

LAND AT POLYGON ROAD CRUMPSALL, MANCHESTER

SUSTAINABLE DRAINAGE STRATEGY

Job Number: FRA 20 1240

Date: July 2021

Client: Mr Adnan Aslam



INCREASING LAND VALUE

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LK Consult			
Document Verification			
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Report Title	Sustainable Drainage Strategy		
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Prepared By	Matthew Craig – Environmental Scientist	Signature	
Reviewed By	Mark Jones - Associate	Signature	

Revision Record			
Revision No.	Date	Nature of Revision	Approved By

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EXECUTIVE SUMMARY

Scope and Background

This Sustainable Drainage (SuDS) Strategy has been undertaken by LK Consult Ltd (LKC) to support a planning application for the development of land at Polygon Road, Manchester. The development comprises a residential development comprising of (UU) apartments, with provision for soft landscaping and car parking.

LKC has prepared this SuDS Strategy in line with the NPPF and Technical Guidance where appropriate.

Consultations

The Environment Agency (EA) website has been utilised to assess if there are any limitations that may affect the form of SuDS that may be appropriate to this site. The records show that the site is within Flood Zone 1.

Manchester City Council – Lead Local Flood Authority and United Utilities (UU) have also been contacted during preparation of this report.

Mitigation

Design

The ground conditions beneath the site are recorded as Till, Devensian superficial deposits over Sandstone bedrock.

The site is relatively level.

In considering the potential drainage options for the site at present it is assumed that surface water runoff arising from the development will discharge into the existing combined sewer.

The flows from the site should be restricted to an acceptable level to the Lead Local Flood Authority and UU.

Although the building has been extended, the proportion of the site covered by impermeable surfaces will remain similar to the existing and will therefore generate similar runoff. Attenuation will be required to allow for climate change and restrictions due the site being within a critical drainage area.

The outline drainage strategy considers the use of attenuation-based SuDS to be feasible with a discharge to the combined sewer within Polygon Road to the west of the site. Therefore, the most effective strategy, in line with the SuDS management train, would be to have a detention basin at the northern boundary towards the northeast corner. For the 5l/s discharge rate the required attenuation tank or similar has been estimated to be **19.7m³** for the 1 in 30-year event.

Similarly, the estimated volume to be retained on site for the 1 in 100-year storm event including the allowance for climate change is between **39.4m³** and **49.5m³**.

The estimated volume can be stored within the site boundary.

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1 Introduction

1.1 Background

LK Consult Ltd (LKC) were commissioned by Mr Adnan Aslam to carry out a Sustainable Drainage Strategy for land at Polygon Road, Crumpsall, Manchester. The report was undertaken in support of a planning application to redevelop the site for residential use.

The report will consider the impact of the development on surface water runoff accounting for climate change. The sustainable drainage assessment in Section 4 will provide an overview of the SuDS techniques which could be considered on the site.

This preliminary SuDS assessment complies with the principles presented in the Draft National Standards for Sustainable Drainage Systems (Defra, 2015)¹ and the Planning Practice Guidance (PPG) March 2014². The sustainable drainage assessment is presented with reference to the hydrological and hydrogeological context of the development.

The report findings are based upon professional judgement and are summarised below. The report includes baseline data from the Environment Agency (EA), rainfall data from the Wallingford Studies and Hydrogeological information from the British Geological Survey (BGS). The assessment will summarise and refer to these datasets in the text.

Drainage on the site has been assessed by considering the following key constraints:

- » Topography of the site.
- » Local water features and hydrological context.
- » Underlying geology, soil types and permeability.
- » Layout and geometry of the proposed development.

1.2 Site Details

A summary of the general site details is presented in Table 1-1. Plans, Drawings and Figures are provided in Appendix A. Figures 1 and 2 indicate the site location and boundary. Figure 3 indicates the proposed development.

Site Details	
Location	Junction of Polygon Road and Crumpsall Lane, M8 5EF. Centred at approximate National Grid Reference 383745E 402410N.
Area	Approximately 1900m ² .
Topography	Site has a slight fall towards the northeast to 80.9mAOD.
Current Land Use	<u>Site</u> Existing detached residential property with soft landscaping. <u>Surrounding Area/ Boundary Treatment</u> North: Crumpsall Lane; Residential. East: Residential South: Residential, with school buildings and grounds beyond. West: Polygon Road; Residential.
Proposed Development	Redevelopment and extension of the existing building including, a lower ground floor, into residential apartments.

Table 1-1: Summary of site details.

¹ Non-statutory Technical Standards for Sustainable Drainage Systems – DEFRA March 2015

² Planning Practice Guidance – Department for Communities and Local Government April 2014

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2 Site Setting

2.1 Environmental Setting

LKC has undertaken a review of public domain information including British Geological Survey data, Environment Agency data, historical mapping and aerial photography to provide a summary of the environmental setting of the site. This is summarised in Table 2-1 below.

Summary of the Environmental Setting			
Geology	Superficial		Till, Devensian – Diamicton.
	Bedrock		Collyhurst Sandstone Formation fully across the site Chester Formation (Sandstone) adjacent to the northern edge of the site
	BGS Boreholes		There are no available boreholes within the vicinity of the site.
	Defra Soilscape Mapping		Slowly permeable seasonally wet acid loamy and clayey soils have been identified within the site.
Hydrogeology	Aquifer	Superficial	Secondary Undifferentiated Aquifer.
	Designation	Bedrock	Principal Aquifer.
	Source Protection Zone (SPZ)		Site not within an SPZ.
Hydrology	All adjacent and internal surface water		There are no watercourses in the vicinity of the site.
Site History			Agricultural buildings pre-dating 1850. Residential pre-dating 1900.

Table 2-1: Summary of the Environmental Setting.

2.2 Site Reconnaissance

A site reconnaissance was undertaken in July 2021 and photographs are provided in Appendix B.

Relevant features identified on site are summarised below:

- The site is a derelict residential building, surrounded by a hardstanding driveway to the south, and overgrown garden area to the north.
- There is a wall and fence around the site boundary, with mature trees.
- The site is approximately level.
- There is a stairwell to a basement below ground level; this is the only significant depression within the site.
- There is no evidence of any surface water retention within the site boundary, although there is a small area of surface water on Polygon Road adjacent to the driveway.
- There are manholes and gullies visible in the adjacent roads. There is no evidence of any drainage within the site boundary.

2.3 Site and Access Levels

A topographic survey of the site has been undertaken to OS GPS datum, and information is included on the drawings in Appendix B. The site is approximately level.

2.4 Site Investigation

LKC undertook the excavation of 2 no. hand dug trial holes in the northern grassed area of the site. Made ground was noted in both trial holes (maximum 0.35mbgl). The made ground to the NW of the site contained small amounts of brick. To the NE however large amounts of ash, brick and reworked clay were found in the made ground. Made ground was underlain by natural black sandy Silt. The underlying Glacial Till deposits may impede the use of soakaways.

3 Consultation

Information from consultees is summarised in Table 3-1 below.

Relevant correspondence / information is provided in Appendix C.

Source	Details	
Environment Agency	Flood Zone 1: Very Low risk, with annual probability of flooding from rivers and the sea of less than 0.1% (1 in 1000).	
United Utilities	Likely conditions for connecting into their sewerage system	United Utilities would request conditions for a separate system with only foul draining to foul / combined sewers and surface water draining to soakaway/SuDS, watercourse or surface water sewer. United Utilities Developer Enquiry team was contacted regarding sewer flooding history for the site. Water Company confirmed that they did not have any record of internal or external sewer flooding of properties in the vicinity of the site as a result of overloaded sewers. All surface water flow from the proposed development should drain in-line with the drainage hierarchy, as outlined in Paragraph 80 of the National Planning Practice Guidance. Surface water runoff generated from this development should discharge to the ground via infiltration system where feasible. If not feasible, UU will consider a connection to the 300mm diameter public combined sewer located in Polygon Road at a pass forward flow to be agreed by the Lead Local Flood Authority. UU request that any agreed rate does not exceed 5l/s. Foul flow from this site will be allowed to drain into the 300mm diameter combined sewer within Polygon Road at an unrestricted rate.
	Sewer Map	There is a 300mm diameter combined sewer within Polygon Road to the west, and a 450mm diameter combined sewer within Crumpsall Lane to the north.

Table 3-1: Summary Consultee Information.

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4 Sustainable Drainage Strategy

4.1 Introduction

The NPPF recognises that flood risk and other environmental damage can be managed by minimising changes in the volume and rate of surface run-off from development sites through the use of Sustainable Drainage Systems (SuDS), this being complementary to the control of development within the floodplain.

SuDS will not alleviate flooding in an area prone to flooding; however, properly designed SuDS have the potential to prevent the surface water runoff from new development worsening the flood risk. The effective disposal of surface water from development is a material planning consideration in determining proposals for the development and use of land.

The accepted principles are that surface water arising from a developed area should, as far as practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account.

The Building Regulations Requirement H3³ stipulates that rainwater from roofs and paved areas is carried away from the surface to discharge to one of the following, listed in order of priority:

- an adequate soakaway or other adequate infiltration system,
- a watercourse or, where that is not practicable,
- a sewer.

The concept of a sustainable drainage system has been incorporated into the outline drainage strategy for the study area in order to comply with the Flood and Water Management Act 2010⁴.

Suitability of different SuDS will be governed by prevailing site conditions, such as the type and scale of development, topography, ground conditions (soil permeability, ground stability, depth to water table), local hydrogeology and risk of groundwater contamination (presence of sensitive aquifers and source protection zones) etc.

4.1 Infiltration

The Groundwater Source Protection Zone mapping from the EA website shows that the site is not within any identified protection zones.

A summary of the British Geological Survey superficial and bedrock aquifer descriptions and classifications supplemented by local records is shown in Table 4-1 below:

³ Building Regulations part H3 2010: Approved Document, Drainage and Waste Disposal.

⁴ Flood and Water Management Act 2010: UK Government.

Classification	Description	Aquifer Classification	Recorded Water Table Depth	Soakaway Potential
Till, Devensian	Diamicton	Secondary Undifferentiated	N/A	Poor
Collyhurst Sandstone Formation	Sandstone	Principal	N/A	Good

Table 4-1: Geological and Hydrogeological Setting.

The site is constrained by the highway and building foundations and has a partially buried lower ground floor. Infiltration methods such as soakaways are unlikely to be feasible, but this may be investigated further at the detailed design stage, if required.

There is a slope over the surrounding area which indicates that groundwater in the vicinity of the site would likely drain towards the northeast.

4.2 Watercourses

There are no observable watercourses within or near the boundary of the site. Currently surface water from the site runs overland to the adjacent combined sewer.

4.3 Public Sewer

There is a 300mm diameter combined sewer in Polygon Road to the west, and a 450mm diameter combined sewer in Crumpsall Road to the north.

4.4 Other Sewers

There is a private connection to the public sewer from the study land.

4.5 Surface Water Drainage Strategy

The drainage options relating to the final discharge of surface water for this section of the site are listed in Table 4-2 in order of priority within the NPPF:

Option No:	Drainage Solution	Most feasible solution	Comments
a	Soakaway/Infiltration	2	Unlikely to be feasible on account of the impermeable ground conditions and site constraints.
b	Connection to Watercourse	N/A	Would require third party access/a road crossing and EA/LLFA consent and would be expensive due to distance between site and watercourse.
c	Discharge into a sewer	1	A connection into the 300mm diameter combined sewer in Polygon Road would be possible – subject to approval from LLFA and a connection consent from UU.

Table 4-2: Drainage options.

Table 4-3 provides a summary of the SuDS options appraisal with consideration of CIRIA C697 (The SUDS Manual)⁵ for the development:

SuDS Option	Appropriate to Development	Comments
Soakaways	X	Due to the nature of the ground conditions, the use of infiltration systems is unlikely to be feasible.
Infiltration basin	X	Depressions that store and dispose of water via infiltration. Unlikely to be appropriate given the ground conditions.
Sand filter	X	Treatment devices using sand beds as filter media.
Filter strip	X	Engineered filters that use vegetation to remove and treat runoff. The filter strip is sloped to allow sheet flow across the vegetated strip. A filter strip offers no storage and is used solely to remove pollutants from surface water.
Filter drains	✓	Linear trenches filled with a permeable granular material, often with a perforated pipe in the base of the trench.
Detention basin	X	Dry depressions designed to hold water for a specific retention time.
Swales	*	Swales are shallow grass-lined channels that provide capacity for conveying flows at a controlled rate into ponds and watercourses.
Rainwater harvesting	*	Rainwater harvesting collects the rain which falls onto roofs, then stores it in a tank until required for a non-potable use. When required, the water is pumped to the point of use, thus displacing what would otherwise be a demand for mains-water. In the process, a volume of water is kept out of the storm-water management system, thereby helping to reduce flooding risks. Rainwater harvesting systems are currently not included in the development proposals.
Green roofs	*	Green roof installations can help to reduce surface water runoff from roof areas depending on the system specified. Green roofs are not currently included in the development proposals.
Geo-cellular storage systems	✓	Modular block systems can be used to provide an underground storage facility. Any geo-cellular storage systems should be lined with a geo-membrane to provide attenuation storage.
Permeable Pavements – with granular and geo-cellular storage systems	✓	Permeable pavements allow inflow of rainwater into underlying construction. Any geo-cellular storage systems would have to be lined with an impermeable membrane to provide storage rather than infiltration for runoff from highways.
Ponds	X	Attenuation ponds can be used to offset the increase in surface water flows attributable to increased area of hard standing, in order to minimise the risk of flooding to and from the proposed development. Ponds will attenuate the surface water flow prior to discharging to the public surface water sewers. The storage volume afforded by these features should not include any permanent water in the pond.
Oversized Pipes	✓	Oversizing the pipes that make up the on-site drainage network is a cost-effective method for providing attenuation storage within the network. Such systems could be considered on the parts of the development where gradients are relatively flat.
Tanks	✓	Prefabricated underground tanks could be considered at the detailed design stage in order to provide storage to attenuate surface water runoff.
Flow control devices	✓	The peak flow rates will be controlled by flow control devices e.g. hydrobrake style flow control systems, and restricted orifices. Flow control devices enable the discharge to be restricted to a constant rate from the development.

Table 4-3: Summary of the SuDS options appraisal.

Notes

- ✓ Suitable for use given the nature and scale of the development.
- * Possibly suitable for use – not included in the client and architect design proposal at present.
- X Not suitable

⁵ CIRIA C697 - The SUDS Manual. London 2015

4.6 Surface Water Attenuation Requirements

From correspondence with United Utilities the flow should be reduced by the minimum of 50% from the existing runoff rates for estimating the attenuation volumes required.

In line with the Local SFRA⁶, the flow from this development should be reduced by the minimum of 50% from the existing runoff rates for estimating the attenuation volumes required.

It is estimated from the supplied plan (see Appendix A) that the site will have the following designated areas (Table 4-4).

Existing Designated Areas	Plot Area
Total area (ha)	0.19
Impermeable Split (ha)	0.11
Permeable Split (ha)	0.08
Designated Areas	Plot Area
Total area (ha)	0.19
Impermeable Split (ha)	0.18
Permeable Split (ha)	0.01

Table 4-4: Assumed plot areas.

Table 4-4 shows the assumed split in area included within the calculations.

It can be seen that there is an increase in the impermeable area from the existing usage to the proposed. This is likely to require attenuation to reduce the existing flow off site to a level which is acceptable to the LLFA and to UU.

4.6.1 Attenuation Estimate

Surface water storage and peak runoff estimations based on the HR Wallingford procedure have been undertaken for the development and the output report is presented in Appendix D.

For the contributing catchment an estimate has been produced assuming a developable area of 0.19ha, of which 0.01ha is impermeable. This gives the following runoff rates and attenuation requirements for this section based on the Wallingford IH 124 method:

Q _{bar} :	11.8 l/s
1 in 1-year peak runoff rate:	8.3 l/s
1 in 30-year peak runoff rate:	20.9 l/s
1 in 100-year peak runoff rate:	26.5 l/s

This reduced by 50% would give the following rates:

Q _{bar} :	5.9 l/s
1 in 1-year peak runoff rate:	4.2 l/s
1 in 30-year peak runoff rate:	10.5 l/s
1 in 100-year peak runoff rate:	13.3 l/s

United Utilities has specified an allowable discharge rate of 5l/s to their adjacent combined sewer. This would provide more than the 50% betterment on the existing Q_{bar} brownfield discharge rate.

The following attenuation has been estimated for the development using 5l/s runoff rates and utilises the FSR methodology⁷ as:

- » Attenuation storage volume: **19.7 m³** (1 in 30-year event)
- » Retention on site volume: **39.4 m³** (1 in 100 year + 20% Climate Change)
- » Retention on site volume: **49.5 m³** (1 in 100 year + 40% Climate Change)

Attenuation storage aims to limit the peak rate of runoff from the development to 5l/s before discharge to the public sewer. As the flow from the development would be reduced there should be little change in the flows that enter the public sewer and thus the risk of flooding as a result from the development should not increase the risk of flooding off-site.

The attenuation required for a 1 in 30-year storm event, requires a storage volume of **19.7 m³** and for the 1 in 100-year event, a storage capacity of between **39.4 m³** and **49.5 m³** will be required from on-site storage as well as SuDS systems. All volumes can be stored within the site boundary and discharges will be limited by flow control devices to the adjacent sewer.

4.7 Site Specific SuDS

The use of attenuation SuDS are deemed to be the most feasible and practical option for the development. The attenuation tank or similar will provide the required storage volume to limit peak runoff arising from the development.

Utilising of the flow control device at the end of the system will control the peak flow rates.

The use of permeable paving may be viable dependant on the detailed design of the proposed development. If this drainage technique is considered to be feasible then it will reduce the requirement for attenuation as it will reduce the contributing impermeable area. The permeable paving will also provide some level of water treatment reducing effects of pollution in runoff on the environment.

A preliminary drainage strategy (shown in Appendix F) has been developed based on an indicative development plan.

Assuming that the outline drainage strategy is acceptable to the Local Authority, a more detailed design can be presented and agreed with the appropriate regulatory bodies during the detailed design phase.

4.8 Foul Drainage

The foul water could be discharged by gravity into the 300mm diameter combined sewer in Polygon Road as relative levels indicate that this will be feasible in terms of fall. There are several possible alternative manholes for the connection of foul drainage from the site.

⁷ Flood Studies Report Wallingford NERC 1975.

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5 Conclusion

The site is currently a derelict detached building with a garden. The proposal is to redevelop the site into residential apartments.

An assessment of the site settings and existing constraints in conjunction with the development proposals have resulted in the following recommendations for the safe development of the site:

- » The recorded geology on site would indicate that infiltration is unlikely to be practical. This may be investigated at the detailed design stage by means of undertaking permeability testing if required.
- » A suitability and a depth of the potential connection into the adjacent sewer should be confirmed on site.
- » There are existing connections of the site to the adjacent public sewers. A pre-development advice received from United Utilities considered a flow rate of 5l/s would be acceptable if infiltration proved to be impractical.
- » All proposed outflow connections from the development should be agreed with the Lead Local Planning Authority and United Utilities.

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APPENDIX A

FIGURES, PLANS AND DRAWINGS

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KEY



Site Location

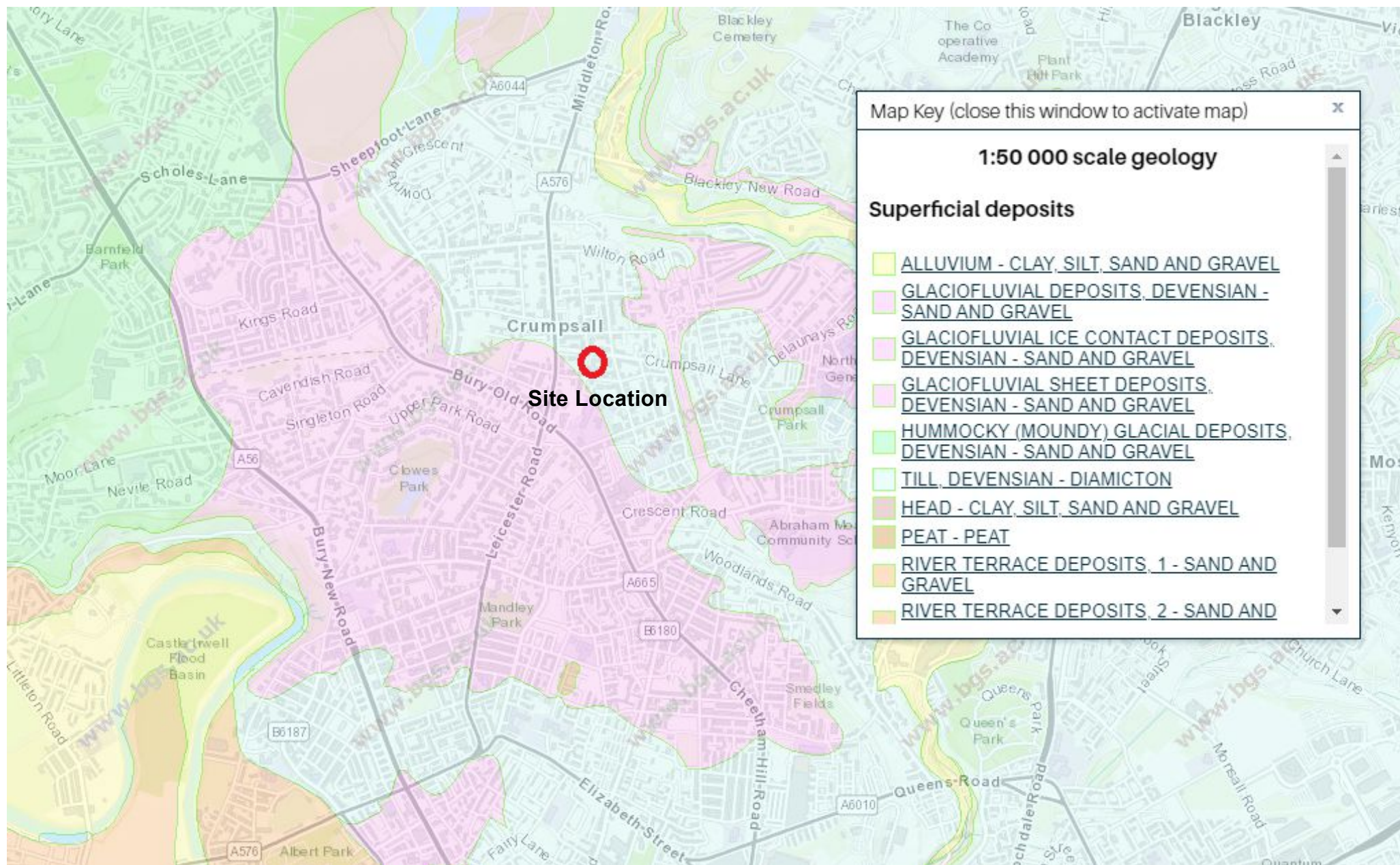
Sampling locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing 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.

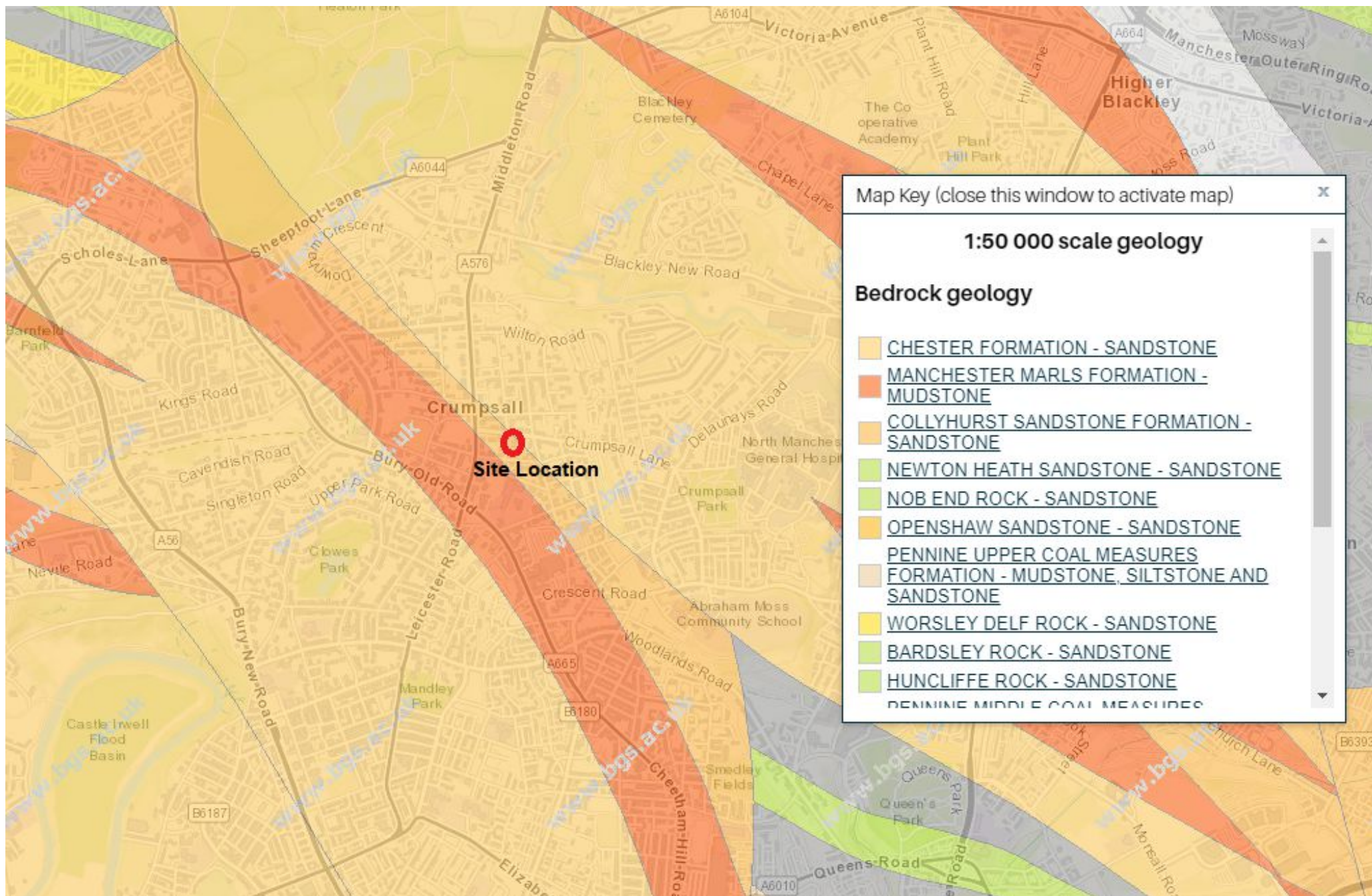
Client: Mr Adnan Aslam				Title: Site Boundary Plan		
Site: Land at Polygon Road, Manchester						
Job No: LKC 20 1240	Drawn By: MC	Checked By: MJ	Drawn: July 2021	Scale (see scale bar): 1:250 @ A4	Figure: 1	Revision:

APPENDIX B

SITE INFORMATION

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APPENDIX C

CONSULTEE CORRESPONDENCE

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LKGroup**Unit 29 Eton Business Park
Eton Hill Road, Radcliffe
Radcliffe, Greater
M26 2ZS****FAO:****How to contact us:****United Utilities Water Limited
Property Searches
Haweswater House
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP****Telephone: 0370 7510101****E-mail: propertysearches@uuplc.co.uk****Your Ref: FRA 20 1240
Our Ref: UUPS-ORD-297864
Date: 18/06/2021****Dear Sirs****Location: FLAT 1 39 TUNSTEAD COURT POLYGON ROAD, CRUMPSALL, MANCHESTER, M8 5EF**

I acknowledge with thanks your request dated 14/06/2021 for information on the location of our services.

Please find enclosed plans showing the approximate position of United Utilities' apparatus known to be in the vicinity of this site.

The enclosed plans are being provided to you subject to the United Utilities terms and conditions for both the wastewater and water distribution plans which are shown attached.

If you are planning works anywhere in the North West, please read United Utilities' access statement before you start work to check how it will affect our network. <http://www.unitedutilities.com/work-near-asset.aspx>.

I trust the above meets with your requirements and look forward to hearing from you should you need anything further.

If you have any queries regarding this matter please [contact us](#).

Yours Faithfully,



Karen McCormack
Property Searches Manager

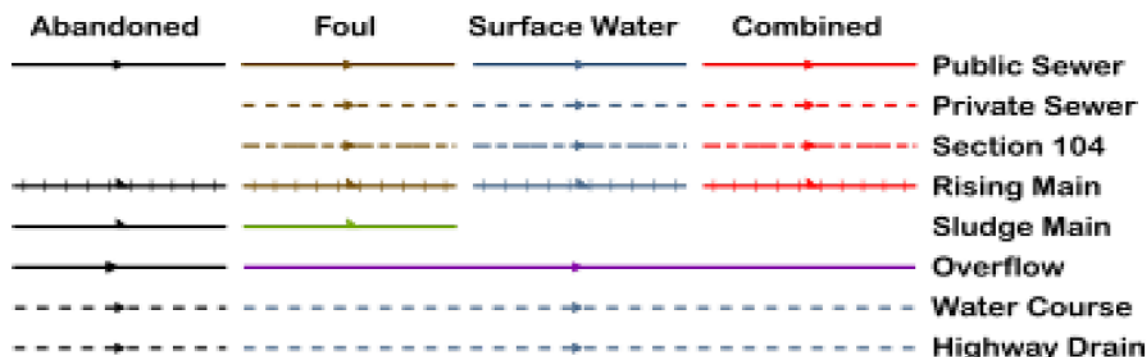
TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

These provisions apply to the public sewerage, water distribution and telemetry systems (including sewers which are the subject of an agreement under Section 104 of the Water Industry Act 1991 and mains installed in accordance with the agreement for the self construction of water mains) (UUWL apparatus) of United Utilities Water Limited "(UUWL)".

TERMS AND CONDITIONS:

- This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.
- This Map and any information supplied with it is provided for general guidance only and no representation, undertaking or warranty as to its accuracy, completeness or being up to date is given or implied.
- In particular, the position and depth of any UUWL apparatus shown on the Map are approximate only. UUWL strongly recommends that a comprehensive survey is undertaken in addition to reviewing this Map to determine and ensure the precise location of any UUWL apparatus. The exact location, positions and depths should be obtained by excavation trial holes.
- The location and position of private drains, private sewers and service pipes to properties are not normally shown on this Map but their presence must be anticipated and accounted for and you are strongly advised to carry out your own further enquiries and investigations in order to locate the same.
- The position and depth of UUWL apparatus is subject to change and therefore this Map is issued subject to any removal or change in location of the same. The onus is entirely upon you to confirm whether any changes to the Map have been made subsequent to issue and prior to any works being carried out.
- This Map and any information shown on it or provided with it must not be relied upon in the event of any development, construction or other works (including but not limited to any excavations) in the vicinity of UUWL apparatus or for the purpose of determining the suitability of a point of connection to the sewerage or other distribution systems.
- No person or legal entity, including any company shall be relieved from any liability howsoever and whensoever arising for any damage caused to UUWL apparatus by reason of the actual position and/or depths of UUWL apparatus being different from those shown on the Map and any information supplied with it.
- If any provision contained herein is or becomes legally invalid or unenforceable, it will be taken to be severed from the remaining provisions which shall be unaffected and continue in full force and affect.
- This agreement shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts, save that nothing will prevent UUWL from bringing proceedings in any other competent jurisdiction, whether concurrently or otherwise.

Wastewater Symbolology



All point assets follow the standard colour convention: **red** – combined **brown** - foul
blue – surface water **purple** - overflow

Manhole	Side Entry Manhole
Head of System	Outfall
Extent of Survey	Screen Chamber
Rodding Eye	Inspection Chamber
Inlet	Bifurcation Chamber
Discharge Point	Lamp Hole
Vortex	T Junction / Saddle
Penstock	Catchpit
Washout Chamber	Valve Chamber
Valve	Vent Column
Air Valve	Vortex Chamber
Non Return Valve	Penstock Chamber
Soakaway	Network Storage Tank
Gully	Sewer Overflow
Cascade	Ww Treatment Works
Flow Meter	Ww Pumping Station
Hatch Box	Septic Tank
Oil Interceptor	Control Kiosk
Summit	
Drop Shaft	Change of Characteristic
Orifice Plate	



Scale: 1:1353
Date: 18/06/2021

SEWER RECORDS

Address or Site Reference: FLAT 1 39 TUNSTEAD COURT POLYGON ROAD,
CRUMPSALL, MANCHESTER, M8 5EF

Printed by: Property Searches



Water for the North West

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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Matthew Craig

From: Perry, Graham <Graham.Perry@uuplc.co.uk>
Sent: 23 June 2021 14:27
To: Matthew Craig
Cc: Wastewater Developer Services
Subject: Pre Development Enquiry for : 8 Polygon Road ,Crumpsall, Manchester ,M8 5EF
UU ref: 4200040816

Pre Development Enquiry for: 8 Polygon Road ,Crumpsall,Manchester , M8 5EF UU Reference Number : 4200040816

We have carried out an assessment of your application which is based on the information provided. This pre-development advice on your drainage strategy will be valid for 12 months. Your drainage strategy will need to be reviewed by other competent authorities as part of the planning process, and we advise that you carry out the necessary site investigations to confirm the viability of your proposals.

If your investigations require access to our public sewer network, we ask that you contact our network engineers with a request for an access certificate via our main contact telephone number 0345 3723223 or refer to the link below:

<https://www.unitedutilities.com/builders-developers/working-near-our-assets/>

Flooding from Sewers

I can confirm that there are no records of any historic flood events and potential sources of flooding from foul and surface water sewers on site or in the area.

Foul Water

Foul flow from this site will be allowed to drain into the public foul water/combined sewer system.

Our preferred point of discharge would be to the 300mm diameter public combined sewer within Polygon Rd located to the west of your proposed development at an unrestricted rate.

If you are able to identify an alternative, more suitable point of discharge, we request that you contact us at your earliest convenience so that we can assess suitability.

Surface Water

All surface water flow from the proposed development should drain in-line with the drainage hierarchy, as outlined in Paragraph 80, (Reference ID: 7-080-20150323), of the National Planning Practice Guidance. We also recommend you prioritise the use of multi-functional sustainable drainage systems for the management of surface water in accordance with national planning policy.

Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable.

This is outlined as follows, in order of priority:

- 1. into the ground (infiltration);**
- 2. to a surface waterbody;**
- 3. to a surface water sewer or highway drain;**

4. to a combined sewer.

For guidance, The North West SuDS Pro-Forma provides information on the appropriate evidence required at each stage of the hierarchy, to demonstrate how each level has been discounted.

The Lead Local Flood Authority has responsibility for all surface water drainage concerns and their input to your proposal is critical. You should also consider whether it is necessary to discuss your proposal with the Environment Agency, or Internal Drainage Board (if operating in your area).

The Local Planning Authority are the determining authority for any application for planning permission and the appropriate authority for determining cost viability of a proposed drainage scheme, such assessments are outside of the jurisdiction of United Utilities.

Infiltration

Surface water runoff generated from this development should discharge to the ground via infiltration system where feasible.

A detailed evidence based feasibility assessment must be carried out in line with Chapter 25 of the CIRIA SuDS Manual 2015 to determine whether infiltration is a suitable method of surface water disposal.

Particular attention must be paid to Ground Water Source Protection Zones to ensure that the risk of pollution to these valuable resources is not compromised. Details can be obtained from the government website:

<https://www.gov.uk/guidance/groundwater-source-protection-zones-spzs#find-groundwater-spzs>

If your site is in a Groundwater Source Protection Zone, you should have regard to the Environment Agency's approach to Groundwater Protection. Information on this is available via the link below:

<https://www.gov.uk/government/publications/groundwater-protection-position-statements>

Please note that such a location could have implications for the principle of your development and the need for additional mitigating measures to protect the groundwater environment and public water supply in the detailed design of your site.

Public Sewer

In accordance with the hierarchy of drainage options within the National Planning Practice Guidance, both discharge to ground via infiltration and discharge to a waterbody should be discounted prior to consideration of discharging surface water to the public sewer system. Evidence should be provided to demonstrate how these have been discounted, as outlined in the North West SuDS pro-forma.

Once evidence is provided as outlined above, United Utilities will consider a connection to the 300mm diameter public combined sewer within Polygon Rd located west of the proposed site at a pass forward flow to be agreed by the Lead Local Flood Authority. United Utilities request that any agreed rate does not exceed 5l/s.

As a Water Company, we have no obligation to accept highway drainage into our public sewer network. However, should your proposals include runoff from highways, we would request that consideration is given to SuDS components that deliver source control are incorporated within the design of the scheme to reduce the volume and frequency of discharges of these flows to the public sewer.

Levels

For low-lying sites, (where the ground level of the site or the level of a basement is below the ground level at the point where the drainage connects to the public sewer), care should be taken to ensure that the property is not at increased risk of flooding. If these circumstances exist, we recommend that you contact us to discuss further. It could affect

the detailed design of your site and result in the need to incorporate appropriate mitigating measures in your drainage scheme.

Land drainage / Overland flows / track drainage

United Utilities have no obligation, and furthermore we do not accept land drainage, overland flows or track drainage into the public sewerage network under any circumstances

Existing Wastewater Assets Crossing the Site

Please be aware that there may be some uncharted public sewers crossing the site that would have transferred under the Public Sewer Transfer Legislation in 2011. We must therefore ask that adequate site investigations are carried out to establish whether this is the case or not.

Existing Water Assets Crossing the Site

It is the developer responsibility to identify utilities on-site. Where clean water assets are shown on our records, we recommend that you contact our Water Pre-Development Team, via the following email address:

DeveloperServicesWater@uuplc.co.uk. Further information for this service can be found on our website via the link below:

<https://www.unitedutilities.com/builders-developers/larger-developments/pre-development/water-pre-dev/>

Connection Application

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

<https://www.unitedutilities.com/builders-developers/larger-developments/wastewater/sewer-connections/>

We recommend that the detailed design should confirm the locations of all utilities in the area and ensure that any proposed drainage solution considers routing and clash checks where required.

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

Kind regards,

Graham Perry



Graham Perry
Development Engineer
Developer Services
M: 07557 577548
T: 01925 679405
unitedutilities.com

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Matthew Craig

From: Matthew Craig
Sent: 22 June 2021 17:53
To: civilcontingencies@bolton.gov.uk
Subject: FRA query - Gilnow Road, Bolton
Attachments: 11 GILNOW ROAD DWG 5 (1).pdf

Dear Sir/Madam

LK Consult Ltd. has been commissioned to undertake a Flood Risk Assessment (FRA), of land at 11 Gilnow Road, Bolton. BL1 4LL.

Centred at approximate National Grid Reference 370335E, 408966N. The area of interest appears to be partially within Flood Zone 3.

To complete the FRA we would be grateful if you could supply us with the following, if available, for the vicinity of the site:

- Records of any historic flood events and potential sources of flooding from foul and surface water sewers on site and in the area.
- Any restrictions to discharge into the sewers

If you have any queries please get in touch with me.

We are, of course, happy to pay your reasonable charge for this service. Please let me know by return what information is available and what the charge will be and we will pay the relevant fees by debit card as soon as possible.

Any advice or recommendations you may have regarding the potential discharges from the development of this site?

We will be in contact with all other relevant authorities to get a more complete understanding of the issues in the area.

Regards

Matthew Craig



Matthew Craig MSc, BSc (hons), MCIWEM
Environmental Scientist – Flood Risk
LK Consult | 0161 763 7200 |
Manchester | London | Liverpool | Glasgow |
www.thelkgroup.com

I N C R E A S I N G L A N D V A L U E

APPENDIX D

CALCULATIONS

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Job No.		
Sheet no. 1		
Date 06/07/21		
By	Checked	Reviewed

Project **Polygon Road, Crumpsall**

Title **Peak Runoff - 1 in 1 year**

Area data:-

FSR data

M5-60 = 18.2

Soil index = 0.15

WRAP value = 1

r = 0.35

SAAR = 1000

Nat grid = SD8103

Site data:-

Ret. period (yrs) = 1

Time of entry = 10.00

Impervious area drained = 1100 m²

Site slope = Mild <2% (1:50)

Length of overland flow = 0.00

ToC = 10.0 mins

Overland flow time = 0.0 mins

Pervious area drained = 759 m²

Soil type = Coarse textured

Climate change factor = 0.0 %

Calculated data:-

Calculated runoff factor = 40.0%

Rainfall rate= 40.3 mm/Hr

UCWI = 102.9

Runoff rate (gross)= 8.3 l/s

Methods

Runoff factor (RF) = 40.0, calculated from:-

Runoff factor = $(0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$

where

PIMP = $\text{Impervious Area} \times 100 / (\text{Impervious Area} + \text{Pervious Area})$

UCWI = Calculated value for Wetness Index

Calculations produced by MasterDrain Surface Water design program



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Sheet no. 1		
Date 06/07/21		
By	Checked	Reviewed

Project **Polygon Road, Crumpsall**

Title **Peak runoff - 1 in 30 year**

Area data:-

FSR data

M5-60 = 18.2

Soil index = 0.15

WRAP value = 1

r = 0.35

SAAR = 1000

Nat grid = SD8103

Site data:-

Ret. period (yrs) = 30

Time of entry = 6.00

Impervious area drained = 1100 m²

Site slope = Mild <2% (1:50)

Length of overland flow = 0.00

ToC = 6.0 mins

Overland flow time = 0.0 mins

Pervious area drained = 759 m²

Soil type = Coarse textured

Climate change factor = 0.0 %

Calculated data:-

Calculated runoff factor = 40.0%

Rainfall rate = 101.4 mm/Hr

UCWI = 102.9

Runoff rate (gross) = 20.9 l/s

Methods

Runoff factor (RF) = 40.0, calculated from:-

Runoff factor = $(0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$

where

PIMP = $\text{Impervious Area} \times 100 / (\text{Impervious Area} + \text{Pervious Area})$

UCWI = Calculated value for Wetness Index

Calculations produced by MasterDrain Surface Water design program



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Job No.		
Sheet no. 1		
Date 06/07/21		
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Project **Polygon Road, Crumpsall**

Title **Peak runoff - 1 in 100 year**

Area data:-

FSR data

M5-60 = 18.2

Soil index = 0.15

WRAP value = 1

r = 0.35

SAAR = 1000

Nat grid = SD8103

Site data:-

Ret. period (yrs) = 100

Time of entry = 6.00

Impervious area drained = 1100 m²

Site slope = Mild <2% (1:50)

Length of overland flow = 0.00

ToC = 6.0 mins

Overland flow time = 0.0 mins

Pervious area drained = 759 m²

Soil type = Coarse textured

Climate change factor = 0.0 %

Calculated data:-

Calculated runoff factor = 40.0%

Rainfall rate = 128.3 mm/Hr

UCWI = 102.9

Runoff rate (gross) = 26.5 l/s

Methods

Runoff factor (RF) = 40.0, calculated from:-

Runoff factor = $(0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$

where

PIMP = $\text{Impervious Area} \times 100 / (\text{Impervious Area} + \text{Pervious Area})$

UCWI = Calculated value for Wetness Index

Calculations produced by MasterDrain Surface Water design program



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Job No.		
Sheet no. 1		
Date 06/07/21		
By	Checked	Reviewed

Project	Polygon Road, Crumpsall
Title	Peak flow storage - 1 in 30 year

Data:-

FSR Hydrology:-

Location = Prestwich
M5-60 (mm) = 18.2
Soil index = 0.15
Return period = 30
UCWI = 105.3

Grid reference = SD8103
r = 0.35
SAAR (mm/yr) = 1000
WRAP = 1
Climate change = 0

- Well drained permeable sandy or loam soils and shallower analogues over highly permeable limestone, chalk, sandstone or related drifts;
- Earthy peat soils drained by dykes and pumps;
- Less permeable loamy over clayey soils on plateaux adjacent to very permeable soils in valleys.

Runoff factor (RF) = 70.0, calculated from:-

$$\text{Runoff factor} = (0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$$

where

PIMP = Impervious Area*100/(Impervious Area+Pervious Area)

UCWI = Calculated value for Wetness Index

Design data:-

Imperv. area = 1774 m²
Total area (TA) = 1859 m²
Allowed discharge rate = 5.000 l/s
Additional flow = 0.00 l/s

Pervious area = 85 m²
Equiv area = 1301 m² (TA x RF).
Areal reduction factor = 1.000
Climate change factor = 0

Calculated data:-

Time to max = 37.0 mins
Rainfall at max = 38.38 mm/hr
Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Calculated storage volume = 19.7 m³
Allowed discharge rate = 5.000 l/s
Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours
Rainfall rate = 8.00 mm/hr

Calculated storage volume = 0.0 m³
Allowed discharge rate = 5.000 l/s

Rainfall intensities calculated using the Wallingford Procedure

Storage lengths for initial calculation (x 1.1, 1.2, 1.3 or 1.5 as above if required) :-

Diam	Len	Diam	Len	Ovoid	Len	Box culvert	Len
100	2508.8	1125	19.8	400 x 600	109.4	500 x 500	78.8
150	1115.0	1200	17.4	600 x 900	47.7	500 x 750	52.5
225	495.6	1275	15.4	800 x 1200	26.8	500 x 1000	39.4
300	278.8	1350	13.8			750 x 1000	26.3
375	178.4	1425	12.4			750 x 1200	21.9
450	123.9	1500	11.2			750 x 1500	17.5
525	91.0	1575	10.1			1000 x 1000	19.7
600	69.7	1650	9.2			1000 x 1200	16.4
675	55.1	1725	8.4			1000 x 1500	13.1
750	44.6	1800	7.7			1000 x 1800	10.9
825	36.9	1875	7.1			1000 x 2000	9.9
900	31.0	1950	6.6			1500 x 1500	8.8
975	26.4	2025	6.1			1500 x 1800	7.3
1050	22.8	2100	5.7			1500 x 2000	6.6



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Data:-

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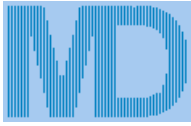
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Job No.		
Sheet no. 2		
Date 06/07/21		
By	Checked	Reviewed

Project	Polygon Road, Crumpsall
Title	Peak flow storage - 1 in 30 year

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	81.0	17.559	3.000	14.559
20	56.0	24.250	6.000	18.250
30	44.0	28.498	9.000	19.498
40	37.0	31.675	12.000	19.675
50	32.0	34.238	15.000	19.238
60	28.0	36.399	18.000	18.399
70	25.0	38.273	21.000	17.273
80	23.0	39.934	24.000	15.934
90	21.0	41.427	27.000	14.427
100	20.0	42.785	30.000	12.785
110	18.0	44.031	33.000	11.031
120	17.0	45.184	36.000	9.184
130	16.0	46.257	39.000	7.257
140	16.0	47.260	42.000	5.260
150	15.0	48.203	45.000	3.203
160	14.0	49.093	48.000	1.093
170	14.0	49.934	51.000	0.000
180	13.0	50.733	54.000	0.000
190	12.0	51.494	57.000	0.000
200	12.0	52.219	60.000	0.000
210	12.0	52.912	63.000	0.000
220	11.0	53.576	66.000	0.000
230	11.0	54.213	69.000	0.000
240	11.0	54.825	72.000	0.000
250	10.0	55.414	75.000	0.000
260	10.0	55.981	78.000	0.000
270	10.0	56.528	81.000	0.000
280	9.0	57.057	84.000	0.000
290	9.0	57.567	87.000	0.000
300	9.0	58.062	90.000	0.000
310	9.0	58.540	93.000	0.000
320	9.0	59.004	96.000	0.000
330	8.0	59.488	99.000	0.000
340	8.0	59.951	102.000	0.000
350	8.0	60.403	105.000	0.000
360	8.0	60.845	108.000	0.000
370	8.0	61.278	111.000	0.000
380	7.0	61.701	114.000	0.000
390	7.0	62.116	117.000	0.000
400	7.0	62.522	120.000	0.000
410	7.0	62.920	123.000	0.000
420	7.0	63.311	126.000	0.000
430	7.0	63.694	129.000	0.000
440	7.0	64.071	132.000	0.000
450	7.0	64.441	135.000	0.000
460	6.0	64.804	138.000	0.000
470	6.0	65.161	141.000	0.000
480	6.0	65.512	144.000	0.000
490	6.0	65.858	147.000	0.000
500	6.0	66.198	150.000	0.000
510	6.0	66.532	153.000	0.000
520	6.0	66.862	156.000	0.000
530	6.0	67.186	159.000	0.000
540	6.0	67.506	162.000	0.000
550	6.0	67.821	165.000	0.000
560	6.0	68.132	168.000	0.000
570	6.0	68.438	171.000	0.000
580	5.0	68.740	174.000	0.000
590	5.0	69.038	177.000	0.000
600	5.0	69.332	180.000	0.000

Storage volume (m³) = 19.7 m³



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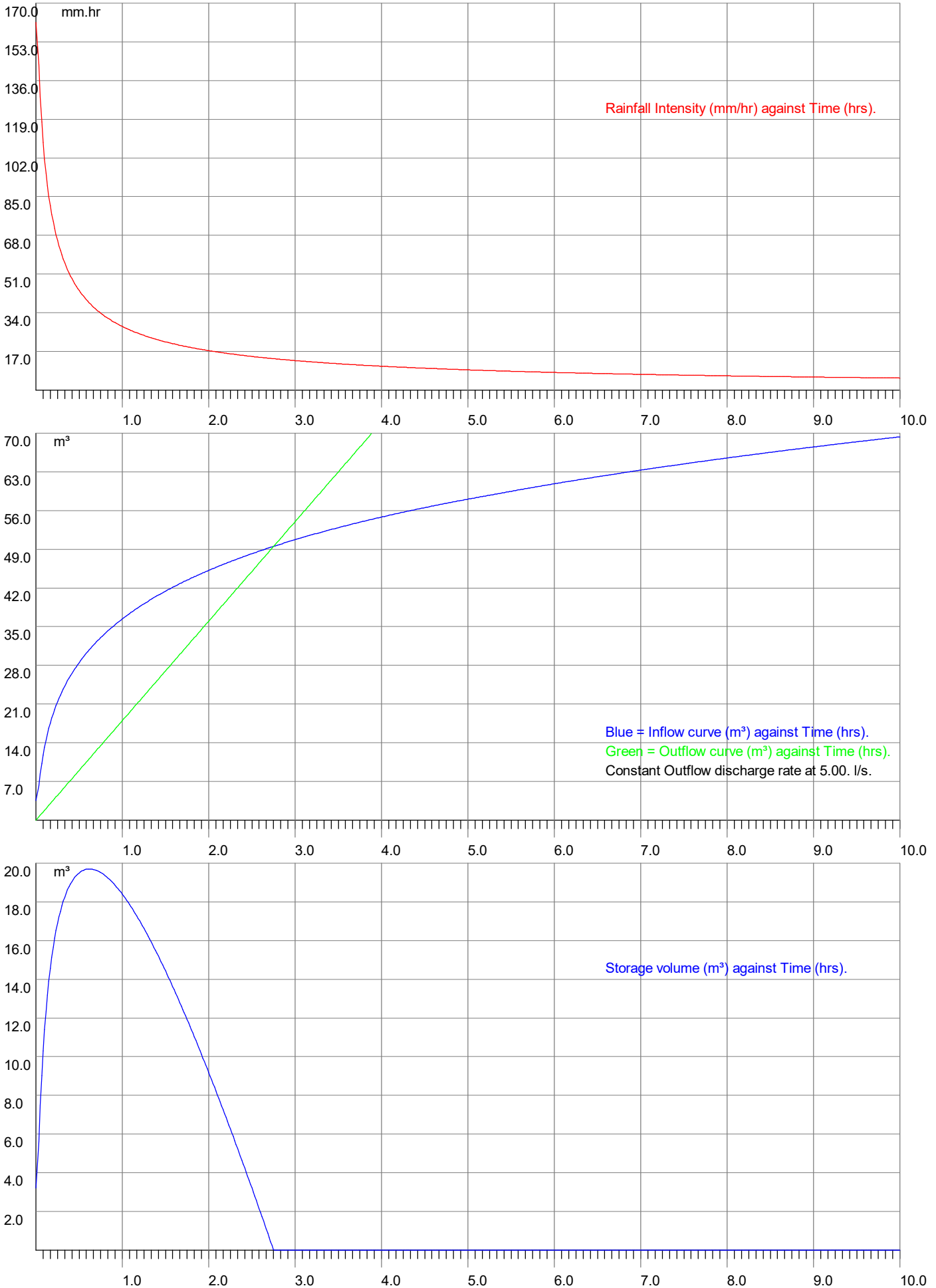
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Job No.		
Sheet no. 3		
Date 06/07/21		
By	Checked	Reviewed

Project **Polygon Road, Crumpsall**

Title **Peak flow storage - 1 in 30 year**





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Job No.		
Sheet no. 1		
Date 06/07/21		
By	Checked	Reviewed

Project	Polygon Road, Crumpsall
Title	Peak flow storage - 1 in 100 year + 20% CC

Data:-

FSR Hydrology:-

Location = Prestwich
M5-60 (mm) = 18.2
Soil index = 0.15
Return period = 100
UCWI = 105.3

Grid reference = SD8103
r = 0.35
SAAR (mm/yr) = 1000
WRAP = 1
Climate change = 20

- Well drained permeable sandy or loam soils and shallower analogues over highly permeable limestone, chalk, sandstone or related drifts;
- Earthy peat soils drained by dykes and pumps;
- Less permeable loamy over clayey soils on plateaux adjacent to very permeable soils in valleys.

Runoff factor (RF) = 70.0, calculated from:-

$$\text{Runoff factor} = (0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$$

where

PIMP = Impervious Area*100/(Impervious Area+Pervious Area)

UCWI = Calculated value for Wetness Index

Design data:-

Imperv. area = 1774 m²
Total area (TA) = 1859 m²
Allowed discharge rate = 5.000 l/s
Additional flow = 0.00 l/s

Pervious area = 85 m²
Equiv area = 1301 m² (TA x RF).
Areal reduction factor = 1.000
Climate change factor = 20

Calculated data:-

Time to max = 65.0 mins
Rainfall at max = 41.78 mm/hr
Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Calculated storage volume = 39.4 m³
Allowed discharge rate = 5.000 l/s
Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours
Rainfall rate = 12.00 mm/hr

Calculated storage volume = 0.0 m³
Allowed discharge rate = 5.000 l/s

Rainfall intensities calculated using the Wallingford Procedure

Storage lengths for initial calculation (x 1.1, 1.2, 1.3 or 1.5 as above if required) :-

Diam	Len	Diam	Len	Ovoid	Len	Box culvert	Len
100	5016.7	1125	39.6	400 x 600	218.9	500 x 500	157.6
150	2229.7	1200	34.8	600 x 900	95.3	500 x 750	105.1
225	991.0	1275	30.9	800 x 1200	53.6	500 x 1000	78.8
300	557.4	1350	27.5			750 x 1000	52.5
375	356.7	1425	24.7			750 x 1200	43.8
450	247.7	1500	22.3			750 x 1500	35.0
525	182.0	1575	20.2			1000 x 1000	39.4
600	139.4	1650	18.4			1000 x 1200	32.8
675	110.1	1725	16.9			1000 x 1500	26.3
750	89.2	1800	15.5			1000 x 1800	21.9
825	73.7	1875	14.3			1000 x 2000	19.7
900	61.9	1950	13.2			1500 x 1500	17.5
975	52.8	2025	12.2			1500 x 1800	14.6
1050	45.5	2100	11.4			1500 x 2000	13.1



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Data:-

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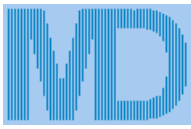
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Job No.		
Sheet no. 2		
Date 06/07/21		
By	Checked	Reviewed

Project	Polygon Road, Crumpsall
Title	Peak flow storage - 1 in 100 year + 20% CC

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	124.0	26.969	3.000	23.969
20	87.0	37.741	6.000	31.741
30	69.0	44.597	9.000	35.597
40	57.0	49.729	12.000	37.729
50	50.0	53.863	15.000	38.863
60	44.0	57.340	18.000	39.340
70	40.0	60.348	21.000	39.348
80	36.0	63.002	24.000	39.002
90	33.0	65.379	27.000	38.379
100	31.0	67.533	30.000	37.533
110	29.0	69.501	33.000	36.501
120	27.0	71.314	36.000	35.314
130	26.0	72.993	39.000	33.993
140	25.0	74.557	42.000	32.557
150	23.0	76.019	45.000	31.019
160	22.0	77.392	48.000	29.392
170	21.0	78.686	51.000	27.686
180	20.0	79.907	54.000	25.907
190	20.0	81.064	57.000	24.064
200	19.0	82.163	60.000	22.163
210	18.0	83.207	63.000	20.207
220	18.0	84.202	66.000	18.202
230	17.0	85.152	69.000	16.152
240	17.0	86.061	72.000	14.061
250	16.0	86.930	75.000	11.930
260	16.0	87.763	78.000	9.763
270	15.0	88.563	81.000	7.563
280	15.0	89.331	84.000	5.331
290	14.0	90.070	87.000	3.070
300	14.0	90.781	90.000	0.781
310	14.0	91.466	93.000	0.000
320	13.0	92.126	96.000	0.000
330	13.0	92.849	99.000	0.000
340	13.0	93.530	102.000	0.000
350	12.0	94.195	105.000	0.000
360	12.0	94.844	108.000	0.000
370	12.0	95.479	111.000	0.000
380	12.0	96.100	114.000	0.000
390	11.0	96.708	117.000	0.000
400	11.0	97.302	120.000	0.000
410	11.0	97.885	123.000	0.000
420	11.0	98.456	126.000	0.000
430	11.0	99.016	129.000	0.000
440	10.0	99.566	132.000	0.000
450	10.0	100.105	135.000	0.000
460	10.0	100.635	138.000	0.000
470	10.0	101.155	141.000	0.000
480	10.0	101.666	144.000	0.000
490	10.0	102.168	147.000	0.000
500	9.0	102.662	150.000	0.000
510	9.0	103.148	153.000	0.000
520	9.0	103.627	156.000	0.000
530	9.0	104.097	159.000	0.000
540	9.0	104.561	162.000	0.000
550	9.0	105.017	165.000	0.000
560	9.0	105.467	168.000	0.000
570	9.0	105.910	171.000	0.000
580	8.0	106.346	174.000	0.000
590	8.0	106.777	177.000	0.000
600	8.0	107.202	180.000	0.000

Storage volume (m³) = 39.4 m³



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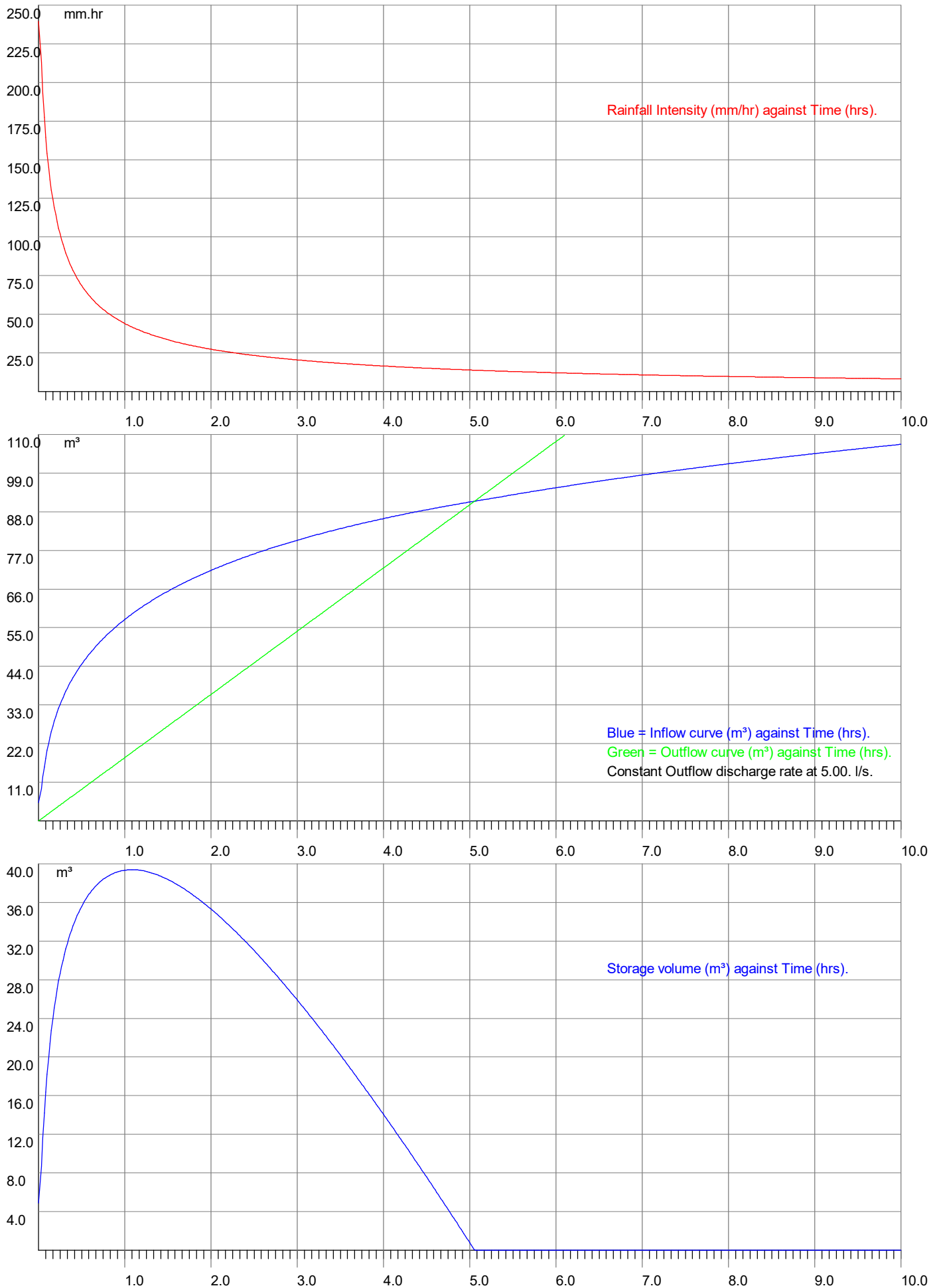
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Job No.		
Sheet no. 3		
Date 06/07/21		
By	Checked	Reviewed

Project **Polygon Road, Crumpsall**

Title **Peak flow storage - 1 in 100 year + 20% CC**





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Date 06/07/21		
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Project	Polygon Road, Crumpsall
Title	Peak flow storage - 1 in 100 year + 40% CC

Data:-

FSR Hydrology:-

Location = Prestwich
M5-60 (mm) = 18.2
Soil index = 0.15
Return period = 100
UCWI = 105.3

Grid reference = SD8103
r = 0.35
SAAR (mm/yr) = 1000
WRAP = 1
Climate change = 40

- Well drained permeable sandy or loam soils and shallower analogues over highly permeable limestone, chalk, sandstone or related drifts;
- Earthy peat soils drained by dykes and pumps;
- Less permeable loamy over clayey soils on plateaux adjacent to very permeable soils in valleys.

Runoff factor (RF) = 70.0, calculated from:-

$$\text{Runoff factor} = (0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$$

where

PIMP = Impervious Area * 100 / (Impervious Area + Pervious Area)

UCWI = Calculated value for Wetness Index

Design data:-

Imperv. area = 1774 m²
Total area (TA) = 1859 m²
Allowed discharge rate = 5.000 l/s
Additional flow = 0.00 l/s

Pervious area = 85 m²
Equiv area = 1301 m² (TA x RF).
Areal reduction factor = 1.000
Climate change factor = 40

Calculated data:-

Time to max = 78.0 mins
Rainfall at max = 43.10 mm/hr
Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Calculated storage volume = 49.5 m³
Allowed discharge rate = 5.000 l/s
Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours
Rainfall rate = 14.00 mm/hr

Calculated storage volume = 0.4 m³
Allowed discharge rate = 5.000 l/s

Rainfall intensities calculated using the Wallingford Procedure

Storage lengths for initial calculation (x 1.1, 1.2, 1.3 or 1.5 as above if required) :-

Diam	Len	Diam	Len	Ovoid	Len	Box culvert	Len
100	6305.1	1125	49.8	400 x 600	275.1	500 x 500	198.0
150	2802.3	1200	43.8	600 x 900	119.8	500 x 750	132.0
225	1245.5	1275	38.8	800 x 1200	67.4	500 x 1000	99.0
300	700.6	1350	34.6			750 x 1000	66.0
375	448.4	1425	31.1			750 x 1200	55.0
450	311.4	1500	28.0			750 x 1500	44.0
525	228.8	1575	25.4			1000 x 1000	49.5
600	175.1	1650	23.2			1000 x 1200	41.3
675	138.4	1725	21.2			1000 x 1500	33.0
750	112.1	1800	19.5			1000 x 1800	27.5
825	92.6	1875	17.9			1000 x 2000	24.8
900	77.8	1950	16.6			1500 x 1500	22.0
975	66.3	2025	15.4			1500 x 1800	18.3
1050	57.2	2100	14.3			1500 x 2000	16.5



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Data:-

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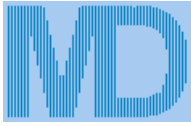
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Project	Polygon Road, Crumpsall
Title	Peak flow storage - 1 in 100 year + 40% CC

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	145.0	31.464	3.000	28.464
20	102.0	44.032	6.000	38.032
30	80.0	52.030	9.000	43.030
40	67.0	58.017	12.000	46.017
50	58.0	62.840	15.000	47.840
60	51.0	66.896	18.000	48.896
70	46.0	70.406	21.000	49.406
80	42.0	73.502	24.000	49.502
90	39.0	76.276	27.000	49.276
100	36.0	78.788	30.000	48.788
110	34.0	81.085	33.000	48.085
120	32.0	83.199	36.000	47.199
130	30.0	85.159	39.000	46.159
140	29.0	86.983	42.000	44.983
150	27.0	88.689	45.000	43.689
160	26.0	90.291	48.000	42.291
170	25.0	91.800	51.000	40.800
180	24.0	93.225	54.000	39.225
190	23.0	94.575	57.000	37.575
200	22.0	95.856	60.000	35.856
210	21.0	97.075	63.000	34.075
220	21.0	98.236	66.000	32.236
230	20.0	99.344	69.000	30.344
240	19.0	100.404	72.000	28.404
250	19.0	101.418	75.000	26.418
260	18.0	102.391	78.000	24.391
270	18.0	103.323	81.000	22.323
280	17.0	104.220	84.000	20.220
290	17.0	105.082	87.000	18.082
300	16.0	105.911	90.000	15.911
310	16.0	106.710	93.000	13.710
320	15.0	107.481	96.000	11.481
330	15.0	108.324	99.000	9.324
340	15.0	109.118	102.000	7.118
350	14.0	109.894	105.000	4.894
360	14.0	110.652	108.000	2.652
370	14.0	111.392	111.000	0.392
380	14.0	112.117	114.000	0.000
390	13.0	112.826	117.000	0.000
400	13.0	113.520	120.000	0.000
410	13.0	114.199	123.000	0.000
420	13.0	114.866	126.000	0.000
430	12.0	115.519	129.000	0.000
440	12.0	116.160	132.000	0.000
450	12.0	116.789	135.000	0.000
460	12.0	117.407	138.000	0.000
470	12.0	118.014	141.000	0.000
480	11.0	118.610	144.000	0.000
490	11.0	119.196	147.000	0.000
500	11.0	119.773	150.000	0.000
510	11.0	120.340	153.000	0.000
520	11.0	120.898	156.000	0.000
530	11.0	121.447	159.000	0.000
540	10.0	121.987	162.000	0.000
550	10.0	122.520	165.000	0.000
560	10.0	123.044	168.000	0.000
570	10.0	123.561	171.000	0.000
580	10.0	124.071	174.000	0.000
590	10.0	124.573	177.000	0.000
600	10.0	125.069	180.000	0.000

Storage volume (m³) = 49.5 m³



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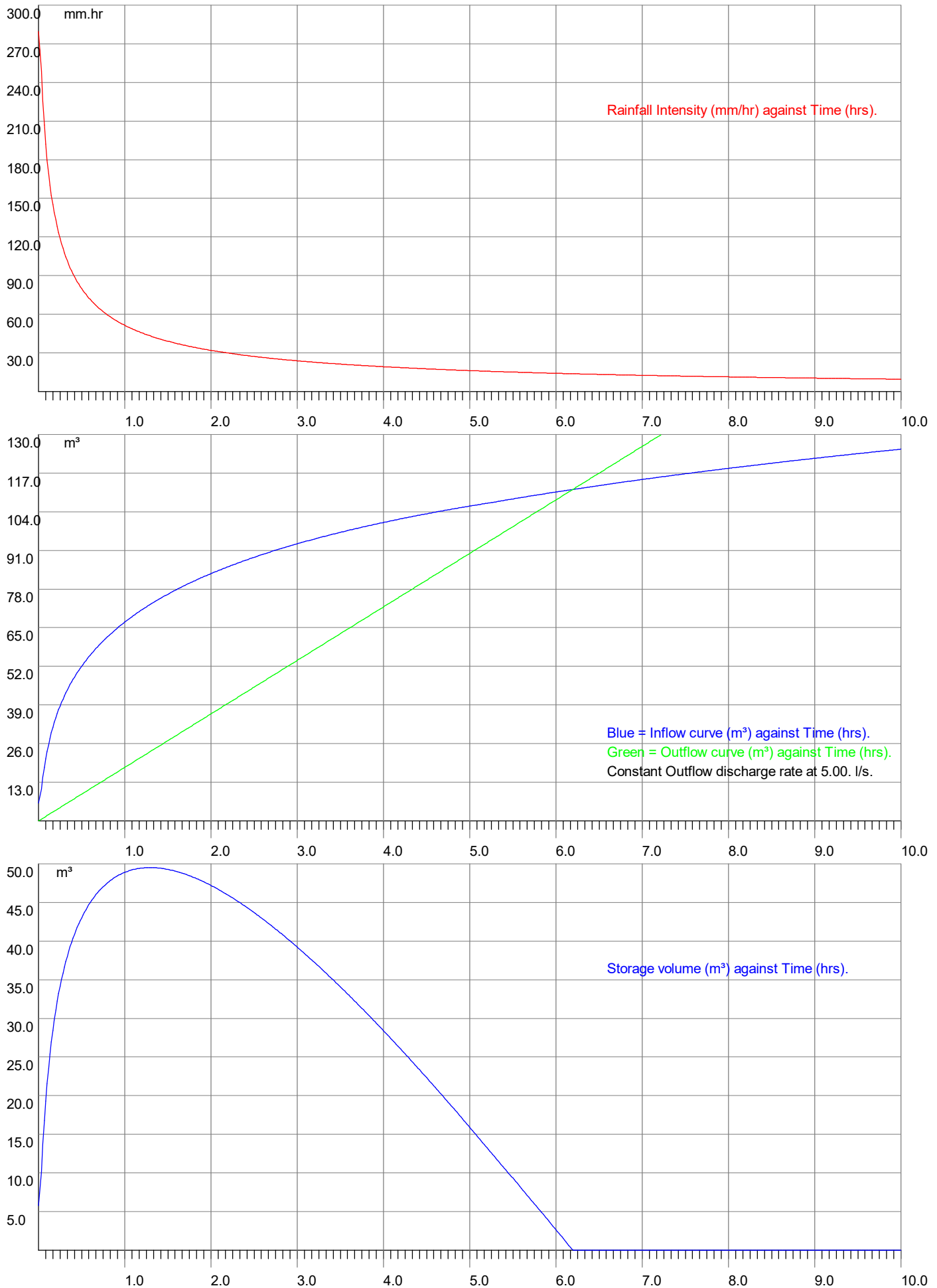
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Project **Polygon Road, Crumpsall**

Title **Peak flow storage - 1 in 100 year + 40% CC**





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Title Peak flow storage - 1 in 100 year + 40% CC					

Explanatory notes for Peak Flow Storage

- 1) This system uses the rainfall intensity/ duration curve calculated using either the Wallingford or FEH method as selected.
- 2) The balance is calculated from the inflow minus the outflow.
- 3) The storage volume is the maximum value of the balance curve.
- 4) This method was described by Davis (1963) - see Butler & Davies, 2nd edition, p294
- 5) References to 'storm duration' relate only to the hydrograph method (qv).
- 6) There are always 600 steps in the calculation process, thus a 'run' time of 10 hours will be sampled every minute,

Explanatory notes for Hydrograph Storage

- 1) The user has the choice of Summer or Winter curves
- 2) The mean intensity varies with the duration of the storm curve
- 3) There are always 120 steps in the calculation process, irrespective of storm duration.
- 4) The balance is calculated from the inflow minus the outflow.
- 5) The storage volume is the sum of the balance values for each step.
- 6) Varying durations should be tried to find the maximum storage value - this can be narrowed down very closely.

*Modelling using the flow characteristics of the restrictor is available using Vortex Control modelling function. Please be aware that this function needs the full design data file to function.

Why do the two methods give different results?

The rainfall characteristics for each method are very different.

The Peak flow (using the Intensity/Duration/Frequency curve) does not model the actual rainfall. This curve is joined points which represent the mean intensity of a storm at a given duration i.e. a value of 19.5 mm/hr for a 60 minute storm indicates that over the sixty minute period, the mean intensity was 19.5 mm/hr. The calculation method samples the IDF curve for a given location and frequency (Return Period) and calculates the storage for that rate and duration less the outflow volume. The maximum value is displayed as the 'worst case' storage.

The hydrograph method uses a standard curve for either Winter or Summer storms. Traditionally these are symmetrical about the central peak. UK rainfall does not fit into this convenient curve, so the calculations are dealing with a stylised set of data. The mean intensity for the storm is calculated from the IDF curve and applied to the curve data, calculating the storage for that step less the outflow volume. The final storage volume is the sum of the storage for all the steps.

It can be seen that these two methods are very different, and the user may have the choice of which result to use. This is not an exact science, though is often treated as such by those that do not understand the principles of the calculations.

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