

LAND AT BURY NEW ROAD / FAIRY LANE MANCHESTER

FLOOD RISK ASSESSMENT & OUTLINE DRAINAGE STRATEGY

Job Number: FRA 20 1130

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Client: BOI Trading Company Ltd



INCREASING LAND VALUE

LK
GROUP

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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 development of land at Bury New Road / Fairy Lane in Manchester. The report is for what is understood to be a mixed-use development comprising ground floor retail/commercial units with several storeys of residential apartments.

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 and modelled flood levels data for River Irwell.

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

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

Flood Risk

Environment Agency flood maps indicate that the area in the south and southwest of the site is potentially vulnerable to fluvial flooding from the River Irwell, southwest of the site. This part of the site is shown on the Environment Agency's (EA) website Flood Zone Mapping as being in Flood Zone 2, as defined in PPG Table 1. The remainder of the site is within Flood Zone 1.

The site is partially in Flood Zone 1 – Very Low Risk – annual probability of flooding less than 0.1% (1 in 1000).

The site is also in Flood Zone 2 – Low Risk – between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%).

The comparison of modelled flood level data with the levels obtained from Bury New Road adjacent to the site shows that the 1% (1 in 100-year event) will not affect any part of the site. The flood levels including climate change allowance will however affect the area shown as being within Flood Zone 2, therefore the risk of fluvial flooding is considered Low.

There is a Low risk of flooding from sewers identified within the site.

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 dwellings will be set as high as possible above the flood level giving regard to necessary access for the less able.

The development will not result in a reduction in flood plain storage compared to the existing situation.

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 surface water sewer in Bury New Road.

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 public foul sewer in Bury New Road.

The outline drainage strategy considers the use of attenuation-based SuDS to be feasible with a discharge to the surface water sewer in Bury New Road. Therefore, the most effective strategy, in line with the SuDS management train, would be to have an attenuation tank or similar within proposed car parking or soft landscaping. The required storage has been estimated to be between **131.5m³** for the 1 in 30-year greenfield 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 **267.3m³** and **330.4m³**.

The site is considered to be at low risk of flooding. It is recommended that the minimum finished floor levels within the southwest of the site should be set at a minimum of 29.55m AOD and at a nominal height above the proposed ground levels everywhere else. This is to allow for overland flow during exceedance flows from an extreme event or a drainage failure.

Access

Access close to the site is elevated above existing 100-year flood levels and will provide safe access to and from the site from Bury New Road.

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1 Introduction

1.1 Background

LK Consult Ltd (LKC) were commissioned by BOI Trading Company Ltd to carry out a Flood Risk Assessment (FRA) and Outline Drainage Strategy for land at Bury New Road / Fairy Lane, Manchester. The report was undertaken in support of a future planning application to redevelop the site for mixed commercial and residential end 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. The Outline Drainage Strategy in Section 5 will provide an overview of the SuDS techniques which could be considered on the site. The issues of actual flood risk are discussed in Section 4.

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.

SuDS should be designed where practical to maximise the opportunities and benefits that can be secured from surface water management. The strategy will consider the four 'pillars' of SuDS. To maximise these benefits, surface water management should be considered from the beginning of the development planning process and throughout influencing site and wildlife layout and design, and the use and characteristics of open spaces.

¹ DCLG (2018). "National Planning Policy Framework." Department of Communities and Local Government. June 2018.

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

The main drivers for SuDS are the controlling water quantity and water quality³ (Plate 1), with an increasing emphasis on amenity and biodiversity benefits where practical.

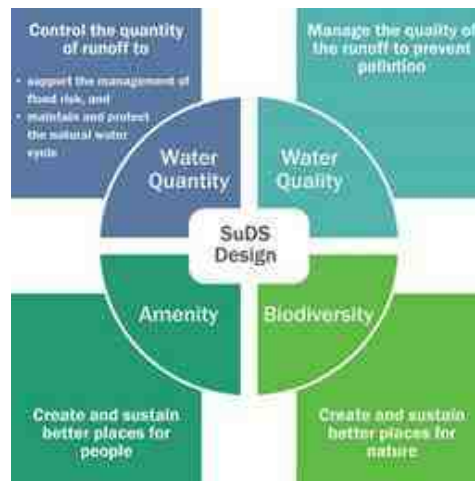


Plate 1: Four 'pillars' of SuDS design as defined by CIRIA in The SuDS Manual.

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	Southwest end of Fairy Lane, at the junction with Bury New Road, northwest of Manchester City Centre. Centred at approximate National Grid Reference 383340E 400050N.
Area	6500m ² .
Topography	29-35 metres Above Ordnance Datum (AOD). Site is uneven. Eastern area of site is situated higher than remainder of site.
Current Land Use	<u>Site</u> Site is currently comprising vacant, rough land across the majority of the site and a hardstood track present along the eastern boundary. <u>Surrounding Area</u> North: Fairy Lane and commercial buildings. East: Residential properties. South: Bury New Road and commercial buildings. West: Bury New Road and commercial buildings.
Proposed Development	Mixed use development comprising ground floor retail/commercial units with several storeys of one-bed and two-bed apartments above. It is presumed that shared soft landscaping is proposed.

Table 1-1: Summary of site details.

³ The SuDS Manual (C753) – CIRIA November 2015.

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 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 – medium to 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 1 and 2, as described in the PPG (paragraph 065, Table 1).

The part development site is in Flood Zone 2, so under current regulations a Flood Risk Assessment will be necessary to accompany the Planning Application.

The proposed development is for a 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 have previously undertaken a Preliminary Risk Assessment for the site⁴ and pertinent environmental information for the site is summarised in Table 2-1 below.

Summary of the Environmental Setting		
Geology	Superficial	Till across majority of site. Alluvium deposits (Clay, Silt, Sand and Gravel) in the southern corner of site. Potential River Terrace Deposits (Sand and Gravel) along the NW boundary. Potential Glaciofluvial Deposits (Sand and Gravel) along N site boundary.
	Bedrock	Chester Formation (Sandstone).
	BGS Boreholes	BH Ref: SD80SW368, onsite SW: made ground to 2.97mbgl, soft brown/yellow/grey mottled slightly sandy silty CLAY with occasional pebbles to 4.62mbgl. BH Ref: SD80SW369, 8m NW: made ground to 1.67mbgl, very soft to soft brown/grey silty sandy CLAY with organic remains to 4.52mbgl.
Hydrogeology	Superficial	Secondary A / Undifferentiated Aquifer.
	Bedrock	Principal Aquifer. Site is not within any Source Protection Zone (SPZ).
Hydrology	All adjacent and internal surface water	There are no watercourses within and within the vicinity of the site boundary. River Irwell is running 300m southeast of the site.
Site History		Brick Field / Old Clay Pits present in the northeast and northwest from 1848 mapping, Terrace houses present from 1890 mapping. No longer present by 1973 mapping. Existing track in the north present from 1983 mapping.

Table 2-1: Summary of the Environmental Setting.

2.4 Site Reconnaissance

A site reconnaissance was undertaken in February 2020 and photographs are provided in Appendix B.

Relevant features identified on site are summarised below:

- The site is currently vacant and comprises rough ground with overgrown grass and brambles. A hardstanding track is present along the eastern perimeter of the site. Trees are present along the eastern boundary.
- The site is topographically higher than land to the south.
- The site surface was noted to be uneven with undulations across the surface of the site. There is a steep slope across the southeast of the site towards existing access.
- A public sewer is present in the north of the site (four manholes noted).
- Gullies were noted adjacent to the access gate.
- Made ground was observed, which contained rootlets, brick, ash, clinker, glass, concrete, and rubber to 0.40mbgl. Natural ground was not identified.

⁴ Phase 1 Preliminary Risk Assessment: LK Consult Ltd, LKC 20 1271, February 2020.

2.5 Site and Access Levels

No topographic survey has been undertaken for the site. The site generally falls from the north to south and towards Bury New Road from 35m AOD to approximately 29m AOD within the southeast (Contour map, Appendix B). The road levels opposite the site are 30.2m AOD adjacent to Fairy Lane, similarly the road level adjacent to the southern extent of the site is 28.7m AOD.

The final site levels and ground floor levels of buildings have not yet been determined.

The site access is currently from Bury New Road at approximately 28.7m AOD and it has been assumed that it will remain the same.

2.6 Geo-Environmental Investigation.

Sub Soil Surveys Ltd. undertook a ground investigation⁵ in August 2010 for a site next door located immediately to the north of Fairy Lane, 12m away from the north of the study site.

The investigation comprised of four light cable percussion boreholes to depths of approximately 13-15mbgl and four trial pits to depths of 1.0-1.2mbgl.

Made ground was recorded to depths of 1.3-3.0mbgl across the site, comprising of tarmac, concrete, bricks, sandstone, and reworked clay strata. Made ground was associated with old foundations, services, and basements.

Approximately 3.6-5.2m of sandy silty organic clay was encountered above slightly silty sand and gravel to 9.5m. Sandstone bedrock recorded at 11.7-13.7mbgl.

Groundwater table was recorded at about 5.9-7.0mbgl and this was associated with the Sand and Gravel Zone 1. Subsequent water level monitoring undertaken in the standpipes indicated a possible perched groundwater table within the made ground deposit with levels between 1.2-4.0mbgl.

⁵ Report on Ground Investigation at Bury New Road, Manchester – Sub Soil Surveys Ltd., Ref: 2010/29-001-CON-Rev0, August 2010.

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3 Consultation

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

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

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). – within the north and northeast of the site. Flood Zone 2: Low risk, with annual probability of flooding of 0.1 to 1.0% from rivers and 0.1 to 0.5% from the sea. – within the south of the site and along Bury New Road.	
	Modelled Levels for River Irwell	Node 3: Level of 26.63m for 1% annual probability event. Level of 29.24m for 1% event with climate change allowance. Level of 30.73m for 0.1% annual probability event. Node 4: Level of 27.4m for 1% annual probability event. Level of 28.8m for 1% event with climate change allowance. Level of 30.71m for 0.1% annual probability event.
	Records of Flooding	Extent of 1844 flooding recorded within edge of the site. Extent of 1946 and 2015 flooding within the area to the southwest and south of the site.
	Records of Flood Warning Service	Area within Flood Zone 2 is within a flood warning service area.
	Surface Water Flooding	Very low risk indicated by online mapping.
	Flooding from reservoirs	Limited risk along Bury New Road.
	Groundwater Source Protection Zone	Not within Source Protection Zone.
	Flood Defences	Site outside of area benefiting from flood defences located to the southwest of the site, along River Irwell.
Lead Local Flood Authority (Manchester City Council)	No records of flooding incidents from surface water or groundwater in the area. Any new connection of surface water into ordinary watercourses should be at the greenfield runoff rate. Any connection to sewers should be agreed with United Utilities. No surface water should connect into the highway drainage. LLFA would require that Non-Statutory Technical Standards for SuDS is followed when designing sustainable drainage systems. LLFA would require that evidence that drainage hierarchy has been applied in line with Building regulations part H3 and NPPG.	
United Utilities	Sewer Map	There is a 300mm diameter surface water sewer and a 225mm diameter foul sewer within the northeast of the site. There are various size ovoid surface water sewers and 675/670mm diameter combined sewer in Bury New Road.

Table 3-1: Summary consultee information.

Source	Details	
United Utilities	Likely conditions for connecting into their sewerage system	UU would allow to connect either into the surface water within the site boundary and surface water sewer in Bury New Road at a maximum flow rate of 5l/s. 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. Foul will be allowed to drain to the public foul sewer network at an unrestricted rate, and at any convenient point. UU have no current record of sewer flooding within the vicinity of the proposed development.
Strategic Flood Risk Assessment (SFRA)	Level 2 SFRA ⁶	The site has a history of flooding from fluvial source. The site is within Critical Drainage Area (CDA). The site is not within the groundwater flooding area.
Preliminary Flood Risk Assessment (PFRA) ⁷	The Preliminary Flood Risk Assessment (PFRA) ⁷ for the area indicates that there are records of fluvial flooding for the area which conforms with information supplied by the EA. The PFRA also indicates that the site is not in the area susceptible to groundwater flooding (<25% susceptibility).	

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

⁶ Strategic Flood Risk Assessment Level 2: Manchester City, Salford City Council and Trafford Councils Level 2 Hybrid SFRA, Final 2011, JBA Consulting.

⁷ Preliminary Flood Risk Assessment: Manchester City Council; 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 Zones 1 and 2 and is outside of the area benefiting from flooding (see Appendix C).

A direct comparison was made between the provided by the EA flood levels for River Irwell and the levels obtained from Bury New Road. The nearest extent of Flood Zone 3 was also considered to identified potential risk associated with the site and to identified potential finished floor levels.

The ground level at the nearest extents of Flood Zone 3 is 27.8m AOD. The road levels opposite the site are 30.2m AOD adjacent to Fairy Lane, similarly the road level adjacent to the southern extent of the site is 28.7m AOD.

This 100-year level is in between the 100-year levels for nodes 3 and 4, as specified in Table 3.1. It is about a third of the difference. Therefore, the assumed flood levels on site are:

100-year level	27.80mAOD
100-year + 35% level	28.95mAOD
1000-year level	30.72mAOD

The EA design flood levels for 100-year flood event are therefore lower than the site. The actual flood position is considered to be better than that indicated by the published flood map.

The above also indicates that the 1% (100-year plus CC) flood level will likely affect the south-western corner of the site.

The extents of the 0.1% (1000-year) flood level covers a part of the development area (Flood Zone 2).

4.2 Sources of Flooding

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

Fluvial – The EA has confirmed the south and southwest area of the site is within Flood Zone 2. Therefore, the flood risk associated with this source is Low and should be considered further in terms of finished floor levels 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 do not indicate any areas that may be affected by pluvial flooding during prolonged heavy rainfall. The topography of the site provides that the site is free draining. No standing water was observed during site walkover. The flood risk associated with this source is considered Very Low.

Surface Water (Overland flow) – This relates to surface water entering the site. The only observed impermeable area at a level generally above that of the study area is Fairy Lane adjacent to the site however any surface water arising from Fairy Lane will flow towards Bury New Road and therefore pose no threat to the development. The risk is considered to be Very Low.

Groundwater – The LLFA has no records of groundwater flooding within the study area. The nearest ground investigation identified ground water level at 5.9-7.0mbgl and perched water level within made ground with variable depth subject to weather conditions. The SFRA and PFRA indicated that the site is not within area susceptible to groundwater flooding. The flood risk associated with this source is considered Very Low, however the perched water within made ground should be considered during construction.

Sewers – United Utilities sewer records show foul and surface water sewers within the site boundary and the nearest vicinity of the site. There is also a number of sewers serving the adjacent residential area to the north, which join the network within the northeast of the site. There are no current records of sewer flooding at the site location. The flood risk associated with this source is considered Low.

Artificial sources – According to the EA online maps, the limited area adjacent to Bury New Road is at risk from reservoir flooding. The likely risk of any incident occurring if the reservoirs are adequately maintained and monitored is very low. Therefore, the flood risk associated with this source is considered Very Low.

4.3 Summary of Flood Risk

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

Table 4-1: Summary of Existing Risk Level.

The site is located within Flood Zone 1 and 2 and has a Low risk of flooding from fluvial and sewers sources. 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 H3⁸ 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 2010⁹.

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.

⁸ Building Regulations part H3 2010: Approved Document, Drainage and Waste Disposal.

⁹ Flood and Water Management Act 2010: UK Government.

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
Till across majority of site, Alluvium deposits in the southern corner of site, Potential River Terrace Deposits along the NW boundary, Potential Glaciofluvial Deposits along N site boundary.	Made ground. Silty, sandy gravelly clay. Sand and gravel.	Secondary A / Undifferentiated Aquifer.	1.2-4.0mbgl	Limited
Chester Formation Bedrock	Sandstone	Principal Aquifer	5.9-7.0mbgl	Poor

Table 5-1: Geological and Hydrogeological Setting.

The onsite borehole record and the records within the adjacent area identified that deep made ground to depth of 1.2-3.0m is expected across the site. This is associated with the old foundations and likely buried structures present on site. Slowly permeable seasonally wet loamy and clayey soils are expected across the site as identified on the Soilscape mapping (Appendix. B).

Infiltration methods such as soakaways are likely to be limited and are not considered to be feasible for the development.

5.2 Surface Water Drainage Strategy

There is a slope over the site and surrounding area to the northwest which indicates that groundwater in the vicinity of the site would drain towards Bury New Road.

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

There is a surface water sewer running through the site and adjacent to the site in Bury New Road.

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	N/A	Reasoning: Deep made ground with perched water level present across the site underlain by slowly permeable clay-based soils.
b	Connection to Watercourse	N/A	There are no watercourses (including culvert watercourses) in the vicinity of the site where connection could be made.
c	Discharge into a sewer	1	Connection could be made to the adjacent surface water sewer at the maximum flow rate of 5l/s – subject to approval from LLFA and UU.

Table 5-2: Drainage options.

Table 5-3 provides a summary of the SuDS options appraisal with consideration of CIRIA C753 (The SUDS Manual)¹⁰ for the development:

SuDS Option	Appropriate to Development	Comments	Benefits	Comments
Infiltration				
Soakaways	X	Due to the nature of the ground conditions, the use of infiltration systems may not be feasible.	Water quantity Water quality	Soakaways provide stormwater attenuation, stormwater treatment and groundwater recharge. Runoff is treated by physical filtration to remove solids, by absorption into the soil and removal and by biochemical reactions involving micro-organisms growing on the soil.
Infiltration basin	X	Depressions that store and dispose of water via infiltration. May be appropriate given the ground conditions.	Water quantity Water quality Biodiversity Amenity	Infiltration basin reduces the volume of runoff from a drainage area, can be very effective at pollutant removal via filtering through the soils, contributes to groundwater recharge and baseflow augmentation. Runoff is treated by physical filtration to remove solids, by absorption into the soil and removal and by biochemical reactions involving micro-organisms growing on the soil.
Infiltration trench	X	Infiltration trenches are shallow excavations with rubble or stone.	Water quantity Water quality Amenity	An Infiltration trench can create temporary subsurface storage of stormwater runoff, thereby enhancing the natural capacity of the ground to store and drain water. Infiltration trenches allow water to dissipate into the surrounding soils from the bottom and sides of the trench where runoff is treated by physical filtration, adsorption and biochemical reactions involving micro-organisms growing in the soil. Infiltration trenches are easy to integrate into a site. They are ideal for use around playing fields, recreational areas, or public open space.
Rain gardens	*	Rain gardens are relatively small depressions in the ground that are planted up with native vegetation. Most likely to be implemented on private property close to buildings on relatively flat areas.	Amenity Biodiversity Water quality Water quantity	Attractive features that can help to improve open space. Can be planned as landscaping features. Flexible layout to fit into landscape. Runoff can be treated by physical filtration to remove solids, by absorption and removal by biochemical reactions involving micro-organisms growing on the soil. They can reduce rate of run off and provide some volume reduction.
Filtration				
Filter drain / trench	X	Linear trenches filled with a permeable granular material, often with a perforated pipe in the base of the trench.	Water quantity Water quality	Filter trenches create temporary subsurface storage of stormwater runoff and provide stormwater treatment. These trenches can be used to filter and convey stormwater to downstream SuDS components.
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. May be appropriate given the site topography.	Water quality Amenity Biodiversity	A filter strip offers no storage and is used solely to remove pollutants from surface water. The vegetation traps organic and mineral particles that are then incorporated into the soil, while the vegetation takes up any nutrients. A filter strip features medium amenity potential. Local wild grass and flower species can be introduced for visual interest and to provide a wildlife habitat.

Table 5-3: Summary of the SuDS options appraisal.

¹⁰ CIRIA C753 - The SUDS Manual. London 2015.

SuDS Option	Appropriate to Development	Comments	Benefits	Comments
Retention & Detention				
Detention basin	*	Dry depressions designed to hold water for a specific retention time. Basins tend to be found towards the end of the SuDS management train, so are used if extended treatment of the runoff is required or if they are required for wildlife or landscape reasons.	Water quantity Water quality Biodiversity Amenity	Detention basins provide flow control through attenuation of stormwater runoff for a wide range of rainfall events. Basins treat runoff in a variety of ways: settlement of solids in still or slow-moving water, adsorption by the soil, biological activity. Basins offer many opportunities for the landscape designer. Basins should not be built on but can be used for sports and recreation. Basins can be part of public open space.
Attenuation Ponds	*	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.	Water quantity Water quality Biodiversity Amenity	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. Ponds treat runoff in a variety of ways: settlement of solids in still water (having plants in the water enhances calm conditions and promotes settlement), adsorption by aquatic vegetation, biological activity. Permanently wet ponds can be used to store water for reuse and offer excellent opportunities for the provision of wildlife habitats. Ponds can be part of public open space.
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.	Water quantity	Geo-cellular systems can be used to control and manage rainwater surface water runoff either as a soakaway or as a storage tank. Geo-cellular storage systems provide high storage volume capacity High void ratios (up to 96%). Capable of managing high flow events.
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.	Water quantity	Oversized pipes can reduce rate of run off and provide some volume reduction.
Tanks	✓	Prefabricated underground tanks could be considered at the detailed design stage in order to provide storage to attenuate surface water runoff.	Water quantity	Storage tanks can be used to control and manage rainwater surface water runoff providing high storage volume capacity. Tanks are capable of managing high flow events.

Table 5-3 (continued): Summary of the SuDS options appraisal.

SuDS Option	Appropriate to Development	Comments	Benefits	Comments
Swales & conveyance channels				
Swales	*	Swales are shallow grass-lined channels that provide capacity for conveying flows at a controlled rate into ponds and watercourses.	Water quality Biodiversity Amenity Water quantity	Swales are effective at removing polluting suspended solids through filtration and sedimentation. The vegetation traps organic and mineral particles that are then incorporated into the soil, while the vegetation takes up any nutrients. Swales are often integrated into the surrounding land use. Local wild grass and flower species can be introduced for visual interest and to provide a wildlife habitat. Swales are usually designed as conveyance systems but can also be designed with check dams to increase attenuation and, where applicable, infiltration.
Channels & rills	*	Channels and rills are open surface water channels with hard edges.	Water quality Amenity Water quantity Biodiversity	Effective in water & pollution treatment. Can act as pre-treatment to remove silt before water is conveyed into further SuDS features. Can be visually appealing in urban landscapes. Amenity value for the local community and biodiversity value (design dependant).
Control structures				
Flow control devices	✓	Flow control devices e.g. hydro-brake style flow control systems, and restricted orifices enable the discharge to be restricted to a constant rate from the development.	Water quantity	Control the peak flow. Complex controls can reduce upstream storage requirements.
Inlets, outlets, and controls	✓	There are many different designs and variations, including landscaped pipes, perforated pipes, weirs.	Water quality Amenity	Inlets, outlets, and other control structures are key elements of well-designed SuDS. Inlet and outlet features allow water to flow into and out of features and also limit the rate at which water flows along and out of the system. There are many different approaches and products available and they can be easily designed to add interest to the urban landscape. Can provide accurate flow control from one SuDS feature to another.
Source control				
Green roofs	*	Green roofs comprise a multi-layered system that covers the roof of a building or podium structure with vegetation cover/landscaping.	Water quality Water quantity Amenity Biodiversity	Green roof installations can help to reduce surface water runoff from roof areas depending on the system specified. Good removal capability of atmospherically deposited urban pollutants. Ecological, aesthetic and amenity benefits.
Blue roofs	*	A blue roof is a roof design that is explicitly intended to store water, typically rainfall.	Water quantity Amenity Biodiversity	Blue roofs are designed to attenuate and manage stormwater on a flat roof in urban areas where options for ground-based attenuation systems are limited, and in particular, where construction is being carried out within flood sensitive areas. Amenity value for the local community.

Table 5-3 (continued): Summary of the SuDS options appraisal.

SuDS Option	Appropriate to Development	Comments	Benefits	Comments
Rainwater harvesting	*	Rainwater harvesting collects the rain which falls onto roofs, then stores it in a tank until required for a non-potable use.	Water quantity	In the process, a volume of water is kept out of the storm-water management system, thereby helping to reduce flooding risks. When required, the water is pumped to the point of use, thus displacing what would otherwise be a demand for mains-water. Reduces demand on mains water.
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.	Water quality Water quantity	Reduced peak flows to watercourses, reducing the risk of flooding downstream. Reduced effects of pollution in runoff on the environment.
Other SuDS				
Wetlands	X	These comprise of shallow ponds and marshy areas, covered almost entirely in aquatic vegetation.	Water quality Water quantity Amenity Biodiversity	Wetlands provide both stormwater attenuation and treatment. Wetlands detain flows for an extended period to allow sediments to settle, and to remove contaminants by facilitating adhesion to vegetation and aerobic decomposition. They also provide significant ecological benefits.

Table 5-3 (continued): 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 LLFA the flow should be limited to a 'greenfield scenario' for estimating the attenuation volumes required. This strategy is considering that surface water from the development will discharge to the surface water sewer at the maximum flow rate of 5l/s, as requested by UU.

For the purpose of this strategy it has been estimated 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)	0.65
Development Area (ha)	0.65
Green Infrastructure (ha)	0.00
Catchment Area	
Catchment Area (ha)	0.65
Impermeable split (ha)	0.65
Permeable split (ha)	0.00

Table 5-4: Assumed plot areas.

5.3.1 Attenuation Estimate

Surface water storage and greenfield runoff estimations based on the HR Wallingford procedure (IH 124¹¹) have been undertaken for the development and the output report is presented in Appendix E.

Given the total site area of 0.65ha, the greenfield runoff rates based on the Wallingford IH 124 method are as below:

Q _{bar} :	4.03 l/s
1 in 1-year greenfield runoff rate:	3.43 l/s
1 in 30-year greenfield runoff rate:	6.77 l/s
1 in 100-year greenfield runoff rate:	8.47 l/s

United Utilities has specified an allowable discharge rate of 5l/s to their adjacent surface water drain.

For the contributing catchment, an estimate has been produced assuming a developable area of 0.65ha and from the 0.65ha plot. It has been assumed that 100% of the proposed development is impermeable.

The following attenuation has been estimated for the development using 5l/s runoff rate and utilises the FSR methodology¹² as:

- » Attenuation storage volume: **131.5 m³** (1 in 30-year event)
- » Retention on site volume: **270.8 m³** (1 in 100 year + 20% Climate Change)
- » Retention on site volume: **330.9 m³** (1 in 100 year + 40% Climate Change)

Attenuation storage aims to limit the peak rate of runoff from the development to the corresponding limited runoff for a range of annual flow rate probabilities before discharge to public sewer. As the flow from the development would be restricted to 5l/s there should be little change in the flows that enter the public sewer and thus the risk

¹¹ IH124 Flood Estimation of Small Catchments.

¹² Flood Studies Report Wallingford NERC 1975.

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 **131.5 m³** and for the 1 in 100-year event, a storage capacity of between **270.8 m³** and **330.9 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 surface water sewer.

5.4 Site Specific SuDS

The use of attenuation-based SuDS deem to be the most feasible and practical option for the development. The attenuation tank or similar will provide required storage volume to limit peak runoff arising from the development. SuDS can be utilised within car park or landscaped areas.

Utilising of the flow control device at the end of the system will reduce upstream storage requirements and 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.

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.

5.5 Foul Drainage

Foul will be allowed to drain to the public foul sewer network in Bury New Road at an unrestricted rate, and at any convenient point.

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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 a minimum of 600mm 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.

On the basis of the information provided, this flood level should be taken as 28.95m AOD. Normal Environment Agency recommendation is to set ground floor level for the development at a minimum of 600mm above the 'design' level, or 29.55m AOD. The lowest levels on site have an approximate level of 28.7m AOD which is below this level but the residential part of the development is raised above the commercial part of the development that is in Flood Zone 2.

6.2 Safe Access

Safe and dry access is available via Bury New Road (approximately 28.7m AOD) to the south at 0.9m above the 1% annual probability event (27.8m AOD). Therefore, no mitigation is proposed.

6.3 Flood Resistance and Resilience

The development proposed may be subject to groundwater entering excavations for foundations and services due to the potentially shallow perched water table. Dewatering may be required for excavations and means of limiting flows in service trench bedding be incorporated. However, the risk appears to be sufficiently low that flood resilience measures need not 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 600mm above the modelled 1% plus climate change event level adjacent to the flood zones. Proposed finished floor levels above this level across the remainder of the site should provide a nominal freeboard to allow overland flow under exceptional conditions. Overland flow routes should be considered in case of drainage failure and the extreme events.

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7 Conclusions

The site is shown on published mapping to be located within the Environment Agency's Flood Zone 1 and 2 - Low Risk of fluvial flooding.

There is also a Low risk of flooding from sewers that has been identified for the site.

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 within the southwest of the site is 29.55m AOD. This is 600mm above the 1% plus climate change level.
- » The finished floor levels elsewhere should be set at a nominal height above the finished ground levels to allow for overland flow routes in extreme events and drainage failures.
- » Pedestrian and vehicular safe access to and from the site is achievable via the access road off Bury New Road.
- » Potential for soakaway use for rainwater disposal is low; however, this can be investigated further at the detailed design phase, if required.
- » Surface water flow will need to be attenuated to the rate agreed with the UU.
- » Surface water arising from the site could potentially discharge into a surface water sewer.
- » Proposed SuDS should be selected to provide a wide range of benefits including amenity, biodiversity and maintaining water quality where practical. During construction, adequate measures should be proposed to control pollution to existing watercourses and groundwater.
- » Foul sewage could be discharged into the existing public foul sewer in Bury New Road subject to the agreement of UU.
- » A formal evacuation plan is not considered to be required.

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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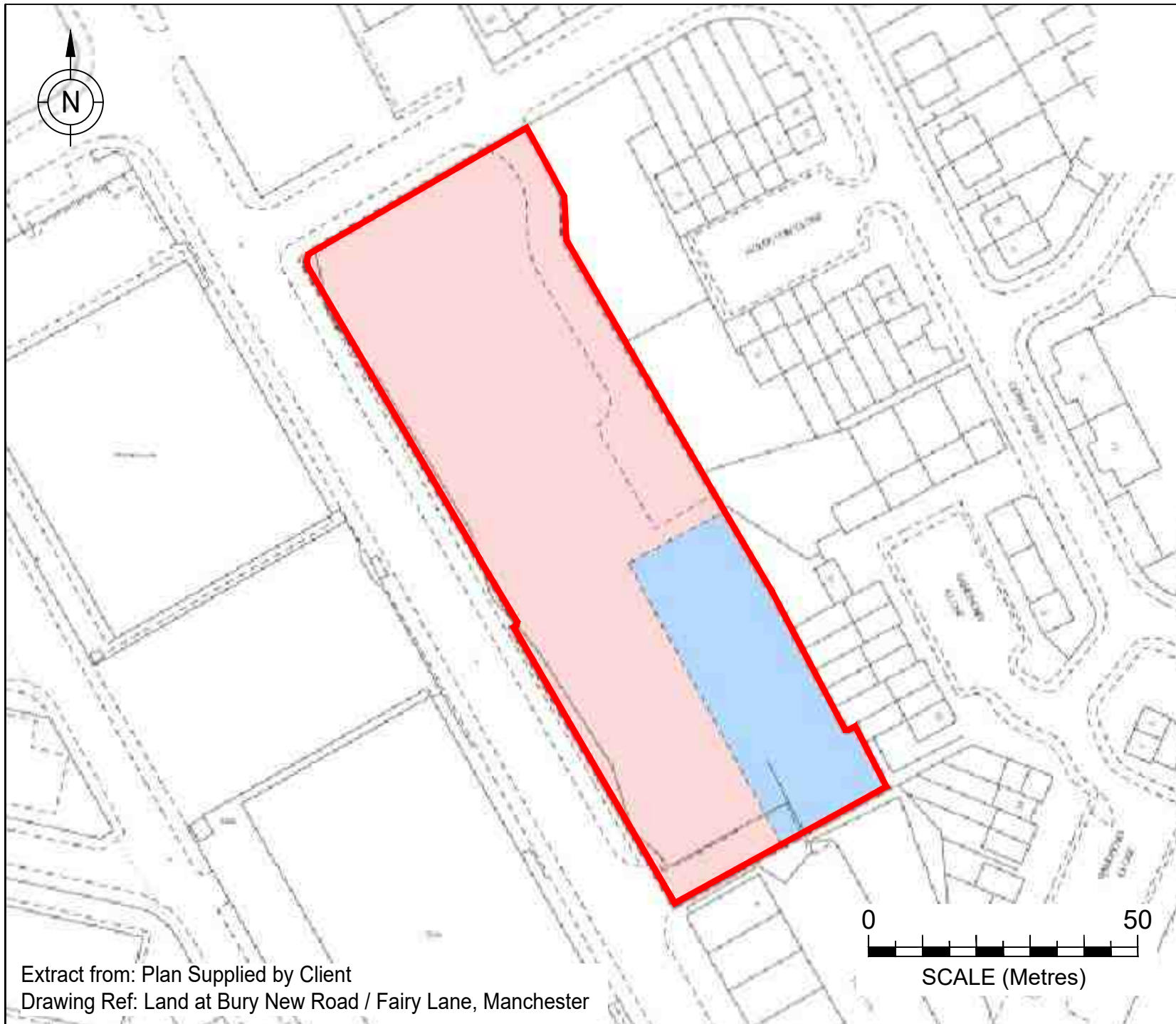
Appendix A

Figures, Plans and Drawings



Figure 1: Site Location Plan, Land at Bury New Road / Fairy Lane, Manchester

Drawn: February 2020 Scale: 1:25,000 @ A4 (see scale bar)



KEY

 Preliminary Boundary

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.

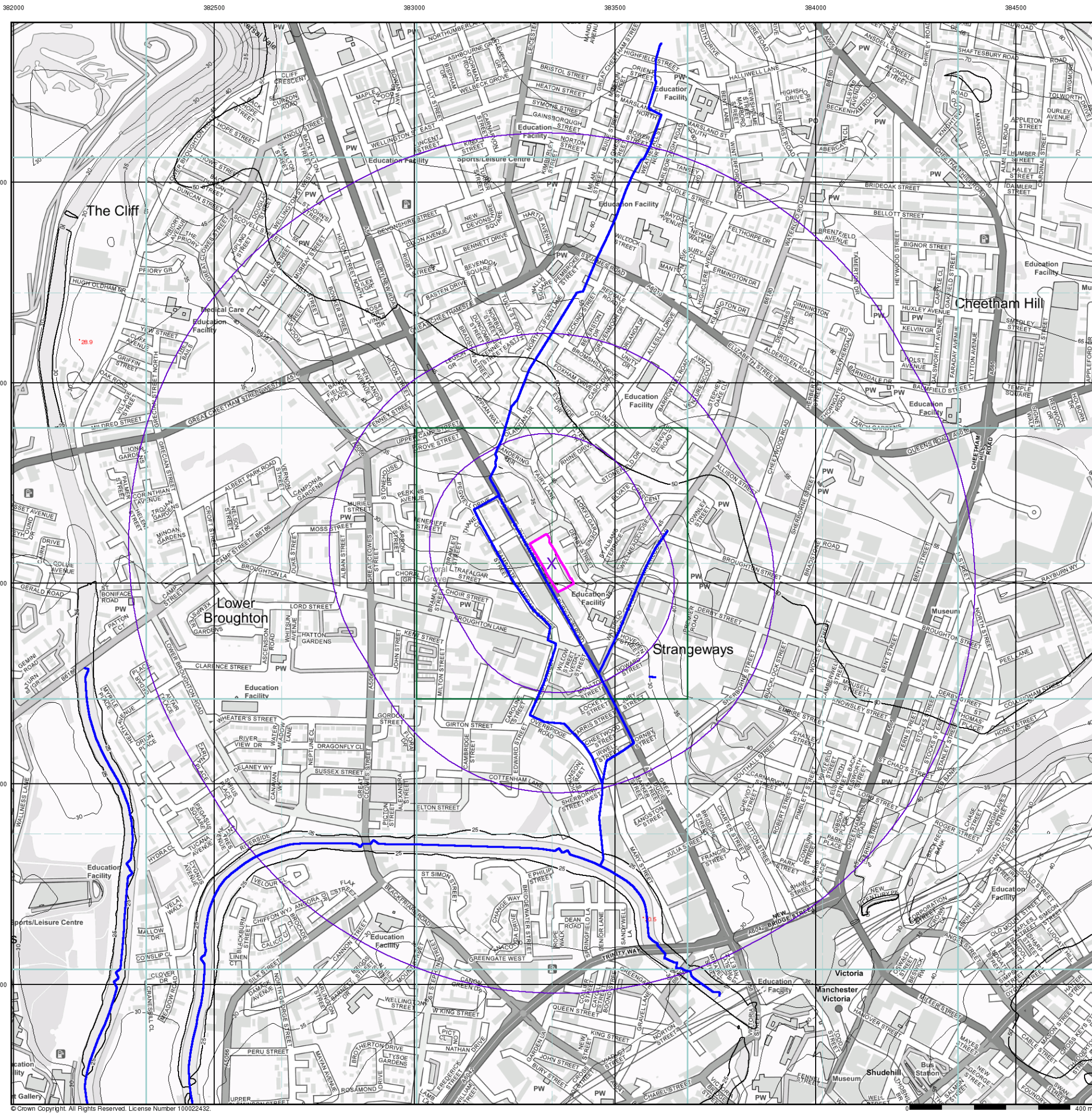


Client: BOI Trading Company Ltd			
Site: Land at Bury New Road / Fairy Lane, Manchester			
Title: Site Boundary Plan			
Job No.: LKC 20 1271	Scale (See Scale Bar): 1:1000 @ A4	Figure: 2	Revision:
Drawn By: AC	Checked By: HM	Drawn: Feb 2020	

Extract from: Plan Supplied by Client
Drawing Ref: Land at Bury New Road / Fairy Lane, Manchester

Appendix B

Site Information



General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

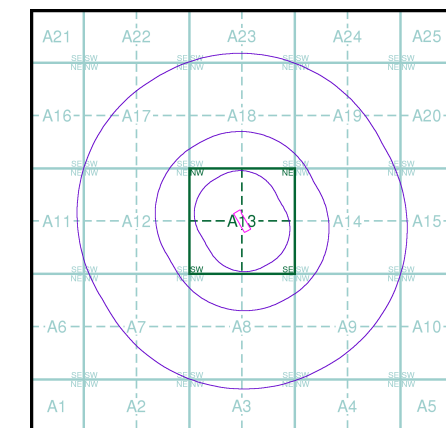
OS Water Network Data

- | | |
|--------------|-------------------------|
| Canal | Drain |
| Reservoir | Other |
| Foreshore | Lake |
| Marsh | Transfer |
| Tidal River | Lock Or Flight Of Locks |
| Inland River | Sea |

Contours (height in meters)

- Standard Contour 105 100 95
- Master Contour
- Spot Height 167.3
- MLW Mean Low Water
- MHW Mean High Water

OS Water Network Map - Slice A



Order Details

Order Number: 234972396_1_1
Customer Ref: LKC 20 1271
National Grid Reference: 383340, 400050
Slice: A
Site Area (Ha): 0.65
Search Buffer (m): 1000

Site Details

Land at Bury New Road / Fairy Lane, Manchester, M8 9SG



Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk

Geology 1:50,000 Maps Legends

Artificial Ground and Landslip

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	WMGR	Infilled Ground	Artificial Deposit	Not Supplied - Holocene
	MGR	Made Ground (Undivided)	Artificial Deposit	Not Supplied - Holocene
	WGR	Worked Ground (Undivided)	Void	Not Supplied - Holocene
	SLIP	Landslide Deposit	Unknown/Unclassified Entry	Not Supplied - Quaternary

Superficial Geology

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	ALV	Alluvium	Clay, Silt, Sand and Gravel	Not Supplied - Holocene
	TILLD	Till, Devensian	Diamicton	Not Supplied - Devensian
	GFDUD	Glaciofluvial Deposits, Devensian	Sand and Gravel	Not Supplied - Devensian
	GFSDD	Glaciofluvial Sheet Deposits, Devensian	Sand and Gravel	Not Supplied - Devensian
	HMGDD	Hummocky (Moundy) Glacial Deposits, Devensian	Sand and Gravel	Not Supplied - Devensian
	RTD1	River Terrace Deposits, 1	Sand and Gravel	Not Supplied - Quaternary
	PEAT	Peat	Peat	Not Supplied - Quaternary
	RTD2	River Terrace Deposits, 2	Sand and Gravel	Not Supplied - Quaternary

Bedrock and Faults

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	CHES	Chester Formation	Sandstone	Not Supplied - Olenekian
	MM	Manchester Marls Formation	Mudstone	Not Supplied - GUADALUPIAN
	CS	Collyhurst Sandstone Formation	Sandstone	Not Supplied - Cisuralian
	HA	Halesowen Formation	Mudstone, Siltstone and Sandstone	Not Supplied - Westphalian
	WDR	Worsley Delf Rock	Sandstone	Not Supplied - Westphalian

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	PUCM	Pennine Upper Coal Measures Formation	Mudstone, Siltstone and Sandstone	Not Supplied - Westphalian
	NHSS	Newton Heath Sandstone	Sandstone	Not Supplied - Westphalian
	PMCM	Pennine Middle Coal Measures Formation	Mudstone, Siltstone and Sandstone	Not Supplied - Westphalian
	ETM	Etruria Formation	Sandstone and Mudstone	Not Supplied - Westphalian
		Faults		
		Rock Segments		



Geology 1:50,000 Maps

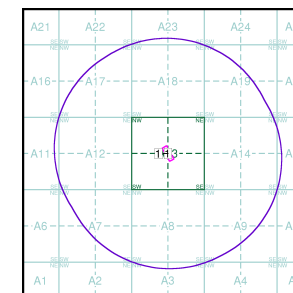
This report contains geological map extracts taken from the BGS Digital Geological map of Great Britain at 1:50,000 scale and is designed for users carrying out preliminary site assessments who require geological maps for the area around the site. This mapping may be more up to date than previously published paper maps.

The various geological layers - artificial and landslip deposits, superficial geology and solid (bedrock) geology are displayed in separate maps, but superimposed on the final 'Combined Surface Geology' map. All map legends feature on this page. Not all layers have complete nationwide coverage, so availability of data for relevant map sheets is indicated below.

Geology 1:50,000 Maps Coverage

Map ID: 1
 Map Sheet No: 085
 Map Name: Manchester
 Map Date: 2010
 Bedrock Geology: Available
 Superficial Geology: Not Available
 Artificial Geology: Not Available
 Faults: Not Supplied
 Landslip: Not Available
 Rock Segments: Not Supplied

Geology 1:50,000 Maps - Slice A



Order Details:

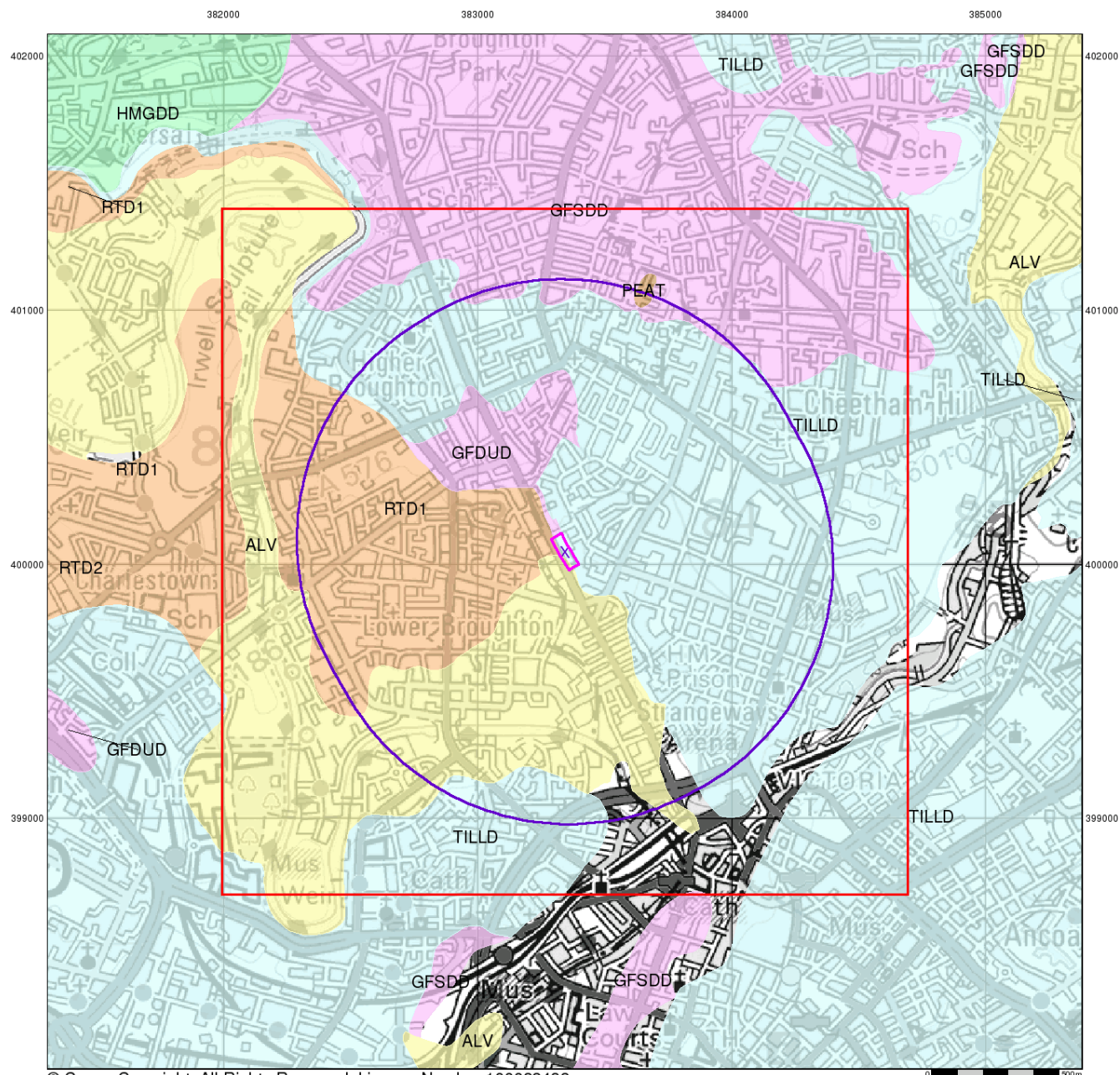
Order Number: 234972396_1_1
 Customer Reference: LKC 20 1271
 National Grid Reference: 383340, 400050
 Slice: A
 Site Area (Ha): 0.65
 Search Buffer (m): 1000

Site Details:

Land at Bury New Road / Fairy Lane, Manchester, M8 9SG

Landmark
 INFORMATION GROUP

Tel: 0844 844 9952
 Fax: 0844 844 9951
 Web: www.envirocheck.co.uk



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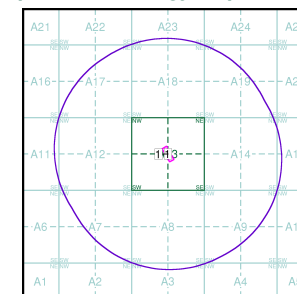
Superficial Geology

Superficial Deposits are the youngest geological deposits formed during the most recent period of geological time, the Quaternary, which extends back about 1.8 million years from the present.

They rest on older deposits or rocks referred to as Bedrock. This dataset contains Superficial deposits that are of natural origin and 'in place'. Other superficial strata may be held in the Mass Movement dataset where they have been moved, or in the Artificial Ground dataset where they are of man-made origin.

Most of these Superficial deposits are unconsolidated sediments such as gravel, sand, silt and clay, and onshore they form relatively thin, often discontinuous patches or larger spreads.

Superficial Geology Map - Slice A



Order Details:

Order Number: 234972396 1_1
 Customer Reference: LKC 20 1271
 National Grid Reference: 383340, 400050
 Slice: A
 Site Area (Ha): 0.65
 Search Buffer (m): 1000

Site Details:

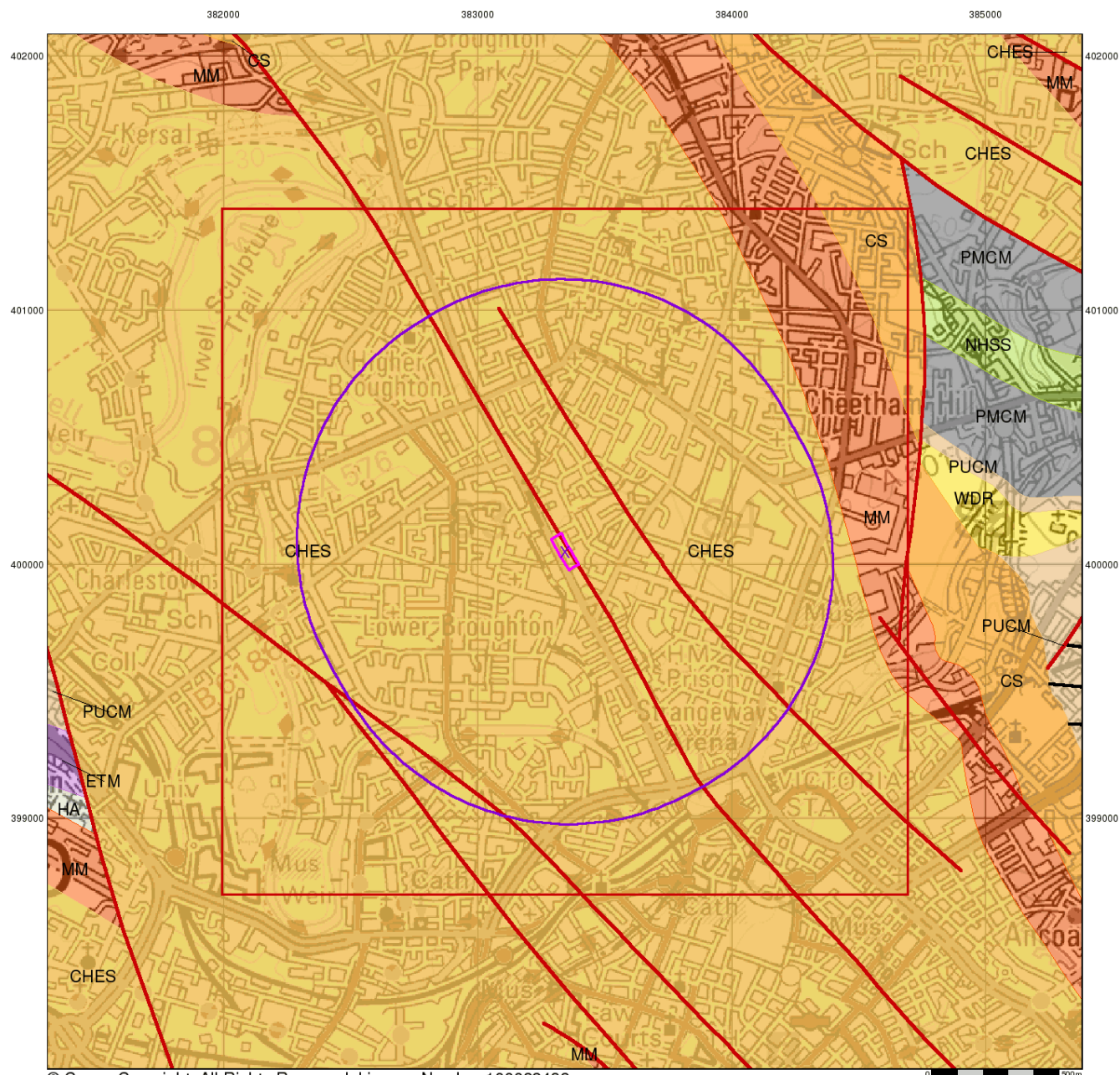
Land at Bury New Road / Fairy Lane, Manchester, M8 9SG



Tel: 0844 844 9952
 Fax: 0844 844 9951
 Web: www.envirocheck.co.uk

v15.0 18-Feb-2020

Page 3 of 5



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Bedrock and Faults

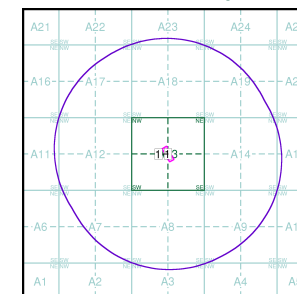
Bedrock geology is a term used for the main mass of rocks forming the Earth and are present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

The bedrock has formed over vast lengths of geological time ranging from ancient and highly altered rocks of the Proterozoic, some 2500 million years ago, or older, up to the relatively young Pliocene, 1.8 million years ago.

The bedrock geology includes many lithologies, often classified into three types based on origin: igneous, metamorphic and sedimentary.

The BGS Faults and Rock Segments dataset includes geological faults (e.g. normal, thrust), and thin beds mapped as lines (e.g. coal seam, gypsum bed). Some of these are linked to other particular 1:50,000 Geology datasets, for example, coal seams are part of the bedrock sequence, most faults and mineral veins primarily affect the bedrock but cut across the strata and post date its deposition.

Bedrock and Faults Map - Slice A



Order Details:

Order Number: 234972396 1_1
 Customer Reference: LKC 20 1271
 National Grid Reference: 383340, 400050
 Slice: A
 Site Area (Ha): 0.65
 Search Buffer (m): 1000

Site Details:

Land at Bury New Road / Fairy Lane, Manchester, M8 9SG



Tel: 0844 844 9952
 Fax: 0844 844 9951
 Web: www.envirocheck.co.uk

v15.0 18-Feb-2020

GEO-RESEARCH LTD.
BRIGHTON ROAD,
HEATON NORRIS,
STOCKPORT, CHESHIRE.

Borehole No. 24 SD80SW
Sheet No. 1 368
Date Commenced 21/6/73
Date Completed 21/6/73
Scale 1:50 8333 0003

CONTRACT: 'G' SEWER
LOCATION: MANCHESTER

Stratum	Legend	Thick- ness	Depth	Sample No.	N Value	Level	Remarks
TOPSOIL		0.150	GL 0.150				
Cinders, bricks and wood FILL			1.060 1.210	D1 CP1 B1	45		
			2.430 2.590	CP2 B2	55		
		2.820	2.970				
Soft brown/yellow/grey mottled slightly sandy silty CLAY with occasional pebbles			3.040	D2 U1			
			3.960	D3			Damp
			4.160	U2			
		1.650	4.620				
Borehole Complete							On completion of borehole at 4.570 Casing at 4.620 Water Nil. Borehole backfilled as casing withdrawn.

GEO-RESEARCH LTD.
BRIGHTON ROAD,
HEATON NORRIS,
STOCKPORT, CHESHIRE.

Borehole No. 25 SD80SW.
Sheet No. 1 369.
Date Commenced 22/6/73
Date Completed 22/6/73
Scale 1:50 8331 0012.

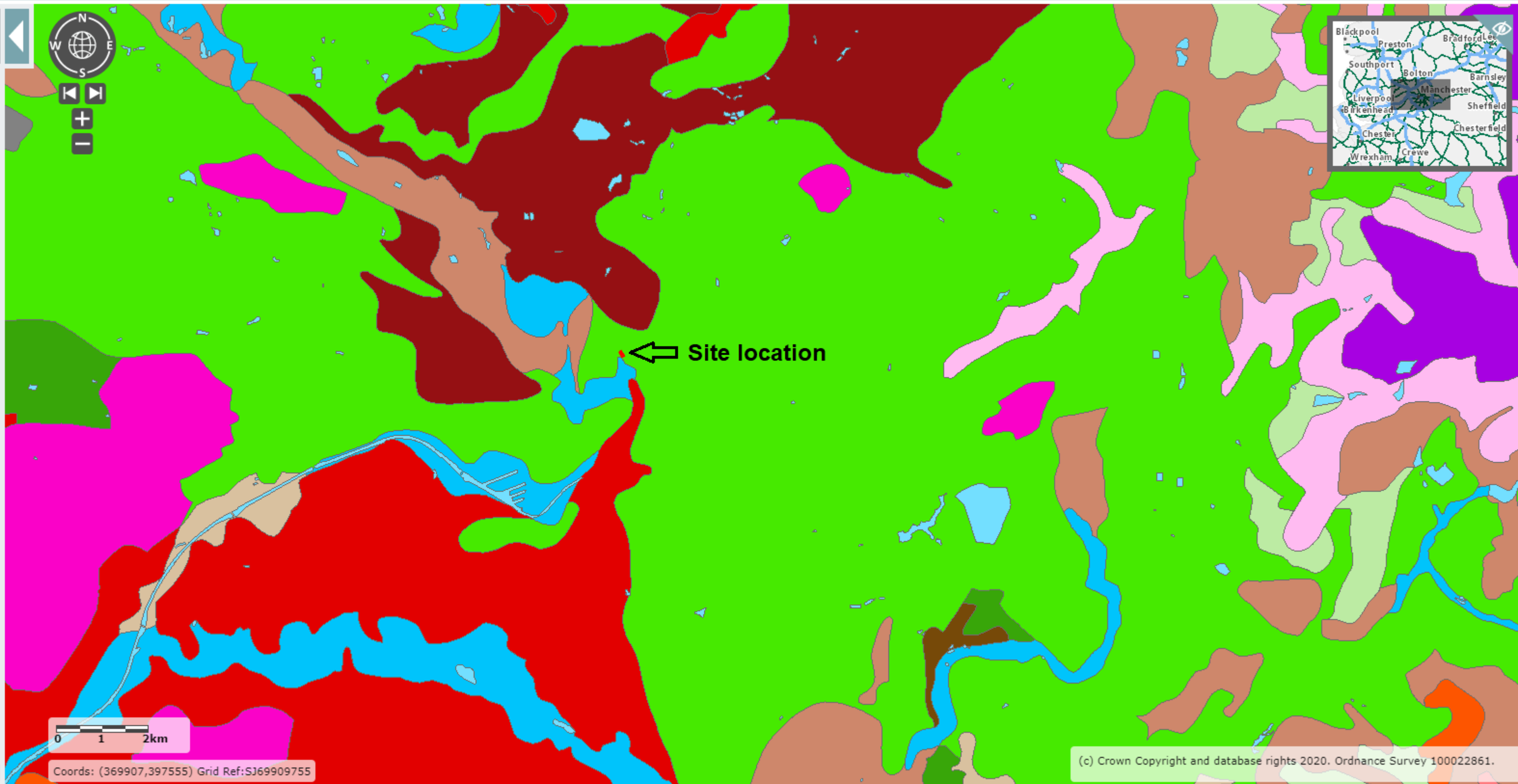
CONTRACT: 'G' SEWER
LOCATION: MANCHESTER

Stratum	Legend	Thick- ness	Depth	Sample No.	N Value	Level	Remarks
			GL				
TARMAC and SETTS		0.220	0.220				
CINDERS		0.180	0.400				
SETTS		0.150	0.550				
Cinder FILL				D1			
			1.060 1.210	P1 B1	3		
		1.120	1.670				
Very soft to soft brown/ grey silty sandy CLAY with organic remains				D2			
			2.510	U1			
			3.580	D3			
			4.060	U2			
		2.850	4.520				
Borehole Complete							On completion of borehole at 4.520 casing at 4.420 Water Nil. Borehole backfilled as casing withdrawn.

Wet

Table of Contents

- 8 - Slightly acid loamy and clayey soils with impeded drainage
- 9 - Lime-rich loamy and clayey soils with impeded drainage
- 10 - Freely draining slightly acid sandy soils
- 11 - Freely draining sandy breckland soils
- 12 - Freely draining floodplain soils
- 13 - Freely draining acid loamy soils over rock
- 14 - Freely draining very acid sandy and loamy soils
- 15 - Naturally wet very acid sandy and loamy soils
- 16 - Very acid loamy upland soils with a wet peaty surface
- 17 - Slowly permeable seasonally wet acid loamy and clayey soils
- 18 - Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils
- 19 - Slowly permeable wet very acid upland soils with a peaty surface
- 20 - Loamy and clayey floodplain soils with naturally high groundwater
- 21 - Loamy and clayey soils of coastal flats with naturally high groundwater
- 22 - Loamy soils with naturally high groundwater
- 23 - Loamy and sandy soils with naturally high groundwater and a peaty surface
- 24 - Restored soils mostly from quarry and opencast spoil
- 25 - Blanket bog peat soils
- 26 - Raised bog peat soils
- 27 - Fen peat soils
- 28 - Sea
- 30 - UC
- 31 - Water



Site Reconnaissance – Land at Bury New Road / Fairy Lane, Manchester, M8 9SG



Photograph 1 (P1)
Gated access to the site through a driveway off Bury New Road.



Photograph 2 (P2)
Hardwood track crossing the site in the eastern perimeter.



Photograph 3 (P3)
Rough ground with brambles present across the site.



Photograph 4 (P4)
Public sewer in the north of the site.



Photograph 5 (P5)
Gullies present within the south of the site.

Trial Hole 1 (TH1)

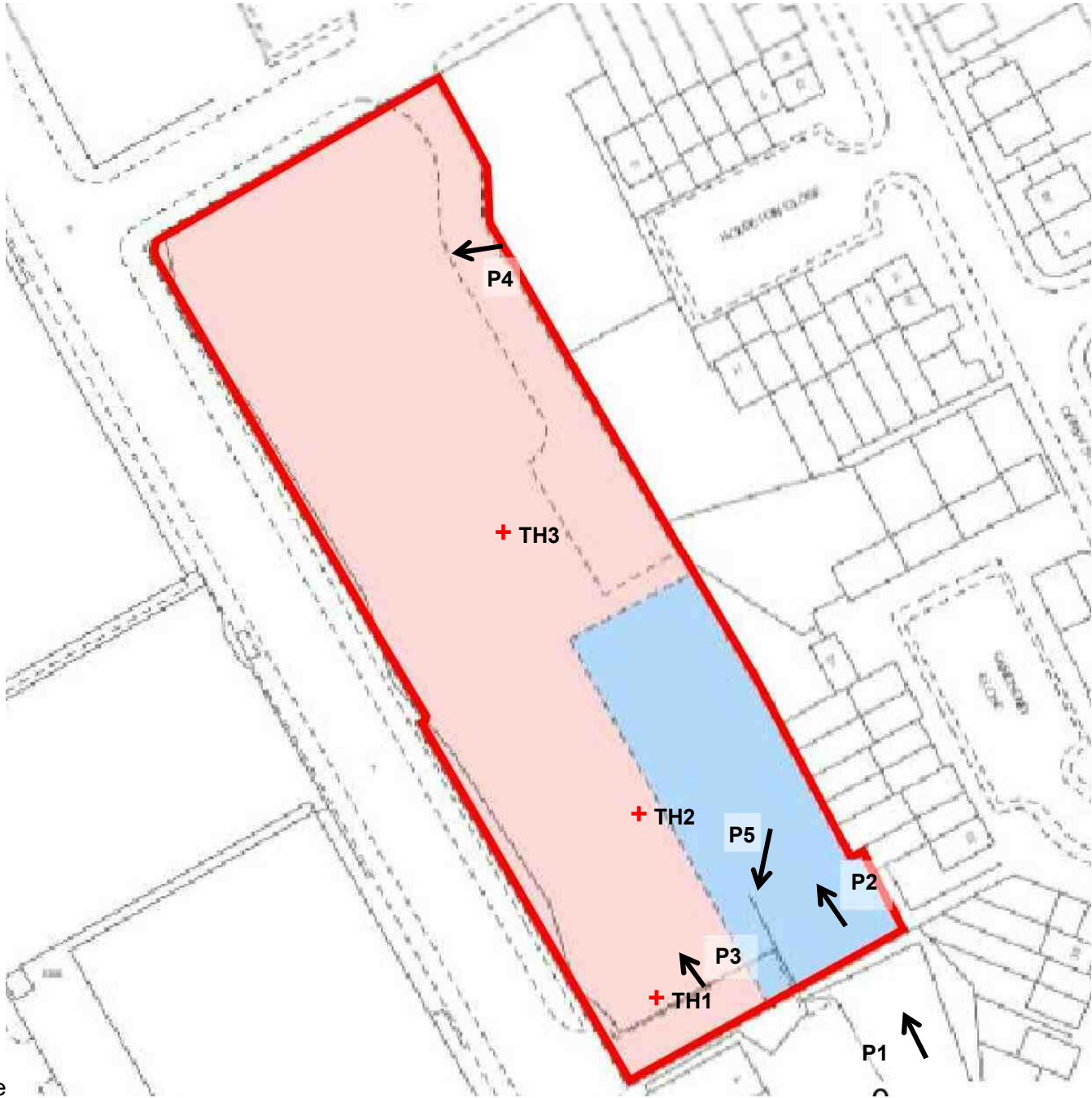
- Made ground (sandy clay with rootlets, brick, ash, clinker and glass fragments) to 0.4m
- Made ground (gravelly clay with rare ash and clinker) to >1m.

Trial Hole 2 (TH2)

- Made ground (sandy clay with rootlets, brick, ash, clinker and glass fragments) to 0.4m
- Made ground (concrete and bricks of buried structures) at 0.4mbgl.

Trial Hole 3 (TH3)

- Made ground (sandy clay with rootlets, brick, ash, clinker and rubber sheet) to 0.4m
- Made ground (concrete and bricks of buried structures) at 0.4mbgl.



Not to Scale

Appendix C

Environment Agency Data

Anna Mierzejewska

From: GMMC Info Requests <InfoRequests.GMMC@environment-agency.gov.uk>
Sent: 24 March 2020 16:18
To: Anna Mierzejewska
Subject: RE: GMMC163739AB Response attached from the Environment Agency
Attachments: GMMC163739AB - RFO.PDF; GMMC163739AB - Table.pdf; GMMC163739AB - DFM.PDF; GMMC163739AB - Def.pdf

Dear Anna,

I enclose the data requested.

Kind regards,

Anne

From: Anna Mierzejewska [mailto:a.mierzejewska@thelkgroup.com]
Sent: 23 March 2020 11:24
To: GMMC Info Requests <InfoRequests.GMMC@environment-agency.gov.uk>
Subject: RE: GMMC163739AB Response attached from the Environment Agency

Dear Anne,

Thank you for your response.

Please could you update the site location as shown on the attached plans. The location marked on provided flood maps seems to be incorrect.

Many thanks,
Anna



Anna Mierzejewska MSc
Environmental Scientist
LK Group | 0161 763 7200 | 07515 051 602
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

From: GMMC Info Requests <InfoRequests.GMMC@environment-agency.gov.uk>
Sent: 20 March 2020 11:38
To: Anna Mierzejewska <a.mierzejewska@thelkgroup.com>
Subject: GMMC163739AB Response attached from the Environment Agency

Dear Anna,

Thank you for your enquiry which was received on 26/2/20.

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

I enclose the data requested.

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/>

Here are some useful links below:

<https://www.gov.uk/guidance/flood-risk-assessment-local-planning-authorities>

<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.

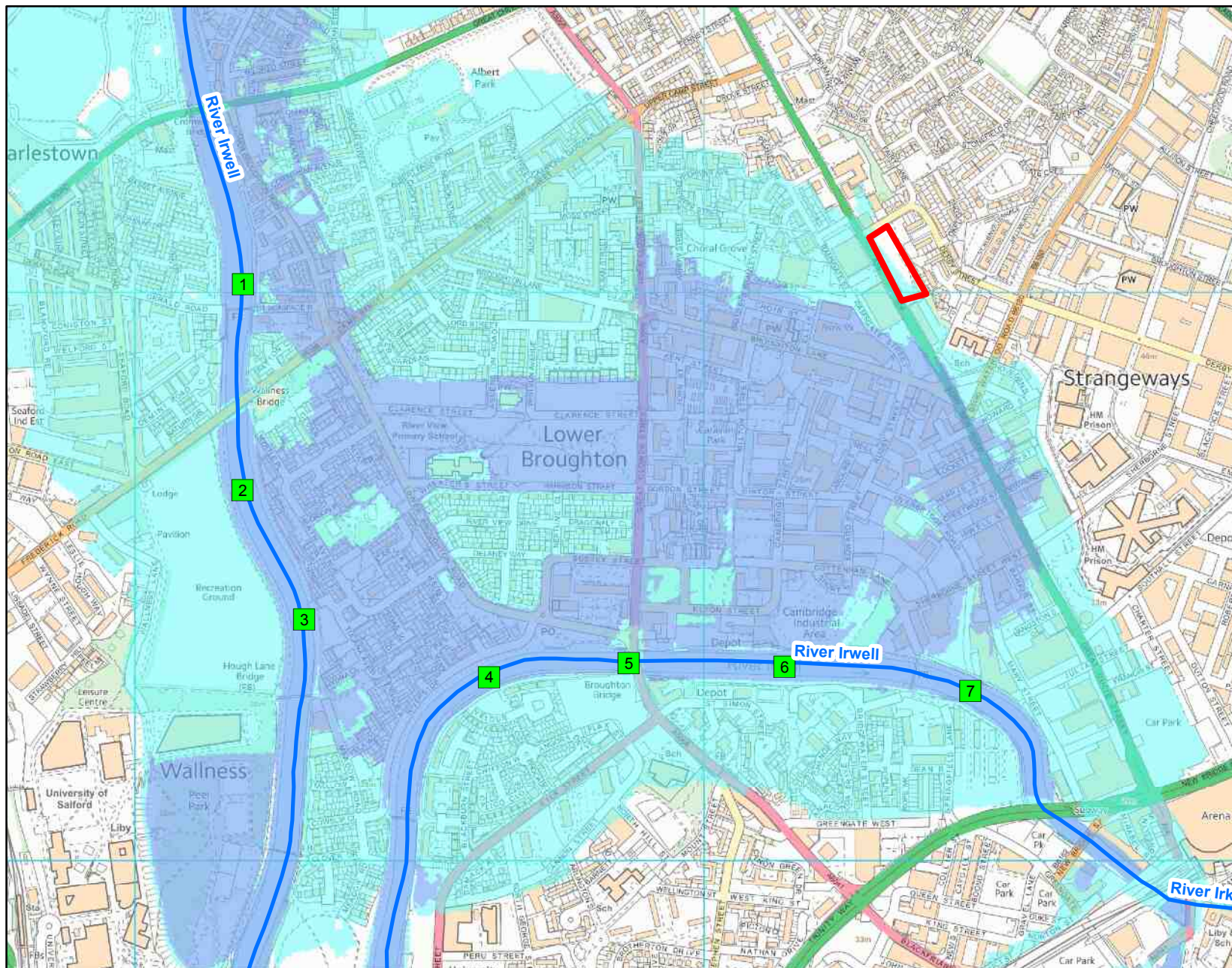
Kind regards,

Anne Ball
Customer and Engagement Officer
Greater Manchester, Merseyside and Cheshire
External: 020 302 51232
Mobile: 07769285094
Email: inforequests.gmmc@environment-agency.gov.uk

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Detailed Flood Map centred on Bury New Road, Manchester, M8 8EB. Created on 24/03/2020 [GMMC163739]



1:10,001



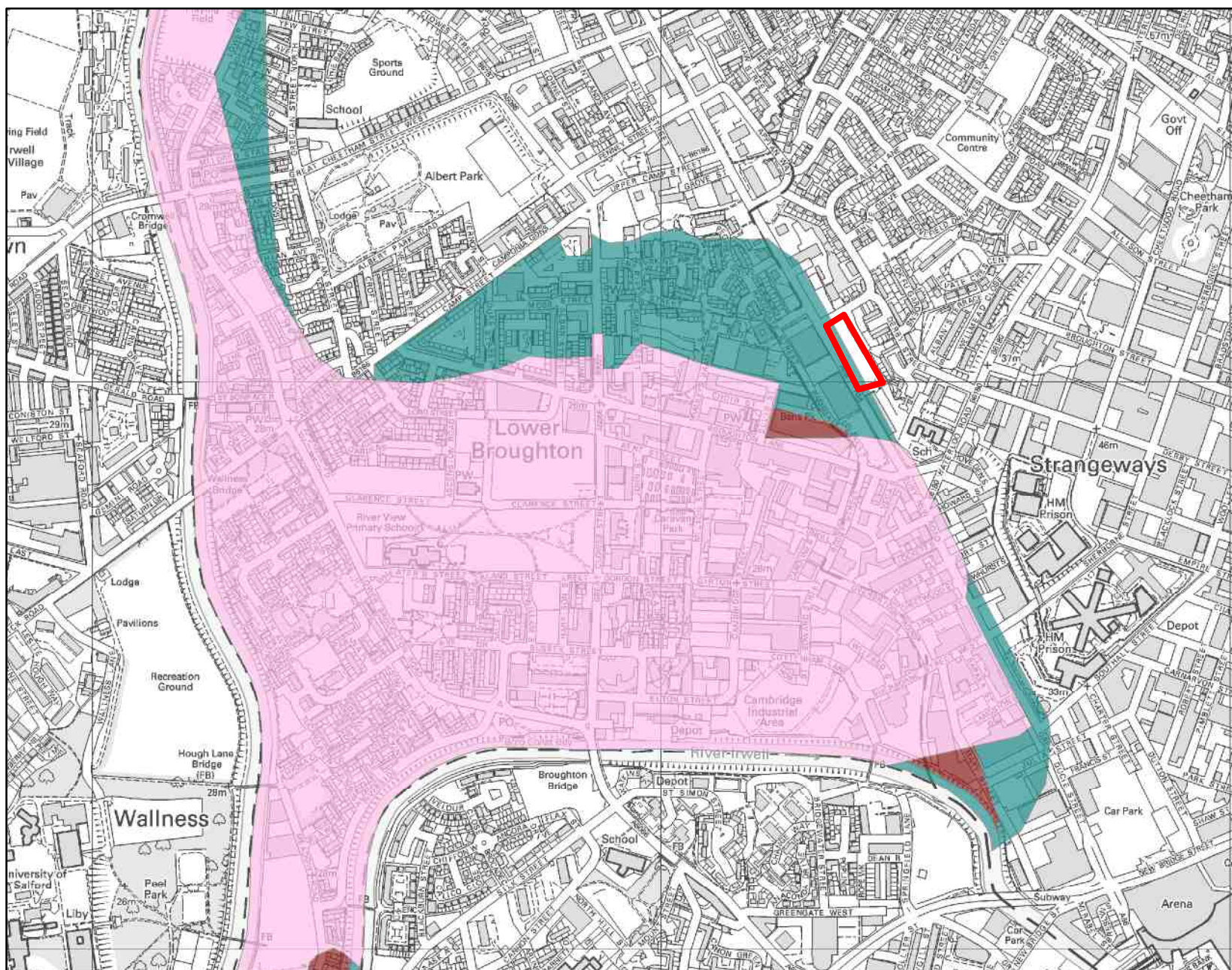
Legend

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

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Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Recorded Flood Outline Map centred on Bury New Road, Manchester, M8 8EB. Created on 24/03/2020 [GMMC163739]



1:10,001



Legend

 Site Location

Recorded Flood Outlines

Start Date

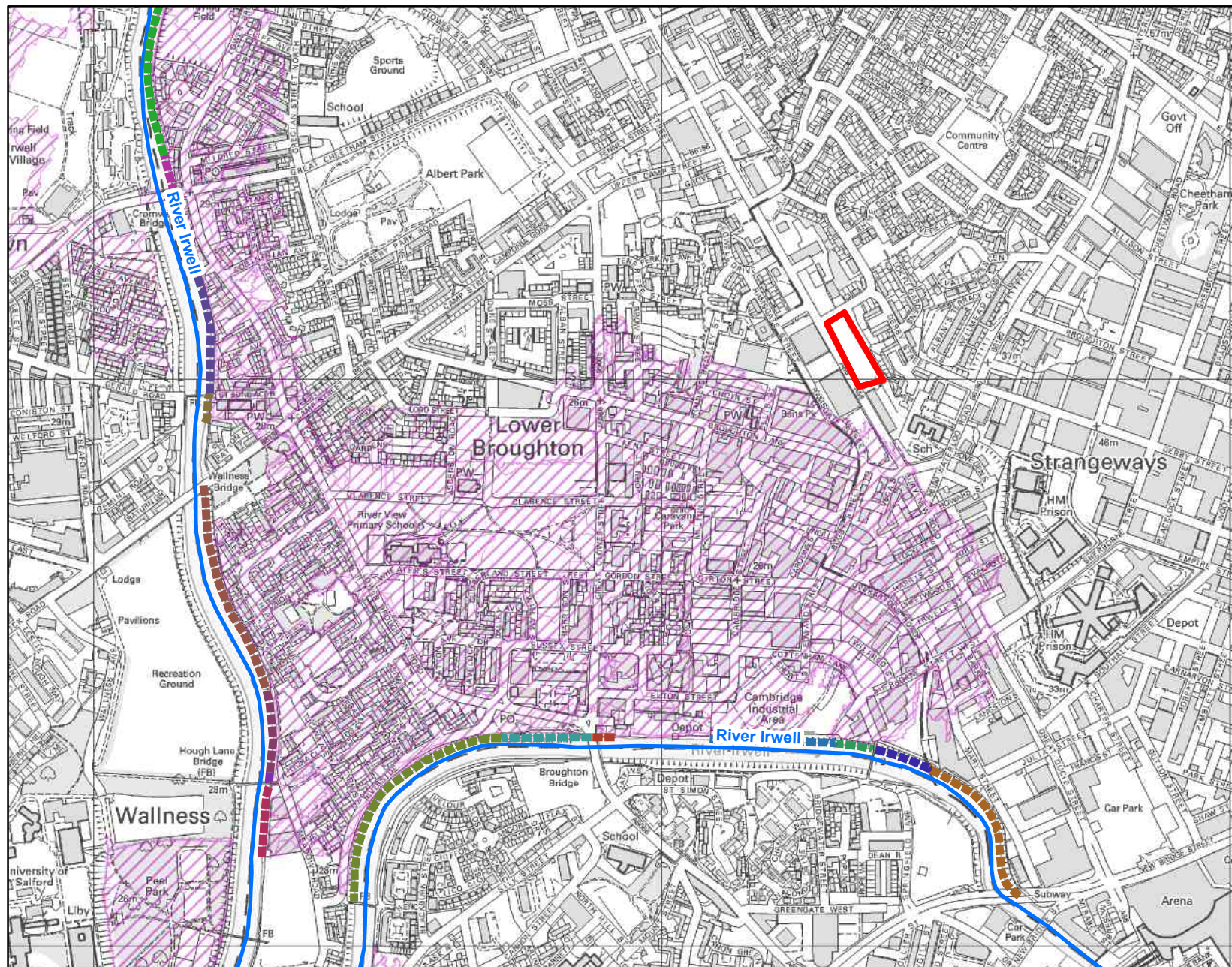
 18661101

 19460920

 20151226

 Main River

Flood Defence Map centred on Bury New Road, Manchester, M8 8EB. Created on 24/03/2020 [GMMC163739]



1:10,001



Legend

Site Location

Defences (EA maintained)

Asset ID

59942

88831

88832

88893

89019

89056

90250

90454

90457

90459

123679

125011

181081

185864

437717

452758

Asset ID

46304

Areas Benefiting

Main River

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Appendix D

Consultee Correspondence

Anna Mierzejewska

From: e.ainsworth@manchester.gov.uk on behalf of floodriskmanagement@manchester.gov.uk
Sent: 09 March 2020 08:51
To: Anna Mierzejewska
Subject: Re: FRA and SuDS enquiry - Land off Bury New Road / Fairy Lane, Manchester
Attachments: Manchester City Council - SuDS Requirement for Developers.pdf

Hi Anna,

- 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.

Manchester City Council does not have any flood defences on ordinary watercourses in the vicinity of the site. The Environment Agency should be contacted regarding flood defences on the River Irwell.

- 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.

We have no flooding incidents from surface water or groundwater in the area. The Environment Agency should be contacted regarding flooding incidents from the River Irwell and United Utilities for sewer flooding.

- Any restrictions applied to ordinary watercourses and sewers in the area.

Any new connection of surface water into ordinary watercourses should be at the greenfield runoff rate. Any connection to sewers should be agreed with United Utilities.

- Highway drainage restrictions and records.

No surface water should connect into the highway drainage as highway drain are only designed to take runoff from the footprint of the highway and not plot development runoff.

- Policies that may relate to Sustainable Drainage Systems (SuDS).

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

From: Anna Mierzejewska <a.mierzejewska@thelkgroup.com>
To: "floodriskmanagement@manchester.gov.uk" <floodriskmanagement@manchester.gov.uk>,
Date: 26/02/2020 15:47
Subject: FRA and SuDS enquiry - Land off Bury New Road / Fairy Lane, Manchester

Dear Sir/Madam,

LK Consult Ltd. has been commissioned to undertake a Flood Risk Assessment (FRA) and SuDS Assessment, for a site located off Bury New Road/Fairy Lane, Manchester. Nearest Postcode M8 8EB, centred at approximate National Grid Reference 383332E, 400057N. The site is proposed for a mixed use development comprising ground floor retail/commercial units with several storeys of one-bed and two-bed apartments. The site used to be occupied by terrace housing until late 1960's and there are indications of connection to the public sewer in Fairy Lane.

The site appears to be partly within fluvial Flood Zone 2.

BGS data indicates that the site is within an area underlain by Till, Devensian superficial deposits and Chester Formation (Sandstone) bedrock. The onsite and nearby borehole records indicate that deep made ground may be present across the site and as such it is envisaged that infiltration is not suitable for the site.

There are no watercourses within the vicinity of the site and there are indication of public sewer in the north of the site and within the adjacent roads.

The site location plan, the nearest borehole records and geology map are 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:

- 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.
- 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 applied to ordinary watercourses and sewers in the area.
- Highway drainage restrictions and records.
- Policies that may relate to Sustainable Drainage Systems (SuDS).

If you have any queries, please do not hesitate to get in touch.

We are, of course, happy to pay your reasonable charge for this service. Please let me know by return what information is available, 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 would also be appreciated.

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

Regards

Anna

	Anna Mierzejewska MSc Environmental Scientist LK Group 0161 763 7200 07515 051 602 Manchester London Liverpool Glasgow www.thelkgroup.com INCREASING LAND VALUE
--	---

[attachment "Land at Bury New Road, Manchester.pdf" deleted by Esther Ainsworth/Corporate.Services/MCC] [attachment "Page 1 Borehole SD80SW368 Borehole Logs.pdf" deleted by Esther Ainsworth/Corporate.Services/MCC] [attachment "Page 1 Borehole SD80SW369 Borehole Logs.pdf" deleted by Esther Ainsworth/Corporate.Services/MCC] [attachment "LKC_20_1271_EC_A_GeologyDatasheet.pdf" deleted by Esther Ainsworth/Corporate.Services/MCC]

Lead Local Flood Authority - Manchester City Council

SuDS Requirements for New Developments Update 2019

The Government has strengthened planning policy on the provision of sustainable drainage systems (SuDS) for 'major' planning applications which is being introduced from 6 April 2015 (Paragraph 103 of National Planning Policy Framework and Ministerial Statement on SuDS).

Changes were made to the Town and Country Planning Policy and Guidance to give Local Authority Planning Departments the responsibility for ensuring that new developments are drained in a sustainable way, through the planning process, in consultation with the Lead Local Flood Authorities. As per the guidance issued by the Department of Communities and Local Government (DCLG), all 'major' planning applications being determined from 6 April 2015, must consider sustainable drainage systems.

Decisions about the suitability of sustainable drainage provision are made by the Local Planning Authority. However, under the new consultation arrangements Manchester City Council, in its role as Lead Local Flood Authority, is a statutory consultee for all major applications with regards to sustainable drainage. All 'major' planning applications submitted from 15 April 2015 are required to include a Surface Water Drainage Statement.

Developers submitting the planning application to Manchester City Council are advised to:

- Assess the suitability of sustainable drainage systems in accordance with: paragraphs 051, 079 and 080 of the revised NPPF Planning Practice Guidance (PPG) for Flood Risk and Coastal Change.

Design sustainable drainage systems in line with national Non-Statutory Technical Standards for SuDS: <https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards>

and local policies DM1, EN08, EN14 and EN17 of the Core Strategy. Use of Green Infrastructure is strongly encouraged to manage surface water runoff (sustainable drainage systems – SuDS) and feasibility of its use will be evaluated by LLFA during planning application stage. Developers are encouraged to look into CIRIA SuDS Manual 2015 for details of these systems to manage surface water runoff.

- Assess surface water attenuation requirements that offer a reduction in surface water runoff rate in line with the 'Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA, User Guide, Final, dated May 2010'. (Section 3.4.1 Critical Drainage Areas, page 31). Please note that all new connections to the watercourses shall comply with reduction of flows to Greenfield runoff rates.

http://www.manchester.gov.uk/downloads/download/3871/strategic_flood_risk_assessment-manchester_salford_trafford

- Submit hydraulic calculations and drawings to support the design along with proposed standards of operation and maintenance in accordance with paragraph 081 of NPF (PPG).
- It will be essential that the type of sustainable drainage system for a site, along with details of its extent/position, is identified at the design stage of the whole scheme. This information will be required for both outline and full applications so it is clearly

demonstrated that the SuDS can be accommodated within the development that is proposed. It will no longer be acceptable to leave the design of SuDS to a later stage to be dealt with by planning conditions.

- Surface water run-off should be controlled as near to its source as possible through a sustainable drainage approach to surface water management. SuDS seek to mimic natural drainage systems and retain water on or near to the site, when rain falls, in contrast to traditional drainage approaches, which tend to pipe water off-site as quickly as possible. SuDS therefore offer significant advantages over conventional piped drainage systems.

Applicants are strongly advised to discuss their proposals with relevant planning officers at the pre-application stage to ensure that an acceptable SuDS scheme is submitted.

Minimum requirements for approval

In order to avoid objection, the following three elements of evidence are required:

- Surface Water Management Statement for the site is submitted that is in line with requirement of NPPF PPG Paragraph 079:
 - “New development should only be considered appropriate in areas at risk of flooding if priority has been given to the use of sustainable drainage systems. Additionally, and more widely, when considering major development, as defined in the Town and Country Planning (Development Management Procedure) (England) Order 2015, sustainable drainage systems should be provided unless demonstrated to be inappropriate”.
 - The strategy should be accompanied by at least an outline layout of the proposed drainage systems with space allocation for the proposed attenuation in line with relevant flow reduction requirements.
- Evidence that drainage hierarchy has been applied in line with NPPF PPG Paragraph 080. The aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable:
 - into the ground (infiltration);
 - to a surface water body;
 - to a surface water sewer, highway drain, or another drainage system;
 - to a combined sewer.
- Evidence that one viable solution for draining the site is secured:
 - Results of ground investigation carried out under Building Research Establishment Digest 365. Site investigations should be undertaken in locations and at proposed depths of the proposed infiltration devices. Proposal of the attenuation that is achieving half emptying time within 24 hours. If no ground investigations are possible or infiltration is not feasible on site, evidence of alternative surface water disposal routes (as follows) is required.
 - Where surface water is connected to Main River, any works within or adjacent to the river that would affect it would require consent from Environment Agency. An email of acceptance of proposed flows and/or new connection will suffice.

- Where surface water is connected to the public sewer, agreement in principle from United Utilities is required that there is adequate spare capacity in the existing system taking future development requirements into account. An email of acceptance of proposed flows and/or new connection will suffice.

Where surface water is connected to the ordinary watercourse, agreement in principle from Manchester City Council as Lead Local Flood Authority is required. Please note that all new connections to the watercourses shall comply with reduction of flows to Greenfield runoff rates. An email of acceptance of proposed flows and/or new connection will suffice.

- Where surface water is connected to ordinary watercourse, any works within or adjacent to the watercourse that would affect it would require consent from Manchester City Council as Lead Local Flood Authority. Consent forms can be obtained on the website at:

http://www.manchester.gov.uk/downloads/download/5567/land_drainage_consent_and_guidance.com

Avoiding or discharging drainage condition

- Evidence of consideration of green SuDS solution wherever practicable and viable in line with NPPF PPG Paragraph 051. SuDS should be designed to:
 - reduce the causes and impacts of flooding;
 - remove pollutants from urban run-off at source;
 - combine water management with green space with benefits for amenity, recreation and wildlife wherever practicable.
- For Greenfield site developments, details of surface water attenuation that offers a reduction in surface water runoff rate in line with the Manchester Trafford and Salford Strategic Flood Risk Assessment, i.e. to the Greenfield runoff rates;
- For Brownfield site developments, for all sites located within Conurbation Core Critical Drainage Areas, details of surface water attenuation that offers a reduction in surface water runoff rate in line with the Manchester Trafford and Salford Strategic Flood Risk Assessment, i.e. at least a 50% reduction in runoff rate compared to the existing rates with an aim to reduce to Greenfield runoff rates wherever practicable;
- Where surface water runoff is to be disposed through infiltration, details of surface water attenuation that is adequate for infiltration capacity of the underlying soil is required. This capacity has to be assessed through site investigation carried out in line with Building Research Establishment Digest 365. Site investigations should be undertaken in locations and at proposed depths of the proposed infiltration devices. Half emptying time of proposed attenuation within 24 hours should be achieved.
- Evidence that the drainage system has been designed (unless an area is designated to hold and/or convey water as part of the design) so that flooding does not occur during a 1 in 100 year rainfall event in any part of a building; The NPPF suggests that 'for events with a return-period in excess of 30 years, surface flooding of open spaces such as landscaped areas or car parks is acceptable for short periods, but the layout and landscaping of the site should aim to route water away from any vulnerable property, and avoid creating hazards to access and egress routes. No flooding of property should occur as a result of a one in 100 year storm event (including an appropriate

allowance for climate change)'.

- Assessment of overland flow routes for extreme events that is diverted away from buildings providing long and cross sections for the proposed drainage system and finished floor levels;
- Evidence that runoff volume in the 1 in 100 year, 6 hours rainfall shall be constrained to a value as close as is reasonably practical to the Greenfield runoff volume for the same event, but never to exceed the runoff volume from the development site prior to redevelopment;
- Hydraulic calculation of the proposed drainage system;
- Design construction drawings of proposed SuDS elements and flow controls;
- For sites where proposed development would cause unusual pollution risk to surface water (large car park areas (>50 parking spaces) or industrial estates), evidence of pollution control measures (preferably through SuDS) is required.
- Where an application is part of a larger site which already has planning permission it is essential that the new proposal does not compromise the drainage scheme already approved.

SuDS Maintenance

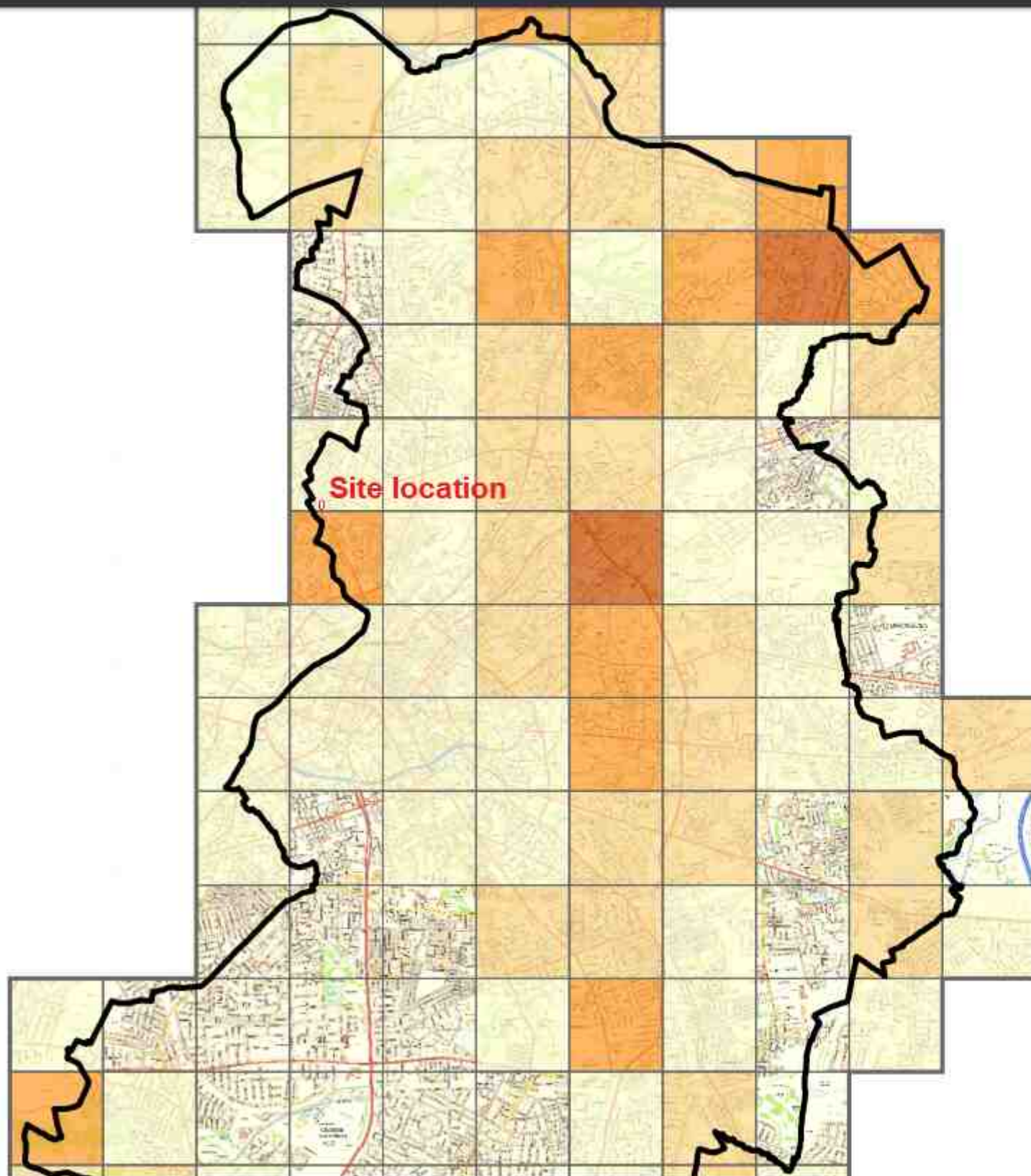
Maintenance of SuDS is essential for its proper operation and a clear management and maintenance plan for the lifetime of the development is required as part of the planning application.

In considering a development that includes a sustainable drainage system, Manchester City Council as local planning authority will want to be satisfied that the proposed minimum standards of operation are appropriate and that there are clear arrangements in place for ongoing maintenance. Information sought by Manchester City Council would be no more than necessary, having regard to the nature and scale of the development concerned in line with NPPF Paragraph 081.

In some instances where no clear adoption of the drainage system is proposed, a drainage maintenance condition could be attached to the planning applications. In order to discharge this condition, the following evidence should be provided following *construction*:

- Verification report providing photographic evidence of construction as per design drawings;
- As built construction drawings if different from design construction drawings;
- Management and maintenance plan for the lifetime of the development which shall include the arrangements for adoption by any public body or statutory undertaker, or any other arrangements to secure the operation of the sustainable drainage scheme throughout its lifetime.

Applicants are strongly advised to discuss their proposals with relevant planning officers at the pre-application stage to ensure that an acceptable SuDS scheme is submitted.



Legend

□ Manchester PFRA Study Area

RISK

- $\geq 75\%$
- $\geq 50\% < 75\%$
- $\geq 25\% < 50\%$
- $< 25\%$

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 1130
Our Ref: UUPS-ORD-153797
Date: 26/02/2020**

Dear Sirs

Location: Fairy Lane

I acknowledge with thanks your request dated 26/02/2020 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

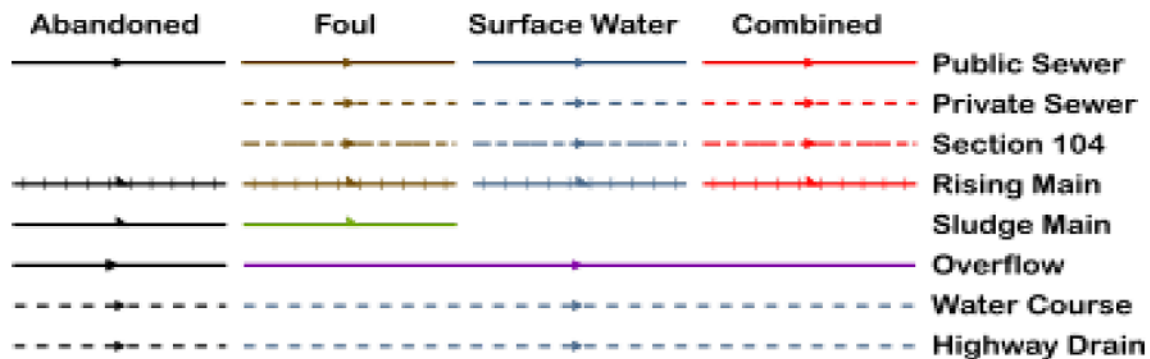
TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

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	



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Anna Mierzejewska

From: Mura, Marie <Marie.Mura@uuplc.co.uk>
Sent: 16 March 2020 10:02
To: Anna Mierzejewska
Cc: Wastewater Developer Services
Subject: FW: FRA and SuDS enquiry - Land off Bury New Road / Fairy Lane, Manchester 4200030562
Attachments: 153797-26-02-2020-02-09-57.pdf

Hi Anna,

We have no objection for a connection to be made to the 300dia surface water sewer within the site boundary a pass forward flow to be agreed by the Lead Local Flood Authority. United Utilities request that any agreed rate does not exceed 5 l/s.

If a connection to the 300dia surface water sewer within the site boundary is no possible, a connection can to be made to the 740dia surface water sewer on Bury New Road a pass forward flow to be agreed by the Lead Local Flood Authority. United Utilities request that any agreed rate does not exceed 5 l/s.

Kind Regards



Marie Mura
Assistant Developer Engineer
Developer Services & Metering
Customer Services
T: 01925 537745
unitedutilities.com

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From: Anna Mierzejewska [<mailto:a.mierzejewska@thelkgroup.com>]

Sent: 04 March 2020 12:22

To: Mura, Marie

Subject: RE: FRA and SuDS enquiry - Land off Bury New Road / Fairy Lane, Manchester 4200030562

Hi Marie,

Thanks for your assessment.

Please see the attached sewer plan. I am assuming that connection could be made to the onsite surface water sewer then (300mm diam.) There is also a surface water sewer in Bury New Road. Would alternatively connection to that sewer be allowed? This may be more practical/feasible due to the current site topography – eastern part of site slopes steeply towards east.

The client has not yet provided site development plan hence we look at all feasible options.

What flow rate would be allowed to drain into the sewer in Bury New Road?

Many thanks,
Anna



Anna Mierzejewska MSc
Environmental Scientist
LK Group | 0161 763 7200 | 07515 051 602
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

From: Mura, Marie <Marie.Mura@uuplc.co.uk>
Sent: Tuesday, March 3, 2020 1:55 PM
To: Anna Mierzejewska <a.mierzejewska@thelkgroup.com>
Cc: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: FW: FRA and SuDS enquiry - Land off Bury New Road / Fairy Lane, Manchester 4200030562

Dear Anna,

Our reference for this pre-development enquiry: 4200030562

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 foul 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.

Surface water will be allowed to drain to the 300mm public surface water sewer at a pass forward flow to be agreed by the Lead Local Flood Authority. United Utilities request that any agreed rate does not exceed 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 (UUV) 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.

Our response does not include:

- *any sewer flooding events caused by blockages or collapses which are the result of third party actions, natural events or other actions over which UUV has no control and not a facet of sewer capacity; or*

- any historical sewer flooding events that have been removed from the register as a result of investment in our infrastructure.

As with all development sites, we recommend you liaise with our water and wastewater engineers by contacting our Developer Services team so the details of your development proposal can be considered further. Details can be found at the following link.

<https://www.unitedutilities.com/services/builders-developers/>

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.

Existing Sewers Crossing the Site

A public sewer crosses this site and we will require unrestricted access to the sewer for maintenance purposes, you must maintain a minimum 3m clearance either side from the centre line of the pipe. If you cannot achieve this then you may wish to consider diverting the public sewer.

Please refer to the link below to obtain full details of the processes involved in sewer diversion.

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

Kind Regards

Marie Mura

Assistant Developer Engineer
Developer Services & Metering
Customer Services
United Utilities
Ext: 01925 537745 **Int:** 37745
unitedutilities.com

From: Anna Mierzejewska [<mailto:a.mierzejewska@thelkgroup.com>]
Sent: 26 February 2020 15:25
To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: FRA and SuDS enquiry - Land off Bury New Road / Fairy Lane, Manchester

Dear Sir/Madam,

LK Consult Ltd. has been commissioned to undertake a Flood Risk Assessment (FRA) and SuDS Assessment, for a site located off Bury New Road/Fairy Lane, Manchester. Nearest Postcode M8 8EB, centred at approximate National Grid Reference 383332E, 400057N. The site is proposed for a mixed use development comprising ground floor retail/commercial units with several storeys of one-bed and two-bed apartments. The site used to be occupied by terrace housing until late 1960's and there are indications of connection to the public sewer in Fairy Lane. There are manholes in the north of the site which are assumed to serve the previous housing. Please advise on the allowable rates for surface water and foul discharge from the development.

BGS data indicates that the site is within an area underlain by Till, Devensian superficial deposits and Chester Formation (Sandstone) bedrock. The onsite and a nearby borehole records indicate that deep made ground may be present across the site. Any infiltration methods of surface water disposal are deemed not feasible due to deep made ground cohesive soils below.

There are no watercourses within the vicinity of the site and there are indication of public sewer in the north of the site and in within the adjacent roads.

The site location plan, borehole records and Pre-development Enquiry Form are attached to this email. The proposals plan has not yet been developed.

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 do not hesitate to get in touch.

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

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

Regards,
Anna



Anna Mierzejewska MSc
Environmental Scientist
LK Group | 0161 763 7200 | 07515 051 602
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

EMGateway3.uuplc.co.uk made the following annotations

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Appendix E

Calculations



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				Sheet no. 1	
				Date 03/04/20	
Project Greenfield Runoff				By	Checked
Title IoH 124 Runoff calcs for Fairy Lane					Reviewed

Hydrological Data:-

FSR Hydrology:-

Location	= Fairy Lane	Grid reference	= SD8300
M5-60 (mm)	= 18	r	= 0.36
Soil runoff	= 0.45	SAAR (mm/yr)	= 940
WRAP	= 4	Area	= England & Wales
Hydrological area	= 10	Hydrological zone	= 5

Soil classification for WRAP type 4

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

Design data:-

Area = 0.0065 Km² - 0.65 Ha - 6500 m²

Calculation method:-

Runoff is calculated from:-

$$Q_{\text{BAR(rural)}} = 0.00108 \text{ AREA}^{0.89} \cdot \text{SAAR}^{1.17} \cdot \text{SOIL}^{2.17}$$

where

AREA = Site area in Km²
 SAAR = Standard Average Annual Rainfall (mm/yr)
 SOIL = Soil value derived from Winter Rainfall Acceptance Potential
 Q_{BAR(rural)} = Runoff (cumecs)

Q_{BAR(rural)} is then multiplied by a growth factor - GC(T) - for different storm return periods derived from EA publication W5-074/A.

Calculated data:-

For areas less than 50Ha, a modified calculation which multiplies the 50Ha runoff value by the ratio of the site area to 50Ha is used
Reducing factor used for these calculations is 0.013

Mean Annual Peak Flow $Q_{\text{BAR(rural)}} = 4.03 \text{ l/s}$



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By	Checked	Reviewed

Project	Greenfield Runoff
Title	IoH 124 Runoff calcs for Fairy Lane

Values for $Q_{BAR(rural)}$

Ret. per.	m ³ /hr	l/s	l/s/ha	Ret. per.	m ³ /hr	l/s	l/s/ha
1yr	12.337	3.427	5.272	100yr+20%	36.575	10.160	15.630
2yr	13.498	3.749	5.768	100yr+30%	39.623	11.006	16.933
5yr	17.562	4.878	7.505	100yr+40%	42.671	11.853	18.235
10yr	20.029	5.564	8.559	200yr	34.833	9.676	14.886
30yr	24.383	6.773	10.420	200yr + 30%	45.283	12.579	19.352
50yr	26.851	7.459	11.475	500yr	39.623	11.006	16.933
100yr	30.479	8.466	13.025	1000yr	44.122	12.256	18.856

Growth factors -

1yr	2yr	5yr	10yr	30yr	50yr	100yr	200yr	500yr	1000yr
0.85	0.93	1.21	1.38	1.68	1.85	2.10	2.40	2.73	3.04

The above is based on the Institute of Hydrology Report 124
to which you are referred for further details (see Sect 7).
Note that the 200 and above year growth curves were taken from W5-074.



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Job No.		
Sheet no. 1		
Date 03/04/20		
By	Checked	Reviewed

Project 30-years storage		
Title Peak flow storage calcs for Fairy Lane		

Data:-

FSR Hydrology:-

Location = Fairy Lane
M5-60 (mm) = 18
Soil index = 0.45
Return period = 30
UCWI = 99.9

Grid reference = SD8300
r = 0.36
SAAR (mm/yr) = 940
WRAP = 4
Climate change = 0

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

Runoff factor (RF) = 81.0, 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 = 6500 m²
Total area (TA) = 6500 m²
Allowed discharge rate = 5.000 l/s
Additional flow = 0.00 l/s

Pervious area = 0 m²
Equiv area = 5265 m² (TA x RF).
Areal reduction factor = 1.000
Climate change factor = 0

Calculated data:-

Time to max = 183.0 mins
Rainfall at max = 12.61 mm/hr
Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Calculated storage volume = 147.6 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 = 131.5 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	18796.9	1125	148.5	400 x 600	820.0	500 x 500	590.4
150	8354.2	1200	130.5	600 x 900	357.0	500 x 750	393.6
225	3713.0	1275	115.6	800 x 1200	200.8	500 x 1000	295.2
300	2088.5	1350	103.1			750 x 1000	196.8
375	1336.7	1425	92.6			750 x 1200	164.0
450	928.2	1500	83.5			750 x 1500	131.2
525	682.0	1575	75.8			1000 x 1000	147.6
600	522.1	1650	69.0			1000 x 1200	123.0
675	412.6	1725	63.2			1000 x 1500	98.4
750	334.2	1800	58.0			1000 x 1800	82.0
825	276.2	1875	53.5			1000 x 2000	73.8
900	232.1	1950	49.4			1500 x 1500	65.6
975	197.7	2025	45.8			1500 x 1800	54.7
1050	170.5	2100	42.6			1500 x 2000	49.2



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Data:-

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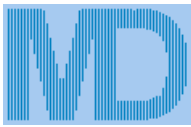
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Project 30-years storage		
Title Peak flow storage calcs for Fairy Lane		

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	81.0	71.058	3.000	68.058
20	56.0	97.723	6.000	91.723
30	44.0	114.531	9.000	105.531
40	36.0	127.051	12.000	115.051
50	31.0	137.121	15.000	122.121
60	28.0	145.595	18.000	127.595
70	25.0	152.938	21.000	131.938
80	23.0	159.434	24.000	135.434
90	21.0	165.269	27.000	138.269
100	19.0	170.574	30.000	140.574
110	18.0	175.441	33.000	142.441
120	17.0	179.942	36.000	143.942
130	16.0	184.128	39.000	145.128
140	15.0	188.045	42.000	146.045
150	15.0	191.724	45.000	146.724
160	14.0	195.194	48.000	147.194
170	13.0	198.479	51.000	147.479
180	13.0	201.597	54.000	147.597
190	12.0	204.564	57.000	147.564
200	12.0	207.396	60.000	147.396
210	11.0	210.102	63.000	147.102
220	11.0	212.695	66.000	146.695
230	11.0	215.183	69.000	146.183
240	10.0	217.574	72.000	145.574
250	10.0	219.876	75.000	144.876
260	10.0	222.094	78.000	144.094
270	9.0	224.234	81.000	143.234
280	9.0	226.301	84.000	142.301
290	9.0	228.301	87.000	141.301
300	9.0	230.236	90.000	140.236
310	9.0	232.111	93.000	139.111
320	8.0	233.930	96.000	137.930
330	8.0	235.694	99.000	136.694
340	8.0	237.408	102.000	135.408
350	8.0	239.074	105.000	134.074
360	8.0	240.838	108.000	132.838
370	7.0	242.508	111.000	131.508
380	7.0	244.143	114.000	130.143
390	7.0	245.744	117.000	128.744
400	7.0	247.313	120.000	127.313
410	7.0	248.851	123.000	125.851
420	7.0	250.359	126.000	124.359
430	7.0	251.838	129.000	122.838
440	7.0	253.291	132.000	121.291
450	6.0	254.717	135.000	119.717
460	6.0	256.119	138.000	118.119
470	6.0	257.496	141.000	116.496
480	6.0	258.851	144.000	114.851
490	6.0	260.183	147.000	113.183
500	6.0	261.493	150.000	111.493
510	6.0	262.783	153.000	109.783
520	6.0	264.053	156.000	108.053
530	6.0	265.304	159.000	106.304
540	6.0	266.536	162.000	104.536
550	6.0	267.750	165.000	102.750
560	5.0	268.947	168.000	100.947
570	5.0	270.127	171.000	99.127
580	5.0	271.290	174.000	97.290
590	5.0	272.438	177.000	95.438
600	5.0	273.570	180.000	93.570

Storage volume (m³) = 147.6 m³



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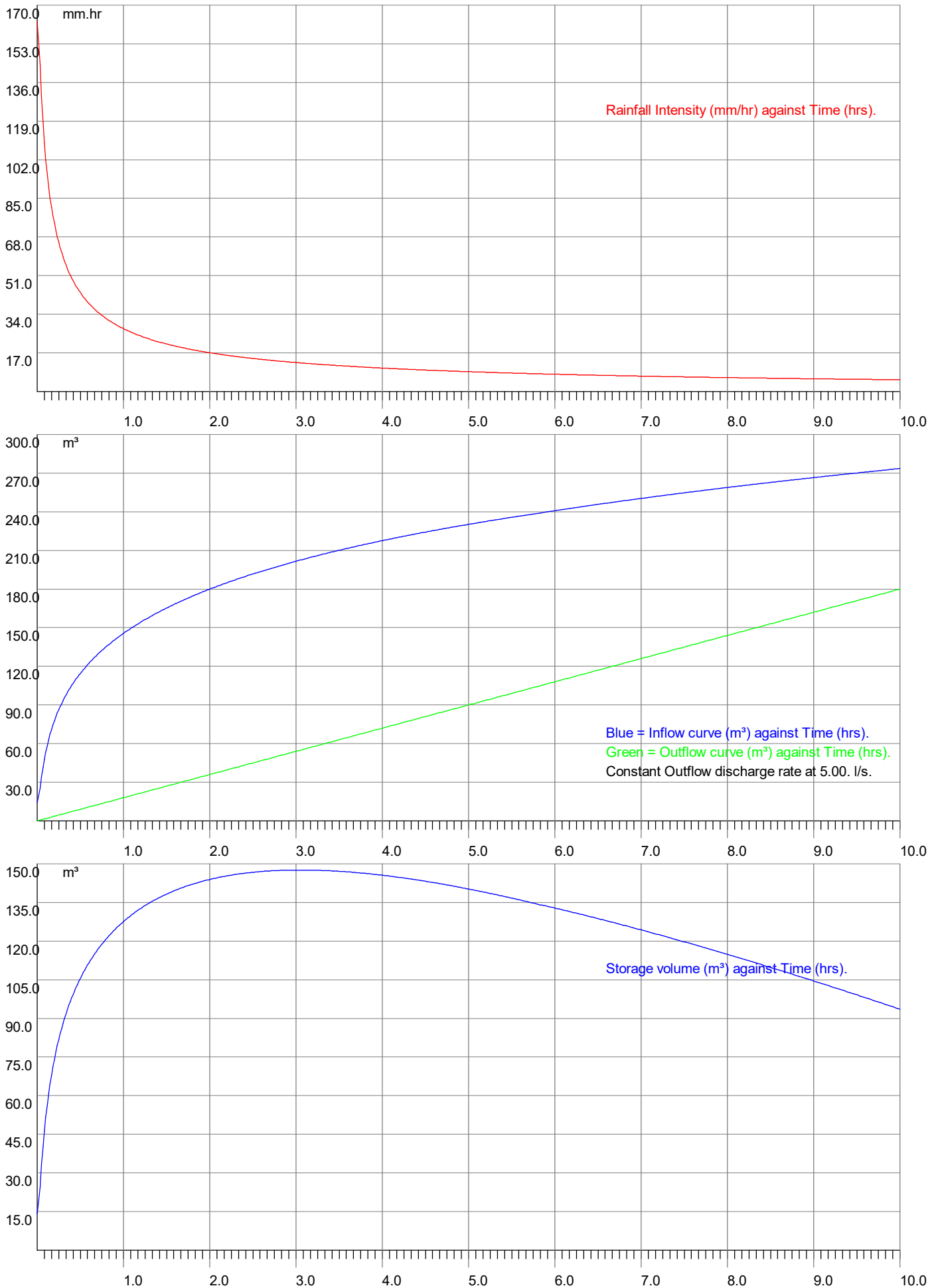
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Project **30-years storage**
Title **Peak flow storage calcs for Fairy Lane**





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Sheet no. 1		
Date 03/04/20		
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Project **100year plus 20% cc storage**

Title **Peak flow storage calcs for Fairy Lane**

Data:-

FSR Hydrology:-

Location = Fairy Lane
M5-60 (mm) = 18
Soil index = 0.45
Return period = 100
UCWI = 99.9

Grid reference = SD8300
r = 0.36
SAAR (mm/yr) = 940
WRAP = 4
Climate change = 20

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

Runoff factor (RF) = 81.0, 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 = 6500 m²
Total area (TA) = 6500 m²
Allowed discharge rate = 5.000 l/s
Additional flow = 0.00 l/s

Pervious area = 0 m²
Equiv area = 5265 m² (TA x RF).
Areal reduction factor = 1.000
Climate change factor = 20

Calculated data:-

Time to max = 278.0 mins
Rainfall at max = 14.52 mm/hr
Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Calculated storage volume = 270.8 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 = 267.3 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	34486.1	1125	272.5	400 x 600	1504.5	500 x 500	1083.2
150	15327.1	1200	239.5	600 x 900	655.1	500 x 750	722.1
225	6812.1	1275	212.1	800 x 1200	368.4	500 x 1000	541.6
300	3831.8	1350	189.2			750 x 1000	361.1
375	2452.3	1425	169.8			750 x 1200	300.9
450	1703.0	1500	153.3			750 x 1500	240.7
525	1251.2	1575	139.0			1000 x 1000	270.8
600	957.9	1650	126.7			1000 x 1200	225.7
675	756.9	1725	115.9			1000 x 1500	180.5
750	613.1	1800	106.4			1000 x 1800	150.4
825	506.7	1875	98.1			1000 x 2000	135.4
900	425.8	1950	90.7			1500 x 1500	120.4
975	362.8	2025	84.1			1500 x 1800	100.3
1050	312.8	2100	78.2			1500 x 2000	90.3



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Data:-

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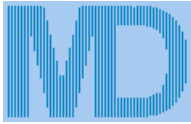
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Project **100year plus 20% cc storage**

Title **Peak flow storage calcs for Fairy Lane**

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	124.0	109.141	3.000	106.141
20	87.0	152.066	6.000	146.066
30	68.0	179.190	9.000	170.190
40	57.0	199.414	12.000	187.414
50	49.0	215.664	15.000	200.664
60	44.0	229.307	18.000	211.307
70	39.0	241.096	21.000	220.096
80	36.0	251.491	24.000	227.491
90	33.0	260.797	27.000	233.797
100	31.0	269.225	30.000	239.225
110	29.0	276.929	33.000	243.929
120	27.0	284.023	36.000	248.023
130	25.0	290.596	39.000	251.596
140	24.0	296.719	42.000	254.719
150	23.0	302.448	45.000	257.448
160	22.0	307.828	48.000	259.828
170	21.0	312.899	51.000	261.899
180	20.0	317.691	54.000	263.691
190	19.0	322.232	57.000	265.232
200	19.0	326.546	60.000	266.546
210	18.0	330.652	63.000	267.652
220	17.0	334.567	66.000	268.567
230	17.0	338.307	69.000	269.307
240	16.0	341.885	72.000	269.885
250	16.0	345.314	75.000	270.314
260	15.0	348.603	78.000	270.603
270	15.0	351.762	81.000	270.762
280	14.0	354.800	84.000	270.800
290	14.0	357.724	87.000	270.724
300	14.0	360.541	90.000	270.541
310	13.0	363.258	93.000	270.258
320	13.0	365.880	96.000	269.880
330	13.0	368.413	99.000	269.413
340	12.0	370.861	102.000	268.861
350	12.0	373.229	105.000	268.229
360	12.0	375.887	108.000	267.887
370	12.0	378.345	111.000	267.345
380	11.0	380.749	114.000	266.749
390	11.0	383.102	117.000	266.102
400	11.0	385.405	120.000	265.405
410	11.0	387.660	123.000	264.660
420	11.0	389.871	126.000	263.871
430	10.0	392.038	129.000	263.038
440	10.0	394.165	132.000	262.165
450	10.0	396.251	135.000	261.251
460	10.0	398.300	138.000	260.300
470	10.0	400.312	141.000	259.312
480	10.0	402.289	144.000	258.289
490	9.0	404.232	147.000	257.232
500	9.0	406.143	150.000	256.143
510	9.0	408.022	153.000	255.022
520	9.0	409.871	156.000	253.871
530	9.0	411.691	159.000	252.691
540	9.0	413.483	162.000	251.483
550	9.0	415.247	165.000	250.247
560	8.0	416.986	168.000	248.986
570	8.0	418.698	171.000	247.698
580	8.0	420.386	174.000	246.386
590	8.0	422.050	177.000	245.050
600	8.0	423.691	180.000	243.691

Storage volume (m³) = 270.8 m³



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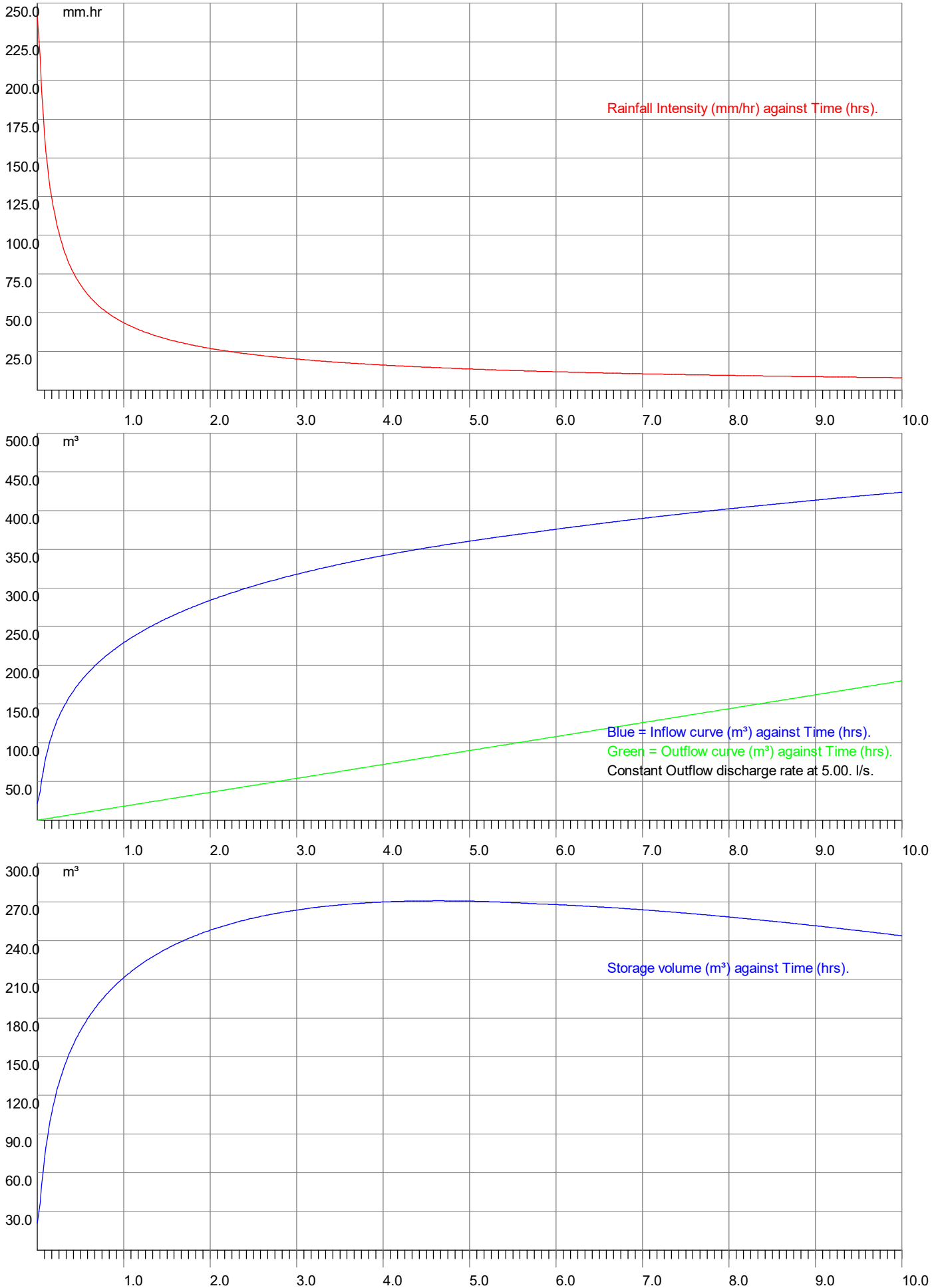
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Project **100year plus 20% cc storage**

Title **Peak flow storage calcs for Fairy Lane**





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Job No.		
Sheet no. 1		
Date 03/04/20		
By	Checked	Reviewed

Project **100year plus 40% cc storage**

Title **Peak flow storage calcs for Fairy Lane**

Data:-

FSR Hydrology:-

Location = Fairy Lane
M5-60 (mm) = 18
Soil index = 0.45
Return period = 100
UCWI = 99.9

Grid reference = SD8300
r = 0.36
SAAR (mm/yr) = 940
WRAP = 4
Climate change = 40

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

Runoff factor (RF) = 81.0, 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 = 6500 m²
Total area (TA) = 6500 m²
Allowed discharge rate = 5.000 l/s
Additional flow = 0.00 l/s

Pervious area = 0 m²
Equiv area = 5265 m² (TA x RF).
Areal reduction factor = 1.000
Climate change factor = 40

Calculated data:-

Time to max = 321.0 mins
Rainfall at max = 15.16 mm/hr
Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Calculated storage volume = 330.9 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 = 330.4 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	42134.4	1125	332.9	400 x 600	1838.1	500 x 500	1323.4
150	18726.4	1200	292.6	600 x 900	800.3	500 x 750	882.3
225	8322.9	1275	259.2	800 x 1200	450.1	500 x 1000	661.7
300	4681.6	1350	231.2			750 x 1000	441.1
375	2996.2	1425	207.5			750 x 1200	367.6
450	2080.7	1500	187.3			750 x 1500	294.1
525	1528.7	1575	169.9			1000 x 1000	330.9
600	1170.4	1650	154.8			1000 x 1200	275.7
675	924.8	1725	141.6			1000 x 1500	220.6
750	749.1	1800	130.0			1000 x 1800	183.8
825	619.1	1875	119.8			1000 x 2000	165.4
900	520.2	1950	110.8			1500 x 1500	147.0
975	443.2	2025	102.8			1500 x 1800	122.5
1050	382.2	2100	95.5			1500 x 2000	110.3



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Data:-

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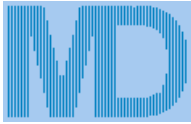
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Project **100year plus 40% cc storage**

Title **Peak flow storage calcs for Fairy Lane**

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	145.0	127.332	3.000	124.332
20	101.0	177.411	6.000	171.411
30	79.0	209.055	9.000	200.055
40	66.0	232.650	12.000	220.650
50	57.0	251.608	15.000	236.608
60	51.0	267.525	18.000	249.525
70	46.0	281.278	21.000	260.278
80	42.0	293.406	24.000	269.406
90	39.0	304.263	27.000	277.263
100	36.0	314.096	30.000	284.096
110	33.0	323.084	33.000	290.084
120	31.0	331.360	36.000	295.360
130	30.0	339.029	39.000	300.029
140	28.0	346.172	42.000	304.172
150	27.0	352.856	45.000	307.856
160	26.0	359.133	48.000	311.133
170	24.0	365.049	51.000	314.049
180	23.0	370.640	54.000	316.640
190	23.0	375.938	57.000	318.938
200	22.0	380.970	60.000	320.970
210	21.0	385.760	63.000	322.760
220	20.0	390.328	66.000	324.328
230	20.0	394.692	69.000	325.692
240	19.0	398.866	72.000	326.866
250	18.0	402.866	75.000	327.866
260	18.0	406.703	78.000	328.703
270	17.0	410.389	81.000	329.389
280	17.0	413.933	84.000	329.933
290	16.0	417.345	87.000	330.345
300	16.0	420.632	90.000	330.632
310	16.0	423.801	93.000	330.801
320	15.0	426.861	96.000	330.861
330	15.0	429.815	99.000	330.815
340	15.0	432.672	102.000	330.672
350	14.0	435.434	105.000	330.434
360	14.0	438.535	108.000	330.535
370	14.0	441.403	111.000	330.403
380	13.0	444.208	114.000	330.208
390	13.0	446.952	117.000	329.952
400	13.0	449.639	120.000	329.639
410	13.0	452.270	123.000	329.270
420	12.0	454.849	126.000	328.849
430	12.0	457.378	129.000	328.378
440	12.0	459.859	132.000	327.859
450	12.0	462.293	135.000	327.293
460	12.0	464.683	138.000	326.683
470	11.0	467.031	141.000	326.031
480	11.0	469.337	144.000	325.337
490	11.0	471.604	147.000	324.604
500	11.0	473.834	150.000	323.834
510	11.0	476.026	153.000	323.026
520	10.0	478.183	156.000	322.183
530	10.0	480.306	159.000	321.306
540	10.0	482.397	162.000	320.397
550	10.0	484.455	165.000	319.455
560	10.0	486.483	168.000	318.483
570	10.0	488.481	171.000	317.481
580	10.0	490.450	174.000	316.450
590	10.0	492.392	177.000	315.392
600	9.0	494.306	180.000	314.306

Storage volume (m³) = 330.9 m³



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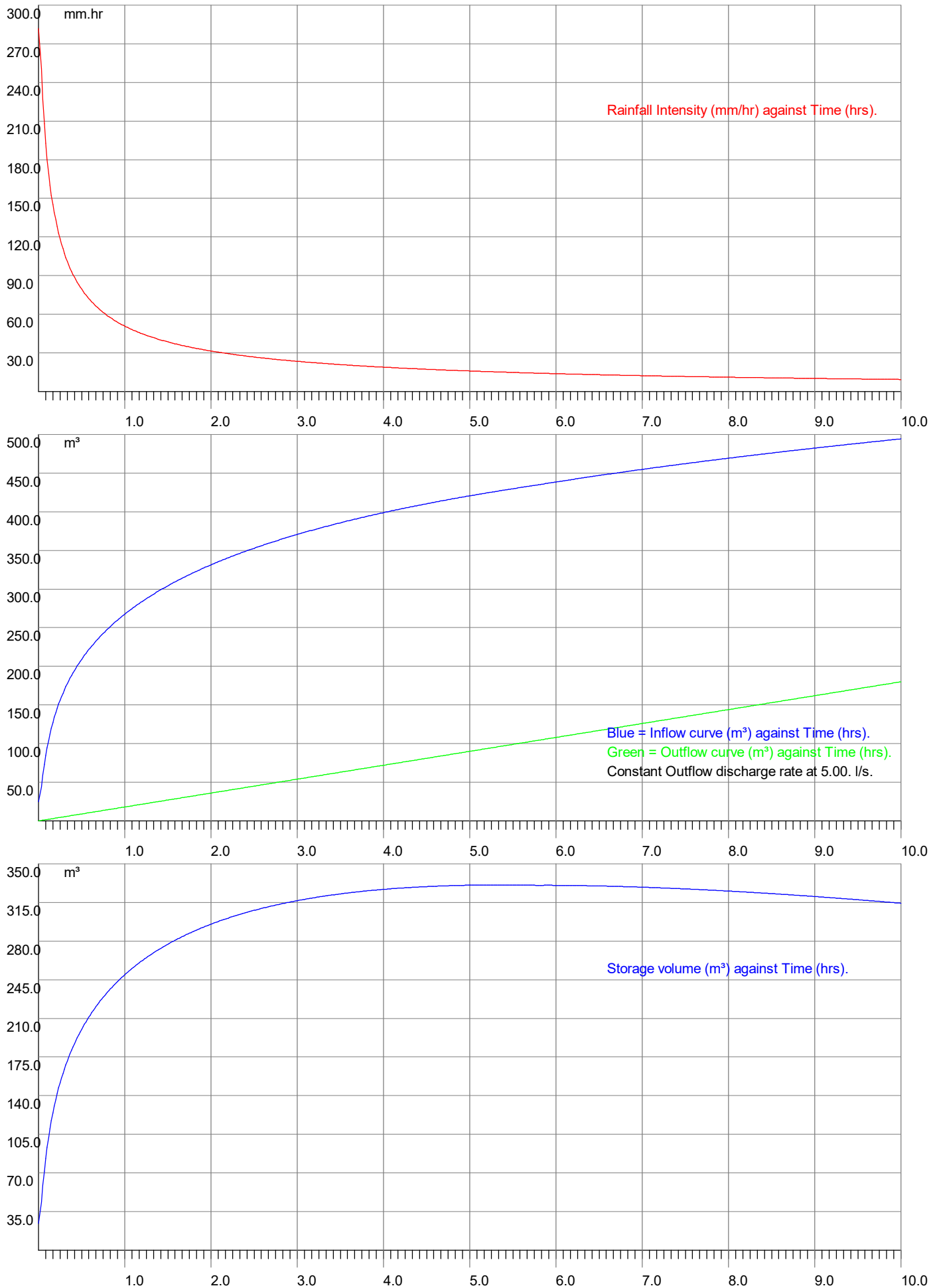
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Project **100year plus 40% cc storage**

Title **Peak flow storage calcs for Fairy Lane**





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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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