

ASHFIELD LODGE DIDSBURY, MANCHESTER

FLOOD RISK ASSESSMENT & OUTLINE DRAINAGE STRATEGY

Job Number: FRA 19 1055

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Client: Ashfield Lodge Management
Company Ltd.



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Prepared By	Mark Jones - Associate	Signature	
Reviewed By	Mathew Craig – Environmental Scientist	Signature	

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EXECUTIVE SUMMARY

Scope and Background

This Flood Risk Assessment and Outline Drainage Strategy (FRA) has been undertaken by LK Consult Ltd (LKC) to support a planning application for the re-development of an existing property at Ashfield Lodge, Didsbury. The development comprises of the redevelopment of an existing property and will not cause any intensification.

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

In considering the proposals the following key principles have therefore been applied:

- Identification of flood risks.
- Protection of users of the new development.
- No increased flood risk to third parties.

Consultations

The Environment Agency (EA) has been consulted to inform the preparation of this report. They have provided a more detailed flood map with modelled data.

Manchester City Council and United Utilities were also consulted concerning flood risk.

All relevant consultees have confirmed that there is a Negligible to Low risk of flooding to this site from all sources except Fluvial.

Flood Risk

Environment Agency flood maps indicate that the site is potentially vulnerable to fluvial flooding from the River Mersey, west of the site.

The site is shown on the Environment Agency's (EA) website Flood Zone Mapping as being in Flood Zone 3 (PPG Table 1).

The site is in Flood Zone 3 – Medium to High risk - annual probability of flooding of 1.0% or greater from rivers.

However, comparison of modelled flood level data with the topographic survey shows that the floor level of the existing property is above the existing predicted flood levels for both the defended and undefended situations for all of the specified events.

There are Low Risks of flooding from Pluvial, Surface Water, Ground Water and Artificial Sources.

Mitigation

Design

Site falls will be arranged to allow reasonably level access for occupants and visitors and allowing the site to be free-draining in case of local ponding at times of heavy rainfall. Floor levels of dwelling will be set as high as possible above the flood level giving regard to necessary access for the less-able.

The development will result in a slight reduction in flood plain storage compared to the existing situation for the defended situation due to the increase in footprint. The site is constrained, and the only available area would be beneath the building or a depression within the remainder greenspace following the development. The storage loss would be less than 10m³ for the defended flood event. As the area is defended up the 75 year level it is likely that water would become trapped within the site for some time and may cause an increased risk of flooding and other risks. In this case it is not proposed to provide flood compensation volume.

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

The proposed development will increase the proportion of the site covered by impermeable surfaces and will therefore generate more runoff. Attenuation will therefore be required.

Foul sewage arising from the development will be discharged into the existing private combined sewer in the access road leading to Palatine Road.

The outline drainage strategy considers the use of attenuation-based SuDS to be feasible with a discharge to the existing sewer to the north of the site. Therefore, the most effective strategy, in line with the SuDS management train, would be to have a detention facility towards the northwest corner. The required detention tank or similar has been estimated to be **0.1m³** for the 1 in 30-year flow restriction.

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 **0.4m³** and **0.7m³**. This is likely to be accommodated within the proposed surface water drainage system with a suitable flow restriction prior to discharge.

The site is considered to be at medium risk of flooding. It is recommended that the minimum finished floor levels for the development should be set at a minimum of 30.05m AOD.

Access

Access close to the site is close to the predicted 1.0% flood levels and an evacuation plan will need to be considered for the future safe access to and from the site from Palatine Road. There is an area just to the east of the proposed development that is also above the 1.0% flood levels within the Ashfield Lodge Park area. As potential flood levels increase over the lifetime of the development the depth of flooding will increase to allow for climate change a safe access plan should be developed.

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1 Introduction

1.1 Background

LK Consult Ltd (LKC) were commissioned by Ashfield Lodge Management Company Ltd to carry out a Flood Risk Assessment (FRA) and Outline Drainage Strategy for the Ashfield Lodge replacement. The report was undertaken in support of a planning application to replace the existing building with continued residential use.

The report will address the vulnerability to flooding from all possible sources and will also consider the impact of the development on surface water runoff accounting for climate change and the potential to increase flood risk elsewhere, Section 4. The Outline Drainage Strategy in Section 5 will provide an overview of the SuDS techniques which could be considered on the site.

Government policy with respect to development in flood risk areas is contained within the Department of Communities and Local Government National Planning Policy Framework¹ and accompanying Technical Guidance of March 2012 (revised to the Planning Practice Guidance (PPG)², which supersedes Planning Policy Statement 25 (PPS25) 'Development and Flood Risk'. The guidance on Climate Change allowance issued by the Environment Agency in February 2016 has also been considered.

LKC has prepared this Flood Risk Assessment (FRA) in line with the NPPF and the PPG where appropriate. The level of detail entered into any flood risk assessment is dependent upon the scale and potential impact of the proposed development, and the vulnerability classification of the proposed land-use.

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.

Site Details	
Location	Ashfield Lodge off Palatine Road, West Didsbury, M20 2UD. To the north of Withington Golf Club. Centred at approximate National Grid Reference 383685E 390970N.
Area	Approximately 250m ² .
Topography	29.5 metres above ordnance datum (AOD) in the northwest of the site and 29.0m AOD in the southeast. Site is sloping down gently to the south.
Current Land Use	<u>Site</u> Existing bungalow raised up above the surrounding ground and road. Small landscaped area to the rear and sides. <u>Surrounding Area/ Boundary Treatment</u> North: Access road. East: Landscaped area and Ashfield Lodge buildings. South: Golf club. West: Landscaped area and Palatine Road.
Proposed Development	Single 3 story residential property including soft landscaping and car parking. Access will be from the existing access road.

Table 1-1: Summary of site details.

¹ DCLG (2019). "National Planning Policy Framework." Department of Communities and Local Government. February 2019.

² DCLG (2014). "Planning Practice Guidance" <http://planningguidance.communities.gov.uk>, April 2014.

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2 Site Setting

2.1 Vulnerability

As an initial phase in identifying whether a site is potentially at risk of flooding, LKC has consulted the Environment Agency's (EA) website Flood Zone Mapping. This mapping is (often) based on coarse scale modelling and provides only an initial indication of the flood risk to a site. The Environment Agency Flood Zone maps were developed using a very coarse Digital Elevation Map (DEM) and are superseded by a more detailed analysis of modelled flood levels and topographic survey levels.

The Flood Zones divide the floodplain into three categories of flood risk, and do not take flood defences into account. The NPPF defines the Flood Zones as:

- Flood Zone 1 – little or no risk, with annual probability of flooding from rivers and the sea of less than 0.1% (1 in 1000).
- Flood Zone 2 – low to medium risk, with annual probability of flooding of 0.1 to 1.0% from rivers and 0.1 to 0.5% from the sea.
- Flood Zone 3 – high risk of flooding with an annual probability of flooding of 1.0% or greater from rivers, and 0.5% or greater from the sea.

The Flood Zone Mapping indicates the site as being within Flood Zone 3 in the PPG (paragraph 065, Table 1).

The development site is in (Flood Zone 3), so under current regulations a Flood Risk Assessment will be necessary to accompany the Planning Application.

The proposed development is for a residential/health/educational/mixed end use and this is classified within the 'More Vulnerable' category in the PPG (paragraph 066, Table 2).

2.2 The Sequential and Exception Tests

The NPPF requires that the Sequential Test be applied to development proposals in Flood Zones 2 or 3 to determine if there are any 'reasonably available' and suitable alternative sites at lower flood risk. The Sequential Test is outside this scope of works and shall be undertaken by others.

Notwithstanding the above, the principles outlined in the Sequential Test guidance should be applied for developments within the site such that, for example, dwellings are situated on a high part of the site when there is a risk of local surface water flooding. The issues of actual flood risk are discussed below. The issues of safety and reduction in flood risk to others required by an Exception Test are also addressed in this document.

The Local Planning Authority (LPA) will make the final decision with regard to any planning application.

2.3 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	Alluvium.
	Bedrock	Wilmslow Sandstone Formation.
	BGS Boreholes	BH Ref: SJ89SW135A, 500m east: Loamy Clay to 3.0m, Gravel to 9m, Clay below. BH Ref: SJ89SW35A, 500m east: Topsoil to 1m, Boulder Clay with stones to 6.5m, Gravel to 7.5m, Sand to 14m, with sandstone below. BH Ref: 89SW84, 450m south: Silty Clay to 1m, Sandy Brown Clay to 3m, Firm grey Silty Clay, to 5.5m, Sand below.
Hydrogeology	Superficial	Secondary A
	Bedrock	Principal Not in a Source Protection Zone
Hydrology	All adjacent and internal surface water	River Mersey 270m to the west flowing north. Fielden Park Brook 60m to the south. Pond to the north of Ashfield Lodge access road.
Site History		The site is part of the Ashfield Lodge residential development and is a former gatehouse. It is currently a bungalow.

Table 2-1: Summary of the Environmental Setting.

2.4 Site Reconnaissance

A site reconnaissance was undertaken in July 2019.

- » The site is currently a bungalow and is raised above the adjacent footpath.
- » The site is within a landscaped area of the Ashfield Lodge Gated Development.
- » There is an existing drainage connection from the site towards the access road.
- » There are steps up to the ground floor level. site is currently a bungalow and is raised above the adjacent footpath.
- » The site size is limited and backs onto the golf course
- » The parking for the site is in marked bays opposite the building.
- » The site relatively flat with a slight fall to the southeast.

2.5 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 falls slightly to the southeast. The final site levels and ground floor levels of dwellings have not yet been determined. The proposed access would join the access road at 29.35m AOD.

3 Consultation

Information from consultees (Environment Agency (EA), Manchester City Council, United Utilities) is summarised in Table 3-1 below.

Relevant correspondence / information is provided in Appendices C (EA) and D (others).

For modelled levels refer to extracted Level table and node location map in Appendix C.

Source	Details	
Environment Agency	Flood Zone 3: Medium risk of flooding with an annual probability of flooding of 1.0% or greater from rivers, and 0.5% or greater from the sea.	
	Modelled Levels for River Mersey and its tributary Fielden Park Brook Nearest Node: 3	<u>Undefended</u> Level of 28.73m for 1% annual probability event. Level of 28.85m for 1% event with 35% climate change allowance. Level of 29.57m for 1% event with 70% climate change allowance Level of 29.66m for 0.1% annual probability event. <u>Defended</u> Level of 29.45m for 1% annual probability event. Level of 29.75m for 1% event with 35% climate change allowance. Level of 29.90m for 1% event with 70% climate change allowance Level of 29.93m for 0.1% annual probability event.
		Records of Flooding
		No records of flooding.
		Records of Flood Warning Service
		The site is within a flood alert service area.
		Surface Water Flooding
Manchester City Council (Lead Local Flood Authority)	No historic records of flooding in the area. The site is within the Didsbury Critical Drainage area.	Very low risk of surface water flooding
		Flooding from reservoirs
		At risk of flooding from reservoirs.
		Groundwater Source Protection Zone
		Not within Source Protection Zone.

Table 3-1: Summary consultee information.

Source	Details	
United Utilities	Likely conditions for connecting into their sewerage system	United Utilities have requested that consideration be given to the SuDS hierarchy within the Building Regulations with surface water draining to soakaway/SuDS, watercourse or surface water sewer before connecting to the combined sewer. With flows restricted to 5l/s if there is no alternative to discharging to the combined sewer. UU was also contacted regarding sewer flooding history for the site. UU 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. UU have confirmed foul flows can be connected at an unrestricted rate.
	Sewer Map	No surface water sewers running parallel to the site's boundary along the access road. A combined sewer runs along the access road and connects into an oval 600mm by 750mm sewer in Palatine Road. There is a 525mm diameter surface water pipe flowing southwest along Palatine Road.
Strategic Flood Risk Assessment (SFRA)	Level 1 SFRA ³	The site has no history of flooding from any source. The site is within a critical drainage area. The area is shown within an area at risk of groundwater flooding.
	Level 2 SFRA ⁴	The site has no history of flooding from any source.
Preliminary Flood Risk Assessment (PFRA) ⁵	The Preliminary Flood Risk Assessment (PFRA) ³ for the area indicates that there are no records of flooding for the area which conforms with information supplied by the EA.	

Table 3-1 (continued): Summary consultee information.

³ Strategic Flood Risk Assessment Level 1: Manchester City, Salford City, Trafford Councils; March 2010, JBA Consulting Ltd.

⁴ Strategic Flood Risk Assessment Hybrid Level 2: Manchester City, Salford City, Trafford Councils; March 2011, JBA Consulting Ltd

⁵ Preliminary Flood Risk Assessment: Manchester City Council; June 2011, JBA Consulting.

4 Assessment of Flood Risk

4.1 Flood Zones

The detailed flood map provided by the EA indicates that the site is in Flood Zone 3 (see Appendix C).

A direct comparison was made between the provided EA flood levels at this location and the topographical levels shows that the site is approximately the same level at the 1.0% flood level for the defended scenario but above the undefended scenario.

The EA design flood levels are marginally higher than the site. It can be reasonably concluded on the evidence above that the site is in Flood Zone 3 for the purposes of this assessment.

Comparison of the modelling data and topographical survey indicates that the 1% (100-year plus 35%) flood level would still affect part of the site for the defended scenario only.

4.2 Sources of Flooding

The risk of flooding from the following flood sources has been considered:

Fluvial – The EA has confirmed the study area is within Flood Zone 3. Therefore, the flood risk associated with this source is considered Medium and should be considered further in terms of vulnerability and flood resilience.

Tidal – The study area is remote from the sea and tidally influenced water bodies. Therefore, the flood risk associated with this source is considered Negligible.

Pluvial (Rainfall) – The surface water flood risk maps show small areas that have the potential to flood during prolonged heavy rainfall. These areas are associated with natural depressions that are likely to be removed/positively drained following the development process. These areas need consideration within the detailed design or there is the potential to have areas of standing water in gardens and landscaped areas not positively drained if overland flow routes are not considered. Therefore, the risk of flooding from surface water flooding is Low but should be considered further during the detailed design.

Surface Water (Overland flow) - The only observed impermeable area at a level generally above that of the study area is the access road to either side. There is a local dip in the in the access adjacent to the site. Any surface water arising from the road is likely to be intercepted by the highway drains and therefore pose little threat to the development. If there was a drainage failure causing overland flow it would flow towards the southern boundary. Therefore, the risk of flooding from surface water flooding is Low but should be considered further during the detailed design.

Groundwater – The BGS has groundwater records for the study area in the form of borehole records. The records show the water table is recorded within the sand and gravel layer below the upper layer of clay. There are no potential sources of Artesian Pressure to force the water to spring in the area. This makes it unlikely for groundwater flooding to occur at the surface but there may be some below the ground level. Therefore, the flood risk associated with this source is considered Low.

Sewers – United Utilities sewer records show no foul and surface water sewers adjacent to the site but a private connection runs along the access road draining the Ashfield Lodge flats. The site has an existing connection to this sewer which in turn connects to the combined sewer in Palatine Road. The Pre-development Enquiry records no sewer flooding incidents. The highway drainage to the front of the property would intercept any overland flow before it enters the site. Therefore, the flood risk associated with this source is considered Very Low.

Artificial sources – According to the EA online maps, the study area is at risk from reservoir flooding. The likely risk of an incident occurring if the reservoir is adequately maintained and monitored is low. Therefore, the flood risk associated with this source is considered Low.

4.3 Summary of Flood Risk

Source of Flooding	Risk Assessment Level
Fluvial	Medium
Pluvial (Rainfall)	Low
Surface Water	Low
Tidal	Negligible
Groundwater	Low
Sewers	Very Low
Artificial Sources	Low

Table 4-1: Summary of Existing Risk Level.

The site is located within Flood Zone 3 and a Medium risk of flooding from fluvial flooding and a Low to Negligible risk from other sources of flooding sources have been identified for the site. LKC therefore consider that a strategy for surface water management will be required at the site to mitigate the risk to others. The assessments of a range of measures that are feasible for the site are outlined in Section 5.

5 Surface Water Management

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 H3⁶ 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 2010⁷.

5.1 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 5-1 below:

Classification	Description	Aquifer Classification	Recorded Water Table Depth	Soakaway Potential
Alluvium	Silt, sand gravel and clay layers	Secondary A	Varies	Limited
Wilmslow Sandstone Formation	Sandstone	Principal	N/A	Good

Table 5-1: Geological and Hydrogeological Setting.

The borehole records record a layer of clay based soils below the surface with a waterlogged gravel layer below. Infiltration methods such as soakaways are unlikely

⁶ Building Regulations part H3 2010: Approved Document, Drainage and Waste Disposal.

⁷ Flood and Water Management Act 2010: UK Government.

to be feasible, but this may be investigated further at the detailed design stage if required.

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

There are no surface water sewers within the vicinity of the site.

The existing building drains to the existing private combined sewer running along the access road flowing northwest.

5.2 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 5-2 in order of priority within the NPPF:

Option No:	Drainage Solution	Most feasible solution	Comments
a	Soakaway/Infiltration	3	Low permeability in upper layers with granular layers below within the water table.
b	Connection to Watercourse	2	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	The depth of the private sewer on adjacent to the site indicate that a connection is possible – subject to approval from LLFA/UU.

Table 5-2: Drainage options.

Table 5-3 provides a summary of the SuDS options appraisal with consideration of CIRIA C697 (The SUDS Manual)⁸ for the development:

⁸ CIRIA C697 - The SUDS Manual. London 2015.

SuDS Option	Appropriate to Development	Comments
Soakaways	X	Due to the nature of the ground conditions, the use of infiltration systems may not be feasible.
Infiltration basin	X	Depressions that store and dispose of water via infiltration. May not 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. A filter strip offers no storage and is used solely to remove pollutants from surface water. the runoff will be basically roof water.
Filter drains	X	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. Limited site area.
Swales	X	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. Limited space.
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 5-3: 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

5.3 Surface Water Attenuation Requirements

From correspondence with the LPA the flow should be reduced by 50% within a critical drainage area for estimating the attenuation volumes required. United Utilities have also limited the flow to 5l/s if no other form of SuDS is appropriate.

It is estimated from the supplied plan (see Appendix A) that the site will have the following designated areas (Table 5-4). Table 5-4 shows the assumed split in area included within the calculations.

Designated Areas	Plot Area
Total area (ha)	0.025
Existing Impermeable Area (ha)	0.010
Existing Green Infrastructure (ha)	0.015
Proposed Areas	
Impermeable split (ha)	0.017
Permeable split (ha)	0.008

Table 5-4: Assumed plot areas.

5.3.1 Attenuation Estimate

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

For the contributing catchment an estimate has been produced assuming an existing building area of 0.010ha and a green space of 0.015ha from the 0.025ha plot. This gives the following existing runoff rates and attenuation requirements for this section based on the Wallingford method:

Q _{bar} :	1.2 l/s
1 in 1-year runoff rate:	0.8 l/s
1 in 30-year runoff rate:	2.1 l/s
1 in 100-year runoff rate:	2.7 l/s

A reduction of 50% would give the following flows:

Q _{bar} :	0.6 l/s
1 in 1-year greenfield runoff rate:	0.4 l/s
1 in 30-year greenfield runoff rate:	1.0 l/s
1 in 100-year greenfield runoff rate:	1.3 l/s

The minimum practical discharge quoted by the current EA guidance is 5l/s. United Utilities has specified an allowable discharge rate of 5l/s to the existing combined drain.

All runoff estimates and subsequent storage estimates are included in Appendix E.

The following attenuation has been estimated for the development using a 5l/s maximum runoff rate and utilises the FSR methodology⁹ as:

- Attenuation storage volume: **0.1 m³** (1 in 30-year event)
- Retention on site volume: **0.4 m³** (1 in 100 year + 20% Climate Change)
- Retention on site volume: **0.7 m³** (1 in 100 year + 40% Climate Change)

⁹ Flood Studies Report Wallingford NERC 1975.

Attenuation storage aims to limit the peak rate of runoff from the development to the corresponding reduced runoff for a range of annual flow rate probabilities before discharge to the sewer. As the flow from the development would be restricted there should be little change in the flows that enter the private 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 **0.1 m³** and for the 1 in 100-year event, a storage capacity of between **0.4 m³** and **0.7 m³** will be required from on-site storage. All volumes can be stored within the site boundary and discharges will be limited by a flow control devices to the adjacent sewer.

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 area.

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.

5.4 Foul Drainage

United Utilities have confirmed that the foul water could be discharged by gravity into the existing combined sewer at an unrestricted rate.

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6 Mitigation Measures

6.1 Proposed Site levels and Developments Level

Current Environment Agency guidance recommends that the minimum ground floor levels of residential developments are set at an appropriate level above the 1% annual probability (1 in 100 year) flood level including an additional fluvial allowance for climate change. It is generally accepted that vehicle parking can be accommodated within the flood zone with suitable safeguards. The 'design' flood level for the site should therefore be the 1% annual probability event with allowance for climate change plus an allowance for freeboard.

The site is above the undefended 100 year + 35% climate change flood level and at a similar level to the estimated defended 100 year flood level. The site is also at the edge of the flood zone extent. It is considered that an additional freeboard is appropriate to the highest of the 100 year + 35% climate change flood scenarios. The existing floor level of 29.97m is above the 1000 year event levels and the 100 year plus 70% climate change levels. The site is towards the outer edge of the current flood zones shown on the EA mapping. The undefended flood levels are below the defended flood levels for all the events considered.

As this is a replacement dwelling there should be no intensification of development, the site is limited in size with the proposed development covering the majority of the site. Currently there is no refuge on upper levels for the bungalow, but upper levels are to be included in the proposals, so safe refuge will be available.

On the basis of the information provided, the existing defended flood level should be taken as 29.45m AOD. Normal Environment Agency recommendation is to set ground floor level for the development with a freeboard above the 'design' level, or 29.75m AOD the 100 year + 35% climate change flood level. Consideration must also be given to the potential effect of the 100 year plus 70% climate change flood level of 29.90m AOD. The lowest levels on site have an approximate level of 29.3m AOD which is below the potential flood levels.

The existing property has an existing floor level that is raised above the surrounding ground at 29.97m. This is higher than all the modelled defended and undefended flood levels up to and including the predicted 1000 year flood levels. In consideration of the above a freeboard of 300mm should be added to the design flood level to allow for uncertainties in the modelling information for the finished floor level. This would lift the proposed Finished Floor Level to 30.05m AOD.

6.2 Safe Access

Safe and dry access is not available via the access road (29.4m AOD) to the east or west at 0.050m below the 1% defended annual probability event (29.45m AOD). The existing vehicular access is within the edge of Flood Zone 3. Either side of the property the footpath climbs above the current 100 year defended flood level. Therefore, a formal evacuation plan may be required, to allow for climate change flood levels.

6.3 Flood Resistance and Resilience

The development proposed may be subject to flooding at more extreme events than those considered. Flood resilience measures should be included into ground floor construction to aid recovery after any event. If utilised, typical measures would include solid floors, use of suitable materials and services fed from upper floors with outlets at

high level. The need can be discussed and agreed with building control officers during detailed design.

6.4 Residual Risk

It is impossible to completely guard against flooding since extreme events greater than the design standard event are always possible. However, ground floor levels should be set 300mm above the modelled 1% plus 35% climate change event level. This is above the predicted 100 year plus 70% climate change and 1000 year event flood levels. Overland flow routes should be considered in case of drainage failure and the extreme events.

7 Conclusions

The site is shown on published mapping to be located within the Environment Agency's Flood Zone 3. Comparison of topographical data with the EA modelled flood level data indicates that the ground level of the site is in Flood Zone 3 – Medium Risk of fluvial flooding.

Low risks of flooding from pluvial, groundwater and artificial sources have been identified from information provided by the EA, UU and BGS.

An assessment of these risks in conjunction with the development proposals have resulted in the following recommendations for the safe development of the site:

- » The recommended minimum finished floor level is 30.05m. This is 300mm above the 1% plus 35% climate change level and above the 1% + 70% climate change level.
- » Pedestrian and vehicular safe access to and from the site is just below the current 100 year defended flood levels via the access road. Over time it is likely that the potential level of flooding will increase so an evacuation plan should be developed.
- » Potential for soakaway use for rainwater disposal is low due to the potential shallow groundwater level and the constraints of the site; however, this could be investigated further at the detailed design phase if required.
- » Foul sewage could be discharged into the existing public combined sewer in Palatine Road via the existing sewer subject to the agreement of United Utilities.
- » Surface water flow will probably need to be attenuated to the 5l/s runoff rate or a rate agreed with the LLFA and United Utilities.
- » Surface water arising from the site could potentially discharge into the private connection to the combined sewer.
- » A formal evacuation plan is considered to be required to allow for potential climate change .

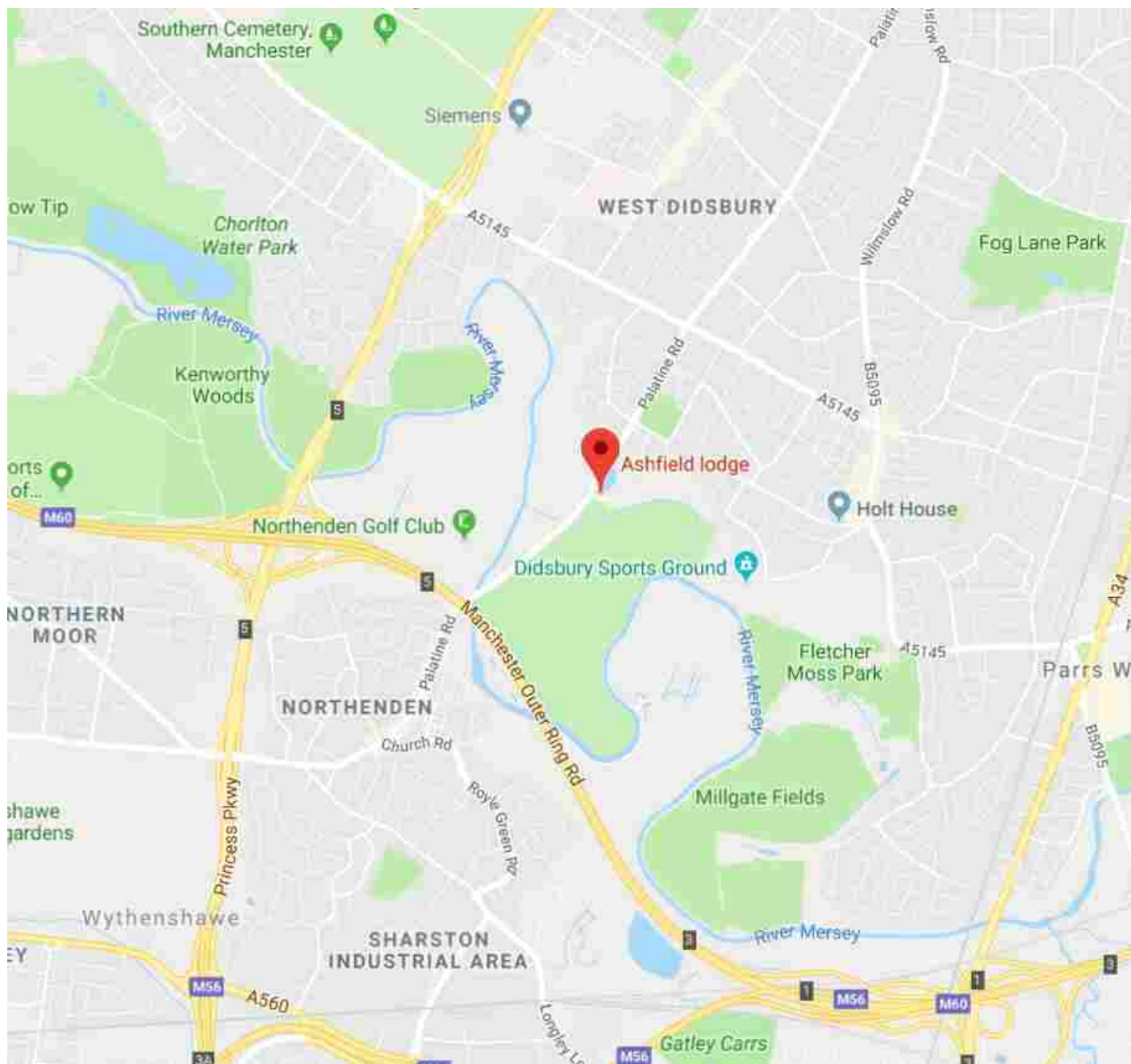
Further details on the proposed mitigation measures are provided in Section 6. All proposed measures should be agreed with the Local Authority prior to commencement of the development.

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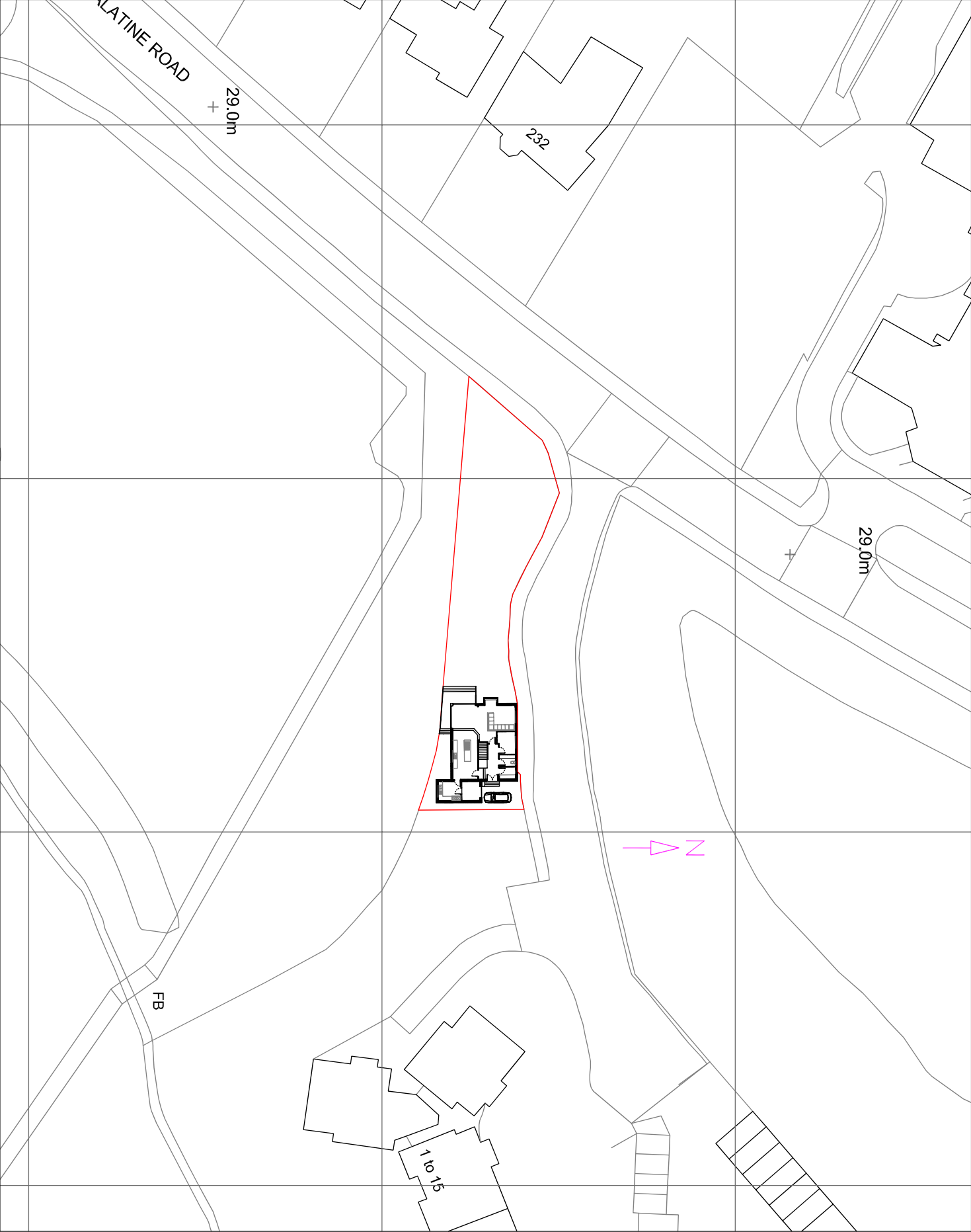
Appendix A

Plans and Figures

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Note to contractor
Contractor to check all dimensions on site. Do not scale from this drawing. All materials and works to comply with BS EN standards as appropriate and to meet Building Control approvals. Services to comply with L8 water regulations, current gas and electricity supply regulations. All materials are to be new, unless otherwise described. This drawing to be read in conjunction with all other contract drawings and documents and also in conjunction where relevant with Mechanical & Electrical details and drawings. All works are to be carried out in compliance with CDM 2016 Regulations and all other Health and Safety legislation.



DO NOT SCALE

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email: info@surveydesignbuild.com

PROJECT Ashfiled Lodge Bungalow M20 2UD			Site Plan	
DRAWN NMM	DATE MAR 19	SCALE 1:500 A3	DRAWING NUMBER 201906[00]03	CHECKED REVISION 1.1

Appendix B

Site Information

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2

WELL BORING at

Didbury Golf Club, Norden, Lancs.

County Lancs

Geol. map

1 in. map New Series 98.

6 in. map

111 SW/E 45

Made by Messrs. Wm. Matthews

Date 1921

Sunk

feet.

Bored

31 feet.

Communicated by Messrs W. Matthews, Widdes to L.R.T.

Rest level of water 6 ft.

Height above Ordnance Datum

Yield

Quality (with copy of analysis on separate sheet)

No good for drinking

SJ 8395 9046

GEOLOGICAL FORMATION.	NATURE OF STRATA.	THICKNESS.		DEPTH.	
		Feet.	Inches.	Feet.	Inches.
Drift	Loamy clay	10		10	-
Dr N.A. 11.4.78	Gravel	20	-	30	-
	Clay	1	-	31	-
5½" diam. boring 5½" outside diam. jointed tiles to 30 ft. Bottom 8 ft. perforated 4" sand screen inside tiles from 20 ft to bottom.					
Visited. Bore now disused and top of bone pipe concreted. Before main water was laid on, this was used for water at Club House for all purposes except drinking. Rotary pump took 2 hrs to fill 500 gallon tank. Never any shortage. O.D. +88. R.W.L. said to be about 6 ft below surface. 7/6/56. R.E.A.					
Sited by © on 6" map Lancs III SW/E.					

[illegible]

GEO-RESEARCH LTD. CALE STREET, CALE GREEN, STOCKPORT, CHESHIRE.				SJ 89 SW 84 8334 9066		Borehole No. 39 Sheet No. 1 Date Commenced 3.5.66 Date Completed 8.4.66 Scale 1/4" = 1 foot	
CONTRACT: Sale Eastern By-Pass LOCATION: MANCHESTER							
Stratum	Legend	Thick- ness	Depth	Sample No.	N Value	Level	Remarks
			G. L.			91.45	
Black top soil		0'6"	0'6"			91.95	
Firm brown laminat ed silty clay		2'0"	1'0"	D1		91.95	Moist
Soft to firm sandy brown with small stone inclusions			2'6"	U1			
			3'0"				
			8'0"	U2			
		6'6"	9'0"			85.45	
Soft dark grey silty clay with fine traces of vegetation			10'0"	D2			Moist
			13'0"	U3			
		5'0"	14'0"			80.45	
Soft silty brown clay with traces of fibrous vegetation and sand			17'0"	D3			Water struck @ 18'0"
		4'0"	18'0"	P1	4	76.45	After 15 mins. SWL 16'0"
Loose coarse well-graded brown sand		2'0"	20'0"			74.45	W1: 13'0"
Loose coarse well-graded brown sand			21'0"	P2	9		
			24'0"	P3	10		
		6'0"	26'0"			68.45	
Very dense gravel with coarse well-graded sand			27'0"	P4	66		3.8.66: 6pm BH @ 2'
		2'6"	28'6"			65.95	Casing @ 25'0" SWL
Borehole continued							4.8.66: 8.10am SWL

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Appendix C

Environment Agency Data

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Mark Jones

From: GMMC Info Requests <InfoRequests.GMMC@environment-agency.gov.uk>
Sent: 15 July 2019 16:03
To: Matthew Craig
Subject: GMMC134408CC Response from the EA
Attachments: GMMC134408CC_Def.pdf; GMMC134408CC_DFM.pdf; GMMC134408CC_P4.pdf; GMMC134408CC_Res.pdf; Reservoir Flood Map Attachment.pdf; Visual condition grading of FCRM assets - Feb 13.pdf; CCA - Area External Guidance v5.pdf

Dear Matthew

Thank you for your enquiry which was received on 10 July 2019

We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004.

Please see attached and supporting comments below:

We have no record of flooding affecting this site. However, this does not mean flooding has not occurred in the past or that it will not flood in future. We recommend that you also contact United Utilities and Manchester Metropolitan District Authority who may hold additional information (the former especially in relation to sewer flooding).

Please be aware you can check your risk of flooding on our external website <https://flood-warning-information.service.gov.uk/long-term-flood-risk/>

Please also note that all current EA flood risk strategy documents can be found on our external website <https://www.gov.uk/guidance/flood-risk-assessment-local-planning-authorities> and <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

Please refer to the [Open Government Licence](#) which explains the permitted use of this information.

Please get in touch if you have any further queries or contact us within two months if you'd like us to review the information we have sent.

Kind regards,

Claire Cooke
Customer and Engagement Officer
Greater Manchester, Merseyside and Cheshire
External: 0203 025 0048
Email: inforequests.gmmc@environment-agency.gov.uk

From: Matthew Craig [<mailto:m.craig@thelkgroup.com>]
Sent: 10 July 2019 11:37
To: Enquiries, Unit <enquiries@environment-agency.gov.uk>
Subject: 190711/ER14 FRA query - Ashfield Lodge, Palatine Road, Manchester

Dear Sir/Madam

LK Consult Ltd. has been commissioned to undertake a Flood Risk Assessment (FRA), of land at Ashfield Lodge, Palatine Road, Manchester. Nearest Postcode M20 2UD.

Centred at approximate National Grid Reference 383686E, 390966N. The area of interest appears to be within Flood Zone 3.

The BGS indicates that the site is within an area underlain by bedrock comprised of Sandstone; and superficial deposits comprised of Clay, Silt, Sand and Gravel.

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

- The modelled 1% and 0.1% annual probability fluvial flood level, the 1% annual probability plus climate change flood level and any lower order flood levels, in particular the modelled 5% fluvial flood level if relevant for functional floodplain, (with confirmation of the reference datum used for the levels – i.e. Local OSBM or OSGPS) if available.
- Details of any flood defences in the immediate area, including their extent, crest levels (and datum), assumed level of standard, construction and maintenance regime, as well as any other structures which may influence the local hydraulics.
- Proposed defence levels and timescale for implementation.
- Results of any breach analyses for defences in the area which may be relevant.
- Records of any historic flood events and potential sources of flooding from rivers, land drainage, groundwater, foul and surface water sewers on site and in the area.
- Any restrictions to infiltration and discharge to the watercourse.
- A copy of your detailed flood zone map and the modelled flood extent plans for the area.

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

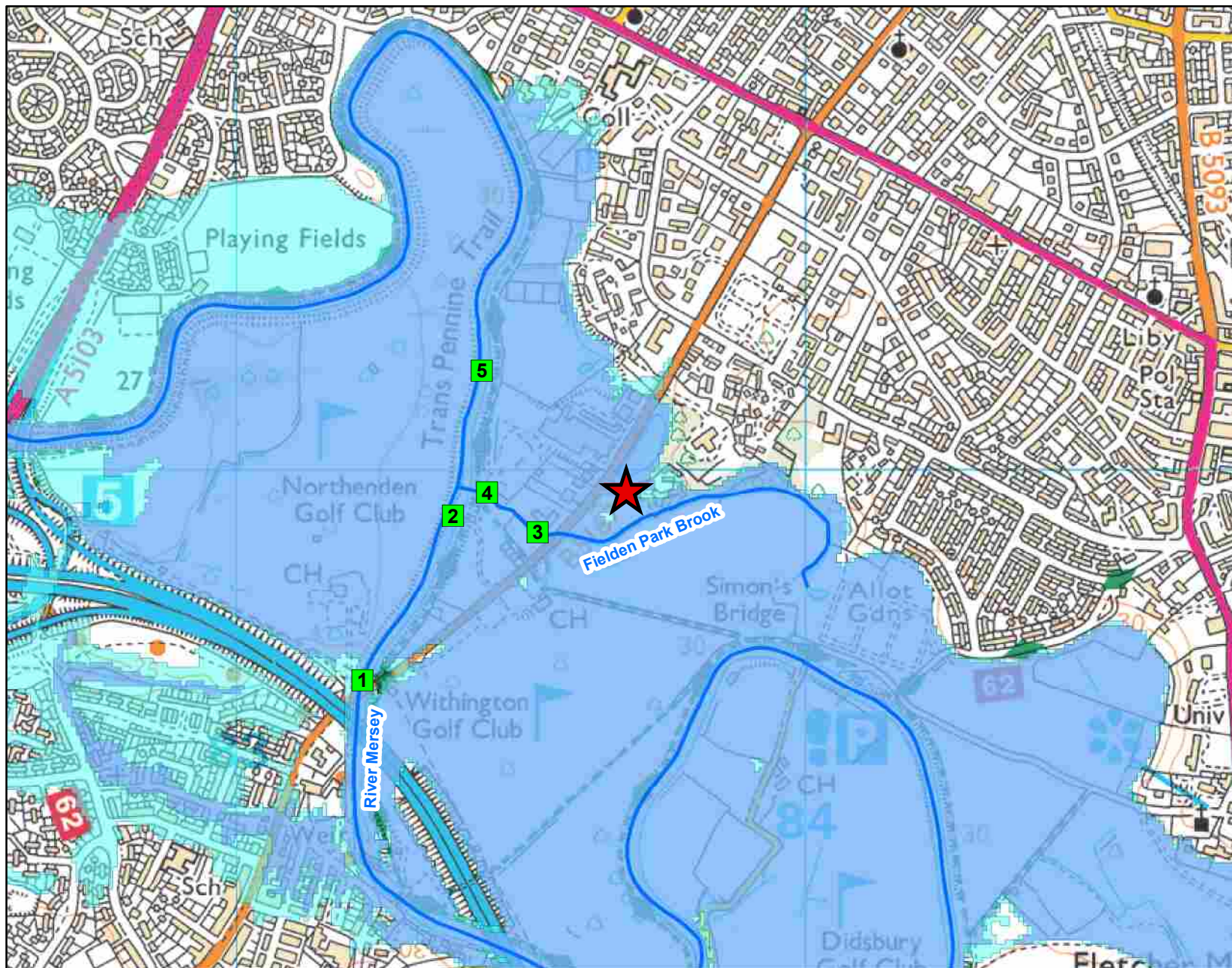
Matthew Craig



Matthew Craig
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

Detailed Flood Map centred on Palatine Road, Manchester, M20 2UD. Created on 15/07/2019 [GMMC134408CC]



1:10,001



Legend

-  Site Location
-  Model Measurements
-  Main River
-  Flood Zone 3
-  Flood Zone 2

Map Reference	Model/Node Reference	Existing	Nothing	Date	Undershot													Overshot													
					20 % ACP (2 in 5 years)	20 % ACP (2 in 10 years)	5 % ACP (2 in 20 years)	4 % ACP (2 in 25 years)	3.33 % ACP (2 in 30 years)	2 % ACP (2 in 50 years)	1.33 % ACP (2 in 75 years)	1 % ACP (2 in 100 years)	1 % ACP (2 in 100 years) 1 % ACP Climate Change	1 % ACP (2 in 100 years) 1 % ACP Climate Change	1 % ACP (2 in 100 years) 1 % ACP Climate Change	0.5 % ACP (2 in 200 years)	0.5 % ACP (2 in 300 years)	0.5 % ACP (2 in 300 years) 1 % ACP Climate Change	20 % ACP (2 in 5 years)	20 % ACP (2 in 10 years)	5 % ACP (2 in 20 years)	4 % ACP (2 in 25 years)	3.33 % ACP (2 in 30 years)	2 % ACP (2 in 50 years)	1.33 % ACP (2 in 75 years)	1 % ACP (2 in 100 years)	1 % ACP (2 in 100 years) 1 % ACP Climate Change	1 % ACP (2 in 100 years) 1 % ACP Climate Change	0.5 % ACP (2 in 200 years)	0.5 % ACP (2 in 300 years)	0.5 % ACP (2 in 300 years) 1 % ACP Climate Change
wa012_0143_MER053_34004	300223	300631	Modelled Water Level (m aath)	27.02	27.05	27.03	27.02	27.00	27.00	27.70	27.69	26.71	26.62	26.35	26.52	26.35	26.63	26.20	26.66	26.75	26.80	26.61	26.95	26.88	26.53	26.37	26.43	26.41	26.22	26.64	26.65
			Modelled Flow (cumecs)	226.00	263.54	271.68	474.63	362.64	265.06	265.06	266.10	261.53	261.00	460.07	361.42	265.34	266.56	227.28	270.55	265.56	266.68	267.12	265.62	267.14	261.77	261.47	263.26	266.42	261.00	276.69	
wa012_0143_MER053_31274	300282	300619	Modelled Water Level (m aath)	26.77	26.67	27.05	27.02	27.00	27.00	27.70	27.69	26.71	26.60	26.36	26.52	26.46	26.61	26.67	26.22	26.50	26.57	26.52	26.52	26.52	26.37	26.29	26.27	26.30	26.42	26.61	
			Modelled Flow (cumecs)	165.17	174.69	161.02	160.48	165.12	166.76	162.02	161.00	153.22	156.13	155.05	167.68	152.66	153.63	153.26	157.34	270.38	165.14	166.58	167.06	166.62	167.06	161.05	161.05	162.07	165.14	166.56	163.69
Delundah0501_2362	300531	300661	Modelled Water Level (m aath)	26.61	27.06	27.02	27.45	27.47	27.00	27.65	27.69	26.72	26.65	26.37	26.52	26.36	26.60	27.42	27.66	26.71	26.75	26.42	26.42	26.42	26.36	26.36	26.36	26.36	26.36	26.36	26.36
			Modelled Flow (cumecs)	262.15	270.00	273.00	272.00	272.00	273.00	273.00	273.00	273.00	273.00	273.00	273.00	273.00	273.00	273.00	273.00	273.00	273.00	273.00	273.00	273.00	273.00	273.00	273.00	273.00	273.00	273.00	273.00
Delundah0501_34004	300462	300661	Modelled Water Level (m aath)	26.75	26.64	27.05	27.02	27.00	27.00	27.70	27.69	26.71	26.62	26.36	26.52	26.46	26.61	26.67	26.22	26.50	26.57	26.52	26.52	26.52	26.37	26.29	26.27	26.30	26.42	26.61	
			Modelled Flow (cumecs)	223	234	236	236	236	236	236	236	236	236	236	236	236	236	236	236	236	236	236	236	236	236	236	236	236	236	236	236
wa012_0143_MER053_2862	300454	301172	Modelled Water Level (m aath)	26.75	26.68	27.05	27.02	27.00	27.00	27.70	27.69	26.71	26.73	26.64	26.36	26.52	26.36	26.65	27.01	26.67	26.57	26.42	26.42	26.42	26.42	26.36	26.36	26.36	26.36	26.36	26.36
			Modelled Flow (cumecs)	236.46	236.76	236.66	236.62	236.66	236.62	236.66	236.62	236.66	236.62	236.66	236.62	236.66	236.62	236.66	236.62	236.66	236.62	236.66	236.62	236.66	236.62	236.66	236.62	236.66	236.62	236.66	236.62

Model data taken from Upper Mersey 2017

ACP - Annual Exceedance Probability

m aath - meters above ordnance datum height

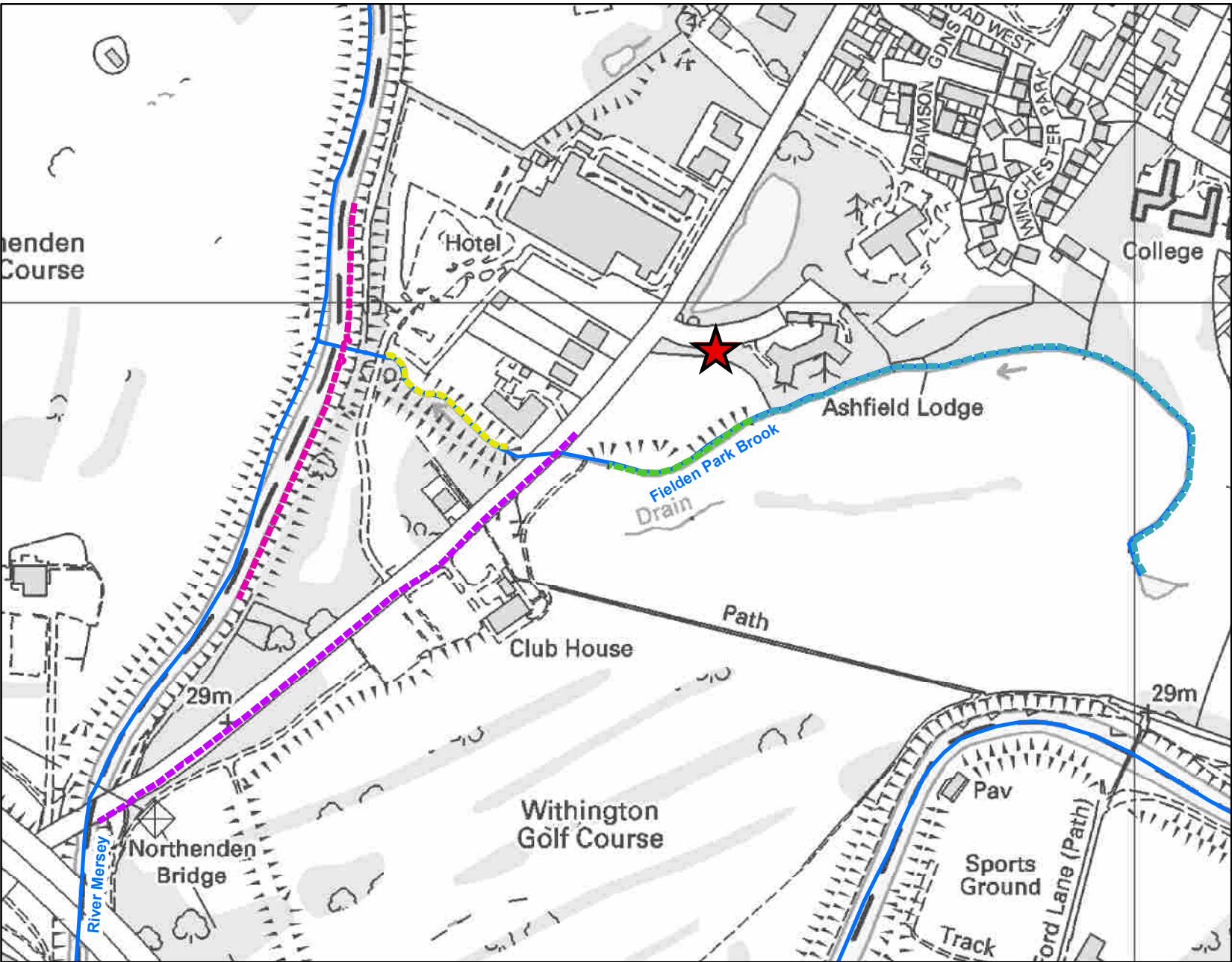
cumecs - cubic meters per second

Notes: *Climate Change Scenario - 35% and 70% increases in flow calculated for the 2080 (2070 - 2125). Please see [https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/404444/Climate_Change_Scenario_-_35%_and_70%_increases_in_flow_calculated_for_the_2080_\(2070_-_2125\).pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/404444/Climate_Change_Scenario_-_35%_and_70%_increases_in_flow_calculated_for_the_2080_(2070_-_2125).pdf) for more information regarding the climate change scenarios for consideration in any flood risk assessments. The location of the site and the type (vulnerability) of development determine the climate change allowances to consider in any flood risk assessments.

Flood Evidence

Asset Code	Asset Type	Asset ID	Stockpile of Protection	Overall Condition Grade	Structural Asset Condition Grade	Environmental Asset Condition Grade
00-01-0000	soil	102876	100	3	2B.4B	2B.3B
00-01-0071	soil, gravel	17948	75	2	2B.3B	2B.07
00-01-0071	embankment	17988	75	2	2B.32	2B.45
00-01-0073	soil, gravel	41245	75	2	2B.5	2B.28
00-00-0000	embankment	420003	100	2	2B.15B	2B.07

Flood Defence Map centred on Palatine Road, Manchester, M20 2UD. Created on 15/07/2019 [GMMC134408CC]





1:4,220

N



Legend

 Site Location

Defences (EA maintained)

Asset Id

-  47125
-  47148
-  47388
-  121970

Defences (3rd party maintained)

Asset Id

-  416020
-  Main River

Reservoir Flood Map



Note - this map provides a general indication of the largest area that might be flooded if a reservoir were to fail and release the water it holds. It is taken from a national assessment and displays a worst case scenario. The map is only intended as a guide and is not a prediction of what will happen.

Important

- This map has been produced for emergency planning purposes and displays a worst case scenario.
- It is not suitable for use at an individual property scale due to the method used.
- This map does not give any information on the likelihood of reservoir flooding or on the depth or speed of floodwaters. It also does not include any smaller reservoirs (which hold less than 25,000 cubic metres of water) or reservoirs commissioned or registered after Spring 2009.
- The information should not be interpreted as stating that the location you are interested in will or won't actually flood, but simply that it is in or not in an area that could be affected by reservoir flooding as shown on the maps

The area within the red circle could be at risk of flooding from the following reservoirs:

Reservoir Name	Reservoir Owner	Location	Local Authority	Environment Agency Office
Didsbury FSR	Environment Agency	383321, 390749	Manchester	Environment Agency - Greater Manchester, Merseysid
Woodhead	United Utilities Water plc	408008, 399372	Derbyshire	Environment Agency - Greater Manchester, Merseysid
Dovestone	United Utilities Water plc	401410, 403650	Oldham	Environment Agency - Greater Manchester, Merseysid
Greenfield	United Utilities Water plc	402720, 405373	Oldham	Environment Agency - Greater Manchester, Merseysid
Rhodeswood	United Utilities Water plc	404334, 398049	Derbyshire	Environment Agency - Greater Manchester, Merseysid
Yeoman Hey	United Utilities Water plc	402127, 404530	Oldham	Environment Agency - Greater Manchester, Merseysid
Fernilee	United Utilities Water plc	401341, 377816	Derbyshire	Environment Agency - Greater Manchester, Merseysid
Errwood	United Utilities Water plc	401570, 375885	Derbyshire	Environment Agency - Greater Manchester, Merseysid
Chew	United Utilities Water plc	403512, 401888	Oldham	Environment Agency - Greater Manchester, Merseysid
Torside	United Utilities Water plc	405510, 398334	Derbyshire	Environment Agency - Greater Manchester, Merseysid

Maximum extent of flood

1:10,000

Appendix D

Consultee Correspondence

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Mark Jones

From: z.todorovic@manchester.gov.uk on behalf of floodriskmanagement@manchester.gov.uk
Sent: 17 July 2019 14:47
To: Matthew Craig
Cc: floodriskmanagement@manchester.gov.uk
Subject: Re: FRA query - Ashfield Lodge, Palatine Road
Attachments: AL A3 SITE PLAN.pdf

Mr Craig

We do not charge for providing this information.

We do not have any record of historical flooding on this site or in immediate vicinity of the site.

With regards to the discharge rates, all developments need to follow the drainage hierarchy which means using infiltration to discharge surface water runoff as the preferred option. If that is not possible, consider discharge into the watercourse and only if any of these options are not possible, consider discharge into the public sewer. With regards to the discharge rates, greenfield runoff rates would be stipulated for all new connections to the watercourse and the sewer.

As the site is within Flood Zone 3, if you already have not been in touch, we suggest to contact Environment Agency to discuss the requirements for setting up the finish floor levels, resilience measures and access and exit from the site in the case of flooding.

Kind regards

Flood Risk Management
Highways Service, Growth and Neighbourhoods Directorate
Manchester City Council
Tel: 0161 219 6295
Email: floodriskmanagement@manchester.gov.uk
Web: <http://www.manchester.gov.uk/>

POSTAL ADDRESS: Manchester City Council, Public Realm, The Neighbourhood Service, PO Box 532, Town Hall, Manchester M60 2LA

Matthew Craig <m.craig@thelkgroup.com> 10/07/2019 11:53	To	"floodriskmanagement@manchester.gov.uk" <floodriskmanagement@manchester.gov.uk>,
	cc	
	Subject	FRA query - Ashfield Lodge, Palatine Road

Dear Sir/Madam

LK Consult Ltd. has been commissioned to undertake a Flood Risk Assessment (FRA), of land at Ashfield Lodge, Palatine Road, Manchester. Nearest Postcode M20 2UD.

Centred at approximate National Grid Reference 383686E, 390966N. The area of interest appears to be within Flood Zone 3.

The BGS indicates that the site is within an area underlain by bedrock comprised of Sandstone; and superficial deposits comprised of Clay, Silt, Sand and Gravel.

The wastewater development form is attached to this email.

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 Environmental Scientist – Flood Risk LK Consult 0161 763 7200 Manchester London Liverpool Glasgow www.thelkgroup.com INCREASING LAND VALUE
---	---

***** Your personal data is very important to us. Please refer to our privacy notice at www.manchester.gov.uk/privacy for further information. This email and any files transmitted with it are confidential and intended solely for the use of the individual or entity to whom they are addressed. If you have received this email in error please notify the system manager. The full text of the Council's email disclaimer is available at <http://www.manchester.gov.uk/emaildisclaimer>. This footnote also confirms that this email message has been swept for the presence of computer viruses. Please contact internet.administrators@manchester.gov.uk with any queries.

Mark Jones

From: Mura, Marie <Marie.Mura@uuplc.co.uk>
Sent: 19 July 2019 08:53
To: Matthew Craig
Cc: Wastewater Developer Services
Subject: FW: FRA query - Ashfield Lodge, Palatine Road, Manchester 4200027081
Attachments: United Utilities - wastewater development.docx; AL A3 SITE PLAN.pdf

Dear Matthew,

Our reference for this pre-development enquiry: 4200027081

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

Foul

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

Surface Water

In order to follow the drainage hierarchy outlined in Building Regulations part H3 and National Planning Practice Guidance (NPPG), surface water should be drained via infiltration systems/soakaways wherever possible. United Utilities would be willing to allow a connection to the public surface water sewer located on Palatine Road at a maximum pass forward flow rate of 5 l/s.

General Information:

'I can confirm that we have no current record of sewer flooding on our DG5 register within the vicinity of the proposed development. The DG5 register is a register of properties that have flooded as a result of hydraulic inadequacy of the public sewer network.'

Please note that United Utilities Water Limited (Uuw) can only record and check flooding events which are reported to us and we have to comply with our Regulators instructions on the qualification of flooding events to place on the register.

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

Connection Application

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

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

Sewer Adoption Agreement

You may wish to offer the proposed new sewers for adoption. United Utilities assess adoption application based on Sewers adoption 6th Edition and for any pumping stations our company addenda document. Please refer to link below to obtain further guidance and application pack:

<http://www.unitedutilities.com/sewer-adoption.aspx>

Please note, if you intend to put forward your wastewater assets for adoption by United Utilities, the proposed detail design will be subject to a technical appraisal by an Adoption Engineer as we need to be sure that the proposals meets the requirements of Sewers for adoption and United Utilities Asset Standards. The proposed design should give consideration to long term operability and give United Utilities a cost effective proposal for the life of the assets. Therefore, further to this enquiry should you wish to progress a Section 104 agreement, we strongly recommend that no construction commences until the detailed drainage design, submitted as part of the Section 104 agreement, has been assessed and accepted in writing by United Utilities. Any works carried out prior to the technical assessment being approved is done entirely at the developers own risk and could be subject to change.

Kind regards,

Marie Mura
Assistant Developer Engineer
Developer Services & Metering (Wastewater)
United Utilities
External 01925 537745 Internal: 37745

From: Matthew Craig [<mailto:m.craig@thelkgroup.com>]
Sent: 10 July 2019 11:34
To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: FRA query - Ashfield Lodge, Palatine Road, Manchester

Dear Sir/Madam

LK Consult Ltd. has been commissioned to undertake a Flood Risk Assessment (FRA), of land at Ashfield Lodge, Palatine Road, Manchester. Nearest Postcode M20 2UD.

Centred at approximate National Grid Reference 383686E, 390966N. The area of interest appears to be within Flood Zone 3.

The BGS indicates that the site is within an area underlain by bedrock comprised of Sandstone; and superficial deposits comprised of Clay, Silt, Sand and Gravel.

The wastewater development form is attached to this email.

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.

LKGroup

**Unit 29, Eton Business Park
Eton Hill Road,
Radcliffe, Greater Manchester
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 19 1055
Our Ref: UUPS-ORD-115788
Date: 01/08/2019**

Dear Sirs

Location: FLAT 1 ASHFIELD LODGE PALATINE ROAD, MANCHESTER, M20 2UD

I acknowledge with thanks your request dated 30/07/2019 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

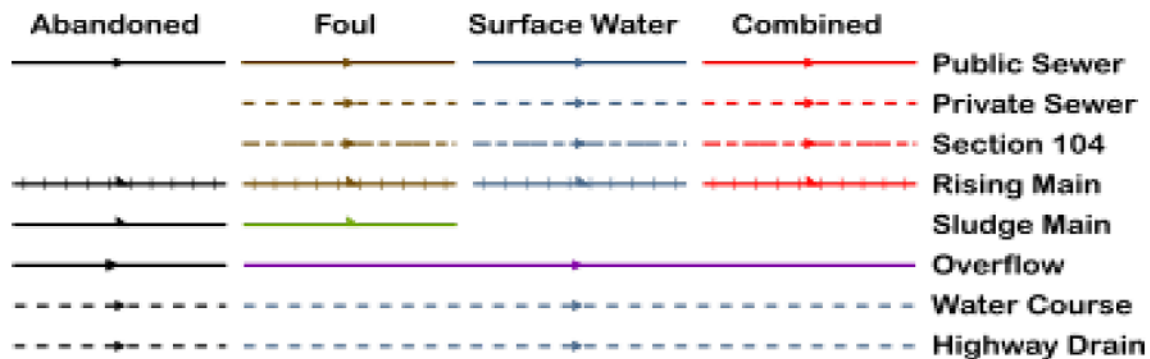
TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

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: 1:2138 Date: 01/08/2019	SEWER RECORDS	
Address or Site Reference: FLAT 1 ASHFIELD LODGE PALATINE ROAD, MANCHESTER, M20 2UD Printed by: Property Searches		

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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Appendix E

Calculations

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Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

Job No.		
Sheet no. 1		
Date 02/08/19		
By	Checked	Reviewed

Project **1 year existing**

Title **Peak runoff calculations for didsbury**

Area data:-

FSR data

M5-60 = 17.7

Soil index = 0.45

WRAP value = 4

$r = 0.37$

SAAR = 825

Nat grid = SJ8591

Site data:-

Ret. period (yrs) = 1

Time of entry = 10.00

Impervious area drained = 100 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 = 150 m²

Soil type = Clay

Climate change factor = 0.0 %

Calculated data:-

Calculated runoff factor = 40.0%

Rainfall rate = 40.1 mm/Hr

UCWI = 86.6

Runoff rate (gross) = 0.8 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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Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

Job No.		
Sheet no. 1		
Date 02/08/19		
By	Checked	Reviewed

Project	existing Qbar
Title	Peak runoff calculations for didsbury

Area data:-

FSR data

M5-60 = 17.7

Soil index = 0.45

WRAP value = 4

r = 0.37

SAAR = 825

Nat grid = SJ8591

Site data:-

Ret. period (yrs) = 2.333

Time of entry = 7.00

Impervious area drained = 100 m²

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

Length of overland flow = 0.00

ToC = 7.0 mins

Overland flow time = 0.0 mins

Pervious area drained = 150 m²

Soil type = Clay

Climate change factor = 0.0 %

Calculated data:-

Calculated runoff factor = 40.0%

Rainfall rate = 57.3 mm/Hr

UCWI = 86.6

Runoff rate (gross) = 1.2 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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Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

Job No.		
Sheet no. 1		
Date 02/08/19		
By	Checked	Reviewed

Project existing 30yr		
Title Peak runoff calculations for didsbury		

Area data:-

FSR data

M5-60 = 17.7

Soil index = 0.45

WRAP value = 4

r = 0.37

SAAR = 825

Nat grid = SJ8591

Site data:-

Ret. period (yrs) = 30

Time of entry = 6.00

Impervious area drained = 100 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 = 150 m²

Soil type = Clay

Climate change factor = 0.0 %

Calculated data:-

Calculated runoff factor = 40.0%

Rainfall rate= 101.3 mm/Hr

UCWI = 86.6

Runoff rate (gross)= 2.1 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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Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

Job No.		
Sheet no. 1		
Date 02/08/19		
By	Checked	Reviewed

Project	100yr existing
Title	Peak runoff calculations for didsbury

Area data:-

FSR data

M5-60 = 17.7

Soil index = 0.45

WRAP value = 4

r = 0.37

SAAR = 825

Nat grid = SJ8591

Site data:-

Ret. period (yrs) = 100

Time of entry = 6.00

Impervious area drained = 100 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 = 150 m²

Soil type = Clay

Climate change factor = 0.0 %

Calculated data:-

Calculated runoff factor = 40.0%

Rainfall rate= 128.2 mm/Hr

UCWI = 86.6

Runoff rate (gross)= 2.7 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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Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

Job No.		
Sheet no. 1		
Date 02/08/19		
By	Checked	Reviewed

Project 30yr event		
Title Peak flow storage calcs for didsbury		

Data:-

FSR Hydrology:-

Location = didsbury
M5-60 (mm) = 17.7
Soil index = 0.45
Return period = 30
UCWI = 88.6

Grid reference = SJ8591
r = 0.37
SAAR (mm/yr) = 825
WRAP = 4
Climate change = 0

Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

Runoff factor (RF) = 54.0, 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 = 170 m²
Total area (TA) = 250 m²
Allowed discharge rate = 5.000 l/s
Additional flow = 0.00 l/s

Pervious area = 80 m²
Equiv area = 135 m² (TA x RF).
Areal reduction factor = 1.000
Climate change factor = 0

Calculated data:-

Time to max = 1.0 mins
Rainfall at max = 163.18 mm/hr
Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Calculated storage volume = 0.1 m³
Allowed discharge rate = 5.000 l/s
Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours
Rainfall rate = 7.00 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	8.6	1125	0.1	400 x 600	0.4	500 x 500	0.3
150	3.8	1200	0.1	600 x 900	0.2	500 x 750	0.2
225	1.7	1275	0.1	800 x 1200	0.1	500 x 1000	0.1
300	1.0	1350	0.0			750 x 1000	0.1
375	0.6	1425	0.0			750 x 1200	0.1
450	0.4	1500	0.0			750 x 1500	0.1
525	0.3	1575	0.0			1000 x 1000	0.1
600	0.2	1650	0.0			1000 x 1200	0.1
675	0.2	1725	0.0			1000 x 1500	0.0
750	0.2	1800	0.0			1000 x 1800	0.0
825	0.1	1875	0.0			1000 x 2000	0.0
900	0.1	1950	0.0			1500 x 1500	0.0
975	0.1	2025	0.0			1500 x 1800	0.0
1050	0.1	2100	0.0			1500 x 2000	0.0



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Data:-

The LK Group

www.thelkgroup.com

Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

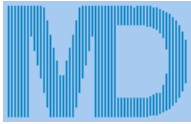
Job No.		
Sheet no. 2		
Date 02/08/19		
By	Checked	Reviewed

Project **30yr event**

Title **Peak flow storage calcs for didsbury**

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	80.0	1.810	3.000	0.000
20	55.0	2.480	6.000	0.000
30	43.0	2.899	9.000	0.000
40	36.0	3.210	12.000	0.000
50	31.0	3.459	15.000	0.000
60	27.0	3.669	18.000	0.000
70	24.0	3.850	21.000	0.000
80	22.0	4.010	24.000	0.000
90	21.0	4.154	27.000	0.000
100	19.0	4.285	30.000	0.000
110	18.0	4.405	33.000	0.000
120	17.0	4.516	36.000	0.000
130	16.0	4.619	39.000	0.000
140	15.0	4.715	42.000	0.000
150	14.0	4.806	45.000	0.000
160	14.0	4.891	48.000	0.000
170	13.0	4.972	51.000	0.000
180	12.0	5.049	54.000	0.000
190	12.0	5.122	57.000	0.000
200	12.0	5.192	60.000	0.000
210	11.0	5.259	63.000	0.000
220	11.0	5.323	66.000	0.000
230	10.0	5.384	69.000	0.000
240	10.0	5.443	72.000	0.000
250	10.0	5.500	75.000	0.000
260	9.0	5.555	78.000	0.000
270	9.0	5.607	81.000	0.000
280	9.0	5.658	84.000	0.000
290	9.0	5.708	87.000	0.000
300	9.0	5.756	90.000	0.000
310	8.0	5.802	93.000	0.000
320	8.0	5.847	96.000	0.000
330	8.0	5.891	99.000	0.000
340	8.0	5.933	102.000	0.000
350	8.0	5.975	105.000	0.000
360	7.0	6.015	108.000	0.000
370	7.0	6.054	111.000	0.000
380	7.0	6.092	114.000	0.000
390	7.0	6.129	117.000	0.000
400	7.0	6.169	120.000	0.000
410	7.0	6.206	123.000	0.000
420	7.0	6.243	126.000	0.000
430	6.0	6.279	129.000	0.000
440	6.0	6.314	132.000	0.000
450	6.0	6.349	135.000	0.000
460	6.0	6.383	138.000	0.000
470	6.0	6.417	141.000	0.000
480	6.0	6.450	144.000	0.000
490	6.0	6.482	147.000	0.000
500	6.0	6.514	150.000	0.000
510	6.0	6.545	153.000	0.000
520	6.0	6.576	156.000	0.000
530	6.0	6.607	159.000	0.000
540	5.0	6.637	162.000	0.000
550	5.0	6.666	165.000	0.000
560	5.0	6.695	168.000	0.000
570	5.0	6.724	171.000	0.000
580	5.0	6.752	174.000	0.000
590	5.0	6.780	177.000	0.000
600	5.0	6.808	180.000	0.000

Storage volume (m³) = 0.1 m³



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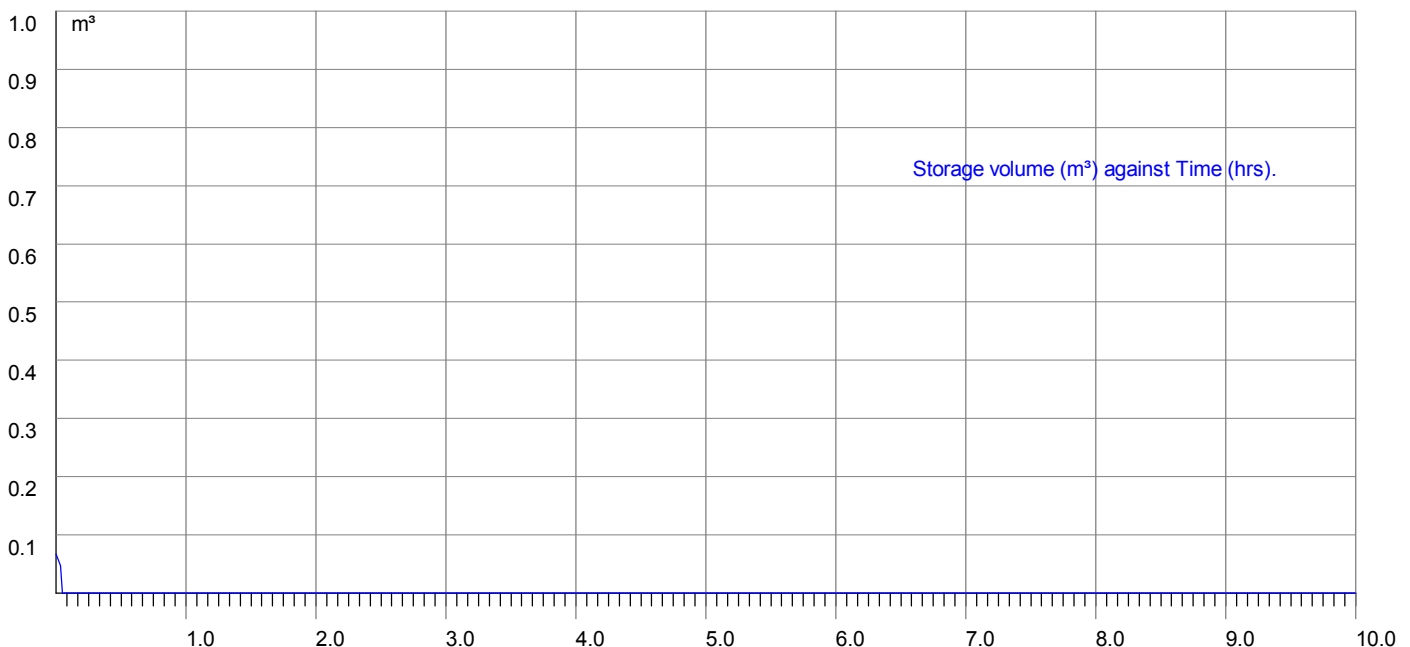
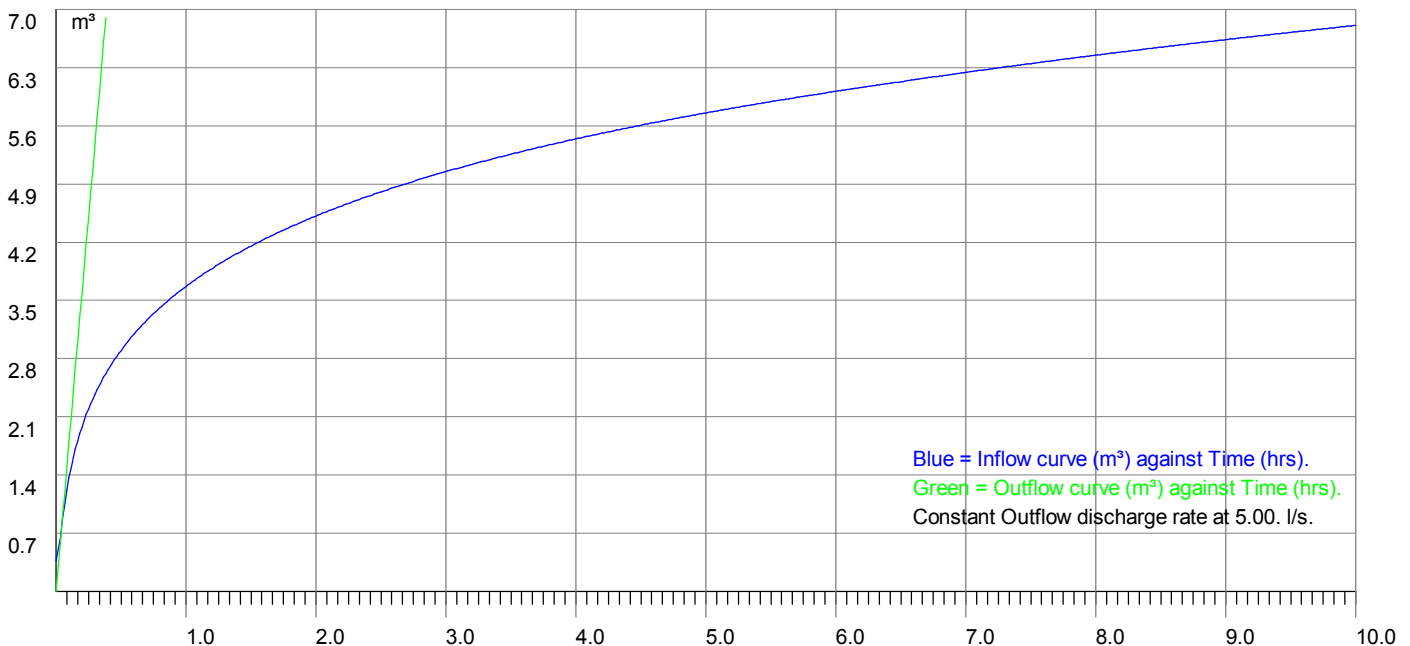
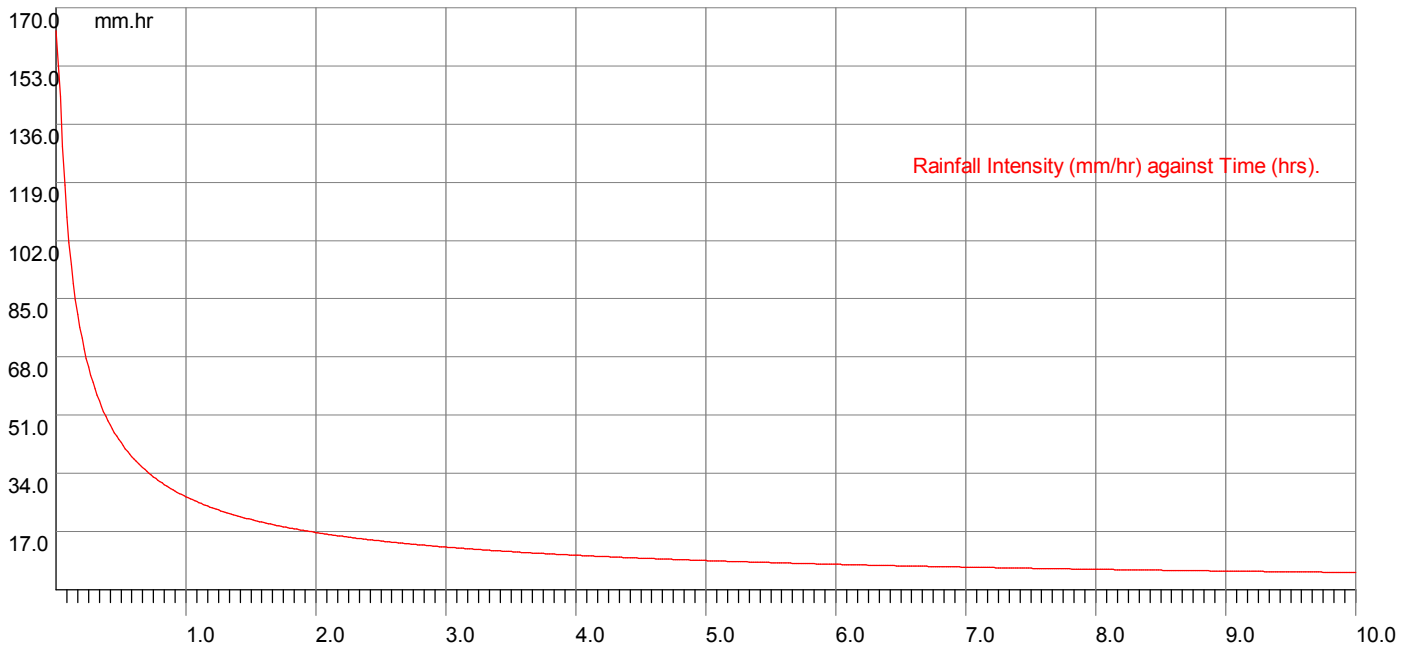
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Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

Job No.		
Sheet no. 3		
Date 02/08/19		
By	Checked	Reviewed

Project **30yr event**

Title **Peak flow storage calcs for didsbury**





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Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

Job No.		
Sheet no. 1		
Date 02/08/19		
By	Checked	Reviewed

Project 100yr +20%		
Title Peak flow storage calcs for didsbury		

Data:-

FSR Hydrology:-

Location = didsbury
M5-60 (mm) = 17.7
Soil index = 0.45
Return period = 100
UCWI = 88.6

Grid reference = SJ8591
r = 0.37
SAAR (mm/yr) = 825
WRAP = 4
Climate change = 20

Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

Runoff factor (RF) = 54.0, 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 = 170 m²
Total area (TA) = 250 m²
Allowed discharge rate = 5.000 l/s
Additional flow = 0.00 l/s

Pervious area = 80 m²
Equiv area = 135 m² (TA x RF).
Areal reduction factor = 1.000
Climate change factor = 20

Calculated data:-

Time to max = 3.0 mins
Rainfall at max = 194.11 mm/hr
Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Calculated storage volume = 0.4 m³
Allowed discharge rate = 5.000 l/s
Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours
Rainfall rate = 11.00 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	52.2	1125	0.4	400 x 600	2.3	500 x 500	1.6
150	23.2	1200	0.4	600 x 900	1.0	500 x 750	1.1
225	10.3	1275	0.3	800 x 1200	0.6	500 x 1000	0.8
300	5.8	1350	0.3			750 x 1000	0.5
375	3.7	1425	0.3			750 x 1200	0.5
450	2.6	1500	0.2			750 x 1500	0.4
525	1.9	1575	0.2			1000 x 1000	0.4
600	1.5	1650	0.2			1000 x 1200	0.3
675	1.1	1725	0.2			1000 x 1500	0.3
750	0.9	1800	0.2			1000 x 1800	0.2
825	0.8	1875	0.1			1000 x 2000	0.2
900	0.6	1950	0.1			1500 x 1500	0.2
975	0.5	2025	0.1			1500 x 1800	0.2
1050	0.5	2100	0.1			1500 x 2000	0.1



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SW

Data:-

The LK Group

www.thelkgroup.com

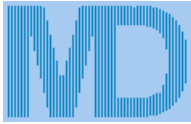
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Tel: 0161 763 7200
email: m.jones@thelkgroup.com

Job No.		
Sheet no. 2		
Date 02/08/19		
By	Checked	Reviewed

Project 100yr +20%		
Title Peak flow storage calcs for didsbury		

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	124.0	2.780	3.000	0.000
20	86.0	3.858	6.000	0.000
30	67.0	4.534	9.000	0.000
40	56.0	5.036	12.000	0.000
50	48.0	5.439	15.000	0.000
60	43.0	5.776	18.000	0.000
70	39.0	6.067	21.000	0.000
80	35.0	6.324	24.000	0.000
90	32.0	6.554	27.000	0.000
100	30.0	6.762	30.000	0.000
110	28.0	6.953	33.000	0.000
120	26.0	7.128	36.000	0.000
130	25.0	7.290	39.000	0.000
140	24.0	7.442	42.000	0.000
150	22.0	7.583	45.000	0.000
160	21.0	7.717	48.000	0.000
170	21.0	7.842	51.000	0.000
180	20.0	7.961	54.000	0.000
190	19.0	8.074	57.000	0.000
200	18.0	8.181	60.000	0.000
210	18.0	8.283	63.000	0.000
220	17.0	8.380	66.000	0.000
230	16.0	8.473	69.000	0.000
240	16.0	8.562	72.000	0.000
250	15.0	8.648	75.000	0.000
260	15.0	8.730	78.000	0.000
270	15.0	8.809	81.000	0.000
280	14.0	8.885	84.000	0.000
290	14.0	8.958	87.000	0.000
300	13.0	9.029	90.000	0.000
310	13.0	9.097	93.000	0.000
320	13.0	9.163	96.000	0.000
330	12.0	9.226	99.000	0.000
340	12.0	9.288	102.000	0.000
350	12.0	9.348	105.000	0.000
360	12.0	9.406	108.000	0.000
370	11.0	9.462	111.000	0.000
380	11.0	9.516	114.000	0.000
390	11.0	9.569	117.000	0.000
400	11.0	9.629	120.000	0.000
410	10.0	9.684	123.000	0.000
420	10.0	9.738	126.000	0.000
430	10.0	9.791	129.000	0.000
440	10.0	9.843	132.000	0.000
450	10.0	9.894	135.000	0.000
460	10.0	9.944	138.000	0.000
470	9.0	9.993	141.000	0.000
480	9.0	10.041	144.000	0.000
490	9.0	10.089	147.000	0.000
500	9.0	10.135	150.000	0.000
510	9.0	10.181	153.000	0.000
520	9.0	10.226	156.000	0.000
530	9.0	10.271	159.000	0.000
540	8.0	10.314	162.000	0.000
550	8.0	10.357	165.000	0.000
560	8.0	10.400	168.000	0.000
570	8.0	10.442	171.000	0.000
580	8.0	10.483	174.000	0.000
590	8.0	10.523	177.000	0.000
600	8.0	10.563	180.000	0.000

Storage volume (m³) = 0.4 m³



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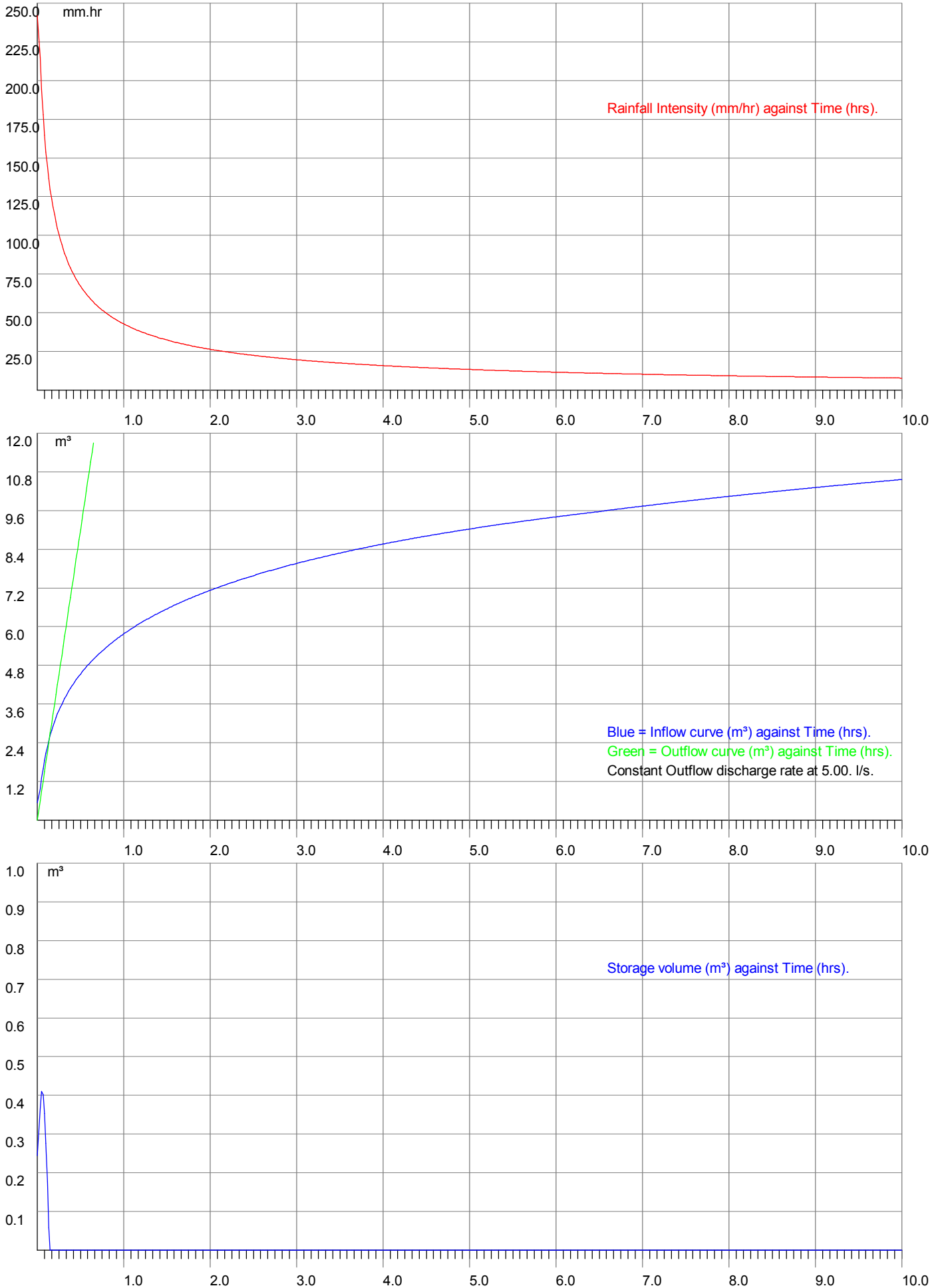
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www.thelkgroup.com

Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

Job No.		
Sheet no. 3		
Date 02/08/19		
By	Checked	Reviewed

Project 100yr +20%
Title Peak flow storage calcs for didsbury





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Eton Hill Road,
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Tel: 0161 763 7200
email: m.jones@thelkgroup.com

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Project 100yr+40%		
Title Peak flow storage calcs for didsbury		

Data:-

FSR Hydrology:-

Location = didsbury
M5-60 (mm) = 17.7
Soil index = 0.45
Return period = 100
UCWI = 88.6

Grid reference = SJ8591
r = 0.37
SAAR (mm/yr) = 825
WRAP = 4
Climate change = 40

Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

Runoff factor (RF) = 54.0, 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 = 170 m²
Total area (TA) = 250 m²
Allowed discharge rate = 5.000 l/s
Additional flow = 0.00 l/s

Pervious area = 80 m²
Equiv area = 135 m² (TA x RF).
Areal reduction factor = 1.000
Climate change factor = 40

Calculated data:-

Time to max = 4.0 mins
Rainfall at max = 207.54 mm/hr
Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Calculated storage volume = 0.7 m³
Allowed discharge rate = 5.000 l/s
Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours
Rainfall rate = 13.00 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	85.0	1125	0.7	400 x 600	3.7	500 x 500	2.7
150	37.8	1200	0.6	600 x 900	1.6	500 x 750	1.8
225	16.8	1275	0.5	800 x 1200	0.9	500 x 1000	1.3
300	9.4	1350	0.5			750 x 1000	0.9
375	6.0	1425	0.4			750 x 1200	0.7
450	4.2	1500	0.4			750 x 1500	0.6
525	3.1	1575	0.3			1000 x 1000	0.7
600	2.4	1650	0.3			1000 x 1200	0.6
675	1.9	1725	0.3			1000 x 1500	0.4
750	1.5	1800	0.3			1000 x 1800	0.4
825	1.2	1875	0.2			1000 x 2000	0.3
900	1.0	1950	0.2			1500 x 1500	0.3
975	0.9	2025	0.2			1500 x 1800	0.2
1050	0.8	2100	0.2			1500 x 2000	0.2



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Data:-

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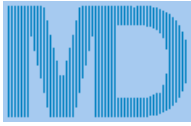
Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

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Project 100yr+40%		
Title Peak flow storage calcs for didsbury		

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	144.0	3.243	3.000	0.243
20	100.0	4.501	6.000	0.000
30	78.0	5.289	9.000	0.000
40	65.0	5.875	12.000	0.000
50	56.0	6.345	15.000	0.000
60	50.0	6.739	18.000	0.000
70	45.0	7.079	21.000	0.000
80	41.0	7.378	24.000	0.000
90	38.0	7.647	27.000	0.000
100	35.0	7.889	30.000	0.000
110	33.0	8.111	33.000	0.000
120	31.0	8.316	36.000	0.000
130	29.0	8.505	39.000	0.000
140	28.0	8.682	42.000	0.000
150	26.0	8.847	45.000	0.000
160	25.0	9.003	48.000	0.000
170	24.0	9.149	51.000	0.000
180	23.0	9.288	54.000	0.000
190	22.0	9.419	57.000	0.000
200	21.0	9.544	60.000	0.000
210	20.0	9.663	63.000	0.000
220	20.0	9.777	66.000	0.000
230	19.0	9.885	69.000	0.000
240	18.0	9.989	72.000	0.000
250	18.0	10.089	75.000	0.000
260	17.0	10.185	78.000	0.000
270	17.0	10.277	81.000	0.000
280	16.0	10.366	84.000	0.000
290	16.0	10.451	87.000	0.000
300	16.0	10.533	90.000	0.000
310	15.0	10.613	93.000	0.000
320	15.0	10.690	96.000	0.000
330	14.0	10.764	99.000	0.000
340	14.0	10.836	102.000	0.000
350	14.0	10.906	105.000	0.000
360	14.0	10.973	108.000	0.000
370	13.0	11.039	111.000	0.000
380	13.0	11.102	114.000	0.000
390	13.0	11.164	117.000	0.000
400	12.0	11.234	120.000	0.000
410	12.0	11.298	123.000	0.000
420	12.0	11.361	126.000	0.000
430	12.0	11.423	129.000	0.000
440	12.0	11.483	132.000	0.000
450	11.0	11.543	135.000	0.000
460	11.0	11.601	138.000	0.000
470	11.0	11.658	141.000	0.000
480	11.0	11.715	144.000	0.000
490	11.0	11.770	147.000	0.000
500	11.0	11.824	150.000	0.000
510	10.0	11.878	153.000	0.000
520	10.0	11.931	156.000	0.000
530	10.0	11.982	159.000	0.000
540	10.0	12.033	162.000	0.000
550	10.0	12.084	165.000	0.000
560	10.0	12.133	168.000	0.000
570	9.0	12.182	171.000	0.000
580	9.0	12.230	174.000	0.000
590	9.0	12.277	177.000	0.000
600	9.0	12.324	180.000	0.000

Storage volume (m³) = 0.7 m³



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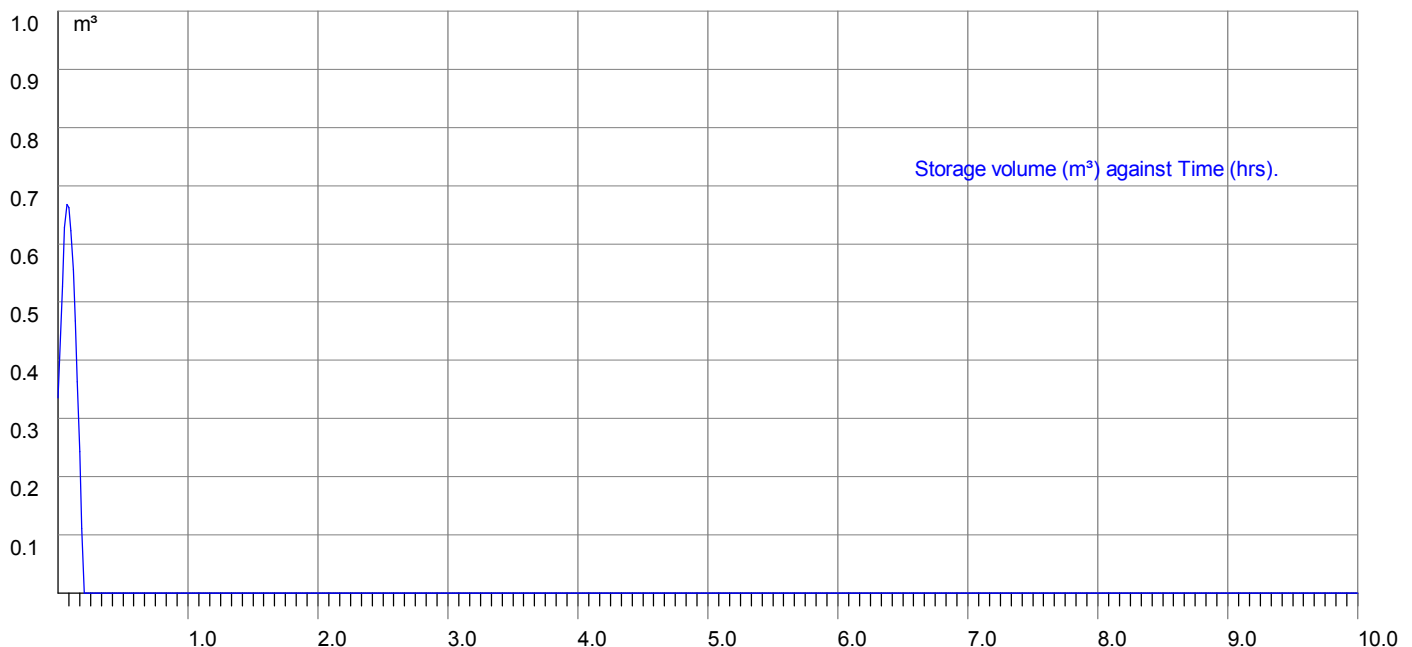
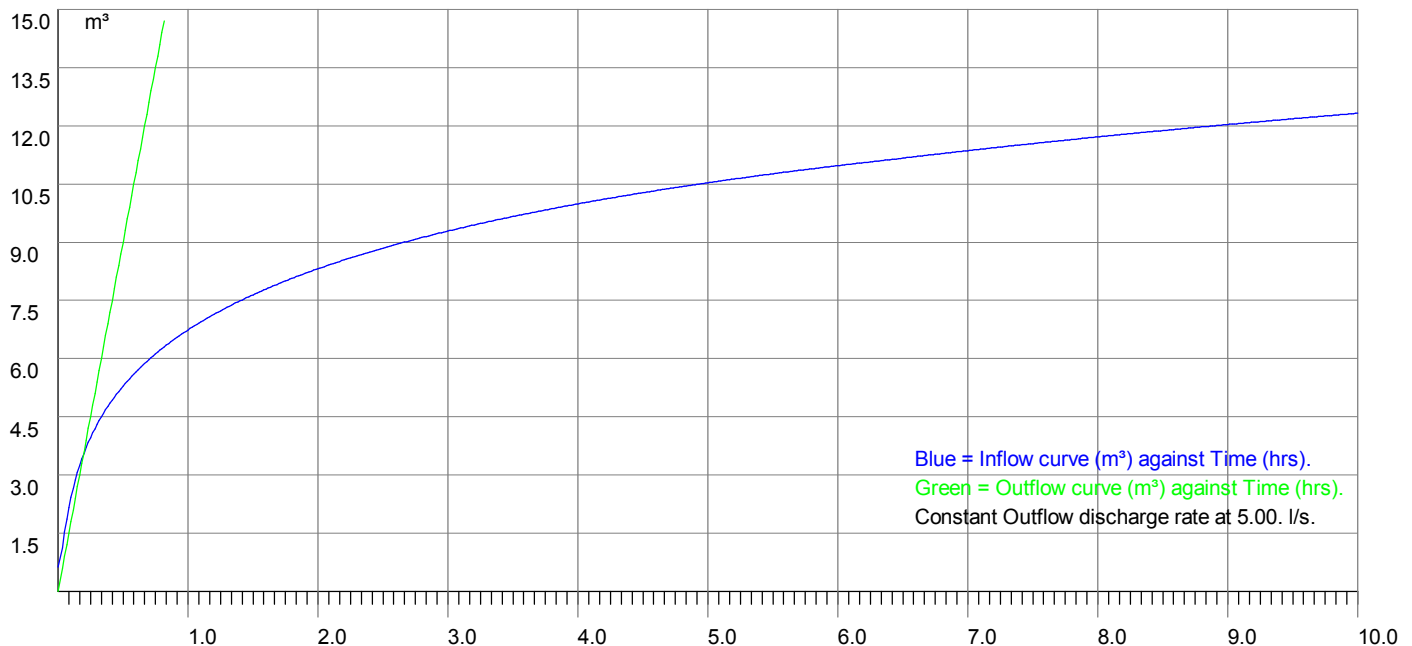
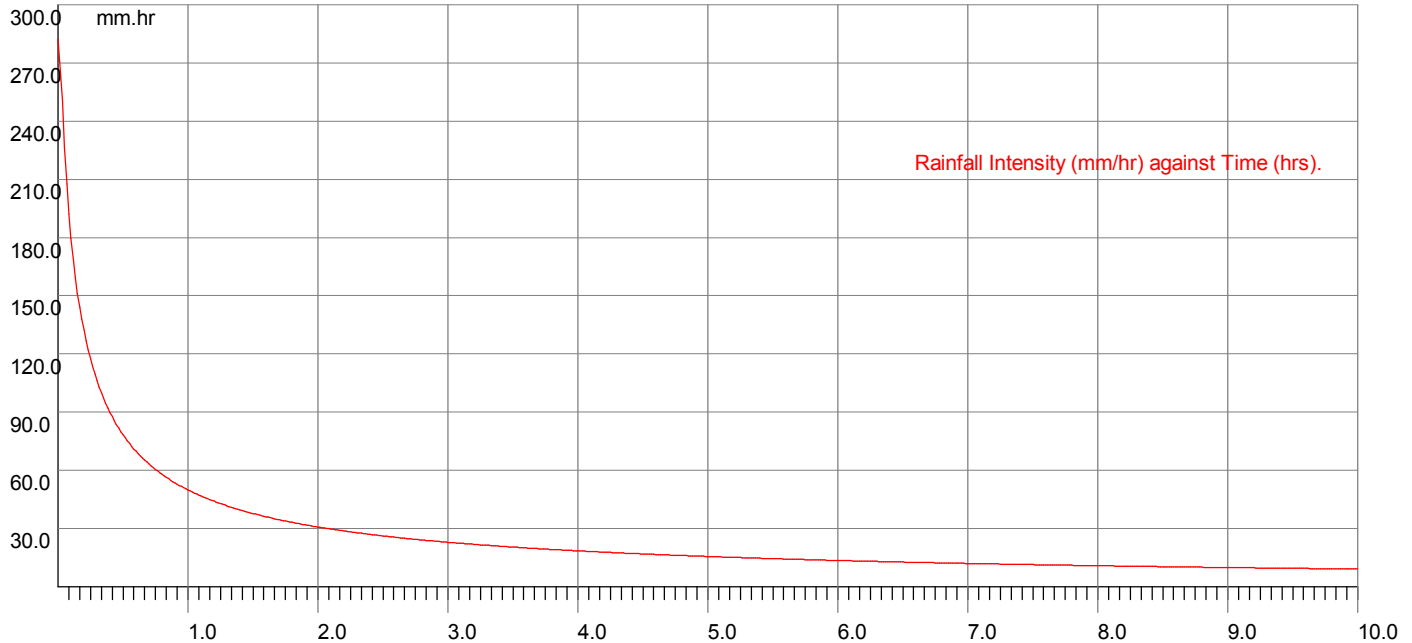
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Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

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Project **100yr+40%**

Title **Peak flow storage calcs for didsbury**





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Title	Peak flow storage calcs for didsbury			

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.