LAND AT DOBFILED HOUSE, ROCHDALE

SUSTAINABLE DRAINAGE STRATEGY

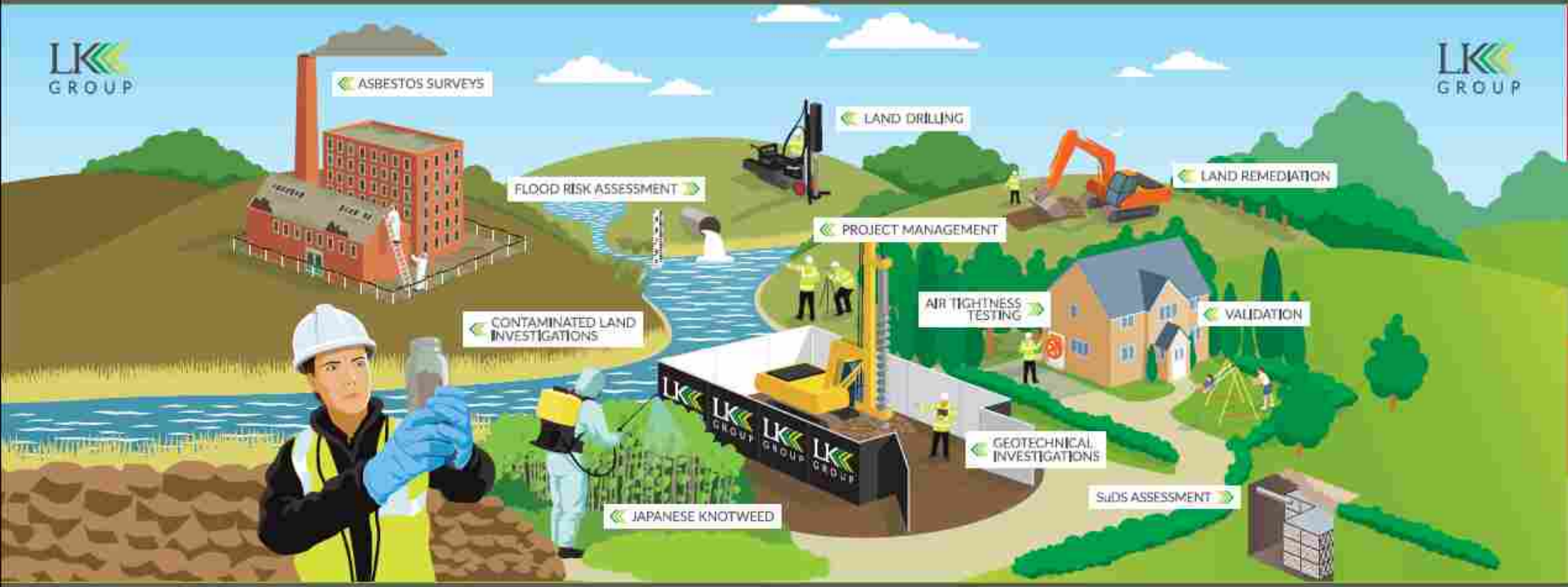
Job Number: FRA 20 1117
Date: February 2020
Client: HNA Architects Ltd



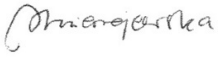
INCREASING LAND VALUE

LK GROUP

INCREASING LAND VALUE



LK GROUP

LK Consult Document Verification			
Site Address	Land at Dobfield House, Rochdale, OL16 3AW		
Report Title	Sustainable Drainage Strategy		
Job Number	FRA 20 1117	**Document Ref.**	FRA 20 1117 - R0
Date Issued	February 2020	**Report Version**	R0
Prepared By	Anna Mierzejewska – Environmental Scientist	**Signature**	
Reviewed By	Mark Jones - Associates	**Signature**	

Revision Record			
Revision No.	**Date**	**Nature of Revision**	**Approved By**

DISCLAIMER

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

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

This report is prepared solely for the benefit of HNA Architects Ltd. It may not be relied upon by, or submitted to a third party for their reliance for the purposes of valuation, mortgage, insurance and regulatory approval, until all invoices have been settled in full.

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

This page has been left blank intentionally

EXECUTIVE SUMMARY

Scope and Background

This Sustainable Drainage (SuDS) Strategy has been undertaken by LK Consult Ltd (LKC) to support a planning application for the development of land at Dobfield House, Rochdale. The development comprises residential houses with soft landscaping and car parking.

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

Consultations

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

Lead Local Flood Authority (Rochdale Council) and United Utilities have also been contacted during preparing this strategy.

Mitigation

Design

The site is underlain by sand and gravel superficial deposits and an onsite shallow hand dug excavation encountered slightly gravelly clayey sand to 0.6mbgl. The site generally falls towards the east. The proposed levels would indicate that surface water would flow on-road from the south towards the central part of the driveway. Some flow of the road would also be towards Dobfield Road.

There will be an increase in impermeable area compared to the current situation. No public surface water drainage system was observed where a connection could be made.

In considering the potential drainage options for the site it is assumed that infiltration methods such as soakaways may be practical, and this could be investigated at the detailed design stage by undertaking infiltration testing. The outline drainage strategy considers, as the first instance, that surface water runoff arising from the development will discharge into a soakaway. Given the ground conditions the permeability rate has been assumed to be between 1 x 10^{-5} m/s and 1 x 10^{-6}m/s which gives the following size and volume estimates.

For an infiltration rate of 1 x 10^{-5}m/s, for example a width of 30m, a length of 15m and a depth of 0.84m soakaway, utilising storage crates (95% void), provides a volume of 359.90m^3.

Whereas for an infiltration rate of 1 x 10^{-6}m/s a width of 100m, a length of 45m and a storage depth of 0.09m soakaway, utilising storage crates, provides a volume of 370.69m^3.

Normal recommendations for soakaways are it should not be installed within 5m from any building foundation and roads, and within 2.5m from the site boundary.

Therefore, the most effective strategy, in line with the SuDS management train, would be to have a soakaway(s) across the landscaped areas. The use of other infiltration-based SuDS may also be practical where space for utilising soakaways is limited.

Alternatively, if infiltration was not feasible the surface water runoff could discharge into a private drain in the adjacent roads and will flow into the River Beal. This would require an agreement with an existing drainage owner and a consent from EA for discharging into the river.

The flows from the site should be restricted to greenfield runoff rates or an acceptable level to the Lead Local Flood Authority and the EA.

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.

Therefore, if infiltration is not feasible, the outline drainage strategy considers the use of attenuation-based SuDS to be feasible with a discharge to the private sewer northeast of the site. The required attenuation tank or similar has been estimated to be **73.6m^3** 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 30% allowance for climate change is **148.6m^3**.

The estimated volume can be stored within the site boundary.

Contents

EXECUTIVE SUMMARY vi

1 Introduction 1
1.1 Background 1
1.2 Site Details 2

2 Site Setting 3
2.1 Vulnerability 3
2.2 Environmental Setting 3
2.3 Site Reconnaissance 4
2.4 Site and Access Levels 4

3 Consultation 5

4 Sustainable Drainage Strategy 7
4.1 Introduction 7
4.1 Infiltration 7
4.2 Watercourses 8
4.3 Public Sewer 8
4.4 Other Sewers 8
4.5 Surface Water Drainage Strategy 9
4.6 Surface Water Attenuation Requirements 15
4.7 Site Specific SuDS 16
4.8 Foul Drainage 17

5 Conclusion 19

Appendices

Appendix A: Figures, Plans and Drawings
Appendix B: Site Information
Appendix C: Environment Agency Data
Appendix D: Consultee Correspondence
Appendix E: Calculations

This page has been left blank intentionally

1 Introduction

1.1 Background

LK Consult Ltd (LKC) were commissioned by HNA Architects to carry out a Sustainable Drainage Strategy for land at Dobfield House in Rochdale. The report was undertaken in support of a future planning application to redevelop the site for end use.

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

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.

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

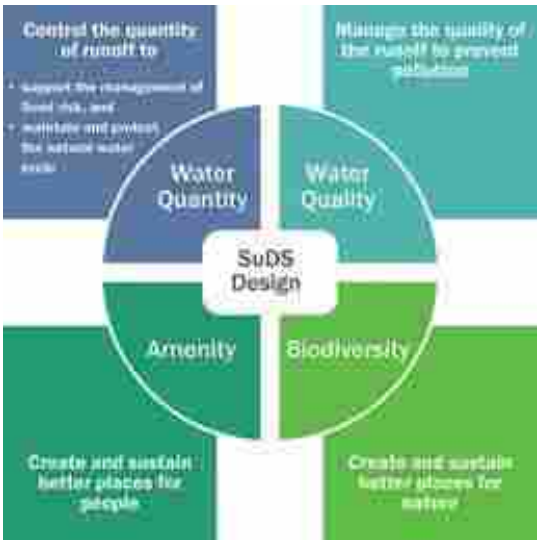


Plate 1: Four 'pillars' of SuDS design as defined by CIRIA in The SuDS Manual.

This preliminary SuDS assessment complies with the principles presented in the Draft National Standards for Sustainable Drainage Systems (Defra, 2015)[2] and the Planning Practice Guidance (PPG) March 20143. The sustainable drainage assessment is presented with reference to the hydrological and hydrogeological context of the development.

The report findings are based upon professional judgement and are summarised below. The report includes baseline data from the Environment Agency (EA), rainfall data from the Wallingford Studies and Hydrogeological information from the British

[1] The SuDS Manual (C753) – CIRIA November 2015.
[2] Non-statutory Technical Standards for Sustainable Drainage Systems – DEFRA March 2015
[3] Planning Practice Guidance – Department for Communities and Local Government April 2014

Geological Survey (BGS). The assessment will summarise and refer to these data sets.

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

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

1.2 Site Details

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

Site Details	
Location	End of Dobfield Road before Belfield Mill Lane, Rochdale, OL16 3AW. Centred at approximate National Grid Reference 391755N 413860E (nearest 5m).
Area	7500m^2.
Topography	147-148 metres Above Ordnance Datum (AOD). Site generally falls to the east.
Current Land Use	Site Hard stood ground in the west and north of the site, majority of the site is grassland and a paddock. Surrounding Area North: Residential properties and office building. East: Public footpath and commercial properties. South: Vacant land, refuse tip. West: Canal, residential properties.
Proposed Development	Residential development including soft landscaping and car parking.

Table 1-1: Summary of site details.

2 Site Setting

2.1 Vulnerability

As an initial phase in identifying which Sustainable Drainage System is appropriate for the site, LKC has consulted the Environment Agency's (EA) website Flood Zone Mapping.

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

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

2.2 Environmental Setting

LKC have previously undertaken a Preliminary Risk Assessment for the site[4] (LKC 20 1164, dated February 2020) and pertinent environmental information for the site is summarised in Table 2-1 below.

Summary of the Environmental Setting		
Geology	Superficial	Glaciofluvial deposits (sand and gravel).
	Bedrock	Pennine Lower Coal Measures (mudstone, siltstone, and sandstone). A rock outcrop occurs across the middle of the site.
	BGS Boreholes	BH Ref: SD912SW146, 373m W: Made ground: Loose black clay, sand and gravel fill with wood fragments and flagstone to 1.7m, soft silty CLAY to 1.9m, soft silty sandy CLAY with occasional gravel to 2.8m, soft silty very sandy gravelly clay with plant debris to 3.7m, sandy gravel to 5.4m, silty sand with occasional fine gravel to 5.9m, firm silty clay with occasional gravel to 10m. Water strike at 3.5mbgl. BH Ref: SD91SW9, 500m S: Sand and gravel to 5.19m, gravel to 9.01m, sand and gravel to 7.32m, loamy sand to 8.53m, clay and gravel to 9.45m, loamy sand to 14.33m over layers of clay, sand, gravel. Bedrock at over 60mbgl. Water level at over 16mbgl.
Hydrogeology	Superficial	Secondary A Aquifer.
	Bedrock	Secondary A Aquifer. Site is not within an SPZ.
Hydrology	All adjacent and internal surface water	Rochdale Canal 5m W. River Beal 130m NE. A surface water drain in adjacent road approximately 40m north from the site, running towards River Beal.
Site History		Drain north of the site annotated on 1968 mapping. Onsite soakaways present approximately from 2016.

Table 2-1: Summary of the Environmental Setting.

[4] Phase 1 Preliminary Risk Assessment: LK Group, LKC 20 1164, January 2020.

2.3 Site Reconnaissance

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

Relevant features identified on site are summarised below:

- Rough ground across the majority of the site, with trees surrounding. Limited hardstood ground in the west area of the site. Compacted tarmac / gravely driveway in the north.
- Site noted to be relatively flat with a gentle slope towards the east. The driveway and adjacent area in the north of the site is sloping gently to the west.
- An embankment is present along southern perimeter and southwestern corner.
- Stable building present in the west of the site was observed to drain on the surface through the downpipes.
- A raised exercise area is present in the south west that currently drains into a soakaway to the north.
- The second soakaway located in the east of the site drains the roof water from the office building.
- Adjacent buildings including Dobfield House drain into a septic tank (offsite).
- No public sewers observed within the site boundary.
- Rochdale Canal present adjacent to the west of the site.
- Site area was noted to be raised above the adjacent land to the east and elevated above Rochdale Canal by few meters.
- A watercourse is located approximately 130m to the northeast adjacent to Firgrove industrial site.
- A drain was noted in Belfield Mill Lane north of the site, running towards River Beal.
- No made ground observed on site, topsoil over slightly gravelly clayey sand present from 0.15m.

2.4 Site and Access Levels

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

Generally, the site falls from 148m AOD in the west to 147m AOD in the south east. The area within the east of the site falls towards the eastern boundary while a driveway falls to the west. The area within the west falls north towards the driveway. There are undulations present across the grassed field. The final site levels and ground floor levels of dwellings have not yet been determined.

The proposed access would join Dobfield Road at around 147.3m AOD.

3 Consultation

Information from consultees (Environment Agency (EA), Rochdale 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).	
Lead Local Flood Authority	LLFA have requested that The Drainage Hierarchy outlined in Building Regulations H3 and NPPG will need to be followed with infiltration into ground considered first. Suitability for soakaway and a soakaway design should follow BRE digest 365 guidance. The soakaway should discharge from full to half-volume within 24 hours in readiness for subsequent storm inflow. Any SuDS design should include 1 in 100year plus 30% climate change event. For greenfield sites, rainfall runoff should be attenuated such that any rainfall discharges from the developed site are not increased. LLFA confirmed that they do not have any records of flooding within and in the vicinity of the site.	
United Utilities	Likely conditions for connecting into their sewerage system	UU have requested that The Drainage Hierarchy outlined in Building Regulations H3 and NPPG will need to be followed with infiltration in to ground considered first. UU would allow that the foul was drained into the public combined/foul sewer network at an unrestricted rate at any convenient point however the most accessible sewer appears to be on Albert Royds Street remote from the site. UU was contacted regarding sewer flooding history for the site. UU confirmed that they did not have any record of internal or external sewer flooding of properties in the vicinity of the site as a result of overloaded sewers.
	Sewer map	No surface water sewers present within the vicinity of the site. There is a 1275mm diameter combined sewer crossing Rochdale Canal north of the site. There are combined public sewers within residential area southwest of the site and a 250mm diameter combined sewer in Albert Royds Street. There is also a surface water sewer in Albert Royds Street. These all are remote and located on the other site of Rochdale Canal.

Table 3-1: Summary Consultee Information.

This page has been left blank intentionally

4 Sustainable Drainage Strategy

4.1 Introduction

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

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

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

The Building Regulations Requirement H3[5] 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 2010[6].

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

4.1 Infiltration

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

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

[5] Building Regulations part H3 2010: Approved Document, Drainage and Waste Disposal.
[6] Flood and Water Management Act 2010: UK Government.

Classification	Description	Aquifer Classification	Recorded Water Table Depth	Soakaway Potential
Glaciofluvial Deposit – Sand and Gravel	Clayey gravelly sand / sand and gravel.	Secondary A	N/A on site Off site at 3.5mbgl.	Good
Pennine Lower Coal Measures Bedrock	Mudstone, Siltstone and Sandstone	Secondary A	Over 16mbgl off site	Limited

Table 4-1: Geological and Hydrogeological Setting.

A good infiltration potential is anticipated on site from the underlying sand and gravel deposits. There are currently two soakaways operating on site, one in the east and one in the west, serving the existing paddock area and the adjacent to the site office building.

Infiltration methods such as soakaways are likely to be feasible, and this may be confirmed further at the detailed design stage.

4.2 Watercourses

Rochdale Canal runs adjacent to the west of the site flowing northeast.
There is an open watercourse located approximately 130m northeast from the site.

4.3 Public Sewer

There are no surface water sewers within the vicinity of the site. There is no existing connection to the public sewers from the study land.

4.4 Other Sewers

There is a private drain in the adjacent road approximately 40m NE from the site, discharging directly to the River Beal.

4.5 Surface Water Drainage Strategy

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

Option No:	Drainage Solution	Most feasible solution	Comments
a	Soakaway/Infiltration	1	Reasoning: potentially good permeability of underlying sandy soils. Current soakaways on site have proven positive drainage.
b	Connection to Watercourse	3	Any connection would require third party access, a road crossing and EA consent and would be expensive due to the distance.
c	Discharge into a private sewer	2	The potential connection to the offsite private drain which discharge directly to River Beal could be investigated. Any connection would require third party access, a road crossing and EA consent.

Table 4-2: Drainage options.

This page has been left blank intentionally

Table 5-3 provides a summary of the SuDS options appraisal with consideration of CIRIA C753 (The SUDS Manual)[7] for the development:

SuDS Option	Appropriate to Development	Comments	Benefits	Comments
Infiltration				
Soakaways	✓	Due to the nature of the ground conditions, the use of infiltration systems may 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	*	Depressions that store and dispose of water via infiltration. May be appropriate given the ground conditions however may be limited by the space required.	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	✓	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	✓	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 not 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.

[7] CIRIA C753 - The SUDS Manual. London 2015.

SuDS Option	Appropriate to Development	Comments	Benefits	Comments
Retention & Detention				
Detention basin	X	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	X	Attenuation ponds can be used to offset the increase in surface water flows attributable to increased area of hard standing, in order to minimise the risk of flooding to and from the proposed development.	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 contaminates 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

4.6 Surface Water Attenuation Requirements

From correspondence with the Rochdale Council (LLFA) the flow should be limited to a 'greenfield scenario' for estimating the attenuation volumes required.

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

Designated Areas	Plot Area
Total area (ha)	0.75
Development Area (ha)	0.75
Catchment	
Catchment Area (ha)	0.75
Impermeable split (ha)	0.41
Permeable split (ha)	0.34

Table 4-4: Assumed plot areas.

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

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

4.6.1 Infiltration Storage Estimate

It is possible that this area maybe drained via infiltration-based SuDS following further testing if required by LLFA.

Typical k Values from 'Environmental Geotechnics' (Sarsby)[8] suggests that values between 10^{-5}m/s and 10^{-6}m/s are typical assuming the area is underlain by sand /fine sand-clay mixtures.

As a result of these figures the volume of the required filled soakaway has been estimated using CIRIA Report 156[9] and is shown in Appendix E. This assumes a safety factor of 2. For an infiltration rate of 1 x 10^{-5}m/s, for example a width of 30m, a length of 15m and a depth of 0.84m using storage crates (95% void) provides a volume of **359.90m^3**. Whereas for an infiltration rate of 1 x 10^{-6}m/s a width of 100m, a length of 45m and a storage depth of 0.09m using storage crates provides a volume of **370.69m^3**.

All estimates have been provided for 1 in 100-year flood event with the 30% allowance for climate change as required by LLFA. All storage volume can readily be achieved within the site boundary.

Any soakaway should not be built within 5m from any building foundation and roads and within 2.5m from the site boundary.

The soakaway should discharge from full to half-volume within 24 hours in readiness for subsequent storm inflow.

[8] Environmental Geotechnics 2nd Edition – Sarsby 2013.
[9] Infiltration drainage, Manual of good practice (R156). 1996.

4.6.2 Attenuation Estimate

Surface water storage and greenfield runoff estimations based on the HR Wallingford procedure (IH 124[10]) have been alternatively undertaken for the development and the output report is presented in Appendix E.

Giving the total site area of 0.75ha the following greenfield runoff rates have been estimated based on the Wallingford IH 124 method:

- Q_{bar}: 4.56 l/s
- 1 in 1-year greenfield runoff rate: 3.88 l/s
- 1 in 30-year greenfield runoff rate: 7.67 l/s
- 1 in 100-year greenfield runoff rate: 9.58 l/s

For the contributing catchment an estimate has been produced assuming a developable area of 0.75ha which comprises of 0.41ha impermeable areas and 0.34ha permeable areas. This gives the following runoff rates and attenuation requirements for this section based on the Wallingford IH 124 method:

The following attenuation has been estimated for the development using greenfield runoff rates and utilises the FSR methodology[11] as:

- Attenuation storage volume: **73.6 m³** (1 in 30-year event)
- Retention on site volume: **148.6 m³** (1 in 100 year + 30% Climate Change)

If infiltration on site is not feasible then the attenuation for a 1 in 30-year storm event, requires a storage volume of **73.6 m³** and for the 1 in 100-year event, a storage capacity of **148.6 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 public sewer.

Attenuation storage aims to limit the peak rate of runoff from the development to the corresponding greenfield runoff for a range of annual flow rate probabilities before discharge to a public sewer. As the flow from the development would be restricted to the greenfield equivalent there should be little change in the flows that enter the unnamed watercourse and thus the risk of flooding as a result from the development should not increase the risk of flooding off-site.

The potential connection to the public sewer in Dobfield Road would need to be agreed with the owner and the flow would be to allowable level to the LLFA.

4.7 Site Specific SuDS

Soakaway and other infiltration-based SuDS may be feasible giving likely permeable ground conditions across the site. A soakaway will provide a significant volume of storage and contribute to surface water treatment via filtering through the soils. Soakaway will also contribute to groundwater recharge and baseflow augmentation (subsurface storage). Infiltration trenches could be utilised where there is a limited space for soakaway. This will provide an effective pre-treatment of suspended solids through filtration and sedimentation and will also provide ecological and amenity benefits.

[10] IH124 Flood Estimation of Small Catchments.
[11] Flood Studies Report Wallingford NERC 1975.

In case of shallow ground water table present across the site, shallow soakaways should be a preferred option.

Overland flow should be considered in the detailed drainage design.

If soakaway SuDS for any reason will prove not to be feasible then attenuation SuDS are deemed to be practical. An underground tank or similar could be located below roads or driveways. The storage systems can provide a high storage volume capacity and are capable of managing high flow events.

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.

4.8 Foul Drainage

UU specified that the most accessible sewer appears to be a combined sewer on Albert Royds Street where foul could be allowed to drain at an unrestricted rate.

LLFA advised that foul water can be either pumped to the nearest UU sewer via pumped main or to packaged sewage plant. If considering a sewage plant, the discharge point of treated effluent will need to be established. The EA will discuss and approve any discharge to the river Beal, whereas the Canal and River Trust will need to agree if discharging to the canal.

This page has been left blank intentionally

5 Conclusion

The site is currently grassland with some areas of hardstood in the north and west. The proposal is to build a new residential development with a driveway from Dobfield Road.

The development will result in the increased proportion of the impermeable areas.

There were no existing connection observed from the site to the public sewers or to a watercourse. An exercise area is currently drained into an onsite soakaway.

The site is shown to be underlain by sand and gravel and it has been assumed that infiltration may be feasible. Alternatively, a connection to the private drain, which connects further to the River Beal may be investigated if infiltration was not a feasible solution.

All proposed outflow connections from the development should be agreed with the LLFA and EA.

This page has been left blank intentionally

APPENDIX A

FIGURES, PLANS AND DRAWINGS

This page has been left blank intentionally



Contains Ordnance Survey data © Crown copyright and database right 2010

Figure 1: Site Location Plan, Land at Dobfield House, Rochdale

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

LK CONSULT LIMITED



KEY

Site 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.

LK CONSULT LIMITED

Client: NHA Architects Ltd

Site: Land at Dobfield House, Rochdale

Title: Site Boundary Plan

Job No.:	Scale (See Scale Bar):	Figure:	Revision:
FRA 20 1117	See Scale Bar	2	

Drawn By:	Checked By:	Drawn:
AC	BS	Jan 2020

0 50

SCALE (Metres)

Extract from: HNA Architects
Drawing Ref: Site Location Plan, No.1285/SLP, Rev:A (27/11/2019)



KEY

Site 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.

0 50

SCALE (Metres)

Extract from: HNA Architects
Drawing Ref: Proposed Site Plan - GF, No.1285/001, Rev:A (25/11/2019)

LK CONSULT LIMITED

Client:	NHA Architects Ltd
Site:	Land at Dobfield House, Rochdale
Title:	Proposed Site Use

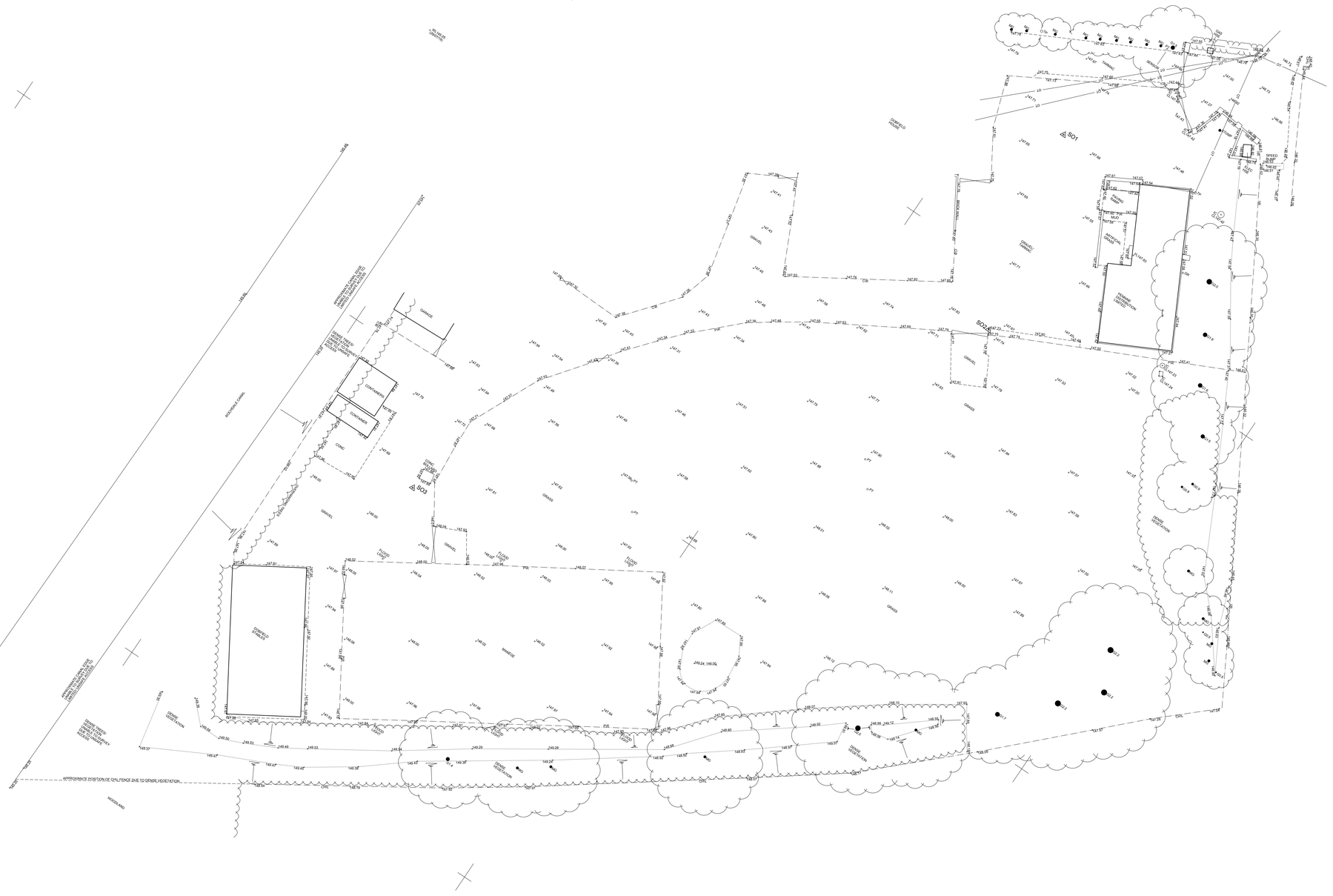
Job No.:	Scale (See Scale Bar):	Figure:	Revision:
FRA 20 1117	See Scale Bar	3	

Drawn By:	Checked By:	Drawn:
AC	BS	Jan 2020

APPENDIX B

SITE INFORMATION

This page has been left blank intentionally


SO1
SO2
SO3
GARAGE
CONTAINERS
CONTAINERS
CONC
GRAVEL
GRASS
MARSHY GRASS
MUD
STONE
CONC
CHAIN LINK FENCE
TIMBER FENCE
WOODLAND
APPROXIMATE POSITION OF C/L FENCE DUE TO DENSE VEGETATION
RIVER IRWELL
RIVER IRWELL
ROCHDALE CANAL
ROCHDALE CANAL
SPEED HUMP
SPEED HUMP
SPEED HUMP

RECORD OF WELL (SHAFT OR BORE) SD 91 SW 9

1" N.S. 76 (5)
1" O.S.
Grid Ref. 13

At Messrs J. & J. Makin Ltd., Wallhead Mills,
Town or Village Rochdale County Lancashire Six-inch quarter sheet 89 NW
Exact site) (A rough sketch-map
in parish of (149.96m)) or a tracing from a map is very desirable)
Level of ground surface above sea-level (O.D.) 492 ft. If well starts below ground surface, state how far ft.
Shaft ft., diameter ft. Bore ft. Diameter of bore: at top 12 ins.; at bottom 7¾ ins.
Details of permanent lining tubes (internal diameters preferred)

Water struck at depths of (feet)
Rest-level of water ~~above~~ below top of well 55 (16.76m) feet. Suction at feet. Yield on hours' days' test
2,000 gallons per hour (with pump of capacity g.p.h.); depressing water level to feet
below top. Time of recovery hrs. Amount normally pumped daily g.p.h. for hours.
Quality (attach copy of analysis if available)
Sunk by Messrs. T. Matthews for Messrs. J. & J. Makin Ltd. Date of well 1933
Information from Messrs. Thomas Matthews, Pendleton, Manchester.

(For Survey use only). GEOLOGICAL CLASSIFICATION.	NATURE OF STRATA (and any additional remarks).	THICKNESS Feet.	THICKNESS Inches.	DEPTH Feet.	DEPTH Inches.
			Depth/m		
	Sand and gravel		5.79	19	-
	Gravel		7.01	23	-
	Sand and gravel		7.32	24	-
	Loamy sand		8.53	28	-
	Clay and gravel		9.45	31	-
Drift	Loamy sand		14.33	47	-
	Clay		24.08	79	-
	Sand		24.99	82	-
	Gravel		31.09	102	-
	Gravel and clay		37.49	123	-
	Shale with ironstone bands at 147 ft.		61.87	203	-
	Light grey sandstone		77.72	255	-

British Geological Survey

GEOLOGICAL SURVEY AND MUSEUM, SOUTH KENSINGTON, LONDON, S.W.7.

For Survey use only

Date received	G.S.M. Office File No.	Site marked on 1" map (use symbol)

(7993) Wt.36064/0349 5,000 12/38 A.&E.W.Ltd. Gp.686

SD91SW 9133 1376 146

STRATA SURVEYS LTD.,
HOLMES CHAPEL ROAD,
MIDDLEWICH, CHESHIRE. CW10 0JB
Telephone: 0606 84 4637 Fax: 0606 84 6657

Borehole Number : A
Sheet 1 of 2.
Scale 0 to 10 metres
Dates : 17 May 89

Job Number : 4889 Location : Belfield Lane, Rochdale.
Client : Trevena Blake and Assoc.

Dia. & Drilling Methods
150mm Diameter Light cable Percussion

Description of Strata	Red. Level	Legend	Thick -ness	Depth m	Sample Depths	Sample Types	N Value	Cu	φ	Water Level	Pie -zo	Daily Prog.
				0.00								
MADE GROUND Loose black clay sand gravel fill with wood fragments and pieces of flagstone			(1.70)		0.50	D 1						
					1.00 - 1.45	S 1	N 4					
Soft black silty CLAY			(0.20)	1.70	1.80	D 2						
Soft black silty sandy CLAY with occasional medium fine gravel			(0.90)	1.90	1.90 - 2.30	U 1		15	5			
					2.50	D 3				▽ tsl		
Soft black silty very sandy gravelly CLAY with plant debris			(0.90)	2.80	3.00 - 3.45	S 2	N 6					SWS
					3.50	W 1				▼ slow		
Medium dense brown sandy coarse medium fine GRAVEL			(1.70)	3.70	3.80 - 4.25	B 1						
					4.00 - 4.45	S 3	N 14					
					4.50 - 4.95	B 2						
Medium dense brown silty coarse medium fine grained SAND with occasional fine gravel			(0.50)	5.40	5.60 - 6.05	S 4	N 10					
Firm dark brown slightly laminated slightly silty CLAY with occasional medium fine gravel			(4.20)	5.90	7.00 - 7.35	U 2		77	0			
					7.70	D 4						
					8.50 - 8.90	U 3		36	0			
					9.20	D 5						
Borehole Continued				10.00								

Key :

Sample Types
U Undisturbed
D Disturbed
B Bulk Disturbed
W Water
P Piston
S SPT

In-Situ Tests
N N Value
+ Sampler Sank

Progress / Water Levels
___ Borehole Depth
_ _ Casing Depth
▽ Water Level
▼ Water Strike

◊ Piezometer Level

General Remarks :
Water strike @ 3.50m rising to 2.60m in 20 min.

Geology 1:10,000 Maps Legends

Artificial Ground and Landslip

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	MGR	Made Ground (Undivided)	Artificial Deposit	Holocene - Holocene
	WGR	Worked Ground (Undivided)	Void	Holocene - Holocene
	WMGR	Infilled Ground	Artificial Deposit	Holocene - Holocene
	SLIP	Landslide Deposit	Unknown/Unclassified Entry	Quaternary - Quaternary

Superficial Geology

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	ALV	Alluvium	Clay, Silt, Sand and Gravel	Flandrian - Pleistocene
	GFDUD	Glaciofluvial Deposits, Devensian	Sand and Gravel	Devensian - Ipswichian
	TILLD	Till, Devensian	Diamicton	Devensian - Ipswichian
	GFSDD	GLACIOFLUVIAL SHEET DEPOSITS, DEVENSIAN	Sand and Gravel	Devensian - Ipswichian
	HMGDD	Hummocky (Moundy) Glacial Deposits, Devensian	Diamicton	Devensian - Ipswichian
	PEAT	Peat	Peat [Unlithified Deposits Coding Scheme]	Quaternary - Ryazanian
	LDE	Lacustrine Deposits	Clay	Quaternary - Ryazanian

Bedrock and Faults

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	PLCM	Pennine Lower Coal Measures Formation	Mudstone, Siltstone and Sandstone	Langsettian - Langsettian
	OL	Old Lawrence Rock	Sandstone	Langsettian - Langsettian
	MLRS	Milnrow Sandstone	Sandstone	Langsettian - Langsettian
	DF	Darwen Flags	Sandstone	Langsettian - Langsettian
	HER	Helpet Edge Rock	Sandstone	Langsettian - Langsettian
	WH	Woodhead Hill Rock	Sandstone	Langsettian - Langsettian
	Rock			
	Fault			

LK GROUP

Geology 1:10,000 Maps

This report contains geological map extracts taken from the BGS Digital Geological map of Great Britain at 1:10,000 scale and is designed for users carrying out preliminary site assessments who require geological maps for the area around a site. This mapping may be more up to date than previously published paper maps.

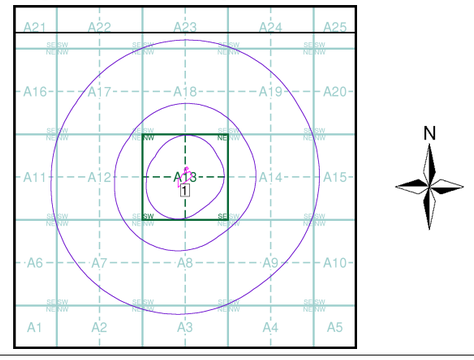
The various geological layers - artificial and landslip deposits, superficial geology and solid (bedrock) geology are displayed in separate maps, but superimposed on the final 'Combined Surface Geology' map. All map legends feature on this page.

Please Note: Not all of the layers have complete nationwide coverage, so availability of data for relevant map sheets is indicated below.

Geology 1:10,000 Maps Coverage

Map ID:		**Map ID:**	1
Map Name:	SD91NW	**Map Name:**	SD91SW
Map Date:	2007	**Map Date:**	2007
Bedrock Geology:	Available	**Bedrock Geology:**	Available
Superficial Geology:	Available	**Superficial Geology:**	Available
Artificial Geology:	Available	**Artificial Geology:**	Available
Faults:	Available	**Faults:**	Available
Landslip:	Available	**Landslip:**	Available
Rock Segments:	Available	**Rock Segments:**	Available

Geology 1:10,000 Maps - Slice A



Order Details

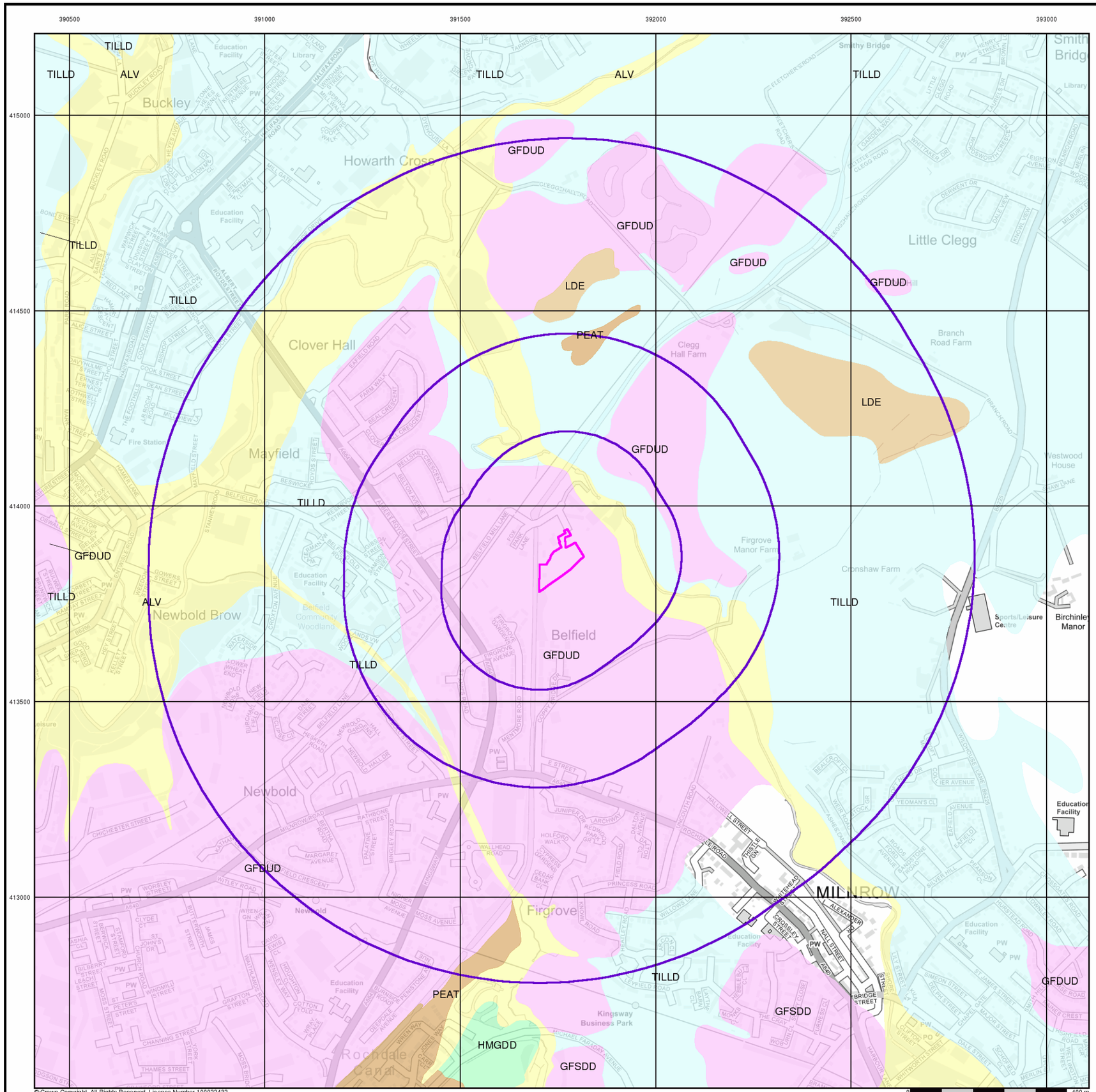
Order Number:	230105286_1_1
Customer Ref:	LKC 20 1164
National Grid Reference:	391750, 413860
Slice:	A
Site Area (Ha):	0.75
Search Buffer (m):	1000

Site Details

Land at Dobfield House, Rochdale, OL16 3AW

Landmark INFORMATION GROUP

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



LK GROUP

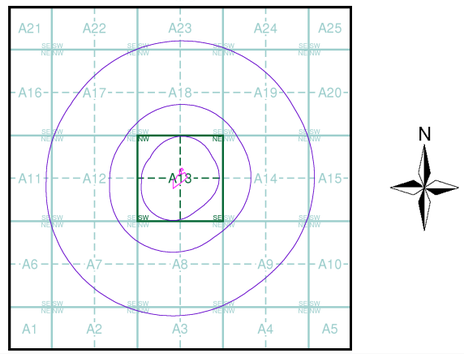
Superficial Geology

BGS 1:10,000 Superficial Deposits are the youngest geological deposits formed during the most recent period of geological time, 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

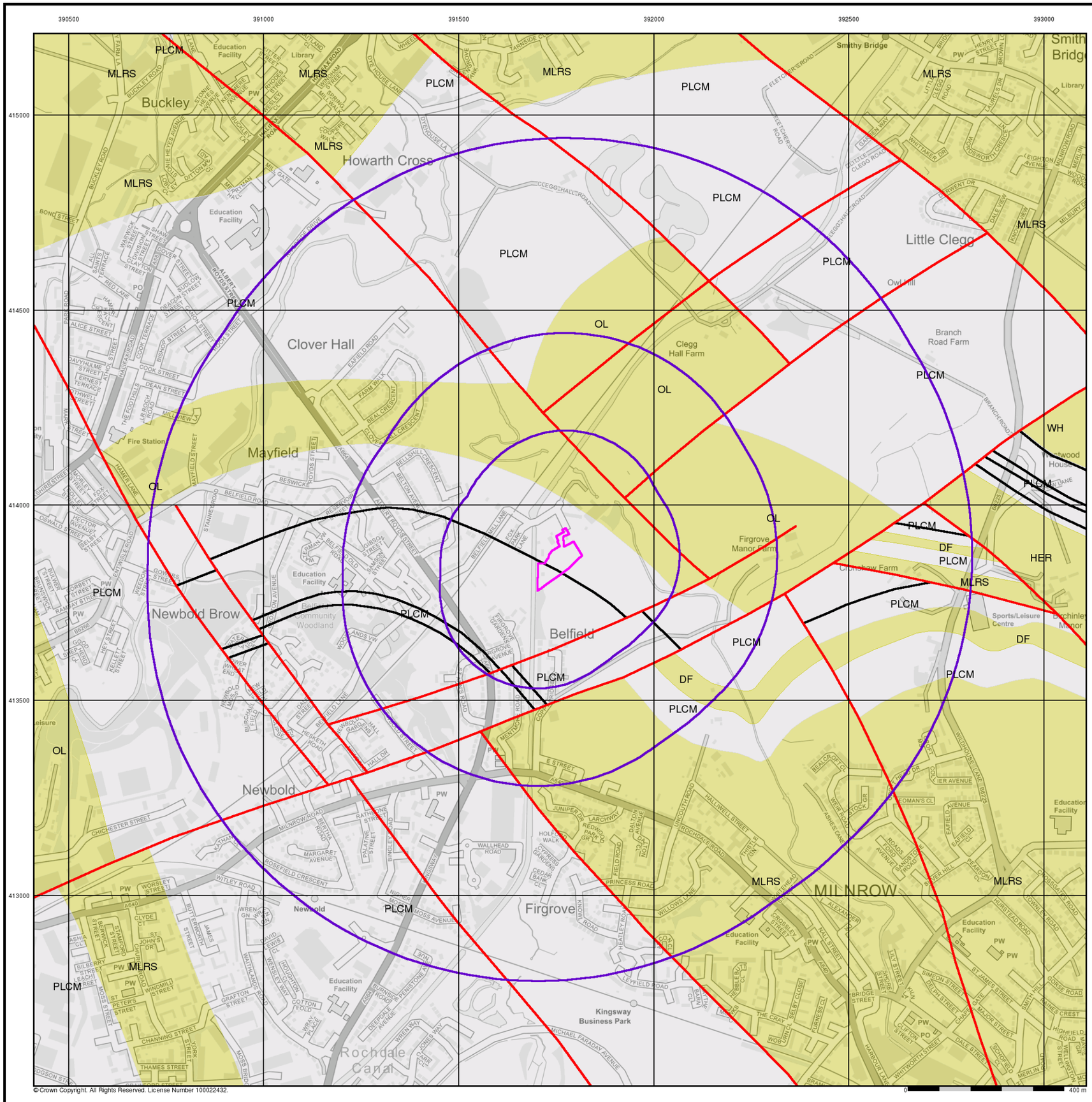


Order Details

Order Number:	230105286_1_1
Customer Ref:	LKC 20 1164
National Grid Reference:	391750, 413860
Slice:	A
Site Area (Ha):	0.75
Search Buffer (m):	1000

Site Details

Land at Dobfield House, Rochdale, OL16 3AW



© Crown Copyright. All Rights Reserved. License Number 100022432.

0 400 m

LK GROUP

Bedrock and Faults

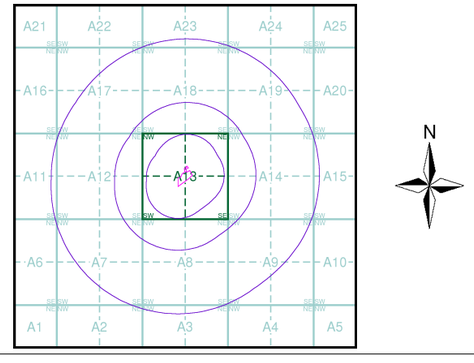
Bedrock geology is a term used for the main mass of rocks forming the Earth and are present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

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 and thin beds mapped as lines such as coal seams and mineral veins. These are not restricted by age and could relate to features of any of the 1:10,000 geology datasets.

Bedrock and Faults Map - Slice A



Order Details

Order Number:	230105286_1_1
Customer Ref:	LKC 20 1164
National Grid Reference:	391750, 413860
Slice:	A
Site Area (Ha):	0.75
Search Buffer (m):	1000

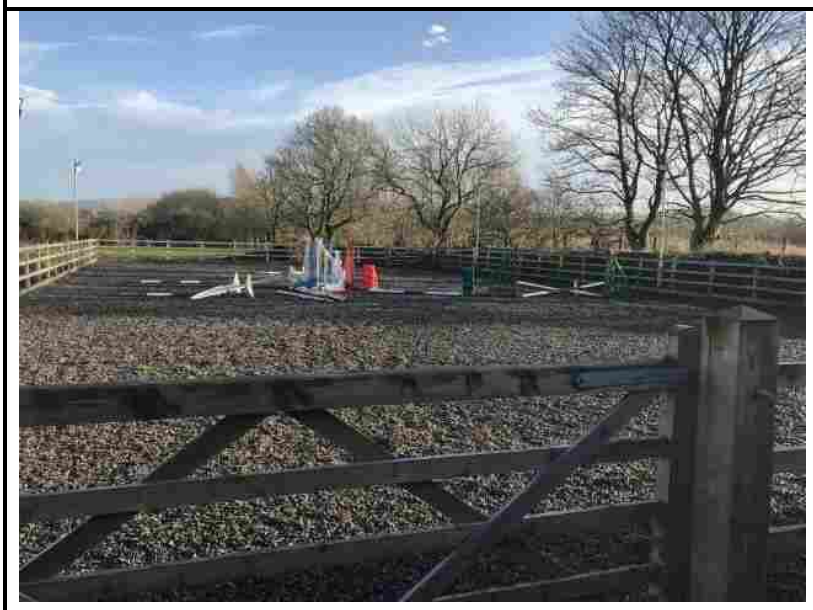
Site Details

Land at Dobfield House, Rochdale, OL16 3AW

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

	**Photograph 1 (facing NE):** View of the existing site access off Dobfield Road.
	**Photograph 2 (facing W):** View of a driveway in the north of site. Dobfield House adjacent to the site.
	**Photograph 3 (facing S):** View of the driveway and fenced grassed field. Office building with a car park present adjacent to the driveway.

	**Photograph 4 (facing SW):** View of the driveway within the north of the site. Stable building at the end of the driveway.
	**Photograph 5 (facing SE):** View of the grassed field. Undulations present across the site.
	**Photograph 6 (facing NW):** View from the south-eastern corner of the site. Site generally falls to the east.

	**Photograph 7 (facing NW):** View of embankment present along the southern boundary.
	**Photograph 8 (facing NW):** Embankment within southwest of the site. Rochdale Canal present at few meters below site levels.
	**Photograph 9 (facing NE):** Exercise area within the west of the site.

	**Photograph 10 (facing S):** Evidence of the onsite soakaway within the east of the site.
	**Photograph 11 (facing NW):** View of a public pathway adjacent to the east of the site. Site is elevated above the pathway.
	**Photograph 12 (facing NE):** View of road adjacent to Firgrove Business Park towards River Beal. A drain observed within the verge of the road.

	**Photograph 13 (facing NE):** Indications of the drain route.
	**Photograph 14 (facing N):** Drain discharging to the river Beal.
	**Photograph 15 (facing W):** Gullies present in Belfield Mill Lane.

	**Photograph 16 (facing W):** View of Dobfield Road to the north of the site.

APPENDIX C

ENVIRONMENT AGENCY DATA

This page has been left blank intentionally

Flood map for planning

Your reference	Location (easting/northing)	Created
FRA 20 1117	**391754/413865**	**8 Jan 2020 14:54**

Your selected location is in flood zone 1, an area with a low probability of flooding.

This means:

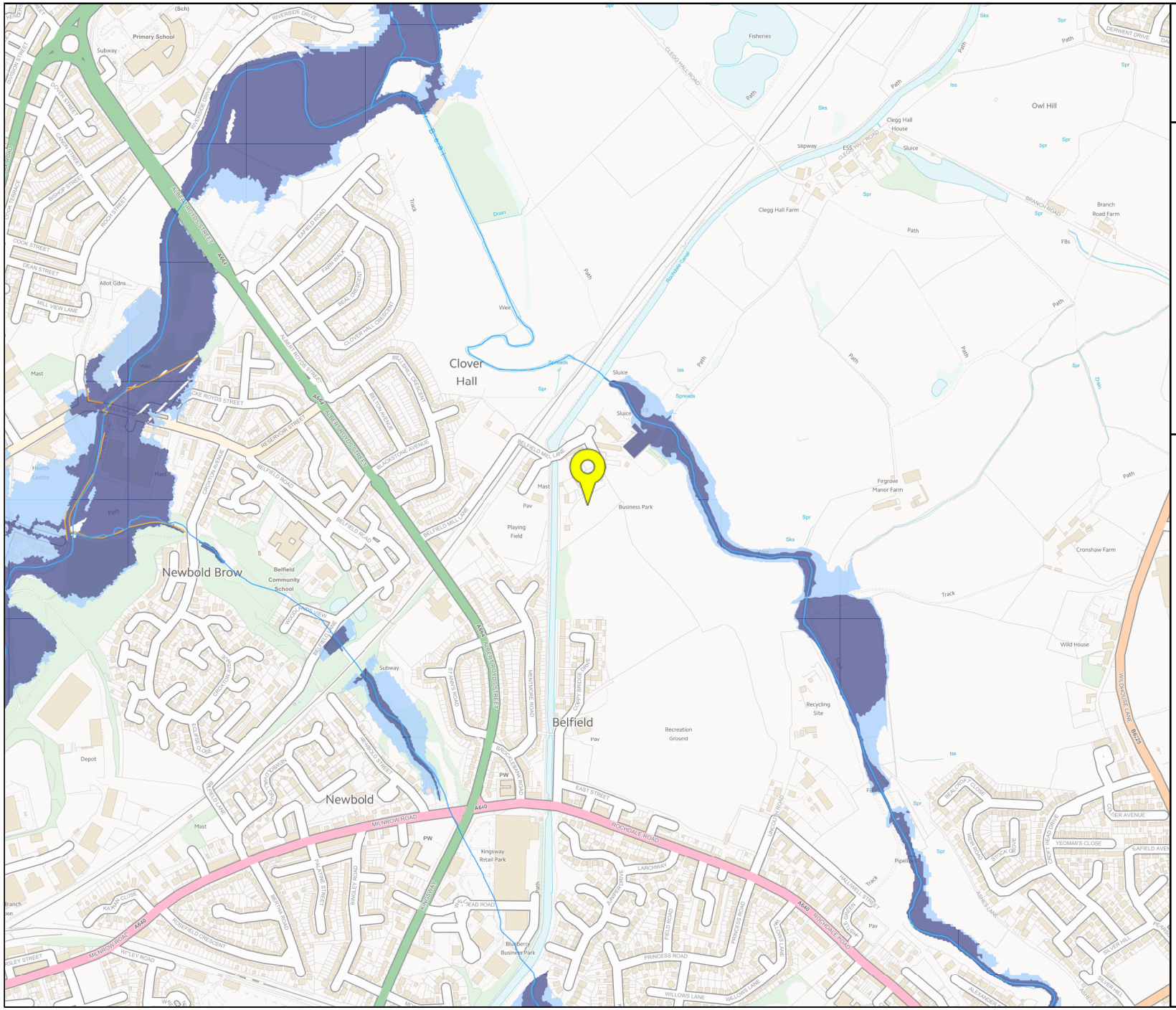
- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

The flood map for planning shows river and sea flooding data only. It doesn’t include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

The Open Government Licence sets out the terms and conditions for using government data.
https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/


Clover Hall
Newbold Brow
Belfield
Newbold
Owl Hill
Clegg Hall Farm
Firgrove Manor Farm
Cronshaw Farm
Wild House
Belfield Community School
Ringsway Retail Park
Recreation Ground
Business Park
Playing Field
Recycling Site
Depot
Blueberry Business Park
Primary School
Subway
Fisheries
Health Centre
Allot Gdns
Branch Road Farm
Clegg Hall House
Slipway
Sluice
Weir
Track
Drain
Path
Mast
Pav
Spr
Sks
Iss
FB
Spreads
A640
A671
A681
ALBERT ROYDS STREET
ROCHDALE ROAD
MILNROW ROAD
BELFIELD MILL LANE
BELFIELD ROAD
EAST STREET
BROADWAY
RINGSWAY
LARCHWAY
PRINCESS ROAD
WILLOWS LANE
B6225
WILDHOUSE LANE
RIVERSIDE DRIVE
DERWENT DRIVE
CLEGG HALL ROAD
BRANCH ROAD
ESS HALL ROAD
CLOVER HALL CRESCENT
BELFIELD AVENUE
BLACKSTONE AVENUE
RESERVOIR STREET
CROMPTON AVENUE
BELTON AVENUE
BRIDGE STREET
BRIDGE ROAD
MEAN MOOR ROAD
COPPY BRIDGE DRIVE
ST ANNES ROAD
ELDFIELD CLOSE
CROMP

APPENDIX D

CONSULTEE CORRESPONDENCE

This page has been left blank intentionally

Highways and Engineering Service - Economy and Environment

DRAINAGE CONSULTATION – PLANNING REF. PREAPP DOBFIELD - NO REF.

Consultation Response, on behalf of Head of Highways and Engineering:-

Date of Response: 23rd Jan 2020

LOCATION & PROPOSED DEVELOPMENT

The site is proposed for a new residential development of approx. 14no dwellings with a new entrance off Dobfield Road.

DOCUMENTATION REVIEWED:

- Email from Anna Mierzejewska of The Keld Group (developer).

DRAINAGE GUIDANCE

For greenfield sites, rainfall runoff should be attenuated such that any rainfall discharges from the developed site are not increased.

In accordance with the National Planning Policy Framework (NPPF) and the National Planning Practice Guidance (NPPG), the site should be drained in the most sustainable way. The drainage scheme for the development shall be in accordance with the NPPG's hierarchy- in the following order of priority:

- into the ground (infiltration);
- to a surface water body;
- to a surface water sewer, highway drain, or another drainage system;
- to a combined sewer.

Drainage Guidance is provided by United Utilities and RBC on their websites:-

https://www.unitedutilities.com/builders-developers/larger-developments/pre-development/wastewater-pre-dev/

http://www.rochdale.gov.uk/pdf/2016-01-25-GM-SuDs-Advice.pdf

Guidance on soakaway suitability can be found in BRE digest 365, available online or from the Authority's Drainage & Flooding Engineer, or by download from:-

https://www.eden.gov.uk/media/1072/bre_digest_soakawaysdesign.pdf

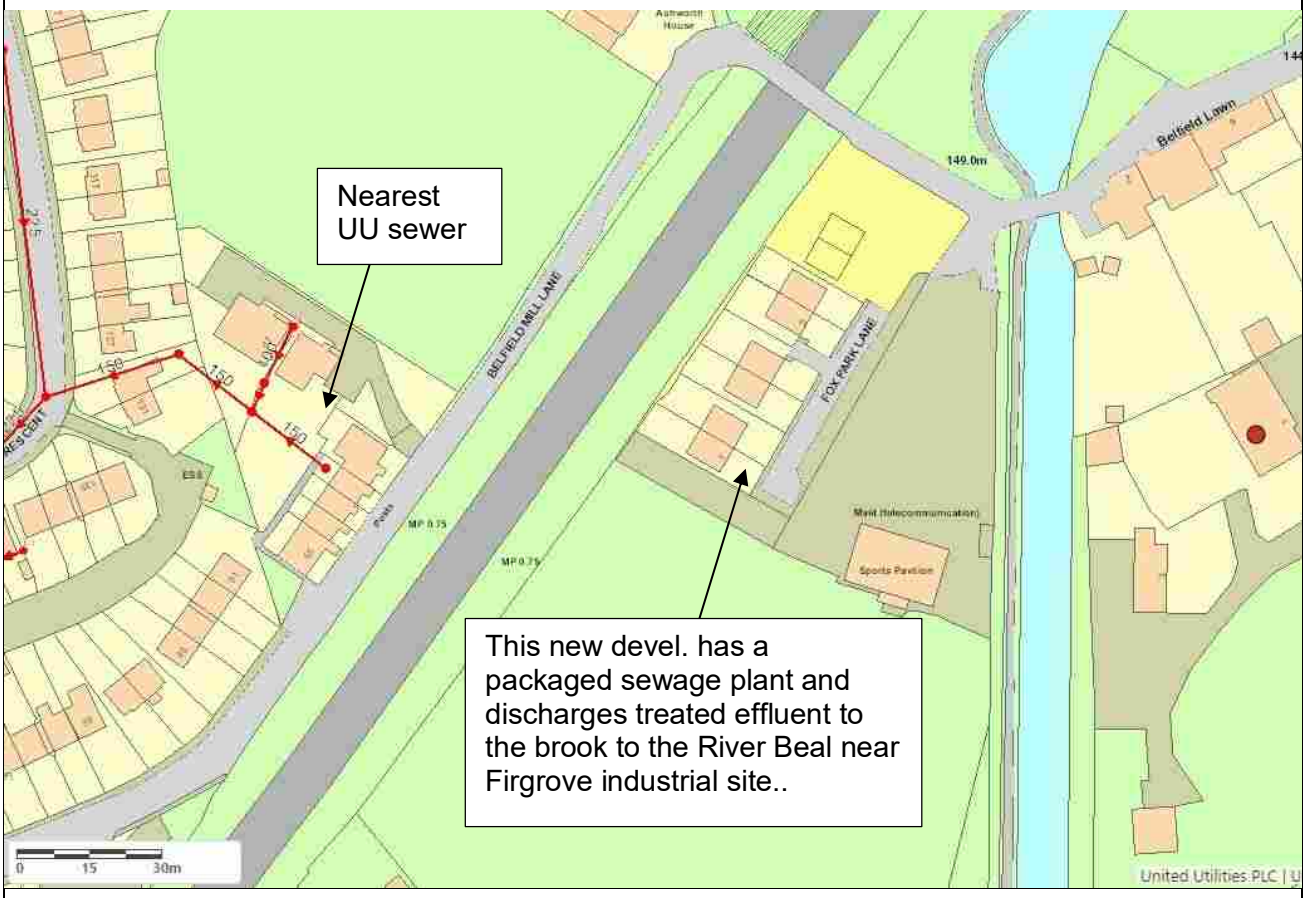
PLANNING ISSUES REGARDING PAVING OF DRIVEWAYS

The Applicant should refer to UK Government Guidance on driveways:_
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/7728/pavingfrontgardens.pdf

You will not need planning permission if a new or replacement driveway of any size uses permeable (or porous) surfacing which allows water to drain through, such as gravel, permeable concrete block paving or porous asphalt, or if the rainwater is directed to a lawn or border to drain naturally.

If the surface to be covered is more than five square metres planning permission will be needed for laying traditional, impermeable driveways that do not provide for the water to run to a permeable area.

UNITED UTILITIES – NEAREST SEWERAGE



DISCUSSION RE. NO PUBLIC SEWERAGE

No nearby public sewerage is present. However, the Developer should look at the General Binding rules:

https://www.gov.uk/guidance/general-binding-rules-small-sewage-discharge-to-the-ground

RULES FOR EXISTING AND NEW DISCHARGES

The Applicant will need to establish whether sewage can be discharged to UU's nearest sewer via a pumped main or whether they would want to provide a packaged sewage plant. If considering a sewage plant, the discharge point will need to be established. The EA will discuss and approve any discharge to the river Beal, whereas the Canal & rivers trust will need to agree if discharging to the canal.

CONSULTATION PROVIDED BY:-

Stephen McCann
Drainage & Flooding Engineer,
Highways, Property & Strategic Housing
01706 924606 stephen.mccann@rochdale.gov.uk

Anna Mierzejewska

From: Andrew Eadie <Andrew.Eadie@Rochdale.Gov.UK>
Sent: Tuesday, January 28, 2020 1:55 PM
To: Anna Mierzejewska
Subject: RE: SuDS enquiry - Land at Dobfield House, 1 Dobfield Road, Rochdale, OL16 3AW

Dear Anna,

Further to your enquiry below, I have checked the records that we hold in respect of historic flooding events, and can confirm that we have no records of historic flooding on this site. However, please note that the records we hold are limited and not necessarily comprehensive, and flooding - on open land for instance - can often go unreported.

For the other information you have requested, this should be held by the Environment Agency or United Utilities. Records of sewers, for instance, should be available from UU.

Many thanks

Andrew Eadie
Principal Planning Officer
Planning & Development

ROCHDALE BOROUGH COUNCIL

01706 924371
andrew.eadie@rochdale.gov.uk

Rochdale Borough Council
Floor 3, Number One Riverside
Smith Street, Rochdale, OL16 1XU

To access our services go to www.rochdale.gov.uk
For news and social media updates go to www.rochdale.gov.uk/news

Please consider the environment before printing this email.

From: Anna Mierzejewska <a.mierzejewska@thelkgroup.com>
Sent: 23 January 2020 14:47
To: Andrew Eadie <Andrew.Eadie@Rochdale.Gov.UK>
Subject: FW: SuDS enquiry - Land at Dobfield House, 1 Dobfield Road, Rochdale, OL16 3AW

Dear Andrew,

Please advise shall you have any records of historic flooding from the sources as specified below that might affect the Site.

I have attached the site boundary plan for you and the site address is also given below. Please note the area of development is limited to the red boundaries on the plan.

Land adj. to Dobfield House
1 Dobfield Road
Rochdale

OL16 3AW

Kind 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

From: Stephen McCann <Stephen.McCann@Rochdale.Gov.UK>
Sent: Thursday, January 23, 2020 2:27 PM
To: Anna Mierzejewska <a.mierzejewska@thelkgroup.com>
Cc: Sharon Hill L <Sharon.Hill@Rochdale.Gov.UK>; Andrew Eadie <Andrew.Eadie@Rochdale.Gov.UK>; John Gillighan WN <john.gillighan@rochdale.gov.uk>
Subject: RE: SuDS enquiry - Land at Dobfield House, 1 Dobfield Road, Rochdale, OL16 3AW

Dear Anna,

Attached is my Drainage Consultation. In looking at your specific queries, I answer in blue text.

- Policies that may relate to Sustainable Drainage Systems (SuDS). Included in the attachment.
- Any restrictions applied to ordinary watercourses and sewers in the area. See included attachment.
    - Highway drainage restrictions and records. The access road is a public adopted road, but has no formal drainage for the last section of this road. If you have any specific highway question, ask john.gillighan@rochdale.gov.uk
    - 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. The Environment Agency has more records. Andrew.Eadie@Rochdale.Gov.UK may have flooding records, if you write to him.

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

ROCHDALE BOROUGH COUNCIL

☎ 01706 924606
✉ stephen.mccann@rochdale.gov.uk

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

To access our services go to www.rochdale.gov.uk
For news and social media updates go to www.rochdale.gov.uk/news

Rochdale Borough Council

Sustainable Drainage Pre-application Standing Advice

Sustainable Drainage and the Planning Process

From April 2015 planning applications relating to major development will ensure that Sustainable Urban Drainage systems (SuDs) for the management of run-off are put in place, unless demonstrated to be inappropriate for reasons of ground suitability, safety or viability.

Alongside the legislative changes to implement SuDs through the planning process, the Lead Local Flood Authorities (LLFAs) are now statutory consultees to Planning Authorities in the role of providing technical advice with regard to local flood risk.

The legislation is aimed at major developments to promote good practice for a SuDS approach to be considered on all development sites, whilst it is acknowledged that each site may present constraints and may limit the potential for a solution to achieve maximum benefits for all functions, it is important that it can be demonstrated that consideration has been given to the hierarchy of drainage techniques and run-off destinations in all instances and opportunities to incorporate SuDS measures into drainage schemes maximised.

To support the design and delivery of sustainable drainage the Government have published Non-Statutory Technical Standards[1] which should be used in conjunction with the National Planning Policy Framework (NPPF)[2], and the associated National Planning Practice Guidance (NPPG).

Major Developments

- A Residential Development consisting of 10 dwellings or more or residential development with a site area of 0.5 hectares or more where the number of dwellings is not yet known.
- A Non Residential Development with provision of a building or buildings where the total floor space to be created is 1000m^2 or more where the floor area is not yet known, a site area of 1 hectare or more.

Planning applications for major development should be accompanied by a site-specific drainage strategy or statement that demonstrates that the drainage scheme proposed is in compliance with the both the NPPF / NPPG and the Non-Statutory Technical Standards.

[1] The Non-Statutory Technical Standards provided by Government relate to the design, construction, operation and maintenance of sustainable drainage systems (SUDS) and have been published as guidance for those designing schemes.

[2] The NPPF (and associated PPG) related to Government policy on the provision and long term maintenance of sustainable drainage systems.

Minor Developments

- A residential development where the number of properties to be constructed is between 1 and 9 inclusive or where the number of properties to be constructed is not given in the application, a site area of less than 0.5 hectares.
- For all other uses, the floor space to be built is less than 1,000 square metres or where the site area is less than 1 hectare.

The density, topography and site history of a proposed development can impact on the types of SuDS features that would be applicable due to previous use and pressures on the area available, often set aside for other uses such as public open space and recreational activities. For this reason it is really important that early consideration and integrated design with respect to SuDS is given which can promote innovative, sustainable and cost effective schemes delivering multiple benefits.

The benefits of sustainable drainage systems (SuDS)

Development can harm water resources if a traditional approach to drainage is adopted. Removing water from site too quickly through piped systems can increase flood risk downstream and reduce infiltration impacting on ground water levels. Surface water run off can also contain contaminates such as oil, toxic metals etc. and can affect water quality in rivers and steams.

SuDS mimic natural drainage processes to reduce the effect on the quality and quantity of run-off from developments. This approach uses a range of techniques including swales, permeable paving and green roofs to mimic the natural drainage of a site. They increase infiltration of water where it lands and reduce the speed of run-off and in addition can provide amenity and biodiversity benefits. When specifying SuDS, early consideration of the potential multiple benefits and opportunities will help deliver the best results.

Hierarchy of drainage techniques

A prioritised order of methods for management of surface water, which is to be considered at all stages of design. Wherever possible the natural drainage of surface water from new developments into the ground will be preferred. Surface water runoff should be managed as close to its source as possible in line with the following drainage hierarchy

The hierarchy of techniques to be used is:

- Prevention of runoff by good site design and reduction of impermeable areas.
- Source control, dealing with water where and when it falls (e.g. infiltration techniques).
- Site control, management of water in the local area (e.g. swales, detention basins).
- Regional control, management of runoff from sites (e.g. balancing ponds, wetlands).

Developers should demonstrate how they have considered and used these techniques.

Runoff Destinations

Surface water runoff not collected for use must be discharged to one or more of the following in the order of priority shown:

- Ground (infiltration),
- Surface water body,
- Surface water sewer, highway drain or other drain,
- Combined sewer.

All SuDS feature design should be completed in accordance with the SuDS Manual (CIRIA C697) with consideration of CIRIA C609B, Sustainable drainage systems: hydraulic, structural and water quality advice.

Pre-application engagement

National Planning Practice Guidance stresses the importance of pre-application engagement with stakeholders to improve efficiency and effectiveness of the planning application system, the planning applications and likelihood of success. Drainage systems considered at the earliest stages of site selection and design are easier to integrate into developments influencing other aspects of the site (i.e. design, layout and function) and reducing impermeable areas wherever possible.

Evidence from case studies suggests that SuDS are cheaper to install and maintain for many new developments. Where SuDS are predominantly green landscaped SuDS measures such as swales and basins much of the maintenance forms part of the site landscaping and is at little or no extra cost.

Effective early engagement can also help deliver SuDS as part of a developments core green infrastructure e.g. in multi-functional spaces such as car parks, landscaped areas, communal spaces etc. and improve cost effectiveness and integration within the development.

Rochdale Borough Council encourages prospective developers to first contact the local planning authority as in doing so it can help to determine whether your development proposal is acceptable in principle and reduce the likelihood of submitting invalid applications.

The following points should be noted:

- Pre-application advice may be charged for.
- The Environment Agency will continue to provide pre-application advice for developments within Flood Zone 2 or 3; however this is chargeable and needs to be addressed separately.
- The likely drainage method should be identified as early as possible to ensure appropriate drainage can be delivered through sustainable development.

- The adopted Rochdale Unitary Development Plan contains planning policies pertaining to flood risk (G/EM/1, EM/7 and EM/8) which should be taken into account and identified at pre-application stage.

Contact Details

Planning Service
Floor 3
Number One Riverside
Smith Street
Rochdale
OL16 1XU

0300 303 8873
development.management@rochdale.gov.uk

Outline Planning Application

An application for outline planning permission allows for a decision on the general principles of how a site can be developed. Outline planning permission will be granted subject to conditions requiring subsequent approval of one or more reserved matters.

The applicant should include the following information as a minimum to enable the LLFA to provide an informed substantive response when advising applicants and when consulted by Local Planning Authorities on planning applications in their role as a statutory consultee.

Outline Planning Application
Compulsory information required to validate the applications. **Drainage statement which includes:**

Outline Drainage Assessment to incorporate the following:
 	
• Topography of the development site, showing existing surface water flow routes, drains, sewers and watercourses
• Geological and soil types.
• Initial scoping of flood risk issues to inform where applicable the flood risk assessment which may include any of the following:
  ◦ Flood risk from main river
  ◦ Surface water
  ◦ Groundwater flood risk

Indicative Site Drainage Strategy, including: • Preliminary sustainable drainage proposals • Outfall locations • Discharge rates • On-site storage requirements
Further information that may be required to validate the application.
An appropriate/proportionate site-specific flood risk assessment where one is required. Guidance can be found: • https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications • https://www.gov.uk/guidance/flood-risk-assessment-standing-advice • http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/site-specific-flood-risk-assessment-checklist/ A flood risk assessment (FRA) will be needed for developments in: • flood zone 2 or 3 including minor developments and change of use • more than 1 hectare in flood zone 1

- less than 1 hectare in flood zone 1, including change of use in development type to a more vulnerable class (e.g. commercial to residential), where they could be affected by sources of flooding other than rivers (e.g. surface water, drains, reservoirs)
- in areas within flood zone 1 which has critical drainage problems as notified by the Environment Agency.

The information provided in the flood risk assessment should be credible and fit for purpose. Site-specific flood risk assessments should always be proportionate to the degree of flood risk and make optimum use of information already available, including information in a Strategic Flood Risk Assessment for the area, and the interactive flood risk maps available on the Environment Agency's web site.

Full Planning Application, Reserved Matters, Discharge of Conditions

Full Planning Application, Reserved Matters ***(in addition to the information required at Outline stage)***
Site and Drainage Layout
Proposed site plan showing excedance flow routes and identification of catchment area(s)
Drainage layout plan, to include: • Sustainable drainage system • Sewers • Drains • Watercourses
Site investigation report, including the results for each sustainable drainage system feature of: • Boreholes or Trial Pits • Infiltration (Permeability) Testing • Factual Ground Investigation Report (GIR) • Geotechnical Design Report (GDR)
Sustainable drainage system flow calculations *(PDF files showing the input and output data for flow calculations)* and storm simulation plan for: • 1 in 1 year; • 1 in 2 year; • 1 in 30 year, and; • 1 in 100 year + 30% climate change

Discharge of Conditions ***(in addition to the information required at Full/Reserved Matters)***
Drawings and Calculations
Detailed design drawings, including: • Details of inlets, outlets and flow controls • Long and cross section drawings of proposed drainage system(s), including design levels • Details of appropriate water quality treatments
Construction
• Specification of materials • Phasing of development including Construction Management Plan • Construction phase Surface Water Management Plan • Construction details • Operational Maintenance Plan • Location plan and as built drawings to be provided (Flood Risk Asset Register – Flood and Water Management Act 2010.
Operation and maintenance plan for a full planning application.
• Whole life cycle costing for the SuDS including replacement cost. • Details of funding arrangements for SuDS maintenance. • Details of the party / organisation responsible for, and maintenance of, each feature. • Specification for inspection and maintenance, including frequency of maintenance tasks required for each proposed SuDS, setting out a minimum standard to which the SuDS system must be maintained an estimate of the expected useful life of the suds provision before replacement required. • Details of additional cleansing, repair and maintenance following flooding events where SuDS features are located in a designated flood zone. • Where SuDS features are attached to private property, confirmation of any associated maintenance / adoption / ownership requirements should be provided. For example, if SuDS features are to be included in property deeds, or if householders are required to pay into a communal fund to fund ongoing maintenance. • Details of proposed contingency plans for failure of any part of the drainage system that could present a hazard to people.
Adoption
• Proposed arrangements for adoption / ownership to secure the operation of the scheme throughout its lifetime, including physical access arrangements for maintenance and establishment of legal rights of access in perpetuity.

Safety and Access

Consideration should always be given to safety in design and appropriate consideration of access during the design of SuDS. CDM Regulations 2015 must also be considered and applied to the planning, design and construction and long term maintenance of SuDS systems.

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

LKGroup

Unit 29 Eton Business Park
Eton Hill Road, Radcliffe
Radcliffe, Greater
M26 2ZS

FAO:

Your Ref: FRA 20 1117
Our Ref: UUPS-ORD-142777
Date: 20/12/2019

Dear Sirs

Location: 1 DOBFIELD ROAD, ROCHDALE, OL16 3AW

I acknowledge with thanks your request dated 18/12/2019 for information on the location of our services.

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

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

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

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

If you have any queries regarding this matter please contact us .

Yours Faithfully,

Karen McCormack
Property Searches Manager

United Utilities Water Limited
Registered In England & Wales No. 2366678
Registered Office Haweswater House, Lingley Mere Business Park,
Lingley Green Avenue, Great Sankey, Warrington, WA5 3LP

TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

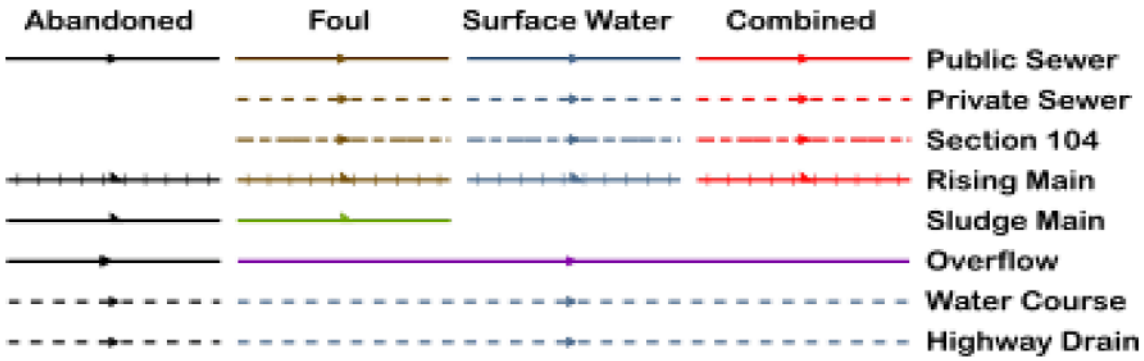
These provisions apply to the public sewerage, water distribution and telemetry systems (including sewers which are the subject of an agreement under Section 104 of the Water Industry Act 1991 and mains installed in accordance with the agreement for the self construction of water mains) (UUWL apparatus)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

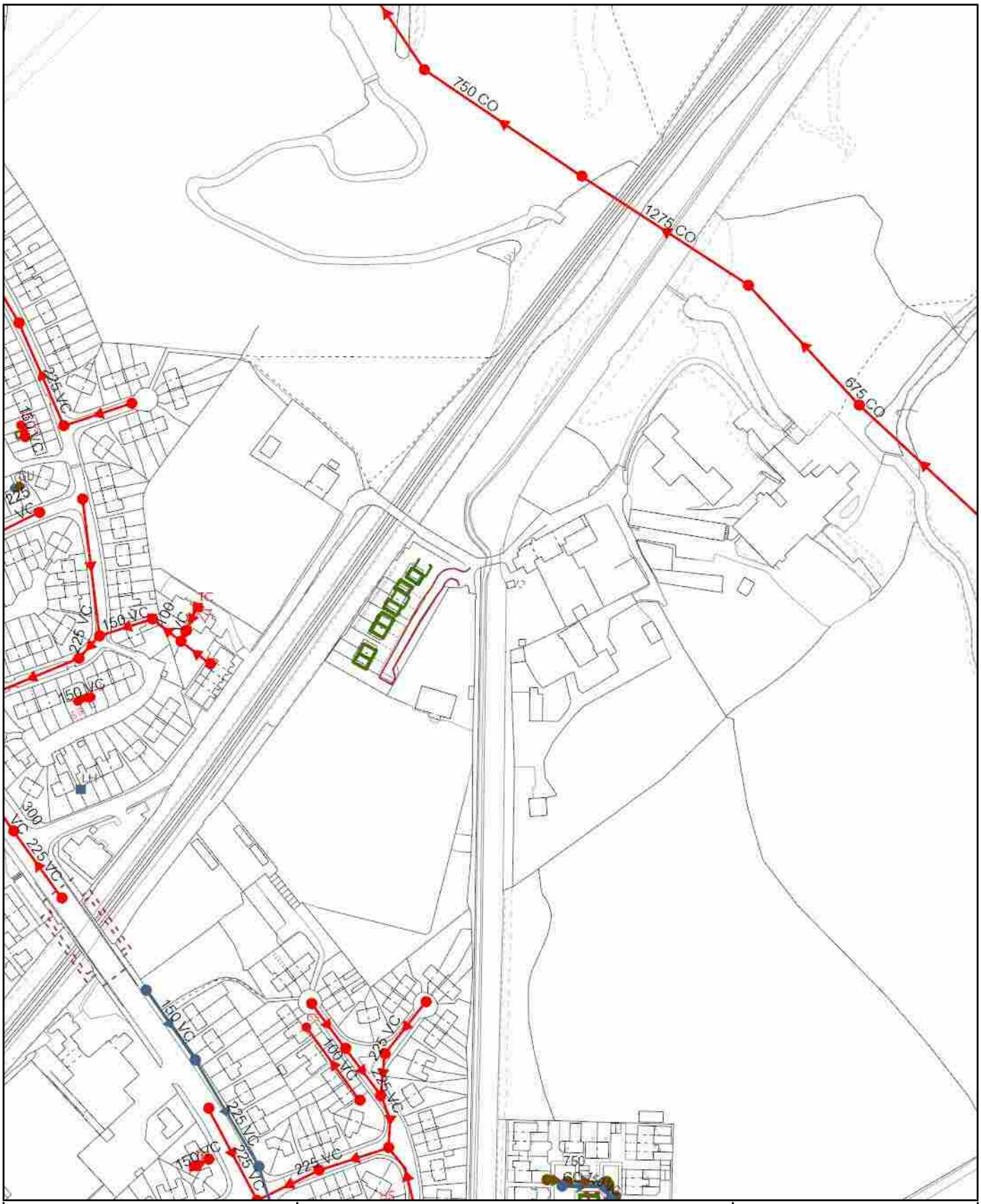
United Utilities Water Limited
Registered In England & Wales No. 2366678
Registered Office Haweswater House, Lingley Mere Business Park,
Lingley Green Avenue, Great Sankey, Warrington, WA5 3LP

Wastewater Symbology



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

- Manhole
- HS Head of System
- ES Extent of Survey
- RE Rodding Eye
- IN Inlet
- DP Discharge Point
- HY Vortex
- PE Penstock
- WO Washout Chamber
- VA Valve
- AV Air Valve
- NRV Non Return Valve
- SO Soakaway
- GU Gully
- CA Cascade
- FM Flow Meter
- HA Hatch Box
- OI Oil Interceptor
- SM Summit
- DS Drop Shaft
- OP Orifice Plate
- Side Entry Manhole
- Outfall
- Screen Chamber
- IC Inspection Chamber
- Bifurcation Chamber
- LH Lamp Hole
- T Junction / Saddle
- CA Catchpit
- VC Valve Chamber
- Vent Column
- Vortex Chamber
- Penstock Chamber
- T Network Storage Tank
- V Sewer Overflow
- WwTW Ww Treatment Works
- Ww Pumping Station
- ST Septic Tank
- CK Control Kiosk
- Change of Characteristic



Scale:	1:2817	**SEWER RECORDS**	United Utilities helping life flow smoothly
Date:	20/12/2019		
Address or Site Reference:	1 DOBFIELD ROAD, ROCHDALE, OL16 3AW		
Printed by:	Property Searches		

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

Crown copyright and database rights 2017 Ordnance Survey 100022432. Unauthorised reproduction will infringe these copyrights.

Anna Mierzejewska

From: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Sent: Friday, January 10, 2020 4:06 PM
To: Anna Mierzejewska
Cc: Wastewater Developer Services
Subject: FW: SuDS enquiry - Land at Dobfield House, 1 Dobfield Road, Rochdale, OL16 3AW - 4200029750
Attachments: Dobfield House - Pre-Development Enquiry.pdf; 1285-SLP Site location plan.pdf; 1285-001A Ground floor site plan over topo.pdf; 500m S Page 1 Borehole SD91SW9 Borehole Logs.pdf; 385m W Page 2 Borehole SD91SW146 Borehole Logs.pdf; 142777-20-12-2019-09-06-58.pdf

Good Afternoon Anna,

Our reference for this pre-development enquiry: 4200029750

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

Records of Sewer Flooding:

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

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

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 UUW 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.

Foul

Foul will be allowed to drain to the public combined/ foul sewer network at an unrestricted rate, and at any conveniant point, though please note there are no public sewers within the vicinity of the site (according to our sewer records, the most accessible sewer appears to be on Albert Royds Street).

Surface Water

In order to follow the drainage heirachy outlined in Building Regulations part H3 and National Planning Practice Guidance (NPPG), surface water must be drained either via infiltration or directly to the adjacent watercourse (as above, there are no public sewers within the vicinity of the site according to our records).

General Information:

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.

Many thanks and kind regards,

Tom

United Utilities
Water for the North West

Thomas Bethell
Assistant Engineer
Developer Services & Metering
Customer Services
T: 01925 679 308
unitedutilities.com

If you have received a great service today why not tell us?
Visit: unitedutilities.com/wow

From: Anna Mierzejewska [mailto:a.mierzejewska@thelkgroup.com]
Sent: 08 January 2020 16:40
To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: SuDS enquiry - Land at Dobfield House, 1 Dobfield Road, Rochdale, OL16 3AW

Dear Sir/Madam,

LK Consult Ltd. has been commissioned to undertake a Sustainable Drainage Strategy (SuDS) for a site located at 1 Dobfield Road, Rochdale, OL16 3AW, centred at approximate National Grid Reference 391755E, 413865N. The site is proposed for a new residential development of approx. 14no dwellings with a new entrance off Dobfield Road.

The area of interest appears to be within Flood Zone 1. Rochdale Canal is located directly to the west and River Beal approx. 120m NE flowing NW. The site is sloping gently to the north. The nearest borehole record identified made ground with clay-based soil to 3.7mbgl and ground water strike at 3.5mbgl. There are no surface water sewers in the vicinity of the site. The surface water arising from the development is not considered to connect to the public sewer at that stage.

BGS data indicates that the site is within an area underlain by Glaciofluvial Deposit, Devensian – Sand and Gravel (superficial deposits) and Pennine Lower Coal Measures – Mudstone, Siltstone, Sandstone bedrock.

The site location plan, proposed layout, the nearest borehole records and the sewer plan are attached to this email. The pre-development enquiry has also been attached to this email in regards to the potential connection of foul drainage from the proposed development.

To complete the SuDS, 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
- Any recommendations on the potential connection of the foul drainage

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

LK GROUP

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

INCREASING LAND VALUE

EMGateway3.uuplc.co.uk made the following annotations

The information contained in this e-mail is intended only
for the individual to whom it is addressed. It may contain

legally privileged or confidential information or otherwise
be exempt from disclosure. If you have received this Message
in error or there are any problems, please notify the sender
immediately and delete the message from your computer. You
must not use, disclose, copy or alter this message for any
unauthorised purpose. Neither United Utilities Group PLC nor
any of its subsidiaries will be liable for any direct, special,
indirect or consequential damages as a result of any virus being
passed on, or arising from the alteration of the contents of
this message by a third party.

United Utilities Group PLC, Haweswater House, Lingley Mere
Business Park, Lingley Green Avenue, Great Sankey,
Warrington, WA5 3LP
Registered in England and Wales. Registered No 6559020

www.unitedutilities.com
www.unitedutilities.com/subsidiaries

APPENDIX E

CALCULATIONS

This page has been left blank intentionally

MasterDrain
HY 10.07

The LK Group
www.thelkgroup.com

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

Job No. FRA 20 1117			
Sheet no. 1			
Date 22/01/20			
Project Greenfield runoff	By AM	Checked	Reviewed
Title IoH 124 Runoff calcs for Dobfield House			

Hydrological Data:-

FSR Hydrology:-

Location = Dobfield House — Grid reference = SD9214
M5-60 (mm) = 19.4 — r = 0.27
Soil runoff = 0.40 — SAAR (mm/yr) = 1150
WRAP = 3 — Area = England & Wales
Hydrological area = 10 — Hydrological zone = 7

Soil classification for WRAP type 3
i) Relatively impermeable soils in boulder and sedimentary clays, and in alluvium, especially in eastern England;
ii) Permeable soils with shallow ground water in low-lying areas;
iii) Mixed areas of permeable and impermeable soils, in approximately equal proportions.

Design data:-

Area = 0.0075 Km² - 0.75 Ha - 7500 m²

Calculation method:-

Runoff is calculated from:-

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

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 0.015

Mean Annual Peak Flow $Q_{BAR(rural)}$ = 4.56 l/s

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

MasterDrain
HY 10.07

Job No.	FRA 20 1117
Sheet no.	2
Date	22/01/20
Project	Greenfield runoff
Title	IoH 124 Runoff calcs for Dobfield House
By	AM
Checked	
Reviewed	

Values for $Q_{BAR(rural)}$

Ret. per.	m³/hr	l/s	l/s/ha	Ret. per.	m³/hr	l/s	l/s/ha
1yr	13.957	3.877	5.169	100yr+20%	41.380	11.494	15.326
2yr	15.271	4.242	5.656	100yr+30%	44.828	12.452	16.603
5yr	19.869	5.519	7.359	100yr+40%	48.276	13.410	17.880
10yr	22.660	6.295	8.393	200yr	39.409	10.947	14.596
30yr	27.586	7.663	10.217	200yr + 30%	51.232	14.231	18.975
50yr	30.378	8.438	11.251	500yr	44.828	12.452	16.603
100yr	34.483	9.579	12.772	1000yr	49.918	13.866	18.488

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.

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

MasterDrain
SW 16.07

Job No.			
Sheet no.	1		
Date	04/02/20		
Project	Filled soakaway, crates, k=1x10-6	By	Checked / Reviewed
Title	Filled pit soakaway calculations for Dobfield House		

Data:-

Location hydrological data (FSR):-

Location	= Dobfield House	Grid reference	= SD9214
M5-60 (mm)	= 19.4	r	= 0.27
Soil index	= 0.40	SAAR (mm/yr)	= 1150
WRAP	= 3	Area = England and Wales	

Soil classification for WRAP type 3
i) Relatively impermeable soils in boulder and sedimentary clays, and in alluvium, especially in eastern England;
ii) Permeable soils with shallow ground water in low-lying areas;
iii) Mixed areas of permeable and impermeable soils, in approximately equal proportions.

Design data:-

Safety factor = 2.0 - Minor inconvenience (SF=2)
Fill porosity = 0.95 - Plastic cells (porosity = 0.95)

Equivalent porosity (n1) = 0.95

Pit dimensions= 100.0 x 45.0 metres

Area drained = 4110 m²

Infiltration coefficient = 0.0036 m/hr
Effective inf.coeff (q) = 0.0018

Return period = 100 yrs

Climate change factor = 30%

Calculations :-

Filled Excavation:-

Perimeter of pit = (2 x Excavation Width)+(2 x Excavation Length)
Area of base = Excavation Width x Excavation Length
Infiltration area = (Area of base)+(Perimeter of pit x Hmax)
Temporary constant 'a'
= (Area of base / perimeter)-((AreaDrained x Rainfall depth /1000)/(Perimeter/Inf. coeff))
Temporary constant 'b' = (Perimeter/Inf. coeff) / (Area of base x porosity)
Hmax = a*((EXP(-1 x b x Duration of storm))-1)

Note: The Hmax calculation is iterated to a maximum value of Hmax.

Note: Duration of storm in hours, Rainfall depth in mm/hr x Climate Change factor.

Results :-

Emptying time to 50% volume = 22:47 (hr:min)
hMax (Depth) = 0.09 metres
Time to maximum = 17:00 hr:min
Rainfall at maximum = 7.27mm/hr
Width (m) = 100.0

Length (m) = 45.0

Total Infiltration area = 4525.1m² (base area + sidewall area).

Total available volume = 370.69m³

N.B. The rainfall rates are calculated using the location specific values above in accordance with the Wallingford procedure.
Formulae and methods from CIRIA 156.

MasterDrain
SW 16.07

The LK Group

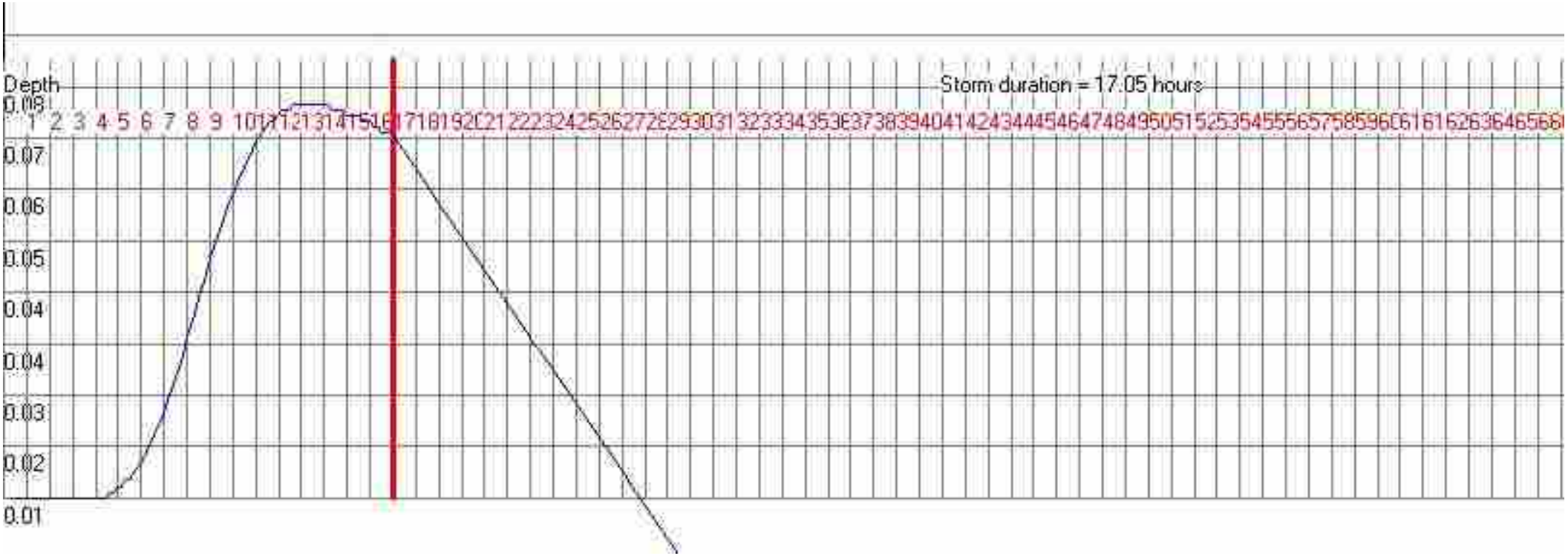
www.thelkgroup.com

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

Job No.	
Sheet no.	2
Date	04/02/20

Project	By	Checked	Reviewed
Filled soakaway, crates, k=1x10-6			

Title: **Worst case soakaway times to empty.**



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

Job No.	
Sheet no.	1
Date	03/02/20

MasterDrain
SW 16.07

Project	Filled soakaway, crates, k=1x10-5	By	Checked / Reviewed
Title	Filled pit soakaway calculations for Dobfield House		

Data:-

Location hydrological data (FSR):-

Location	= Dobfield House	Grid reference	= SD9214
M5-60 (mm)	= 19.4	r	= 0.27
Soil index	= 0.40	SAAR (mm/yr)	= 1150
WRAP	= 3	Area = England and Wales	

Soil classification for WRAP type 3
i) Relatively impermeable soils in boulder and sedimentary clays, and in alluvium, especially in eastern England;
ii) Permeable soils with shallow ground water in low-lying areas;
iii) Mixed areas of permeable and impermeable soils, in approximately equal proportions.

Design data:-

Safety factor = 2.0 - Minor inconvenience (SF=2)
Fill porosity = 0.95 - Plastic cells (porosity = 0.95)

Equivalent porosity (n1) = 0.95

Pit dimensions= 30.0 x 15.0 metres

Area drained = 4110 m²

Infiltration coefficient = 0.036 m/hr
Effective inf.coeff (q) = 0.018

Return period = 100 yrs

Climate change factor = 30%

Calculations :-

Filled Excavation:-

Perimeter of pit = (2 x Excavation Width)+(2 x Excavation Length)
Area of base = Excavation Width x Excavation Length
Infiltration area = (Area of base)+(Perimeter of pit x Hmax)
Temporary constant 'a'
= (Area of base / perimeter)-((AreaDrained x Rainfall depth /1000)/(Perimeter/Inf. coeff))
Temporary constant 'b' = (Perimeter/Inf. coeff) / (Area of base x porosity)
Hmax = a*((EXP(-1 x b x Duration of storm))-1)

Note: The Hmax calculation is iterated to a maximum value of Hmax.

Note: Duration of storm in hours, Rainfall depth in mm/hr x Climate Change factor.

Results :-

Emptying time to 50% volume = 19:44 (hr:min)
hMax (Depth) = 0.84 metres
Time to maximum = 15:00 hr:min
Rainfall at maximum = 7.81mm/hr
Width (m) = 30.0

Length (m) = 15.0

Total Infiltration area = 525.8m² (base area + sidewall area).

Total available volume = 359.90m³

N.B. The rainfall rates are calculated using the location specific values above in accordance with the Wallingford procedure. Formulae and methods from CIRIA 156.

MasterDrain
SW 16.07

The LK Group

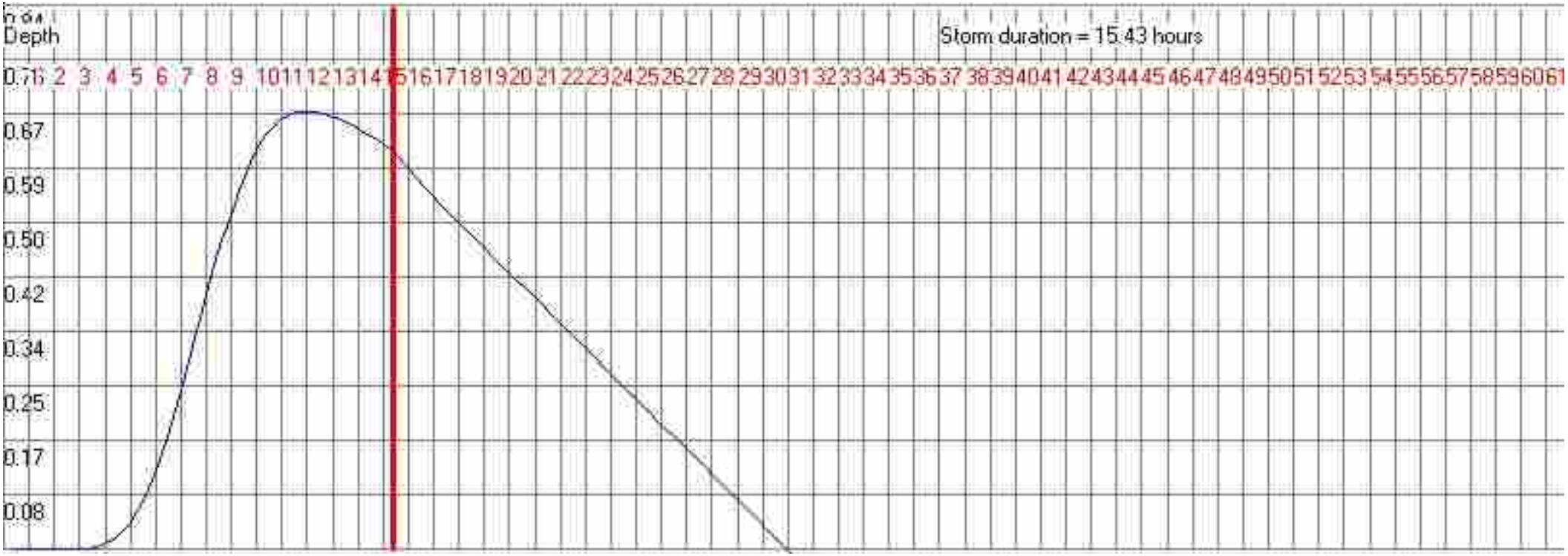
www.thelkgroup.com

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

Job No.	
Sheet no.	2
Date	03/02/20

Project	By	Checked	Reviewed
Filled soakaway, crates, k=1x10-5			

Title: **Worst case soakaway times to empty.**



MasterDrain SW

The LK Group

www.thelkgroup.com

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

Job No. FRA 20 1117			
Sheet no. 1			
Date 04/02/20			
Project 1 in 30yr storage	By AM	Checked	Reviewed
Title Peak flow storage calcs for Dobfield House			

Data:-

FSR Hydrology:-

Location = Dobfield House
M5-60 (mm) = 19.4
Soil index = 0.40
Return period = 30
UCWI = 117.8

Grid reference = SD9214
r = 0.27
SAAR (mm/yr) = 1150
WRAP = 3
Climate change = 0

i) Relatively impermeable soils in boulder and sedimentary clays, and in alluvium, especially in eastern England;
ii) Permeable soils with shallow ground water in low-lying areas;
iii) Mixed areas of permeable and impermeable soils, in approximately equal proportions.

Runoff factor (RF) = 44.0, calculated from:-

Runoff factor = (0.829*PIMP)+(25*SOIL)+(0.078*UCWI)-20.7

where

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

UCWI = Calculated value for Wetness Index

Design data:-

Imperv. area = 4110 m²
Total area (TA) = 7500 m²
Allowed discharge rate = 7.670 l/s
Additional flow = 0.00 l/s

Pervious area = 3390 m²
Equiv area = 3300 m² (TA x RF).
Areal reduction factor = 1.000
Climate change factor = 0

Calculated data:-

Time to max = 92.0 mins
Rainfall at max = 22.90 mm/hr
Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Calculated storage volume = 73.6 m³
Allowed discharge rate = 7.670 l/s
Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours
Rainfall rate = 9.00 mm/hr

Calculated storage volume = 13.4 m³
Allowed discharge rate = 7.670 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
100	9366.9	1125	74.0
150	4163.1	1200	65.0
225	1850.3	1275	57.6
300	1040.8	1350	51.4
375	666.1	1425	46.1
450	462.6	1500	41.6
525	339.8	1575	37.8
600	260.2	1650	34.4
675	205.6	1725	31.5
750	166.5	1800	28.9
825	137.6	1875	26.6
900	115.6	1950	24.6
975	98.5	2025	22.8
1050	85.0	2100	21.2

Ovoid	Len
400 x 600	408.6
600 x 900	177.9
800 x 1200	100.1

Box culvert	Len
500 x 500	294.2
500 x 750	196.1
500 x 1000	147.1
750 x 1000	98.1
750 x 1200	81.7
750 x 1500	65.4
1000 x 1000	73.6
1000 x 1200	61.3
1000 x 1500	49.0
1000 x 1800	40.9
1000 x 2000	36.8
1500 x 1500	32.7
1500 x 1800	27.2
1500 x 2000	24.5

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

Job No.	Sheet no.	Date
FRA 20 1117	2	04/02/20

MasterDrain SW

Project: 1 in 30yr storage

Title: Peak flow storage calcs for Dobfield House

By	Checked	Reviewed
AM		

Data:-

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	78.0	42.654	4.602	38.052
20	56.0	61.303	9.204	52.099
30	45.0	73.866	13.806	60.060
40	38.0	83.609	18.408	65.201
50	33.0	91.661	23.010	68.651
60	30.0	98.566	27.612	70.954
70	27.0	104.633	32.214	72.419
80	25.0	110.055	36.816	73.239
90	23.0	114.963	41.418	73.545
100	22.0	119.450	46.020	73.430
110	20.0	123.582	50.622	72.960
120	19.0	127.412	55.224	72.188
130	18.0	130.981	59.826	71.155
140	17.0	134.320	64.428	69.892
150	17.0	137.457	69.030	68.427
160	16.0	140.412	73.632	66.780
170	15.0	143.204	78.234	64.970
180	15.0	145.849	82.836	63.013
190	14.0	148.360	87.438	60.922
200	14.0	150.830	92.040	58.790
210	13.0	153.247	96.642	56.605
220	13.0	155.580	101.244	54.336
230	12.0	157.836	105.846	51.990
240	12.0	160.022	110.448	49.574
250	12.0	162.141	115.050	47.091
260	11.0	164.198	119.652	44.546
270	11.0	166.199	124.254	41.945
280	11.0	168.145	128.856	39.289
290	11.0	170.041	133.458	36.583
300	10.0	171.889	138.060	33.829
310	10.0	173.693	142.662	31.031
320	10.0	175.454	147.264	28.190
330	10.0	177.175	151.866	25.309
340	10.0	178.858	156.468	22.390
350	9.0	180.505	161.070	19.435
360	9.0	182.118	165.672	16.446
370	9.0	183.698	170.274	13.424
380	9.0	185.247	174.876	10.371
390	9.0	186.767	179.478	7.289
400	9.0	188.257	184.080	4.177
410	8.0	189.721	188.682	1.039
420	8.0	191.159	193.284	0.000
430	8.0	192.571	197.886	0.000
440	8.0	193.960	202.488	0.000
450	8.0	195.325	207.090	0.000
460	8.0	196.668	211.692	0.000
470	8.0	197.990	216.294	0.000
480	8.0	199.291	220.896	0.000
490	7.0	200.573	225.498	0.000
500	7.0	201.835	230.100	0.000
510	7.0	203.079	234.702	0.000
520	7.0	204.305	239.304	0.000
530	7.0	205.513	243.906	0.000
540	7.0	206.705	248.508	0.000
550	7.0	207.881	253.110	0.000
560	7.0	209.041	257.712	0.000
570	7.0	210.185	262.314	0.000
580	7.0	211.315	266.916	0.000
590	7.0	212.431	271.518	0.000
600	6.0	213.533	276.120	0.000

Storage volume (m^3) = 73.6 m^3

The LK Group

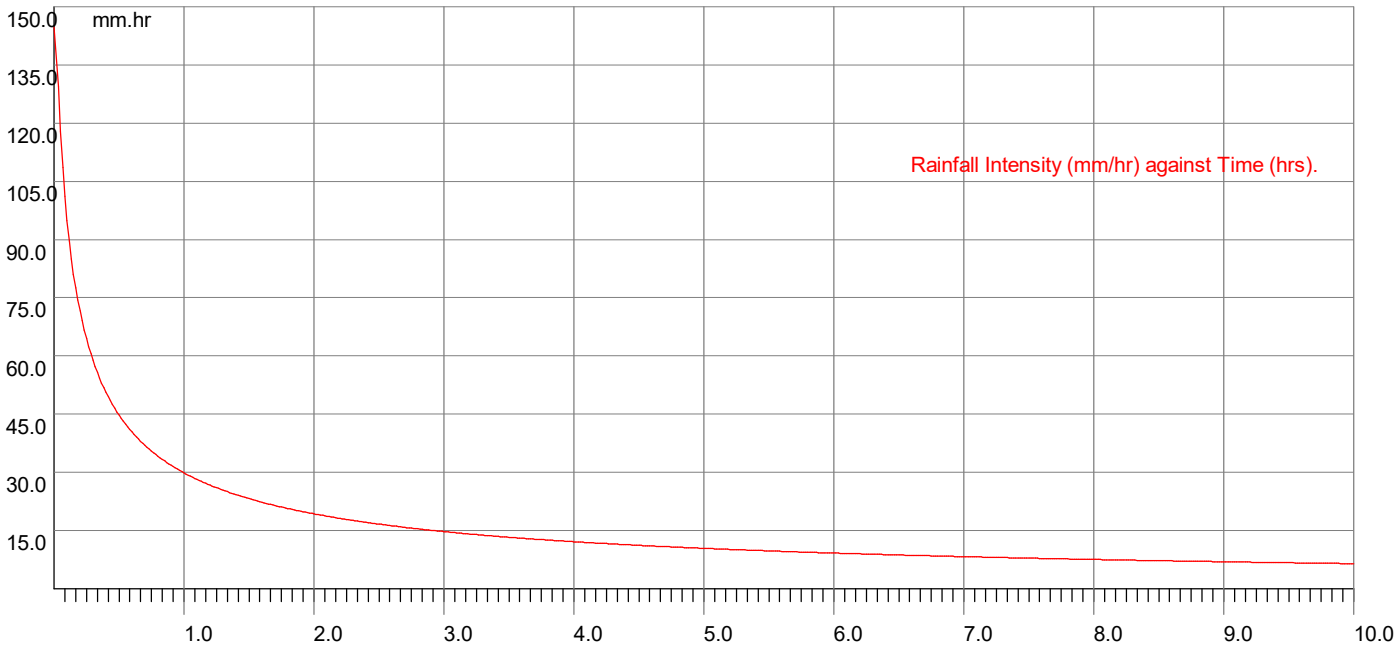
www.thelkgroup.com

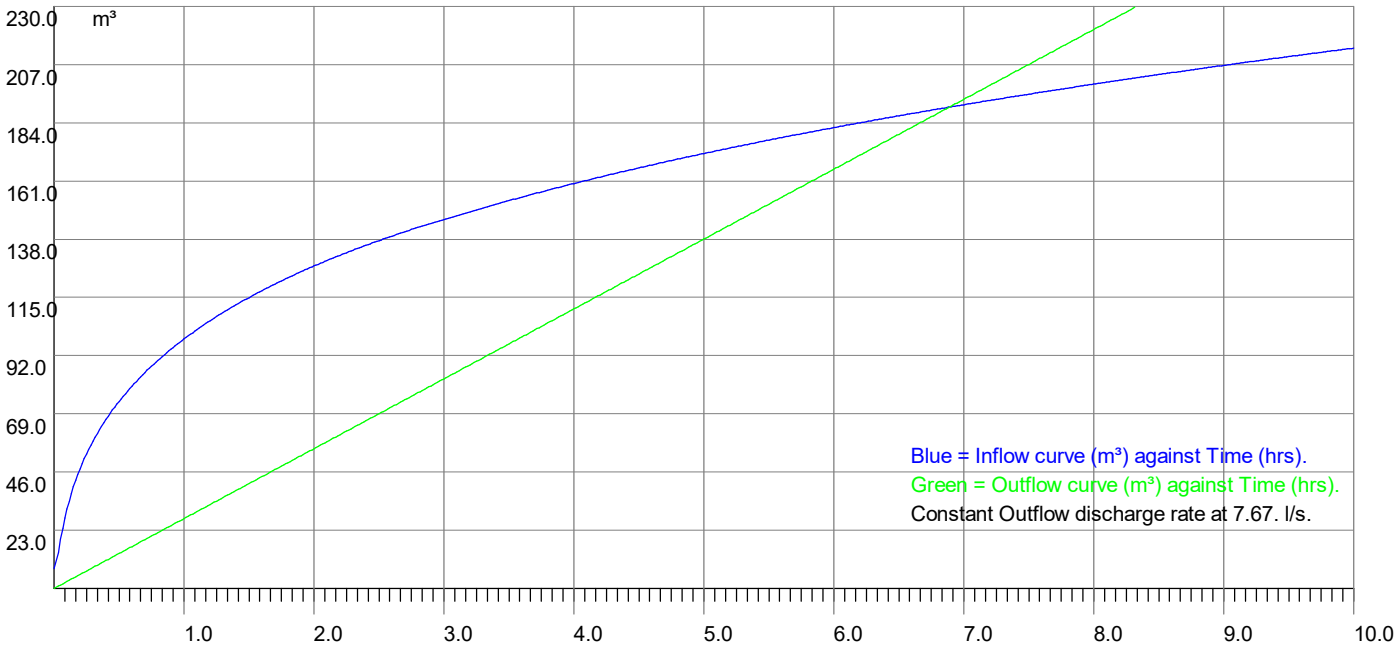
Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

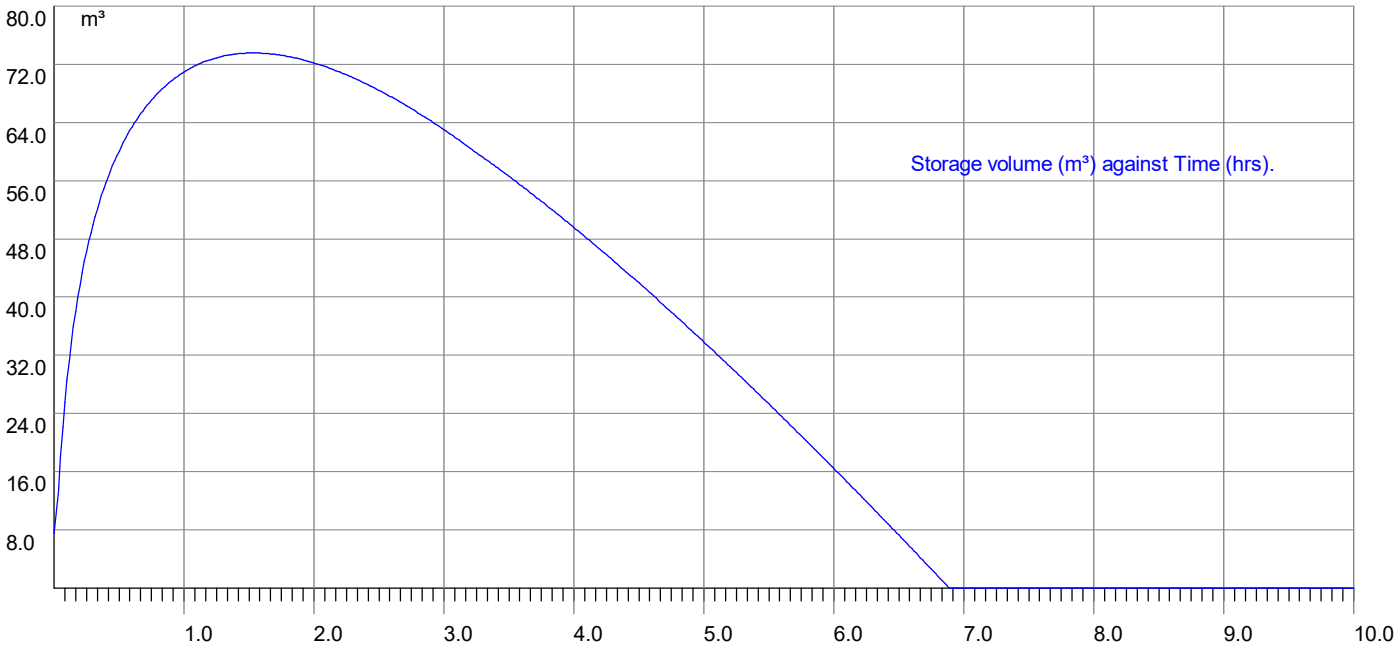
Job No.	FRA 20 1117
Sheet no.	3
Date	04/02/20

MasterDrain SW

Project	1 in 30yr storage	By	AM
Title	Peak flow storage calcs for Dobfield House	Checked	
		Reviewed	







MasterDrain SW

The LK Group

www.thelkgroup.com

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

Job No. FRA 20 1117			
Sheet no. 1			
Date 07/02/20			
Project 1 in 100yr plus 30% climate change storage	By AM	Checked	Reviewed
Title Peak flow storage calcs for Dobfield House			

Data:-

FSR Hydrology:-

Location = Dobfield House
M5-60 (mm) = 19.4
Soil index = 0.40
Return period = 100
UCWI = 117.8

Grid reference = SD9214
r = 0.27
SAAR (mm/yr) = 1150
WRAP = 3
Climate change = 30

i) Relatively impermeable soils in boulder and sedimentary clays, and in alluvium, especially in eastern England;
ii) Permeable soils with shallow ground water in low-lying areas;
iii) Mixed areas of permeable and impermeable soils, in approximately equal proportions.

Runoff factor (RF) = 44.0, calculated from:-

Runoff factor = (0.829*PIMP)+(25*SOIL)+(0.078*UCWI)-20.7

where

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

UCWI = Calculated value for Wetness Index

Design data:-

Imperv. area = 4110 m²
Total area (TA) = 7500 m²
Allowed discharge rate = 9.580 l/s
Additional flow = 0.00 l/s

Pervious area = 3390 m²
Equiv area = 3300 m² (TA x RF).
Areal reduction factor = 1.000
Climate change factor = 30

Calculated data:-

Time to max = 128.0 mins
Rainfall at max = 31.56 mm/hr
Pipeline storage = 0.0 m³
Offline storage = 0.0 m³

Calculated storage volume = 148.6 m³
Allowed discharge rate = 9.580 l/s
Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours
Rainfall rate = 15.00 mm/hr

Calculated storage volume = 94.1 m³
Allowed discharge rate = 9.580 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
100	18928.9	1125	149.6
150	8412.9	1200	131.5
225	3739.1	1275	116.4
300	2103.2	1350	103.9
375	1346.1	1425	93.2
450	934.8	1500	84.1
525	686.8	1575	76.3
600	525.8	1650	69.5
675	415.5	1725	63.6
750	336.5	1800	58.4
825	278.1	1875	53.8
900	233.7	1950	49.8
975	199.1	2025	46.2
1050	171.7	2100	42.9

Ovoid	Len
400 x 600	825.8
600 x 900	359.6
800 x 1200	202.2

Box culvert	Len
500 x 500	594.6
500 x 750	396.4
500 x 1000	297.3
750 x 1000	198.2
750 x 1200	165.2
750 x 1500	132.1
1000 x 1000	148.6
1000 x 1200	123.9
1000 x 1500	99.1
1000 x 1800	82.6
1000 x 2000	74.3
1500 x 1500	66.1
1500 x 1800	55.1
1500 x 2000	49.5

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

Job No.	FRA 20 1117
Sheet no.	2
Date	07/02/20

MasterDrain SW

Project: 1 in 100yr plus 30% climate change storage

Title: Peak flow storage calcs for Dobfield House

By	Checked	Reviewed
AM		

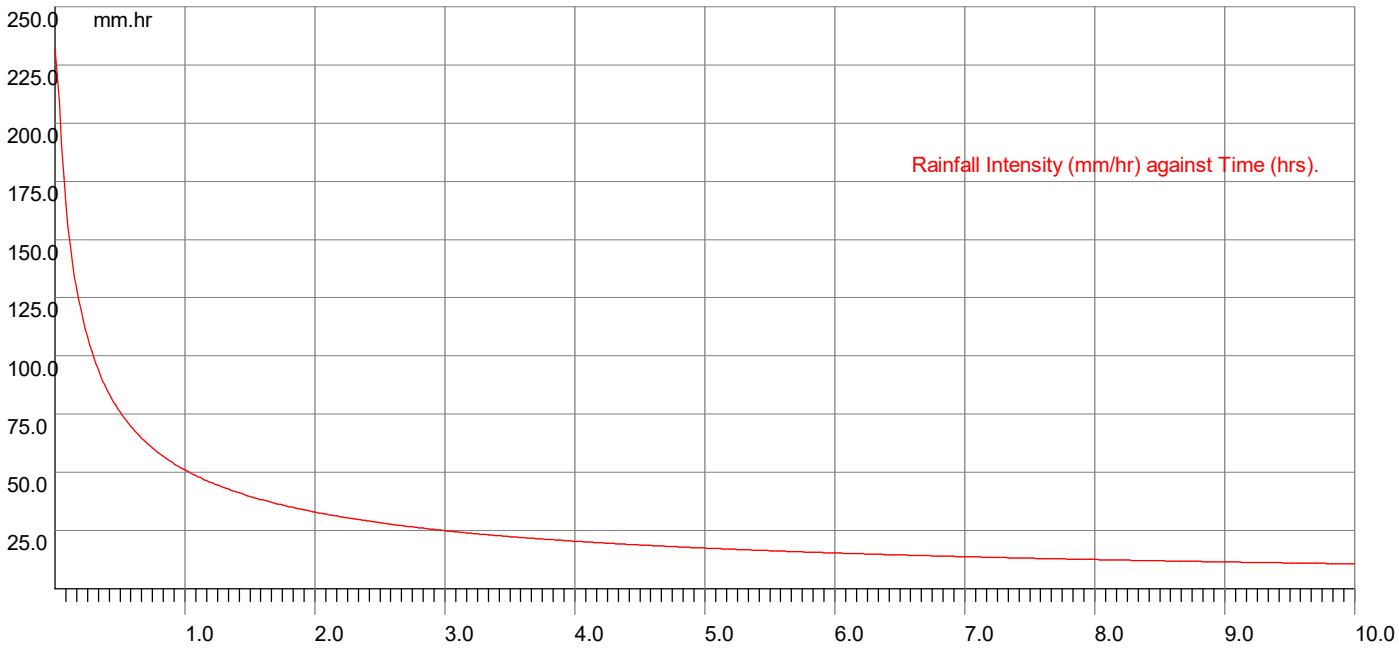
Data:-

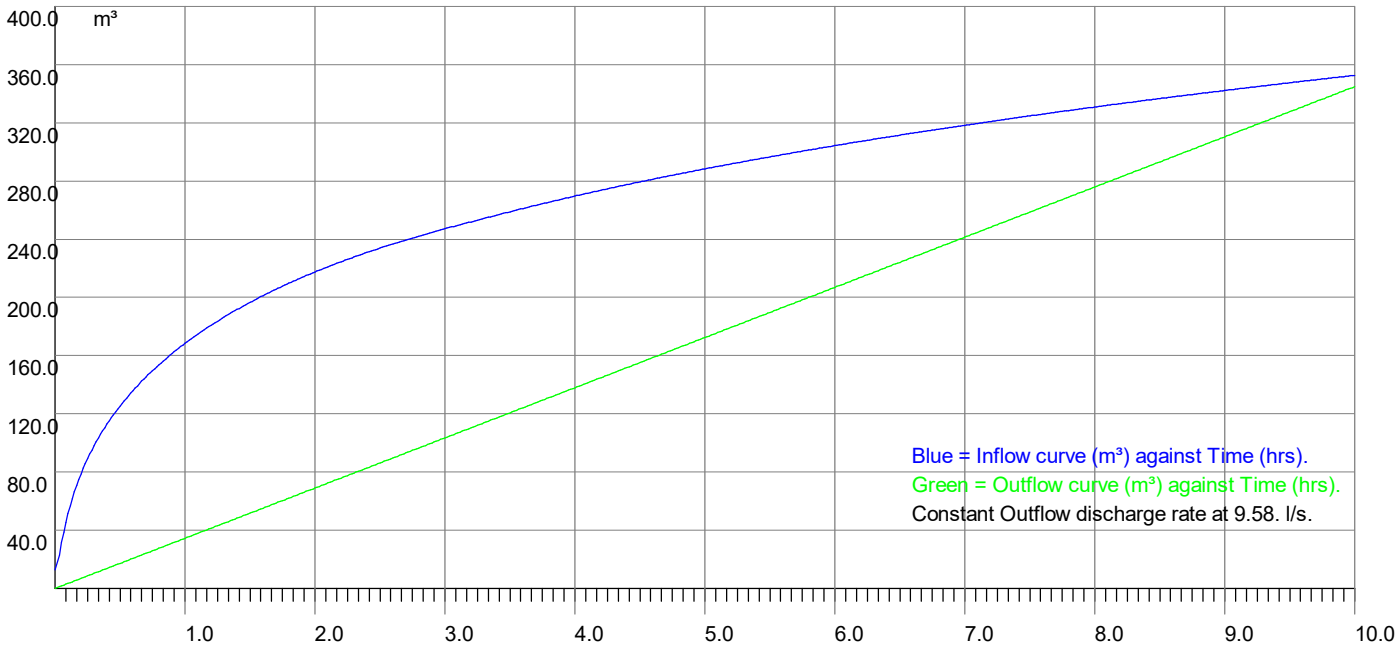
Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	129.0	70.827	5.748	65.079
20	94.0	103.346	11.496	91.850
30	76.0	125.313	17.244	108.069
40	65.0	142.358	22.992	119.366
50	57.0	156.407	28.740	127.667
60	51.0	168.403	34.488	133.915
70	46.0	178.885	40.236	138.649
80	43.0	188.195	45.984	142.211
90	40.0	196.563	51.732	144.831
100	37.0	204.155	57.480	146.675
110	35.0	211.091	63.228	147.863
120	33.0	217.467	68.976	148.491
130	31.0	223.356	74.724	148.632
140	30.0	228.816	80.472	148.344
150	28.0	233.897	86.220	147.677
160	27.0	238.638	91.968	146.670
170	26.0	243.073	97.716	145.357
180	25.0	247.230	103.464	143.766
190	24.0	251.134	109.212	141.922
200	23.0	255.037	114.960	140.077
210	22.0	258.888	120.708	138.180
220	22.0	262.599	126.456	136.143
230	21.0	266.182	132.204	133.978
240	20.0	269.645	137.952	131.693
250	20.0	272.998	143.700	129.298
260	19.0	276.249	149.448	126.801
270	19.0	279.403	155.196	124.207
280	18.0	282.468	160.944	121.524
290	18.0	285.449	166.692	118.757
300	17.0	288.351	172.440	115.911
310	17.0	291.179	178.188	112.991
320	17.0	293.936	183.936	110.000
330	16.0	296.627	189.684	106.943
340	16.0	299.255	195.432	103.823
350	16.0	301.823	201.180	100.643
360	15.0	304.335	206.928	97.407
370	15.0	306.792	212.676	94.116
380	15.0	309.198	218.424	90.774
390	15.0	311.556	224.172	87.384
400	14.0	313.866	229.920	83.946
410	14.0	316.131	235.668	80.463
420	14.0	318.354	241.416	76.938
430	14.0	320.535	247.164	73.371
440	13.0	322.677	252.912	69.765
450	13.0	324.781	258.660	66.121
460	13.0	326.848	264.408	62.440
470	13.0	328.881	270.156	58.725
480	13.0	330.879	275.904	54.975
490	12.0	332.846	281.652	51.194
500	12.0	334.781	287.400	47.381
510	12.0	336.685	293.148	43.537
520	12.0	338.561	298.896	39.665
530	12.0	340.408	304.644	35.764
540	12.0	342.228	310.392	31.836
550	11.0	344.021	316.140	27.881
560	11.0	345.789	321.888	23.901
570	11.0	347.532	327.636	19.896
580	11.0	349.251	333.384	15.867
590	11.0	350.947	339.132	11.815
600	11.0	352.620	344.880	7.740

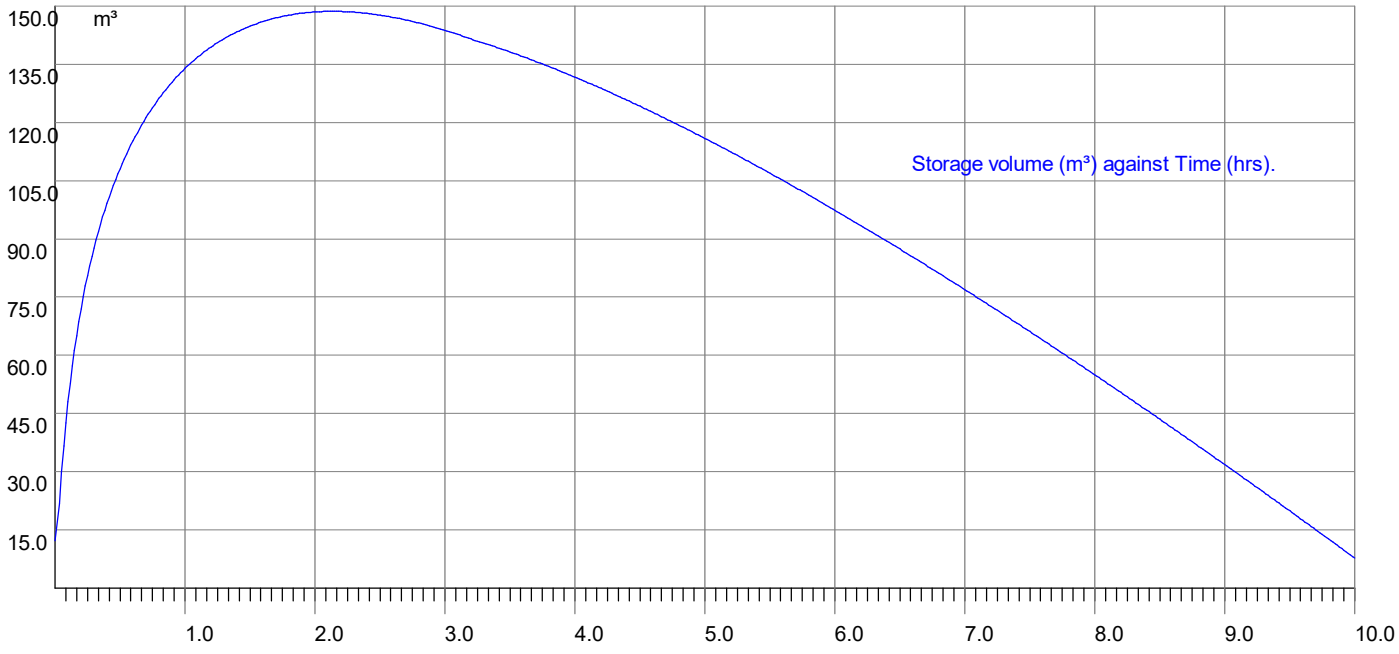
Storage volume (m^3) = 148.6 m^3

MasterDrain SW

The LK Group www.thelkgroup.com	Eton Business Park, Eton Hill Road, Radcliffe M26 2ZS Tel: 0161 763 7200 email: m.jones@thelkgroup.com	Job No. FRA 20 1117 Sheet no. 3 Date 07/02/20	
Project **1 in 100yr plus 30% climate change storage**		By **AM**	Checked / Reviewed
Title **Peak flow storage calcs for Dobfield House**			







MasterDrain SW

The LK Group
www.thelkgroup.com

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

Job No. FRA 20 1117			
Sheet no. 4			
Date 07/02/20			
Project 1 in 100yr plus 30% climate change storage	By AM	Checked	Reviewed
Title Peak flow storage calcs for Dobfield House			

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.

Based across the UK with offices in Manchester, London, Liverpool and Glasgow.

Manchester (Head Office)
Unit 29,
Eton Business Park
Eton Hill Rd, Radcliffe
M26 2ZS

t: 0161 763 7200
e: info@thelkgroup.com

London
2 Falcon Gate
Welwyn Garden City
Hertfordshire
AL7 1TW

t: 01707 909059
e: info@thelkgroup.com

Glasgow
Wright Business Centre
1 Lonmay Road
Glasgow
G33 4EL

t: 0141 773 6269
e: info@thelkgroup.com

Liverpool
The Corn Exchange
Fenwick Street
Liverpool
L2 7QL

t: 0151 235 8716
e: info@thelkgroup.com

LK GROUP

- Geotechnical
- Contaminated Land
- Flood Risk and Drainage
- Asbestos
- Invasive Species
- Land Remediation
- Project Management
- Land Drilling