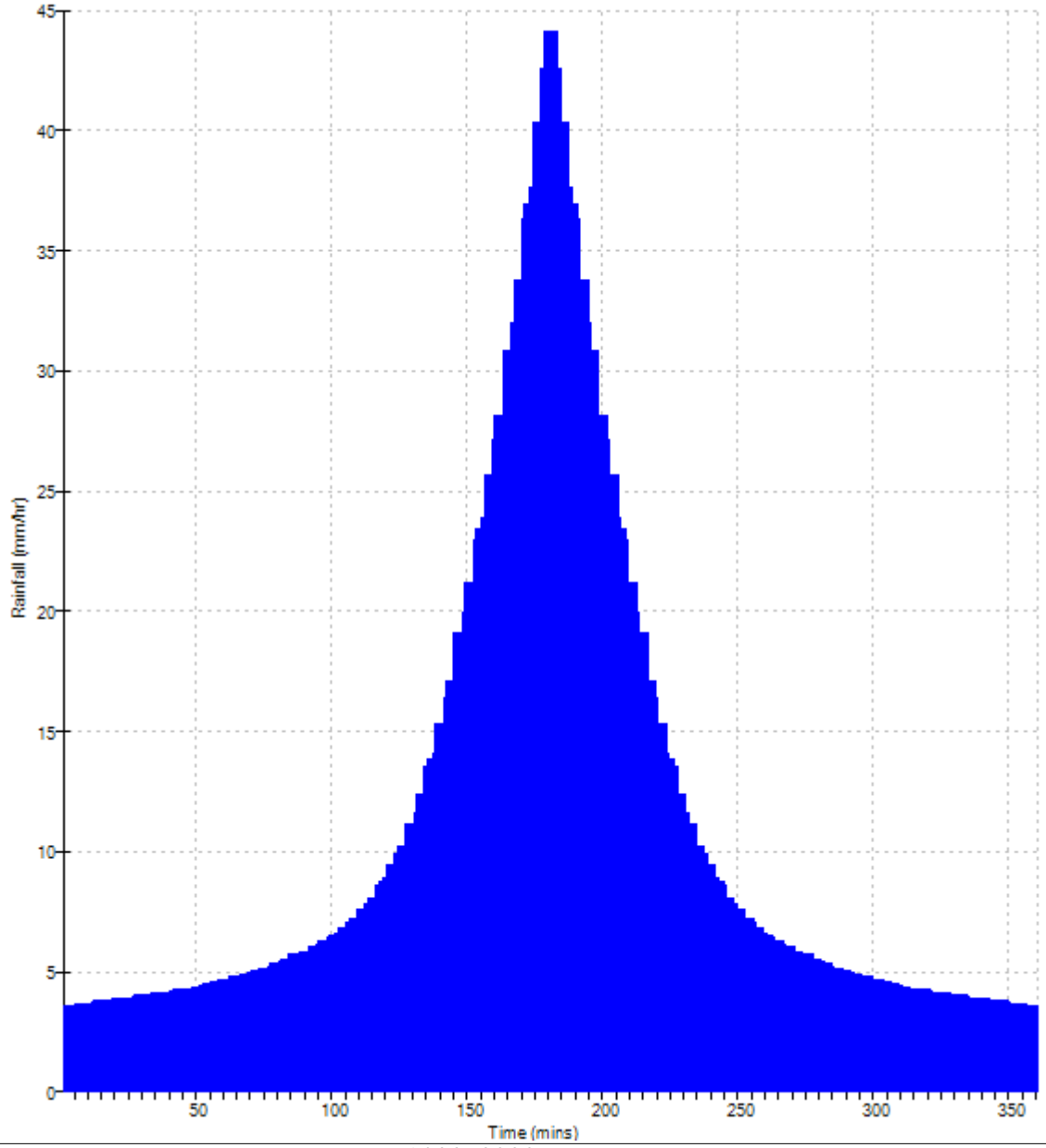
Percentage Runoff (%)	21.86
Greenfield Runoff Volume (m^3)	128.583

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Rainfall profile

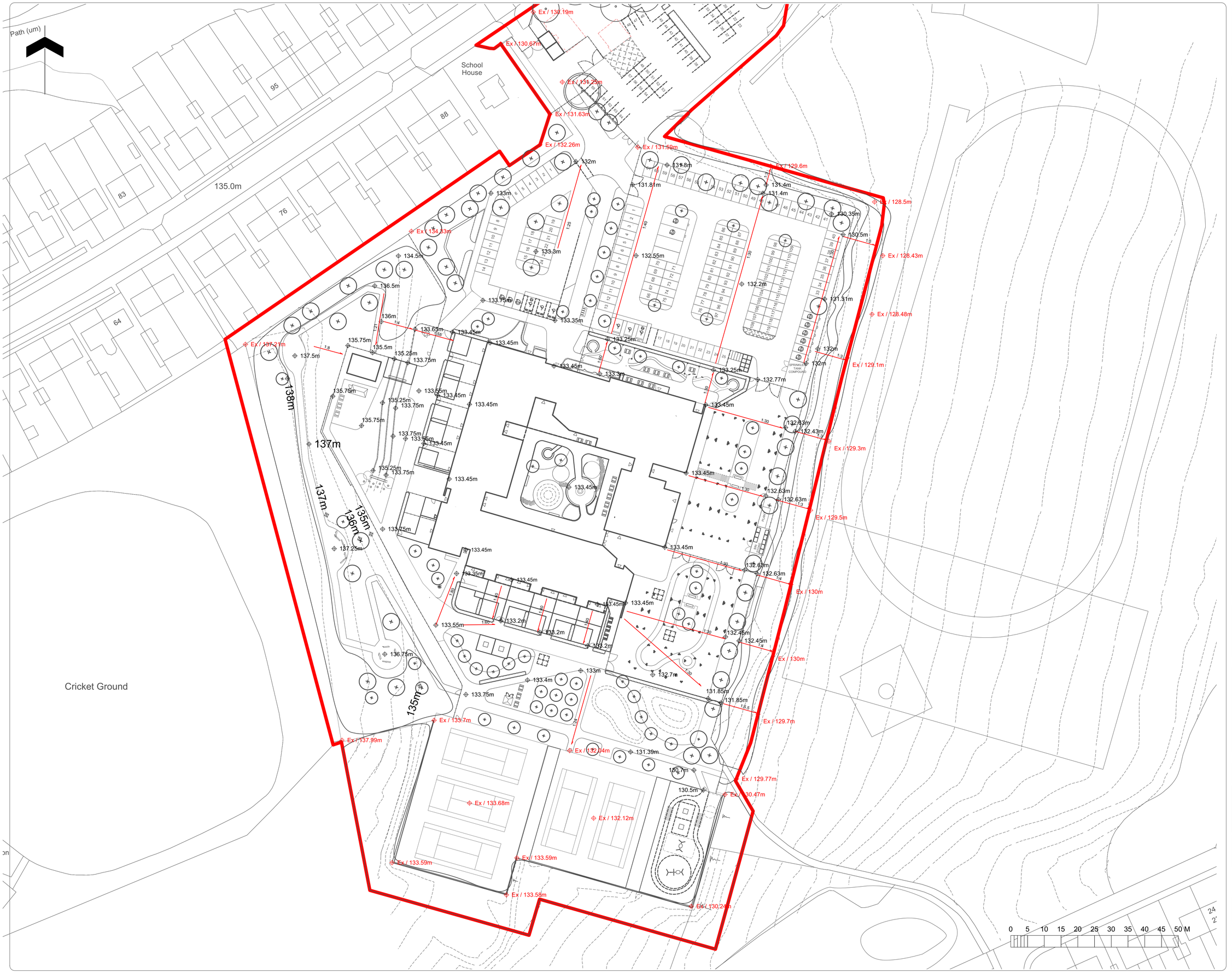
Storm duration (mins) 360

FEH Data	
FEH Rainfall Version	2013
Site Location	GB 417600 415750 SE 17600 15750
Data Type	Catchment
Peak Intensity (mm/hr)	44.165
Ave. Intensity (mm/hr)	11.267
Return Period (years)	100.0



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Appendix 7: Proposed Outline Levels and Proposed Drainage Layout



Note

1. Do not scale from this drawing
2. To be read in conjunction with Project Risk Register REF: XXX
3. To be read in conjunction with all other Landscape Architect's drawings

KEY

22m	Proposed Level
Ex / 22m	Existing Level

ID	RISK	MITIGATION	DATE MITIGATED

RESIDUAL PROJECT RISKS

DATE	REV.	DESCRIPTION OF REVISION	DRAWN BY	APPROVED BY
13/03/2024	P02	1: Levels amended following feedback from engineer.	AT	RS

REVISIONS

STATUS

S1 - *Stage 2 Issue*

Ares Landscape Architects LTD
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51 Eyre Lane
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CLIENT :

Kirklees Council

PROJECT TITLE :

Woodley School and College

DRAWING TITLE :

Outline Levels Strategy

DRAWING SCALE :	DRAWN BY :	DRAWN DATE :
NTS	EM	22/12/2023
PAPER SIZE :	APPROVED BY :	ALA PROJECT CODE:
A1	RS	ALA 823

DRAWING NUMBER : **22315-ALA-00-XX-DR-L-0017** STATUS : **S1** REVISION : **P02**

The CCTV Survey indicates the car park drainage currently drains North into the public sewer located within the existing highway.Existing nursery car park assumed to be retained as existing. Any remedial works subject to receipt of further CCTV survey.

Swale base level 131.860

Potential Swale Location
280mm deep
300mm width base
850mm width slopes at 1:3
500mm offset from top of 1:3 banks

1:80 >>

S01
1200 Ø
CL 131.879
IL 130.606

375Ø @ 1:235 >

S02
1200 Ø
CL 131.599
IL 130.507 (300Ø)
IL 130.432 (375Ø)

375Ø @ 1:46.3 >

S03
1200 Ø
Fitted with a non-return valve.
CL 130.889
IL 129.450 (375Ø)
IL 129.450 (450Ø)

S05
1500 Ø
CL 132.392
IL 130.830 BD (150Ø)
IL 129.330 (450Ø)

< 450Ø @ 1:317

Class 1 Bypass oil separator
SPEL 212 C1/SC
or similar approved.
CL 132.484
IL (IN) 128.874
IL (OUT) 128.824
Oil separator to serve circa. 6000 m²
NB. Separator size based on area served, a different unit may be required based on the inlet and outlet pipe diameter.

Swale base level: 132.700

S04
1200 Ø
CL 133.001
IL 131.838

150 Ø @ 1:38.5 >

S06
1200 Ø
CL 133.424
IL 132.466

F01
1200 Ø
CL 133.407
IL 132.607

F07
1200 Ø
CL 133.450
IL 132.600

F03
1200 Ø
CL 132.813
IL 132.281

< 375Ø @ 1:100

Foul connection to serve sprinkler tank compound

S07
CL 132.697
IL 128.303

150 Ø @ 1:150 >

225 Ø @ 1:20 >

F02
1200 Ø
CL 133.356
IL 132.322

F04
1200 Ø
CL 133.234
IL 132.222

< 150 Ø @ 1:150

Potential stub for drainage of clouded area, if infiltration unsuitable

S11
1200 Ø
CL 130.487
IL 132.408

< 150 Ø @ 1:167

Foul stubs indicative - TBC upon receipt of internal floor plan

S09
1200 Ø
CL 133.450
IL 132.625

Clouded area assumed to drain via infiltration. Confirmation subject to receipt of infiltration resting results

F08
1200 Ø
CL 133.450
IL 132.455

< 225Ø @ 1:167

F05
1200 Ø
CL 133.280
IL 132.114

< 150 Ø @ 1:150

< 150 Ø @ 1:155.8

< 3 No. 2100Ø @ 1:500

Tubosider Attenuation Tank
All characteristics below are approximate and TBC at detailed design:
Volume: 953 m³
Tank Diameter: 2.1m
Tank Length: 90m
Number of legs: 3

S10
1200 Ø
CL 133.450
IL 132.473

F09
1200 Ø
CL 134.133
IL 132.220

F06
1200 Ø
CL 133.271
IL 131.700

< 150 Ø @ 1:150

S12
1200 Ø
CL 134.443
IL 132.346

F10
1200 Ø
CL 134.447
IL 132.086

Gravity RWP locations indicative - TBC upon receipt of roof design by others

300Ø @ 1:15 >

150 Ø @ 1:150 >

225Ø @ 1:167

S13
1200 Ø
CL 133.611
IL 132.204 (225Ø)
IL 132.129 (300Ø)

150 Ø @ 1:150 >

F11
1200 Ø
CL 133.303
IL 131.809

300Ø @ 1:30 >

< 150 Ø @ 1:111.7

150 Ø @ 1:30 >

F012
1200 Ø
CL 132.489
IL 131.231

< 225Ø @ 1:167

150 Ø @ 1:10 >

300Ø @ 1:19 >

225Ø @ 1:117.7

S08
CL 132.101
IL 128.117

MH56
CL 128.650
IL 126.830

Existing drainage to tennis courts area assumed to be retained as existing. Any remedial works subject to receipt of further CCTV survey.

S14
Vortex flow control chamber to limit flow to 49.9 l/s
CL 131.239
IL 128.083

Stub to accommodate flows from existing tennis courts

Existing combined drain retained as surface water and foul water outfall subject to repair of structural defects identified within CCTV survey

Existing off-site connection to public sewer retained as existing

300 CWS >>>

300 CWS >>>

EASTLANDS

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.

Legend

- Combined Sewer
- Foul Water Drainage
- Kerb Drain
- Linear Channel Drain
- SU - Linear Drain Sump Unit
- G - Gully
- RWP - Rain Water Pipe
- RWP(RA) - Rainwater pipe with roddable access point
- Surface Water Drainage
- Catchpit
- Class 1 Bypass Oil Separator & vent pipe
- Swale
- Development Boundary

Important CDM / H&S note

The Designers would draw the readers attention to the key residual health and safety risks that have not been eliminated from the designs shown on this drawing by the design process. These key residual risks are identified below:

- Existing Drainage and Service Infrastructure not to be compromised
- Care to be taken around deep excavations. Plant to be kept at safe distance
- Moving plant. Care to be taken around site
- Care to be taken in vicinity of existing high voltage below and above ground electric cables. REFER TO UTILITIES SURVEYS FOR DETAILS

Any construction personnel including operatives intending to construct the designs shown on this drawing should ensure that they have been regularly and thoroughly briefed by the principal Contractor on all health and safety matters and have had sight of:

1 - The full Designers and Contractors risk assessments and risk registers.
2 - The developed construction health and safety plan.
3 - The Contractors construction method statements.

Hazards that are obvious to a competent Contractor are not shown, as are every day and low risk hazards.

Rev	Date	Details of issue / revision	Drw	Rev
P03	15.06.24	Connection to Forest school added	HTB	HTB
P02	12.06.24	Updated to suit latest masterplan	RP	KMJ
P01	22.03.24	For Information	HW	KMJ

Issues & Revisions

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Client
Kirklees Council

Woodley School and College
Communication • Independence • Achievement

Project Title
Future Woodley School and College

Drawing Title
Proposed Drainage Layout

Drawn:	H.Watts		Reviewed:	K.Jones	
BWB Ref:	22315	Date:	Jan 24	Scale@A1:	1:500

Drawing Status
Preliminary

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
22315-BWB-XX-XX-D-C-0500	**S1**	**P03**

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Appendix 8: Drainage Modelling Network Details and Results

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.340	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	38.842	2.508	15.5	0.054	5.00	0.0	0.600		o	150	Pipe/Conduit	
2.000	10.882	0.097	112.2	0.121	5.00	0.0	0.600		o	300	Pipe/Conduit	
2.001	55.011	0.688	80.0	0.100	0.00	0.0		0.045	3 \=/	300	1:3 Swale	
2.002	13.857	0.594	23.3	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	
2.003	23.692	0.174	136.2	0.159	0.00	0.0	0.600		o	375	Pipe/Conduit	
2.004	11.994	0.259	46.3	0.017	0.00	0.0	0.600		o	375	Pipe/Conduit	
3.000	8.195	0.764	10.7	0.048	5.00	0.0	0.600		o	150	Pipe/Conduit	
2.005	33.468	0.723	46.3	0.054	0.00	0.0	0.600		o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.25	131.838	0.054	0.0	0.0	0.0	2.57	45.5	7.3
2.000	50.00	5.12	132.797	0.121	0.0	0.0	0.0	1.48	104.9	16.4
2.001	50.00	6.96	132.700	0.221	0.0	0.0	0.0	0.50	56.2	29.9
2.002	50.00	7.03	131.200	0.221	0.0	0.0	0.0	3.27	231.1	29.9
2.003	50.00	7.28	130.606	0.380	0.0	0.0	0.0	1.55	171.3	51.5
2.004	50.00	7.36	130.432	0.397	0.0	0.0	0.0	2.67	294.7	53.8
3.000	50.00	5.04	130.937	0.048	0.0	0.0	0.0	3.09	54.7	6.5
2.005	50.00	7.57	130.173	0.499	0.0	0.0	0.0	2.67	294.8	67.6

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
4.000	8.457	0.506	16.7	0.086	5.00	0.0	0.600		o	225	Pipe/Conduit	
2.006	37.938	0.120	316.2	0.086	0.00	0.0	0.600		o	450	Pipe/Conduit	
1.001	12.886	0.202	63.8	0.034	0.00	0.0	0.600		o	375	Pipe/Conduit	
5.000	67.056	3.434	19.5	0.061	5.00	0.0	0.600		o	225	Pipe/Conduit	
1.002	53.857	0.390	138.1	0.070	0.00	0.0	0.600		ooo	2100	Triple Pipe	
6.000	25.412	0.153	166.1	0.061	5.00	0.0	0.600		o	225	Pipe/Conduit	
6.001	65.945	4.283	15.4	0.143	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.003	36.347	0.780	46.6	0.023	0.00	0.0	0.600		ooo	2100	Triple Pipe	
7.000	5.966	3.161	1.9	0.179	5.00	0.0	0.600		o	150	Pipe/Conduit	
8.000	43.542	0.262	166.2	0.040	5.00	0.0	0.600		o	225	Pipe/Conduit	
8.001	23.560	0.142	165.9	0.020	0.00	0.0	0.600		o	225	Pipe/Conduit	
8.002	81.700	4.012	20.4	0.177	0.00	0.0	0.600		o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
4.000	50.00	5.04	129.956	0.086	0.0	0.0	0.0	3.22	127.9	11.6
2.006	50.00	8.12	129.450	0.671	0.0	0.0	0.0	1.14	181.0	90.9
1.001	50.00	8.22	129.330	0.759	0.0	0.0	0.0	2.27	250.9	102.8
5.000	50.00	5.38	132.466	0.061	0.0	0.0	0.0	2.97	118.3	8.3
1.002	50.00	8.42	128.303	0.890	0.0	0.0	0.0	4.48	46542.3	120.5
6.000	50.00	5.42	132.625	0.061	0.0	0.0	0.0	1.01	40.2	8.3
6.001	50.00	5.69	132.473	0.204	0.0	0.0	0.0	4.03	284.6	27.6
1.003	50.00	8.50	127.913	1.117	0.0	0.0	0.0	7.72	80220.2	151.3
7.000	50.00	5.01	131.188	0.179	0.0	0.0	0.0	7.39	130.7	24.2
8.000	50.00	5.72	132.608	0.040	0.0	0.0	0.0	1.01	40.2	5.4
8.001	50.00	6.11	132.346	0.060	0.0	0.0	0.0	1.01	40.2	8.1
8.002	50.00	6.49	132.129	0.237	0.0	0.0	0.0	3.50	247.4	32.1

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.004	14.362	0.034	422.4	0.000	0.00	0.0	0.600		o	450	Pipe/Conduit	
9.000	35.947	1.867	19.3	0.400	5.00	0.0	0.600		o	300	Pipe/Conduit	
1.005	20.962	1.253	16.7	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.004	50.00	8.74	128.117	1.533	0.0	0.0	0.0	0.98	156.3«	207.6
9.000	50.00	5.17	129.950	0.400	0.0	0.0	0.0	3.60	254.4	54.2
1.005	50.00	8.83	128.083	1.933	0.0	0.0	0.0	3.86	273.0	261.8

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.054	0.054	0.054
2.000	-	-	100	0.121	0.121	0.121
2.001	-	-	100	0.100	0.100	0.100
2.002	-	-	100	0.000	0.000	0.000
2.003	-	-	100	0.159	0.159	0.159
2.004	-	-	100	0.017	0.017	0.017
3.000	-	-	100	0.048	0.048	0.048
2.005	-	-	100	0.054	0.054	0.054
4.000	-	-	100	0.086	0.086	0.086
2.006	-	-	100	0.086	0.086	0.086
1.001	-	-	100	0.034	0.034	0.034
5.000	-	-	100	0.061	0.061	0.061
1.002	-	-	100	0.070	0.070	0.070
6.000	-	-	100	0.061	0.061	0.061
6.001	-	-	100	0.143	0.143	0.143
1.003	-	-	100	0.023	0.023	0.023
7.000	-	-	100	0.179	0.179	0.179
8.000	-	-	100	0.040	0.040	0.040
8.001	-	-	100	0.020	0.020	0.020
8.002	-	-	100	0.177	0.177	0.177
1.004	-	-	100	0.000	0.000	0.000
9.000	-	-	100	0.400	0.400	0.400
1.005	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				1.933	1.933	1.933

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.005		128.650	126.830	0.000	0	0

Simulation Criteria for Storm

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

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

Synthetic Rainfall Details

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Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.340		

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Online Controls for Storm

Non Return Valve Manhole: S03, DS/PN: 2.006, Volume (m³): 6.0

Hydro-Brake® Optimum Manhole: S14, DS/PN: 1.005, Volume (m³): 8.8

Unit Reference	MD-SHE-0273-4990-2500-4990
Design Head (m)	2.500
Design Flow (l/s)	49.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	273
Invert Level (m)	128.083
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.500	49.9
Flush-Flo™	0.723	49.8
Kick-Flo®	1.566	39.8
Mean Flow over Head Range	-	43.2

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.6	1.200	47.4	3.000	54.5	7.000	82.1
0.200	28.2	1.400	44.5	3.500	58.7	7.500	84.9
0.300	44.0	1.600	40.2	4.000	62.6	8.000	87.7
0.400	47.0	1.800	42.6	4.500	66.3	8.500	90.3
0.500	48.7	2.000	44.8	5.000	69.7	9.000	92.8
0.600	49.5	2.200	46.9	5.500	73.1	9.500	95.3
0.800	49.7	2.400	48.9	6.000	76.2		
1.000	48.9	2.600	50.8	6.500	79.2		

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.335
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	ON
Analysis Timestep	Fine	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
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	S04	15 Winter	1	+0%				
2.000	SU1	15 Winter	1	+0%				
2.001	SWALE 1A	15 Winter	1	+0%				
2.002	SWALE 1B	15 Winter	1	+0%	100/15 Summer			
2.003	S01	15 Winter	1	+0%	30/15 Summer			
2.004	S02	15 Winter	1	+0%	100/15 Summer			
3.000	SU2	15 Winter	1	+0%	100/15 Summer			
2.005	JUNC	15 Winter	1	+0%				
4.000	SU3	15 Winter	1	+0%	30/15 Summer	100/15 Winter		
2.006	S03	15 Winter	1	+0%	30/15 Summer			
1.001	S05	15 Winter	1	+0%	30/15 Summer			
5.000	S06	15 Winter	1	+0%				
1.002	S07	15 Winter	1	+0%				
6.000	S09	15 Winter	1	+0%				
6.001	S10	15 Winter	1	+0%				
1.003	JUNC	240 Winter	1	+0%				
7.000	SU4	15 Winter	1	+0%				
8.000	S11	15 Winter	1	+0%				
8.001	S12	15 Winter	1	+0%				
8.002	S13	15 Winter	1	+0%				

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	S04	131.877	-0.111	0.000	0.15			6.7	OK
2.000	SU1	132.887	-0.210	0.000	0.19			14.8	OK
2.001	SWALE 1A	132.802	-1.517	0.000	0.00			25.6	OK
2.002	SWALE 1B	131.273	-0.227	0.000	0.13			25.6	OK
2.003	S01	130.742	-0.239	0.000	0.28			41.8	OK
2.004	S02	130.551	-0.256	0.000	0.22			43.2	OK
3.000	SU2	130.972	-0.115	0.000	0.13			6.0	OK
2.005	JUNC	130.282	-0.266	0.000	0.18			54.3	OK*
4.000	SU3	130.005	-0.176	0.000	0.11			10.7	OK
2.006	S03	129.664	-0.236	0.000	0.45			72.4	OK
1.001	S05	129.509	-0.196	0.000	0.46			81.4	OK
5.000	S06	132.504	-0.187	0.000	0.07			7.5	OK
1.002	S07	128.369	-2.034	0.000	0.00			94.4	OK
6.000	S09	132.694	-0.156	0.000	0.20			7.5	OK
6.001	S10	132.531	-0.242	0.000	0.08			22.5	OK
1.003	JUNC	128.327	-1.686	0.000	0.00			20.8	OK*
7.000	SU4	131.234	-0.104	0.000	0.20			22.2	OK
8.000	S11	132.662	-0.171	0.000	0.13			4.8	OK
8.001	S12	132.411	-0.160	0.000	0.19			6.9	OK
8.002	S13	132.194	-0.235	0.000	0.11			25.3	OK

PN	US/MH Name	Level Exceeded
1.000	S04	
2.000	SU1	
2.001	SWALE 1A	
2.002	SWALE 1B	
2.003	S01	
2.004	S02	
3.000	SU2	
2.005	JUNC	
4.000	SU3	1
2.006	S03	
1.001	S05	
5.000	S06	
1.002	S07	
6.000	S09	
6.001	S10	
1.003	JUNC	
7.000	SU4	
8.000	S11	
8.001	S12	
8.002	S13	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.004	S08	240 Winter	1	+0%	30/15 Summer				128.326
9.000	STUB	15 Winter	1	+0%	100/15 Summer				130.044
1.005	S14	15 Winter	1	+0%	30/15 Summer				128.312

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.004	S08	-0.241	0.000	0.27			27.0	OK	
9.000	STUB	-0.206	0.000	0.21			49.8	OK	
1.005	S14	-0.071	0.000	0.14			33.5	OK	

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.335
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	ON
Analysis Timestep	Fine	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
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	S04	15 Winter	30	+40%				
2.000	SU1	15 Winter	30	+40%				
2.001	SWALE 1A	15 Winter	30	+40%				
2.002	SWALE 1B	15 Winter	30	+40%	100/15 Summer			
2.003	S01	15 Winter	30	+40%	30/15 Summer			
2.004	S02	15 Winter	30	+40%	100/15 Summer			
3.000	SU2	15 Winter	30	+40%	100/15 Summer			
2.005	JUNC	15 Summer	30	+40%				
4.000	SU3	15 Winter	30	+40%	30/15 Summer	100/15 Winter		
2.006	S03	15 Winter	30	+40%	30/15 Summer			
1.001	S05	15 Winter	30	+40%	30/15 Summer			
5.000	S06	15 Winter	30	+40%				
1.002	S07	180 Winter	30	+40%				
6.000	S09	15 Winter	30	+40%				
6.001	S10	15 Winter	30	+40%				
1.003	JUNC	180 Winter	30	+40%				
7.000	SU4	15 Winter	30	+40%				
8.000	S11	15 Winter	30	+40%				
8.001	S12	15 Winter	30	+40%				
8.002	S13	15 Winter	30	+40%				

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	S04	131.916	-0.072	0.000	0.52			23.0	OK
2.000	SU1	132.977	-0.120	0.000	0.66			51.2	OK
2.001	SWALE 1A	132.885	-1.434	0.000	0.01			95.4	OK
2.002	SWALE 1B	131.352	-0.148	0.000	0.50			95.0	OK
2.003	S01	131.017	0.036	0.000	1.11			163.2	SURCHARGED
2.004	S02	130.795	-0.012	0.000	0.80			159.0	OK
3.000	SU2	131.006	-0.081	0.000	0.43			20.4	OK
2.005	JUNC	130.548	0.000	0.000	0.65			192.2	SURCHARGED*
4.000	SU3	130.361	0.180	0.000	0.31			31.5	FLOOD RISK
2.006	S03	130.313	0.413	0.000	1.57			251.1	SURCHARGED
1.001	S05	130.012	0.307	0.000	1.59			280.5	SURCHARGED
5.000	S06	132.539	-0.152	0.000	0.22			25.7	OK
1.002	S07	129.213	-1.190	0.000	0.00			98.4	OK
6.000	S09	132.765	-0.085	0.000	0.69			25.6	OK
6.001	S10	132.593	-0.180	0.000	0.33			89.7	OK
1.003	JUNC	129.208	-0.805	0.000	0.00			34.3	OK*
7.000	SU4	131.282	-0.056	0.000	0.70			76.2	OK
8.000	S11	132.714	-0.119	0.000	0.43			16.6	OK
8.001	S12	132.483	-0.088	0.000	0.67			24.8	OK
8.002	S13	132.268	-0.161	0.000	0.43			102.9	OK

PN	US/MH Name	Level Exceeded
1.000	S04	
2.000	SU1	
2.001	SWALE 1A	
2.002	SWALE 1B	
2.003	S01	
2.004	S02	
3.000	SU2	
2.005	JUNC	
4.000	SU3	1
2.006	S03	
1.001	S05	
5.000	S06	
1.002	S07	
6.000	S09	
6.001	S10	
1.003	JUNC	
7.000	SU4	
8.000	S11	
8.001	S12	
8.002	S13	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.004	S08	180 Winter	30	+40%	30/15 Summer				129.204
9.000	STUB	15 Winter	30	+40%	100/15 Summer				130.142
1.005	S14	180 Winter	30	+40%	30/15 Summer				129.293

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.004	S08	0.637	0.000	0.48			47.7	SURCHARGED	
9.000	STUB	-0.108	0.000	0.73			170.6	OK	
1.005	S14	0.910	0.000	0.20			48.8	SURCHARGED	

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.335
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	ON
Analysis Timestep	Fine	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
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	S04	15 Winter	100	+45%				
2.000	SU1	15 Winter	100	+45%				
2.001	SWALE 1A	15 Winter	100	+45%				
2.002	SWALE 1B	15 Winter	100	+45%	100/15 Summer			
2.003	S01	15 Winter	100	+45%	30/15 Summer			
2.004	S02	15 Winter	100	+45%	100/15 Summer			
3.000	SU2	15 Winter	100	+45%	100/15 Summer			
2.005	JUNC	15 Summer	100	+45%				
4.000	SU3	15 Winter	100	+45%	30/15 Summer	100/15 Winter		
2.006	S03	15 Winter	100	+45%	30/15 Summer			
1.001	S05	15 Winter	100	+45%	30/15 Summer			
5.000	S06	15 Winter	100	+45%				
1.002	S07	180 Winter	100	+45%				
6.000	S09	15 Winter	100	+45%				
6.001	S10	15 Winter	100	+45%				
1.003	JUNC	180 Winter	100	+45%				
7.000	SU4	15 Winter	100	+45%				
8.000	S11	15 Winter	100	+45%				
8.001	S12	15 Winter	100	+45%				
8.002	S13	15 Winter	100	+45%				

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	S04	131.932	-0.056	0.000	0.70			30.8	OK
2.000	SU1	133.019	-0.078	0.000	0.88			68.6	OK
2.001	SWALE 1A	132.907	-1.412	0.000	0.01			127.7	OK
2.002	SWALE 1B	131.996	0.496	0.000	0.65			123.3	FLOOD RISK
2.003	S01	131.757	0.776	0.000	1.31			193.1	FLOOD RISK
2.004	S02	131.447	0.640	0.000	1.02			203.4	SURCHARGED
3.000	SU2	131.314	0.227	0.000	0.53			25.1	FLOOD RISK
2.005	JUNC	130.548	0.000	0.000	0.81			237.4	SURCHARGED*
4.000	SU3	130.633	0.452	2.950	0.68			68.2	FLOOD
2.006	S03	130.631	0.731	0.000	1.84			293.7	FLOOD RISK
1.001	S05	130.226	0.521	0.000	1.89			332.7	SURCHARGED
5.000	S06	132.551	-0.140	0.000	0.30			34.4	OK
1.002	S07	130.015	-0.388	0.000	0.01			133.3	OK
6.000	S09	132.798	-0.052	0.000	0.92			34.2	OK
6.001	S10	132.614	-0.159	0.000	0.44			120.0	OK
1.003	JUNC	130.003	-0.010	0.000	0.00			39.0	OK*
7.000	SU4	131.304	-0.034	0.000	0.94			102.0	OK
8.000	S11	132.734	-0.099	0.000	0.58			22.3	OK
8.001	S12	132.515	-0.056	0.000	0.90			33.2	OK
8.002	S13	132.295	-0.134	0.000	0.57			136.9	OK

PN	US/MH Name	Level Exceeded
1.000	S04	
2.000	SU1	
2.001	SWALE 1A	
2.002	SWALE 1B	
2.003	S01	
2.004	S02	
3.000	SU2	
2.005	JUNC	
4.000	SU3	1
2.006	S03	
1.001	S05	
5.000	S06	
1.002	S07	
6.000	S09	
6.001	S10	
1.003	JUNC	
7.000	SU4	
8.000	S11	
8.001	S12	
8.002	S13	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.004	S08	180 Winter	100	+45%	30/15 Summer				129.953
9.000	STUB	15 Winter	100	+45%	100/15 Summer				130.405
1.005	S14	180 Winter	100	+45%	30/15 Summer				129.942

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.004	S08	1.386	0.000	0.49			48.8	SURCHARGED	
9.000	STUB	0.155	0.000	0.95			223.1	SURCHARGED	
1.005	S14	1.559	0.000	0.21			49.0	SURCHARGED	

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 417600 415750 SE 17600 15750
C (1km)	-0.026
D1 (1km)	0.372
D2 (1km)	0.442
D3 (1km)	0.297
E (1km)	0.307
F (1km)	2.373
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	38.842	2.508	15.5	0.054	5.00	0.0	0.600		o	150	Pipe/Conduit	
2.000	10.882	0.097	112.2	0.121	5.00	0.0	0.600		o	300	Pipe/Conduit	
2.001	55.011	0.688	80.0	0.100	0.00	0.0	0.045	3	\=/	300	1:3 Swale	
2.002	13.857	0.594	23.3	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.25	131.838	0.054	0.0	0.0	0.0	2.57	45.5	7.3
2.000	50.00	5.12	132.797	0.121	0.0	0.0	0.0	1.48	104.9	16.4
2.001	50.00	6.96	132.700	0.221	0.0	0.0	0.0	0.50	56.2	29.9
2.002	50.00	7.03	131.200	0.221	0.0	0.0	0.0	3.27	231.1	29.9

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
2.003	23.692	0.174	136.2	0.159	0.00	0.0	0.600		o	375	Pipe/Conduit	
2.004	11.994	0.259	46.3	0.017	0.00	0.0	0.600		o	375	Pipe/Conduit	
3.000	8.195	0.764	10.7	0.048	5.00	0.0	0.600		o	150	Pipe/Conduit	
2.005	33.468	0.723	46.3	0.054	0.00	0.0	0.600		o	375	Pipe/Conduit	
4.000	8.457	0.506	16.7	0.086	5.00	0.0	0.600		o	225	Pipe/Conduit	
2.006	37.938	0.120	316.2	0.086	0.00	0.0	0.600		o	450	Pipe/Conduit	
1.001	12.886	0.202	63.8	0.034	0.00	0.0	0.600		o	375	Pipe/Conduit	
5.000	67.056	3.434	19.5	0.061	5.00	0.0	0.600		o	225	Pipe/Conduit	
1.002	53.857	0.390	138.1	0.070	0.00	0.0	0.600		ooo	2100	Triple Pipe	
6.000	25.412	0.153	166.1	0.061	5.00	0.0	0.600		o	225	Pipe/Conduit	
6.001	65.945	4.283	15.4	0.143	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.003	36.347	0.780	46.6	0.023	0.00	0.0	0.600		ooo	2100	Triple Pipe	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
2.003	50.00	7.28	130.606	0.380	0.0	0.0	0.0	1.55	171.3	51.5
2.004	50.00	7.36	130.432	0.397	0.0	0.0	0.0	2.67	294.7	53.8
3.000	50.00	5.04	130.937	0.048	0.0	0.0	0.0	3.09	54.7	6.5
2.005	50.00	7.57	130.173	0.499	0.0	0.0	0.0	2.67	294.8	67.6
4.000	50.00	5.04	129.956	0.086	0.0	0.0	0.0	3.22	127.9	11.6
2.006	50.00	8.12	129.450	0.671	0.0	0.0	0.0	1.14	181.0	90.9
1.001	50.00	8.22	129.330	0.759	0.0	0.0	0.0	2.27	250.9	102.8
5.000	50.00	5.38	132.466	0.061	0.0	0.0	0.0	2.97	118.3	8.3
1.002	50.00	8.42	128.303	0.890	0.0	0.0	0.0	4.48	46542.3	120.5
6.000	50.00	5.42	132.625	0.061	0.0	0.0	0.0	1.01	40.2	8.3
6.001	50.00	5.69	132.473	0.204	0.0	0.0	0.0	4.03	284.6	27.6
1.003	50.00	8.50	127.913	1.117	0.0	0.0	0.0	7.72	80220.2	151.3

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
7.000	5.966	3.161	1.9	0.179	5.00	0.0	0.600		o	150	Pipe/Conduit	
8.000	43.542	0.262	166.2	0.040	5.00	0.0	0.600		o	225	Pipe/Conduit	
8.001	23.560	0.142	165.9	0.020	0.00	0.0	0.600		o	225	Pipe/Conduit	
8.002	81.700	4.012	20.4	0.177	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.004	14.362	0.034	422.4	0.000	0.00	0.0	0.600		o	450	Pipe/Conduit	
9.000	35.947	1.867	19.3	0.400	5.00	0.0	0.600		o	300	Pipe/Conduit	
1.005	20.962	1.253	16.7	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
7.000	50.00	5.01	131.188	0.179	0.0	0.0	0.0	7.39	130.7	24.2
8.000	50.00	5.72	132.608	0.040	0.0	0.0	0.0	1.01	40.2	5.4
8.001	50.00	6.11	132.346	0.060	0.0	0.0	0.0	1.01	40.2	8.1
8.002	50.00	6.49	132.129	0.237	0.0	0.0	0.0	3.50	247.4	32.1
1.004	50.00	8.74	128.117	1.533	0.0	0.0	0.0	0.98	156.3«	207.6
9.000	50.00	5.17	129.950	0.400	0.0	0.0	0.0	3.60	254.4	54.2
1.005	50.00	8.83	128.083	1.933	0.0	0.0	0.0	3.86	273.0	261.8

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.054	0.054	0.054
2.000	-	-	100	0.121	0.121	0.121
2.001	-	-	100	0.100	0.100	0.100
2.002	-	-	100	0.000	0.000	0.000
2.003	-	-	100	0.159	0.159	0.159
2.004	-	-	100	0.017	0.017	0.017
3.000	-	-	100	0.048	0.048	0.048
2.005	-	-	100	0.054	0.054	0.054
4.000	-	-	100	0.086	0.086	0.086
2.006	-	-	100	0.086	0.086	0.086
1.001	-	-	100	0.034	0.034	0.034
5.000	-	-	100	0.061	0.061	0.061
1.002	-	-	100	0.070	0.070	0.070
6.000	-	-	100	0.061	0.061	0.061
6.001	-	-	100	0.143	0.143	0.143
1.003	-	-	100	0.023	0.023	0.023
7.000	-	-	100	0.179	0.179	0.179
8.000	-	-	100	0.040	0.040	0.040
8.001	-	-	100	0.020	0.020	0.020
8.002	-	-	100	0.177	0.177	0.177
1.004	-	-	100	0.000	0.000	0.000
9.000	-	-	100	0.400	0.400	0.400
1.005	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				1.933	1.933	1.933

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.005		128.650	126.830	0.000	0	0

Simulation Criteria for Storm

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

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

Synthetic Rainfall Details

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Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.340		

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Online Controls for Storm

Non Return Valve Manhole: S03, DS/PN: 2.006, Volume (m³): 6.0

Hydro-Brake® Optimum Manhole: S14, DS/PN: 1.005, Volume (m³): 8.8

Unit Reference	MD-SHE-0272-4990-2600-4990
Design Head (m)	2.600
Design Flow (l/s)	49.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	272
Invert Level (m)	128.083
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.600	49.8
Flush-Flo™	0.752	49.9
Kick-Flo®	1.622	39.7
Mean Flow over Head Range	-	43.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.6	1.200	47.8	3.000	53.4	7.000	80.5
0.200	28.0	1.400	45.3	3.500	57.5	7.500	83.3
0.300	43.5	1.600	40.5	4.000	61.4	8.000	85.9
0.400	46.6	1.800	41.8	4.500	65.0	8.500	88.5
0.500	48.4	2.000	43.9	5.000	68.4	9.000	91.0
0.600	49.4	2.200	46.0	5.500	71.6	9.500	93.5
0.800	49.8	2.400	48.0	6.000	74.7		
1.000	49.2	2.600	49.8	6.500	77.7		

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	1999
Site Location	GB 417600 415750 SE 17600 15750
C (1km)	-0.026
D1 (1km)	0.372
D2 (1km)	0.442
D3 (1km)	0.297
E (1km)	0.307
F (1km)	2.373
Cv (Summer)	0.750
Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	S04	60 Summer	1	+0%				
2.000	SU1	60 Summer	1	+0%				
2.001	SWALE 1A	60 Summer	1	+0%				
2.002	SWALE 1B	60 Summer	1	+0%				
2.003	S01	60 Summer	1	+0%	100/60 Summer			
2.004	S02	60 Summer	1	+0%	100/60 Summer			
3.000	SU2	60 Summer	1	+0%				
2.005	JUNC	60 Summer	1	+0%				
4.000	SU3	60 Summer	1	+0%	100/60 Summer	100/120 Winter		

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	S04	131.869	-0.119	0.000	0.09			4.1	OK
2.000	SU1	132.865	-0.232	0.000	0.12			9.2	OK
2.001	SWALE 1A	132.782	-1.537	0.000	0.00			16.1	OK
2.002	SWALE 1B	131.259	-0.241	0.000	0.08			16.2	OK
2.003	S01	130.715	-0.266	0.000	0.19			27.3	OK
2.004	S02	130.526	-0.281	0.000	0.14			28.5	OK
3.000	SU2	130.964	-0.123	0.000	0.08			3.6	OK
2.005	JUNC	130.259	-0.289	0.000	0.12			35.7	OK*
4.000	SU3	129.993	-0.188	0.000	0.07			6.5	OK

PN	US/MH Name	Level Exceeded
1.000	S04	
2.000	SU1	
2.001	SWALE 1A	
2.002	SWALE 1B	
2.003	S01	
2.004	S02	
3.000	SU2	
2.005	JUNC	
4.000	SU3	3

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
2.006	S03	60 Summer	1	+0%	30/60 Summer				129.618
1.001	S05	60 Summer	1	+0%	30/60 Summer				129.472
5.000	S06	60 Summer	1	+0%					132.495
1.002	S07	60 Summer	1	+0%	100/120 Winter				128.358
6.000	S09	60 Summer	1	+0%					132.677
6.001	S10	60 Summer	1	+0%					132.518
1.003	JUNC	240 Winter	1	+0%					128.305
7.000	SU4	60 Summer	1	+0%					131.223
8.000	S11	60 Summer	1	+0%					132.650
8.001	S12	60 Summer	1	+0%					132.397
8.002	S13	60 Summer	1	+0%					132.181
1.004	S08	240 Winter	1	+0%	30/60 Summer				128.304
9.000	STUB	60 Summer	1	+0%	100/120 Winter				130.021
1.005	S14	240 Winter	1	+0%	30/60 Summer				128.285

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
2.006	S03	-0.282	0.000	0.30			47.4	OK	
1.001	S05	-0.233	0.000	0.31			53.7	OK	
5.000	S06	-0.196	0.000	0.04			4.6	OK	
1.002	S07	-2.045	0.000	0.00			62.6	OK	
6.000	S09	-0.173	0.000	0.12			4.6	OK	
6.001	S10	-0.255	0.000	0.05			14.6	OK	
1.003	JUNC	-1.708	0.000	0.00			20.9	OK*	
7.000	SU4	-0.115	0.000	0.12			13.6	OK	
8.000	S11	-0.183	0.000	0.08			3.0	OK	
8.001	S12	-0.174	0.000	0.12			4.4	OK	
8.002	S13	-0.248	0.000	0.07			16.7	OK	
1.004	S08	-0.263	0.000	0.23			23.0	OK	
9.000	STUB	-0.229	0.000	0.13			30.4	OK	
1.005	S14	-0.098	0.000	0.12			28.4	OK	

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	1999
Site Location	GB 417600 415750 SE 17600 15750
C (1km)	-0.026
D1 (1km)	0.372
D2 (1km)	0.442
D3 (1km)	0.297
E (1km)	0.307
F (1km)	2.373
Cv (Summer)	0.750
Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	S04	60 Summer	30	+40%				
2.000	SU1	60 Summer	30	+40%				
2.001	SWALE 1A	60 Summer	30	+40%				
2.002	SWALE 1B	60 Summer	30	+40%				
2.003	S01	60 Summer	30	+40%	100/60 Summer			
2.004	S02	60 Summer	30	+40%	100/60 Summer			
3.000	SU2	60 Summer	30	+40%				
2.005	JUNC	60 Summer	30	+40%				
4.000	SU3	60 Summer	30	+40%	100/60 Summer	100/120 Winter		

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	S04	131.901	-0.087	0.000	0.37			16.2	OK
2.000	SU1	132.941	-0.156	0.000	0.47			36.4	OK
2.001	SWALE 1A	132.863	-1.456	0.000	0.00			67.1	OK
2.002	SWALE 1B	131.323	-0.177	0.000	0.35			67.1	OK
2.003	S01	130.858	-0.123	0.000	0.78			115.3	OK
2.004	S02	130.643	-0.164	0.000	0.60			120.0	OK
3.000	SU2	130.993	-0.094	0.000	0.30			14.4	OK
2.005	JUNC	130.364	-0.184	0.000	0.51			150.4	OK*
4.000	SU3	130.033	-0.148	0.000	0.26			25.8	OK

PN	US/MH Name	Level Exceeded
1.000	S04	
2.000	SU1	
2.001	SWALE 1A	
2.002	SWALE 1B	
2.003	S01	
2.004	S02	
3.000	SU2	
2.005	JUNC	
4.000	SU3	3

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
2.006	S03	60 Summer	30	+40%	30/60 Summer				129.987
1.001	S05	60 Summer	30	+40%	30/60 Summer				129.807
5.000	S06	60 Summer	30	+40%					132.526
1.002	S07	180 Winter	30	+40%	100/120 Winter				129.222
6.000	S09	60 Summer	30	+40%					132.737
6.001	S10	60 Summer	30	+40%					132.570
1.003	JUNC	180 Winter	30	+40%					129.217
7.000	SU4	60 Summer	30	+40%					131.262
8.000	S11	60 Summer	30	+40%					132.694
8.001	S12	60 Summer	30	+40%					132.457
8.002	S13	60 Summer	30	+40%					132.242
1.004	S08	180 Winter	30	+40%	30/60 Summer				129.213
9.000	STUB	60 Summer	30	+40%	100/120 Winter				130.102
1.005	S14	180 Winter	30	+40%	30/60 Summer				129.228

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
2.006	S03	0.087	0.000	1.23			196.4	SURCHARGED	
1.001	S05	0.102	0.000	1.25			220.6	SURCHARGED	
5.000	S06	-0.165	0.000	0.16			18.3	OK	
1.002	S07	-1.181	0.000	0.00			99.9	OK	
6.000	S09	-0.113	0.000	0.49			18.3	OK	
6.001	S10	-0.203	0.000	0.23			61.9	OK	
1.003	JUNC	-0.796	0.000	0.00			35.3	OK*	
7.000	SU4	-0.076	0.000	0.49			53.8	OK	
8.000	S11	-0.139	0.000	0.31			11.8	OK	
8.001	S12	-0.114	0.000	0.48			17.7	OK	
8.002	S13	-0.187	0.000	0.30			71.6	OK	
1.004	S08	0.646	0.000	0.51			50.7	SURCHARGED	
9.000	STUB	-0.148	0.000	0.51			120.1	OK	
1.005	S14	0.845	0.000	0.20			48.7	SURCHARGED	

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	1999
Site Location	GB 417600 415750 SE 17600 15750
C (1km)	-0.026
D1 (1km)	0.372
D2 (1km)	0.442
D3 (1km)	0.297
E (1km)	0.307
F (1km)	2.373
Cv (Summer)	0.750
Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	S04	60 Summer	100	+45%				
2.000	SU1	60 Summer	100	+45%				
2.001	SWALE 1A	60 Summer	100	+45%				
2.002	SWALE 1B	60 Summer	100	+45%				
2.003	S01	60 Summer	100	+45%	100/60 Summer			
2.004	S02	60 Summer	100	+45%	100/60 Summer			
3.000	SU2	60 Summer	100	+45%				
2.005	JUNC	60 Summer	100	+45%				
4.000	SU3	180 Winter	100	+45%	100/60 Summer	100/120 Winter		

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	S04	131.918	-0.070	0.000	0.55			24.4	OK
2.000	SU1	132.983	-0.114	0.000	0.70			54.7	OK
2.001	SWALE 1A	132.888	-1.431	0.000	0.01			100.9	OK
2.002	SWALE 1B	131.355	-0.145	0.000	0.53			100.9	OK
2.003	S01	131.198	0.217	0.000	1.13			166.0	SURCHARGED
2.004	S02	130.996	0.189	0.000	0.83			165.6	SURCHARGED
3.000	SU2	131.008	-0.079	0.000	0.46			21.7	OK
2.005	JUNC	130.548	0.000	0.000	0.70			206.3	SURCHARGED*
4.000	SU3	130.650	0.469	20.314	0.30			29.8	FLOOD

PN	US/MH Name	Level Exceeded
1.000	S04	
2.000	SU1	
2.001	SWALE 1A	
2.002	SWALE 1B	
2.003	S01	
2.004	S02	
3.000	SU2	
2.005	JUNC	
4.000	SU3	3

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
2.006	S03	240 Winter	100	+45%	30/60 Summer				130.701
1.001	S05	240 Winter	100	+45%	30/60 Summer				130.725
5.000	S06	60 Summer	100	+45%					132.540
1.002	S07	240 Winter	100	+45%	100/120 Winter				130.730
6.000	S09	60 Summer	100	+45%					132.770
6.001	S10	60 Summer	100	+45%					132.595
1.003	JUNC	480 Winter	100	+45%					130.013
7.000	SU4	60 Summer	100	+45%					131.285
8.000	S11	60 Summer	100	+45%					132.717
8.001	S12	60 Summer	100	+45%					132.489
8.002	S13	60 Summer	100	+45%					132.271
1.004	S08	240 Winter	100	+45%	30/60 Summer				130.730
9.000	STUB	240 Winter	100	+45%	100/120 Winter				130.686
1.005	S14	240 Winter	100	+45%	30/60 Summer				130.683

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
2.006	S03	0.801	0.000	0.56			89.5	FLOOD RISK	
1.001	S05	1.020	0.000	0.58			101.2	SURCHARGED	
5.000	S06	-0.151	0.000	0.24			27.6	OK	
1.002	S07	0.327	0.000	0.00			117.2	SURCHARGED	
6.000	S09	-0.080	0.000	0.74			27.5	OK	
6.001	S10	-0.178	0.000	0.34			93.2	OK	
1.003	JUNC	0.000	0.000	0.00			40.0	SURCHARGED*	
7.000	SU4	-0.053	0.000	0.74			80.9	OK	
8.000	S11	-0.116	0.000	0.47			17.8	OK	
8.001	S12	-0.082	0.000	0.72			26.6	OK	
8.002	S13	-0.158	0.000	0.45			107.6	OK	
1.004	S08	2.163	0.000	0.49			48.6	SURCHARGED	
9.000	STUB	0.436	0.000	0.23			53.4	SURCHARGED	
1.005	S14	2.300	0.000	0.21			49.5	SURCHARGED	

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