FLOOD RISK CONSULTANCY LIMITED

Level 2 Scoping Study Flood Risk Assessment

Residential Development, Wilkin Square, Clitheroe

Report No: 2016-128

Date: 30/01/2017

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APPRAISING, MANAGING & REDUCING FLOOD RISK

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Contract

This report describes work commissioned by Charles Stanton of Stanton Andrews Architects, dated 03th January 2017. Chris Vose and Donna Metcalf of The Flood Risk Consultancy carried out the work.

Prepared by……Chris Vose (Flood Risk Consultant)

Reviewed by……Donna Metcalf (Managing Director)

Approved by……Donna Metcalf (Managing Director)

Disclaimer

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Executive Summary

The Environment Agency flood map indicates that the proposed development site is located within Flood Zones 2 and 3, and as such is considered to have a medium to high risk from fluvial flooding.

The primary source of flood risk to the development site is identified to be from Mearley Brook which is located 50m south east of the application site.

Flood defences information has been provided by the EA, however a review of the structures determined that they would provide little protection to the development, as such they where not used when evaluating fluvial flood risk.

Modelled flood data provided by the Environment Agency has determined that the site will become partially inundated during all events from the 1 in 100 year event up to and including the 1 in 1000 year event inline with the EA Flood Map.

Finished floor levels have been set in excess of NPPF requirements as such it is considered that the flood risk onsite can be significantly reduced.

Post development there will be a small reduction in storage volume taken up by the footprint of the proposed development i.e. approximately 13.25m^3.

Greenfield runoff rates have been calculated using the ICP SUDS Method for the 1 year, 30 year and 100 year events as 3.0l/s, 4.9l/s and 5.4l/s.

Taking into account the Hierarchy of Surface Water Disposal Surface water from the proposed development should be directed to watercourse via a new surface water sewer.

Surface water from the site is attenuated within large diameter pipes locate at the front and rear of the properties, restricted to greenfield runoff rates with a minimum discharge rate of 5l/s to prevent siltation of the flow control device.

The attenuation has been sizes so that there is no surface flooding up to and including the 1 in 100 year plus 40% climate change event, as such there are no exceedance routes.

Due to the development comprising of 10+ Units there is a requirement to incorporate SUDS (Sustainable Drainage Systems) where possible, the developer and/or architect may consider retro-fitting suitable SUDS elements if deemed appropriate, due to site constraints such methods may include rainwater harvesting.

It is recommended that the sewer within Wilkin Square is investigated to understand the feasibility of making a foul connection into it, if this is not variable then a new connection to the 225mm diameter public combined sewer should be made.

Following detailed appraisal of secondary flood sources i. e. pluvial; groundwater; infrastructure failure; blockage; overland flow; and ponding; it is concluded that overall they present a low risk to the development site.

Mitigation measures include:

- Finished floor levels set to no less than 75.57m AOD
- Flood resilience/resistance should be set to 300mm above finished floor levels especially in properties at the lower end of the site.

- The residents should sign up to the Environment Agency's free Flood Warning's Direct Service.
- Provide flood storage compensation within rear garden of properties at lower levels where possible.
- Investigation works to determine suitability of a foul connection to the sewer within Wilkin Square.

Contents

Figures

Tables

Appendices

1.0 Introduction

1.1 Terms of Reference

The Flood Risk Consultancy has been appointed by Stanton Andrews Architects, to provide a Flood Risk Assessment in support of a planning application for the redevelopment of a car park north of Wilkin Square, to create 10No apartments within associated car parking for residents and 16No car parking spaces retained for the adjacent Clitheroe Mosque.

The total area of the proposed development site is approximately 0.147 Hectares.

The proposed development site is shown to be located within Flood Zones 2 and 3 on the Environment Agency Flood Map.

Definitions of the different Flood Zones are provided within Section 2.2.2 of this report.

It is usual for the Environment Agency to raise an objection to development applications within the floodplain, or Zones 2 and 3 of the flood map until the issue of flood risk has been properly evaluated. The Agency will also object to developments where the total site area is in excess of 1 Hectare until suitable consideration has been given to surface water runoff.

1.2 Objectives

The objective of this assessment is to evaluate the following issues in regard to flood risk at the application site

- Suitability of the proposed development in accordance with current planning policy.
- Identify the risk to both the proposed development and people from all forms of flooding.
- Provide a preliminary assessment of foul drainage and surface water runoff management.
- Increasing the risk of flooding elsewhere e.g. surface water flows; flood routing; and loss of floodplain storage.
- Recommendation of appropriate measures to mitigate against flooding both within the proposed development, and neighbouring land and property.

1.3 Data Sources

This assessment is based on desk-top study of information from the following sources:

- National Planning Policy Framework (updated 2014)
- Planning Practice Guidance at www.gov.uk (March 2014)
- Building Regulations Approved Document H
- Environment Agency Flood Mapping
- Ribble Valley Borough Council Strategic Flood Risk Assessment (May 2010)
- Ribble Valley Borough Council Core Strategy 2008 – 2028 A Local Plan for Ribble Valley Adoption Version (December 2014)
- CIRIA C697 The SUDS Manual
- Microdrainage Windes
- Local Flood Plan for Mearley Brook 'District Response Forum' (April 2011)
- Chronology of British Hydrological Events (Dundee University)

2.0 Planning Policy Context

2.1 Approach to the Assessment

The project is currently at the planning stage and consequently a detailed site specific flood risk assessment is required.

A Level 2 Scoping Study is designed to provide a qualitative appraisal of flood risk both within the application site and any potential impact that the development will have on flood risk elsewhere; and provide recommendations for mitigation measures which may be included within the design of the development to reduce the overall risk of flooding.

An initial assessment indicates that the primary flood risk at the proposed development is from Mearley Brook.

Consideration has also been given to the site flooding from secondary sources such as pluvial, groundwater; artificial water bodies; infrastructure failure; overland flow and ponding.

2.2 National Planning Policy Framework (NPPF)

The requirements for undertaking site specific flood risk assessments are generally as set out in Guidance Point 10 from the Planning Practice Guide – Flood Risk & Coastal Change (www.gov.uk).

The information provided in the flood risk assessment should be credible and fit for purpose.

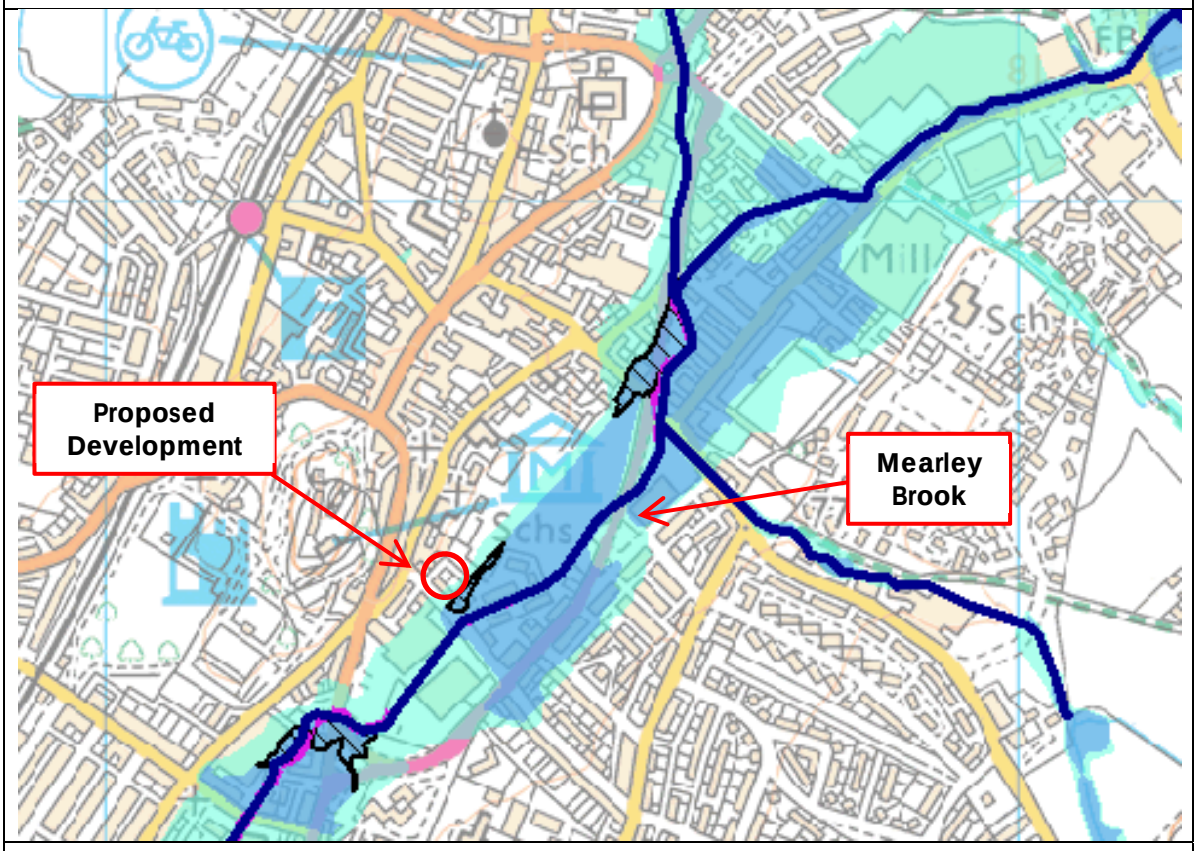
Site-specific flood risk assessments should always be proportionate to the degree of flood risk and make optimum use of information already available, including information in a Strategic Flood Risk Assessment for the area, and the interactive flood risk maps available on the Environment Agency's website.

A flood risk assessment should also be appropriate to the scale, nature and location of the development.

2.2.1 Sources of Flooding

- **Rivers (fluvial):** Flooding occurs when flow within river channels exceeds capacity; and the type of flood event experienced e.g. flash flooding; depends upon the characteristics of the river catchment.
- **The Sea (tidal):** Flooding at low lying coastline and tidal estuaries is caused by storm surges and high tides; with overtopping and breach failure of sea defences possible during extreme storm events.
- **Pluvial (surface flooding or overland flows):** Heavy rainfall, which is unable to soak away via infiltration or enter drainage systems can flow overland, resulting in localised flooding. Topography generally influences the direction and depth of flooding caused by this mechanism.
- **Groundwater:** Caused when ground water levels rise to the surface; and is most likely to occur in low lying areas underlain by aquifers.
- **Sewers and drains:** Generally occurs in more urban areas; where sewers and drains are overwhelmed by heavy rainfall or blocked pipes and gullies.
- **Artificial Sources (reservoirs, canals, lakes and ponds):** Reservoir and canal flooding may occur as a result of capacity exceedance or structural failure.

Figure 2.1: The Environment Agency Flood Map



Source: www.environment-agency.gov.uk

Key

- Flooding from rivers or sea without defences (Flood Zone 3)
- Extent of extreme flood (Flood Zone 2)
- Flood defences
- Areas benefiting from flood defences
- Main rivers
- COW Critical Ordinary Watercourse

2.2.2 Flood Zones

- **Flood Zone 1:** Low probability (less than 1 in 1000 year (<0.1% AEP) annual probability of river or sea flooding in any year.
- **Flood Zone 2:** Medium probability (between 1 in 100 year (1.0% AEP) and 1 in 1000 year (0.1% AEP) annual probability of river flooding; or between 1 in 200 year (0.2% AEP) and 1 in 1000 year (0.1% AEP) annual probability of sea flooding in any year).
- **Flood Zone 3a:** High probability (1 in 100 year (1.0% AEP) or greater annual probability of river flooding in any year or 1 in 200 year (0.5% AEP) or greater annual probability of sea flooding in any year).
- **Flood Zone 3b:** This zone comprises land where water has to flow or be stored in times of flood. Land which would flood with an annual probability of 1 in 20 (5% AEP), or is designed to flood in a n extreme flood (0.1%) should provide a st arting point for discussions to identify functional floodplain.

2.2.3 Vulnerability of Different Development Types

- **Essential Infrastructure:** Transport infrastructure (railways and motorways etc…); utility infrastructure (primary sub-stations, water treatment facilities; power stations; and wind turbines).
- **Water Compatible Development:** Flood control infrastructure; water and sewage infrastructure; navigation facilities.
- **Highly Vulnerable:** Emergency services; basement dwellings; mobile home parks; industrial or other facilities requiring hazardous substance consent.
- **More Vulnerable:** Hospitals; residential dwellings; educational facilities; landfill sites caravan and camping sites.
- **Less Vulnerable:** Commercial premises; emergency services not required during a flood; agricultural land.

2.2.4 Sequential & Exceptions Test

As set out in the National Planning Policy Framework, the aim of the Sequential Test is to steer new development to areas at the lowest probability of flooding.

The Flood Zones are the starting point for the sequential approach.

The Environment Agency Flood Map shows the development site to be located partially within Flood Zones 2 and 3, which is defined as land with a greater than 1 in 100 (1% AEP) annual probability of river flooding in any one year.

Table 1: Flood Risk Vulnerability and Flood Zone 'Compatibility'[1]

Flood Risk Vulnerability Classification		Essential Infrastructure	Water compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	×	Exception Test required	✓
	Zone 3b	Exception Test required	✓	×	×	×

✓ Development is appropriate
× Development should not be permitted

In accordance with Table 2 'Flood Risk Vulnerability Classification' of the Technical Guidance to the National Planning Policy Framework, residential developments are defined as 'Less Vulnerable'

As such Ribble Valley Borough Council may require that Sequential and/or Exception tests are undertaken for the application site.

[1] Extracted from Table 3 of the Technical Guidance to the National Planning Policy Framework Document (March 2012)

2.2.5 Climate Change

The NPPF requires the application of climate change over the lifetime of a development. As of 19th February 2016, the Technical Guidance for NPPF has upd ated the climate change allowances based on the river basin district. The climate change allowance for the North West river basin district is tabulated below:

Table 2: North West Climate Change Allowances[2]

Parameter	Allowance Category	2010 - 2039	2040 - 2059	2060 - 2069	2070 - 2115
Peak Rainfall Intensity	Upper end	+ 10%	+ 20%	+ 40%	
	Central	+ 5%	+ 10%	+ 20%	
Peak River Flow	Upper end	+ 20%	+ 35%		+ 70%
	Higher Central	+ 20%	+ 30%		+ 35%
	Central	+ 15%	+ 25%		+ 30%
Offshore Wind Speed	N/a	+ 5%		+ 10%	
Extreme Wave Height	N/a	+ 5%		+ 10%	

The selection of climate change allowance should be chosen appropriate to the expected lifespan of the proposed development.

The temporary accommodation is expected to have a design life of approximately 100 years; as such an additional 20% and 40% should be applied to peak rainfall intensities to assess the range of impact for this development.

Due to the development being located within Flood Zones 2 and 3 an allowance for peak river flow an additional 70% must be applied.

2.2.6 Sustainable Urban Drainage Systems (SUDS)

The key planning objectives in the NPPF are to appraise, manage and where possible, reduce flood risk.

Sustainable Urban Drainage Systems (SUDS) are designed to reduce the potential impact of new and existing developments with respect to surface water drainage discharges, thereby providing a suitable way of achieving some of these objectives.

Furthermore, the NPPF and Building Regulations Approved Document Part H direct developers towards the use of SUDS wherever possible.

The Floods and Water Management Act 2010 also reinforces the requirements for SUDS to be implemented where practicable.

[2] Extracted from Tables 1-4 of the Technical Guidance for flood risk assessments: Climate change allowances Document (February 2016)

Part H of the Building Regulations requires that surface water should be discharged from new development in accordance with the following hierarchy in order of preference:

- By infiltration to the ground via soakaway or other infiltration device
- To a watercourse
- To a public sewer.

2.2.7 Local Planning Policy

The following policy, relating to water management and flood risk have been taken from the Ribble Valley Borough Council Core Strategy 2008 – 2028 A Local Plan for Ribble Valley Adoption Version published in December 2014:

Policy DME6: Water Management

10.17 Development will not be permitted where the proposal would be at an unacceptable risk of flooding or exacerbate flooding elsewhere.

Applications for development should include appropriate measures for the conservation, protection and management of water such that development contributes to:

1. Preventing pollution of surface and/or groundwater
2. Reducing water consumption
3. Reducing the risk of surface water flooding (for example the use of sustainable drainage systems (SUDS))

As part of the consideration of water management issues, and in parallel with flood management objectives, the authority will also seek the protection of the Borough's water courses for their biodiversity value.

All applications for planning permission should include details for surface water drainage and means of disposal based on sustainable drainage principles. The use of the public sewerage system is the least sustainable form of surface water drainage and therefore development proposals will be expected to investigate and identify more sustainable alternatives to help reduce the risk of surface water flooding and environmental impact.

It is important to ensure the water environment including the use of water, pollution and flood risk can be adequately controlled through the development strategy and its strategic framework as envisaged in the Core Strategy.

3.0 Details of the Site

3.1 Site Details

Table 3: Development Location

Site Name:	Wilkin Square, Clitheroe
Purpose of Development:	Residential
Existing Land Use:	Car Park
OS NGR:	SD744418
Country:	England
County:	Lancashire
Local Planning Authority:	Ribble Valley Borough Council
Internal Drainage Board:	Not Applicable
Other Authority (e.g. British Waterways/ Harbour Authority)	Not Applicable

Location Plan:

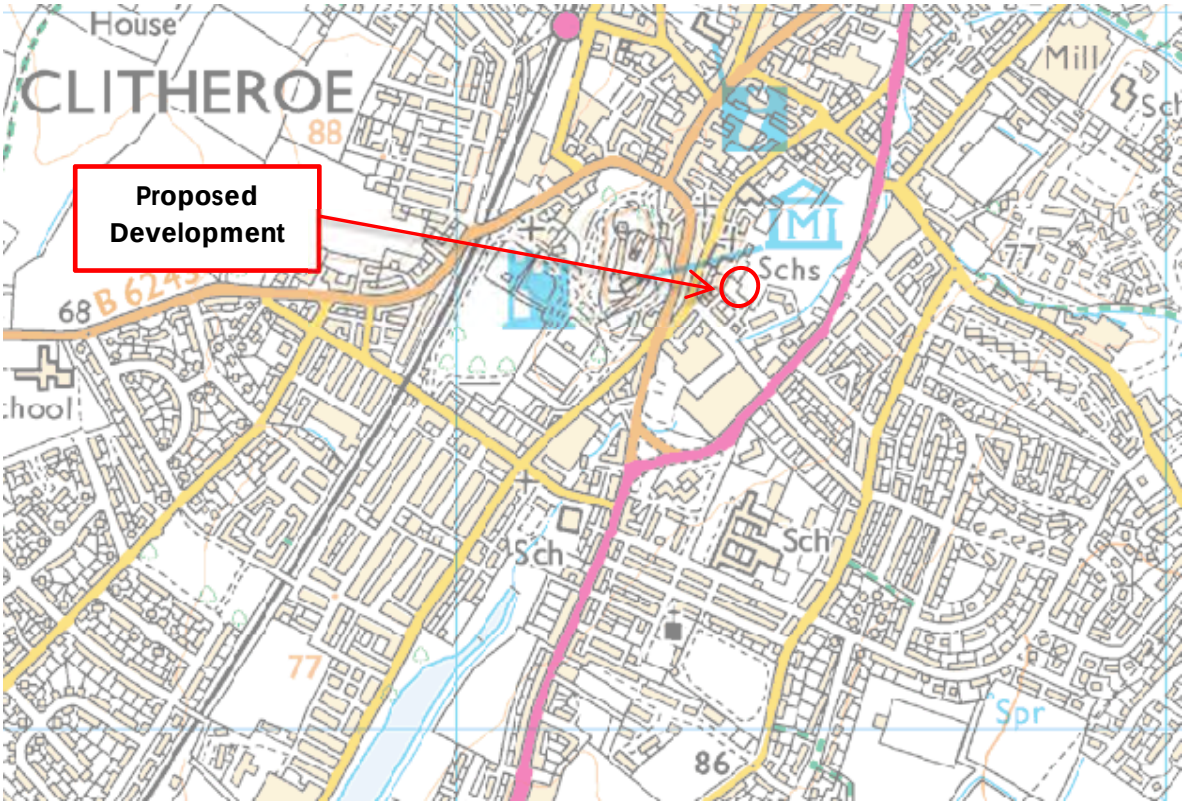


Image produced from the Ordnance Survey Get-a-map service.
Image reproduced with kind permission of Ordnance Survey and Ordnance Survey of Northern Ireland.

3.2 Site Description

The application site comprises of a car park used for overspill parking from Clitheroe Mosque and town centre; and was the previous site of sewing factory located north of Wilkin Square. The site is located towards the south of the centre of the town of Clitheroe to the east of Lowergate Road.

Table 4: Boundaries

North	North of the site is St Michael and St Johns RC Primary School and then St Michael and St Johns RC Church, beyond which is the urbanised area of 'Lowergate'.
East	The east of the site is bound by an access road and a car park, beyond are properties associated with Bayley Fold and a playing field before Mearley Brook.
South	The south of the site is Wilkin Square and then rear gardens associated with Highfield Rd, beyond which is the Sainsbury's store.
West	To the west of the site is Clitheroe Mosque on Lowergate Road then Castle Gate Road, beyond which is Clitheroe Castle.

Vehicular access to the site is currently available from the west of the site from Wilkin Square.

The nearest watercourse to the application site is Mearley Brook located approximately 50m south east of the development site.

Figure 3.1: Site Viewed North from Wilkin Square

Source: Google Earth

The topographical survey indicates the site ranges from approximately 79.000mAOD in the north west of the site to 74.500mAOD in the south east of the site. The site generally falls from the north west to the south east.

Figure 3.2: Aerial View of the Existing Site

Source: Flood Risk Consultancy Ltd

3.3 Proposed Development Details

The development proposals are for the erection of 10No Flats (5No two bed, 5No one bed) with associated parking for residents at the front of the properties and 16No car parking spaces retained for Clitheroe Mosque.

4.0 Historic Flooding

4.1 British Hydrological Society Flood Event Records

A search on the British Hydrological Society (BHS) Chronology of British Hydrological Events website[3] found 1No record of flooding incident that relates to Clitheroe from August 2004:

'The Clitheroe to Blackburn rail line was swamped at Wilpshire Tunnel and at Brownhill, while the East Lancashire line was also closed between Blackburn and Preston due to running flood water, delaying local and Transpennnine Express services.'

It is noted that the Wilpshire Tunnel area is located approximately 10km south west of the development site as such it is not considered that this flood event would have affected the proposed development site.

4.2 Internet Search

An internet search of flooding in the Clitheroe area results in a news story from July 2012 on the Clitheroe Advertiser and Times webpage:

'Flash floods struck parts of Clitheroe and the Ribble Valley again on Thursday evening after torrential downpours.

Heavy rain ran straight off ground already saturated after the wettest June on records and, with drains unable to cope, many roads were soon like rivers, making driving conditions difficult.

Flooding occurred at most of the usual hotspots such as beneath the Waddington Road railways bridge in Clitheroe, which was almost impassable for a time. Several parts of Chatburn and Whalley were also hit.'

It is noted that flooding during this event was caused by overland flow, additionally the Mearley Brook area of Clitheroe, where the development site is located, is not specified as experiencing flooding during this event.

4.3 Ribble Valley Strategic Flood Risk Assessment (Level 1) (2010)

A Strategic Flood Risk Assessment was competed by Ribble Valley Borough Council in May 2010.

Section 4.4 of the SFRA contains information on 9No historical floods in the Ribble catchment from 1771 to 2002;

Table 5: Historical Flood Records

Date	Catchments	Communities Affected
1771	Ribble	No information available
1775	Ribble	No information available
1866	Ribble, Calder	Whalley, Clitheroe, Ribchester
1881	Ribble, Calder, Hodder	Slaidburn

[3] http://www.dundee.ac.uk/geography/cbhe/

Table 5 Cont'd.

1923	Ribble, Calder	Clitheroe
1936	Ribble, Calder, Hodder	Slaidburn, Whalley, Clitheroe, Bolton-by-Bowland
1995	Ribble Calder, Darwen	Ribchester
2000	Ribble, Calder, Darwen	Ribchester
2002	Calder, Darwen	Whalley

Although there are records of flooding within Clitheroe in 1866, 1923 and 1936, the exact location of the flooding has not been provided therefore it is difficult to determine whether the proposed development site has been subject to historical flood incidents.

4.4 Environment Agency Data

The Environment Agency data identifies one historic flooding incident located on Moore Lane dated 19/02/1999, the extent of the flooding is confined to Moore Lane, the source of the flooding is unknown.

4.5 Historic Flooding Post December 2016

An internet search has revelled that although some parts of rural Clitheroe where effected during the floods of December 2015, no reports of flooding within the vicinity of Wilkin Square have been documented.

5.0 Initial Evaluation of Flood Risk

5.1 The Environment Agency Flood Map

The Environment Agency Flood Map illustrated within Figure 2.1, confirms that proposed development site is located in Flood Zone 2 and 3.

The definition for each of the flood zones highlighted above is provided for reference within Section 2.2.2 of this report.

Table 6: Possible Flooding Mechanisms

Source/Pathway	Significant?	Comment/Reason
Fluvial	Yes	EA flood maps indicate development site located within Flood Zones 2 and 3
Canal	No	No canals in the vicinity of the site
Tidal/Coastal	No	Outside the extents of tidal flooding from the Sea
Reservoir	No	EA Map shows that the site is outside flood extents
Pluvial (urban drainage)	Yes	10 flats, surface water drainage will need addressing.
Surface Water Flooding	No	EA Surface Water Flood Maps indicate the site is at very low risk of surface water flooding
Groundwater	No	SFRA indicates that there is no evidence of flooding from this source within Ribble Valley
Overland flow	No	Highly urbanised area and as such overland flow routes are anticipated to intercepted by exiting drainage in the vicinity of the site
Blockage	Yes	Mearley Brook culverted in the vicinity of the site.
Infrastructure failure	Yes	United Utilities sewers located in the vicinity of the site
Rainfall Ponding	No	Redevelopment of existing Mill Buildings on the site as such there should be no depressed areas where ponding may occur

From the initial assessment, it is concluded that the primary source of flood risk will be from fluvial sources, i.e. Mearley Brook.

Fluvial: Mearley Brook

The nearest watercourse to the application site is Mearley Brook approximately 50m south east of the development site.

The source of Mearley Brook is located north east of the village of Worston and flows in a westerly direction where it is known as Worston Brook. Worston Brook becomes Mearley Brook north east of the town of Clitheroe and then flows in a south and south east direction towards Primrose Reservoir before flowing into Pendleton Brook. Pendleton Brook is in turn a tributary to the River Ribble with the confluence of Pendleton Brook and River Ribble located a distance approximating 2km south west of the development site.

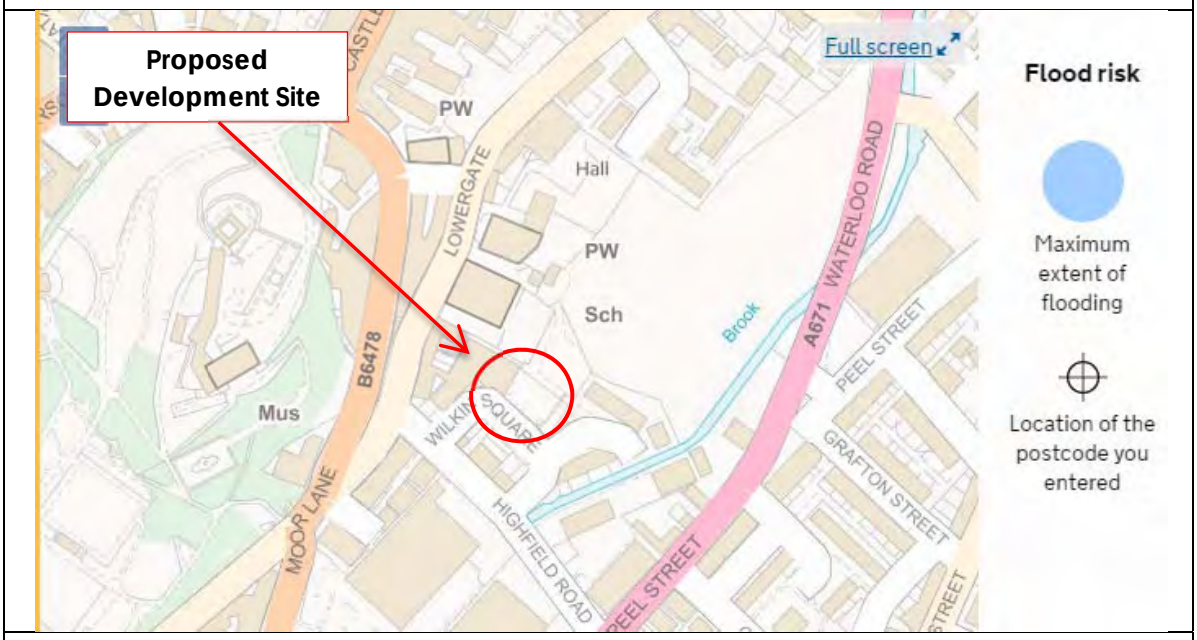
Mearley Brook is classified as 'Main River' and therefore flood management of this watercourse is the responsibility of the Environment Agency.

The development site is located within Flood Zones 2 and 3, therefore the risk of fluvial flooding from this source is regarded to be medium and high, and has therefore been assessed in more detail as part of the quantitative assessment provided within Section 6 of this report.

Reservoir Flooding

The Environment Agency Risk of Flooding from Reser voirs map indicates the proposed development is located outside the maximum extent of flooding following a breach o f a reservoir.

Figure 5.1: Environment Agency Risk of Flooding from Reservoirs Map



Source: Environment Agency

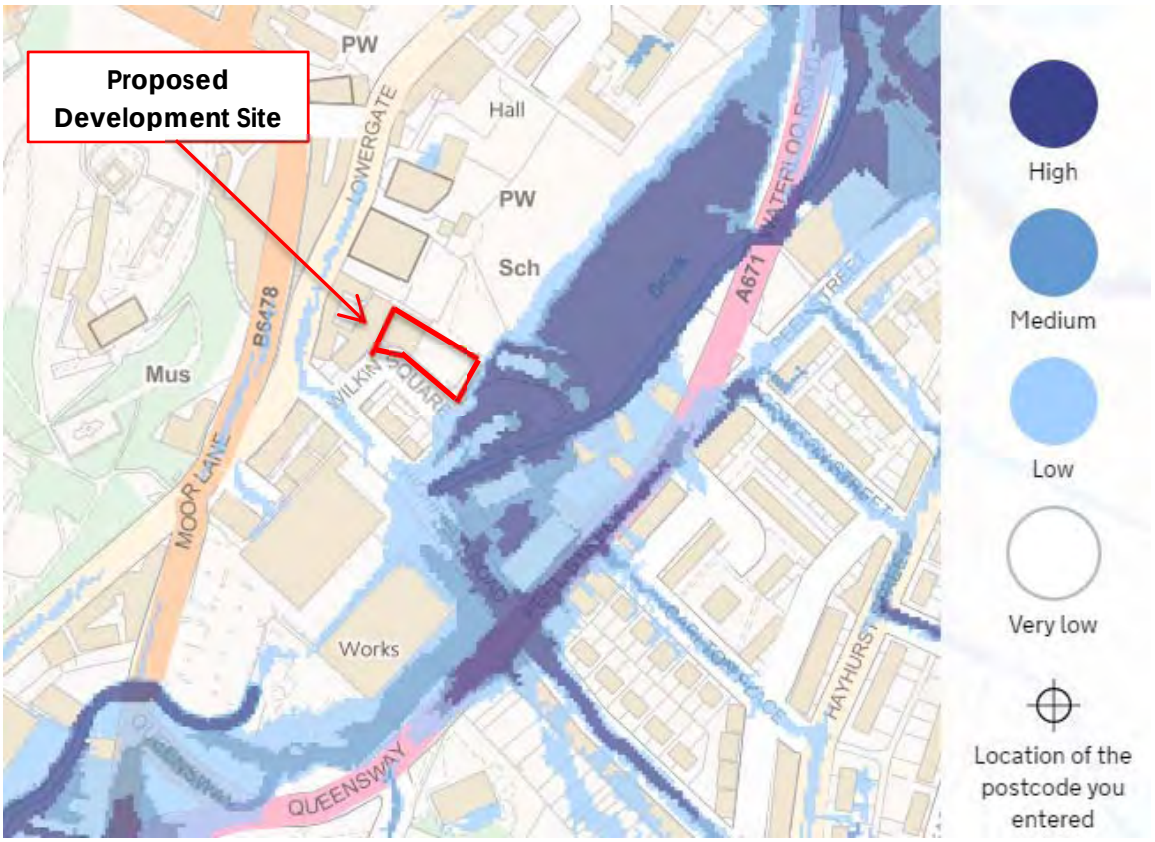
As such it is anticipated the risk of flooding from reservoirs to the development site is very low.

Pluvial: Surface Water Flooding

The Environment Agency's Flooding from Surface Water Map shows that the proposed development site is unlikely to be affected by surface water flow routes.

The site is shown overall to have a low risk from surface water flooding.

Figure 5.2: Risk of Flooding from Surface Water



Source: www.environment-agency.gov.uk

Pluvial: Overland Flow

Flooding from this source generally occurs when the infiltration capacity of land is exceeded and excess rainwater flows overland. Flooding from this source occurs as a result of an accumulation of water within topographic depressions and at areas where its flow route is impeded.

Severe rainfall events, steep slopes, soils, geology and land management all contribute to the effect and severity of flooding resulting from overland flow.

The area surrounding the application site generally falls towards the course of Mearley Brook with and is largely surrounded by urban areas to the north and will therefore bypass the site.

As such it is considered that overland flows present a low risk to the proposed development site.

Pluvial: Exceedance

The following text has been extracted from CIRIA 2906 'Managing Extreme Events by Designing for Exceedance January 2013':

'Climate change and urbanisation is already contributing to increased surface water flooding, where the capacity of the existing drainage systems are overwhelmed (or exceeded).

The traditional approach to fixing the problem is to build bigger pipes or provide underground storage. Ofwat, the Environment Agency and others believe that this approach is unsustainable and unaffordable and are encouraging sewerage undertakers, Lead Local Flood Authorities and highway authorities to look at different approaches to managing sewer and surface water flooding.

One approach being promoted is "designing for exceedance".

Designing for exceedance is an approach to manage flood risk (particularly from extreme events) by planning, designing and retrofitting drainage schemes that can safely accommodate rainfall and flooding that exceeds their design capacity (normally a 1 in 30 rainfall event). This is often achieved by considering flood pathways (such as managing runoff on highways) or providing additional storage (preferably on the surface through car parks, or multifunctional detention basins).

In England and Wales Sewers for Adoption and the National Planning Policy Framework encourage the consideration of drainage exceedance, it is a flexible approach to manage extreme events that can be used to reduce the need for more traditional, expensive underground approaches to manage surface water and often complement sustainable drainage and other local urban design initiatives.'

The impact of extreme rainfall events will therefore need to be assessed as part of the overall surface water management strategy for the proposed development.

Groundwater

Raised groundwater levels caused by prolonged periods of rainfall can result in flooding. The Ribble Valley SFRA infers:

'Following consultation with the EA, no evidence of groundwater flooding in the area has been identified. While no risk has been demonstrated, this is not to say that unrecorded groundwater flooding events may have taken place or that groundwater flooding may not occur in the future, but using the best available information they are not considered to be a significant risk at this time.'

As such the risk of groundwater flooding to the proposed development is considered to be low.

Ponding

On-site observations made during the site visit did not highlight any existing ponds or localised low points where ponding is likely to occur during heavy rainfall.

As such, this mechanism is deemed to present a low flood risk to the development.

Infrastructure Failure – Blockage/Structural Collapse

During flood conditions there is potential for debris to enter open channel sections of the watercourse, and be washed downstream.

Approximately 50 metres south of the site Mearley Brook is culverted for approximately 130 metres under the Sainsburys's store where it exits 50 metres east of Moore Lane approximately 180 metres south west of the application site.

An accumulation of debris at bridges and culverted sections of any watercourse may lead to blockages within structures located along the channel, causing flood water to backup.

Similarly should the existing bridges spanning a river fail, the capacity of the enclosed section of the watercourse is likely to be greatly reduced, which again is likely to cause flood water to backup within the channel upstream from the existing bridge crossing.

As such, in regard to Mearley Brook it is considered likely that the extent of flooding within the local vicinity of the affected structure will be exacerbated in the event of severe blockage or structural collapse.

The Ribble Catchment Flood Management Plan contains information relating to the bridges and culverted sections of Mearley Brook within the Clitheroe area. The Flood Management Plan Sub-area 4 section includes the following information:

***'Policy option 5**: Areas of moderate to high flood risk where we can generally take further action to reduce flood risk.*

Flood risk within Clitheroe is high and will rise significantly in the future if action is not taken. The culverted stretches of Mearley Brook need to be addressed to ensure that they are of a sufficient capacity, and the flood risk associated with the open stretches of Mearley Brook and the River Ribble requires further investigation. In addition, aspects such as sewer flooding and highways drainage flooding need to be considered, and we need to work with our partners to more fully understand and manage these aspects.'

As such it is considered that the culverted sections of Mearley Brook are recognised by the Environment Agency as areas where further action can be taken to reduce flood risk.

Figure 5.3: Head of Culvert Under Sainsbury's Viewed from Highfield Road

Source: Flood Risk Consultancy Ltd

It is noted that Mearley Brook is designated as 'Main River' and therefore the Environment Agency are responsible for managing flood risk along the watercourse.

At present this years Environment Agency's routine maintenance programme is unavailable, as such an extract from the 2014-2015 program has been reviewed and identifies the following within the vicinity of the proposed development:

'The system includes Waddington Brook, West Bradford Brook, the River Ribble, Pimlico Watercourse, Shaw Brook and Pendleton/Mearley Brook. We carry out maintenance of channel/defence, obstruction removal, environmental management and operational inspection.'

As such, structural collapse of the culverted section of watercourse under the Sainsbury's store is therefore considered to have a relatively low probability.

6.0 Quantitative Flood Risk Assessment

6.1 National Planning Policy Framework

6.1.1 Site Specific Flood Risk Assessment Checklist

The following checklist has been extracted from Flood Risk & Co astal Change S ection available from www.gov.uk , updated November 2016.

1. Development site and location

You can use this section to describe the site you are proposing to develop. It would be helpful to include, or make reference to, a location map which clearly indicates the development site.

a. Where is the development site located? (eg postal address or national grid reference)

b. What is the current use of the site? (eg undeveloped land, housing, shops, offices)

c. Which Flood Zone (for river or sea flooding) is the site within? (ie Flood Zone 1, Flood Zone 2, Flood Zone 3). As a first step, you should check the Flood Map for Planning (Rivers and Sea). It is also a good idea to check the Strategic Flood Risk Assessment for the area available from the local planning authority.

2. Development proposals

You can use this section to provide a general summary of the development proposals. It would be helpful to include, or make reference to, an existing block plan and a proposed block plan, where appropriate.

a. What are the development proposal(s) for this site? Will this involve a change of use of the site and, if so, what will that change be?

b. In terms of vulnerability to flooding, what is the vulnerability classification of the proposed development? See Ta ble 2 of this guidance for an explanation of the vulnerability classifications.

c. What is the expected or estimated lifetime of the proposed development likely to be? (eg less than 20 years, 20-50 years, 50-100 years?). See paragraph 026 of this guidance for further advice on how to assess the lifetime of developments for flood risk and coastal chang e purposes. (It may also be advisable to seek advice from the local planning authority).

3. Sequential test

For developments in flood zones 2 or 3 only. (If the development site is wholly within flood zone 1, you can skip this section and go to section 4).

You can use this section to describe how you have applied the sequential test (if needed as set out in paragraphs 101-104 of the National Planning Policy Framework) to the proposed development, and the evidence to demonstrate how the requirements of the test have been met. See paragraph 033 of this guidance for further information. (You are advised to contact the local planning authority to confirm whether the sequential test should be applied and to ensure the appropriate level of information is provided).

a. What other locations with a lower risk of flooding have you considered for the proposed development?

b. If you have not considered any other locations, what are the reasons for this?

c. Explain why you consider the development cannot reasonably be located within an area with the lowest probability of flooding (flood zone 1); and, if your chosen site is within flood zone 3, explain why you consider the development cannot reasonably be located in flood zone 2. See Table 1 for definitions of the flood zones.

d. As well as flood risk from rivers or the sea, have you taken account of the risk from any other sources of flooding in selecting the location for the development?

4. Climate Change

How is flood risk at the site likely to be affected by climate change? (The local planning authority's Strategic Flood Risk Assessment should have taken this into account). Further advice on how to take account of the impacts of climate change in flood risk assessments is available from the Environment Agency.

5. Site specific flood risk

You can use this section to describe the risk of flooding to and from the proposed development over its expected lifetime, including appropriate allowances for the impacts of climate change. It would be helpful to include any evidence, such as maps and level surveys of the site, flood datasets (eg flood levels, depths and/or velocities) and any other relevant data, which can be acquired through consultation with the Environment Agency, the lead local flood authority for the area, or any other relevant flood risk management authority. Alternatively, you may consider undertaking or commissioning your own assessment of flood risk, using methods such as computer flood modelling.

a. What is/ are the main source(s) of flood risk to the site? (eg tidal/sea, fluvial or rivers, surface water, groundwater, other?). You should consider the flood mapping available from the Environment Agency, the Strategic Flood Risk Assessment for the area, historic flooding records and any other relevant and available information.

b. What is the probability of the site flooding, taking account of the maps of flood risk available from the Environment Agency, the local planning authority's Strategic Flood Risk Assessment and any further flood risk information?

c. Are you aware of any other sources of flooding that may affect the site?

d. What is the expected depth and level for the design flood? See paragraph 055 of this guidance for information on what is meant by a "design flood". If possible, flood levels should be presented in metres above Ordnance Datum (ie, the height above average sea level).

e. Are properties expected to flood internally in the design flood and to what depth? Internal flood depths should be provided in metres.

f. How will the development be made safe from flooding and the impacts of climate change, for its lifetime? Further information can be found in paragraphs 054 and 059 (including on the use of flood resilience and resistance measures) of this guidance.

g. How will you ensure that the development and any measures to protect the site from flooding will not cause any increase in flood risk off-site and elsewhere? Have you taken into

account the impacts of climate change, over the expected lifetime of the development? (eg providing compensatory flood storage which has been agreed with the Environment Agency).

h. Are there any opportunities offered by the development to reduce the causes and impacts of flooding? See paragraph 050 of this guidance for further advice.

6. Surface water management

You can use this section to describe the existing and proposed surface water management arrangements at the site using sustainable drainage systems wherever appropriate, to ensure there is no increase in flood risk to others off-site.

a. What are the existing surface water drainage arrangements for the site?

b. If known, what (approximately) are the existing rates and volumes of surface water run-off generated by the site?

c. What are the proposals for managing and discharging surface water from the site, including any measures for restricting discharge rates? For major developments (eg of 10 or more homes or major commercial developments), and for all developments in areas at risk of flooding, sustainable drainage systems should be used, unless demonstrated to be inappropriate – see paragraphs 079-086 of this guidance for further advice.

d. How will you prevent run-off from the completed development causing an impact elsewhere?

e. Where applicable, what are the plans for the ongoing operation and/or maintenance of the surface water drainage systems?

7. Occupants and users of the development

You can use this section to provide a summary of the numbers of future occupants and users of the new development; the likely future pattern of occupancy and use; and proposed measures for protecting more vulnerable people from flooding.

a. Will the development proposals increase the overall number of occupants and/or people using the building or land, compared with the current use? If this is the case, by approximately how many will the number(s) increase?

b. Will the proposals change the nature or times of occupation or use, such that it may affect the degree of flood risk to these people? If this is the case, describe the extent of the change.

c. Where appropriate, are you able to demonstrate how the occupants and users that may be more vulnerable to the impact of flooding (eg residents who will sleep in the building; people with health or mobility issues etc) will be located primarily in the parts of the building and site that are at lowest risk of flooding? If not, are there any overriding reasons why this approach is not being followed?

8. Exception test

You can use this section to provide the evidence to support certain development proposals in flood zones 2 or 3 if, following application of the sequential test, it is appropriate to apply the exception test, as set out in paragraphs 102-104 of the National Planning Policy Framework. See paragraph 035 of this guidance for further information on the exception test. It is advisable

to contact the local planning authority to confirm whether the exception test needs to be applied and to ensure the appropriate level of information is provided.

a. Would the proposed development provide wider sustainability benefits to the community? If so, could these benefits be considered to outweigh the flood risk to and from the proposed development? See paragraph 037 of this guidance for further information.

b. How can it be demonstrated that the proposed development will remain safe over its lifetime without increasing flood risk elsewhere? See paragraph 038 of this guidance for further information.

c. Will it be possible to for the development to reduce flood risk overall (eg through the provision of improved drainage)? See paragraph 050 for further advice.

9. Residual risk

You can use this section to describe any residual risks that remain after the flood risk management and mitigation measures are implemented, and to explain how these risks can be managed to keep the users of the development safe over its lifetime. See paragraph 042 of this guidance for more information.

a. What flood related risks will remain afterthe flood risk management and mitigation measures have been implemented?

b. How, and by whom, will these risks be managed over the lifetime of the development? (eg putting in place flood warning and evacuation plans).

10. Flood risk assessment credentials

You can use this section to provide details of the author and date of the flood risk assessment.

a. Who has undertaken the flood risk assessment?

b. When was the flood risk assessment completed?

Other considerations

- Managing surface water

The site-specific flood risk assessment will need to show how surface water runoff generated by the developed site will be managed. In some cases it may be advisable to detail the surface water management for the proposed development in a separate drainage strategy or plan. You may like to discuss this approach with the lead local flood authority .

Surface water drainage elements of major planning applications (eg of 10 or more homes) are reviewed by the lead local flood authority for the area. As a result, there may be specific issues or local policies, for example the Local Flood Risk Management Strategy or Surface Water Management Plan, that will need to be considered when assessing and managing surface water matters.

It is advisable to contact the appropriate lead local flood authority prior to completing the surface water drainage section of the flood risk assessment, to ensure that the relevant matters are covered in sufficient detail.

- **Proximity to main rivers**

If the development of the site involves any activity within specified distances of main rivers, a flood risk activity permit may be required in addition to planning permission. For non-tidal main rivers, a flood risk activity permit may be required if the development of the site is within 8 metres of a river, flood defence structure or culvert. For tidal main rivers, a flood risk activity permit may be required if the development of the site is within 16 metres of a river, flood defence structure or culvert. Details on obtaining a Flood Risk Activity Permit are available from the www.gov.uk website.

6.2 Fluvial: Mearley Brook

6.2.1 General

The proposed development is situated approximately 50m north west of Mearley Brook and is designated on the Environment Agency Flood Map as being located within Flood Zones 2 and 3; the medium to high flood risk area.

Mearley Brook is classified as 'Main River' and is therefore the responsibility of the Environment Agency. The Brook is an open channel as it passes by the development site; however it is highly channelised and flood defences along the northern banks of the river are shown on the Environment Agency data.

Mearley Brook is culverted directly east of the development site underneath the Sainsbury's store.

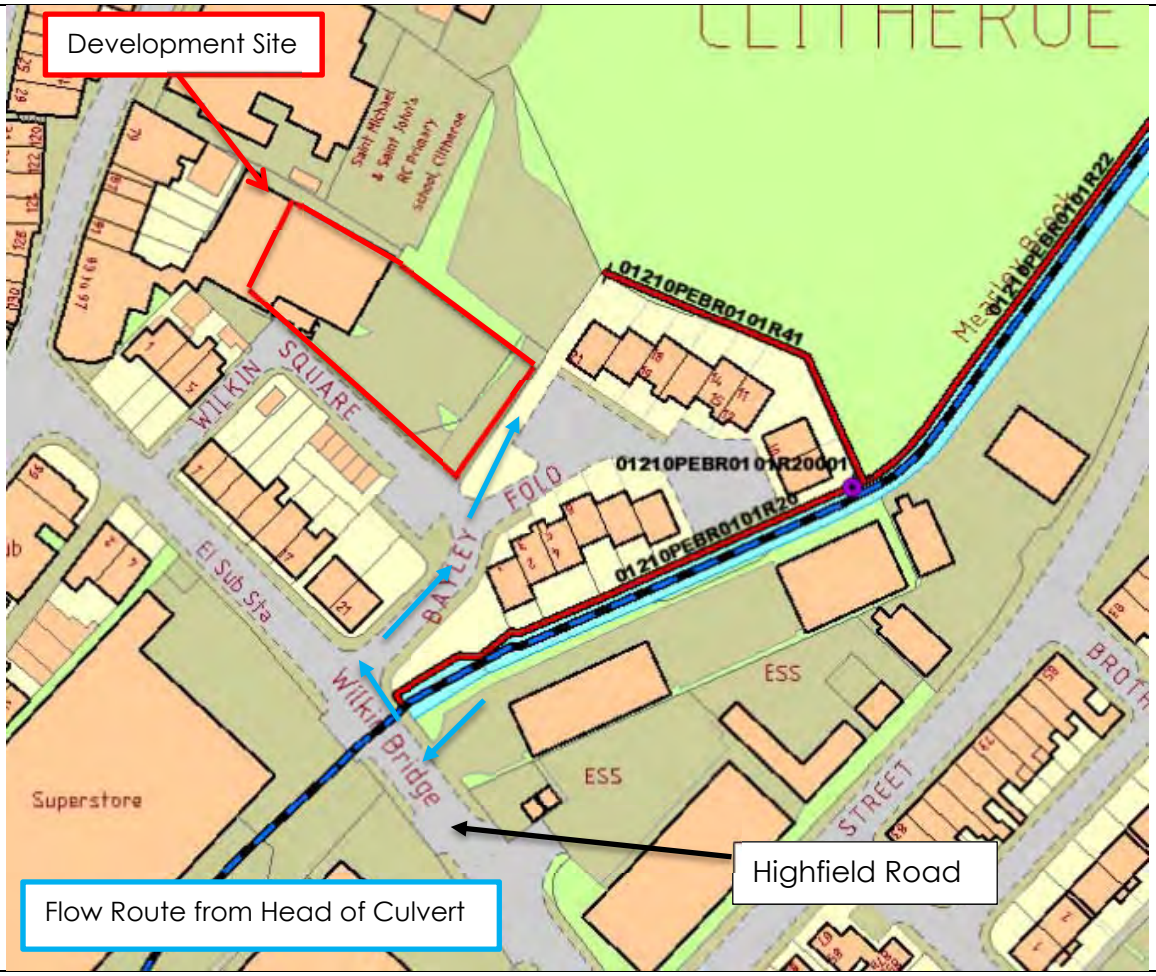
In order to suitably assess flood risk at the development site from this source; a comparison of flood levels for the watercourse against site levels is usually undertaken.

6.2.2 Flood Defences

The Flood Data provided by the Environment Agency identifies that the proposed development site is protected by the following assists which are identified within the figure below.

- **01210PEBR0101R41** – High Ground, Length 65.4m, Design Standard 50 Years, US/CL 74.47m AOD, DS/CL 73.79m AOD.
- **01210PEBR0101R20** – Wall, Length 97.7m, Design Standard 100 Years, US/CL 75.76m AOD, DS/CL 74.95m AOD.

Figure 6.1: Environment Agency Flood Defence's



Source: Flood Risk Consultancy Ltd

It is noted that there are no flood defences located along the south banks of the watercourse, therefore during flood conditions flood water will eventually migrate north via Bayley Fold once the level of Highfields Road is exceeded.

The road level on Highfields Road is approximately 74m AOD deducing the downstream crest level of Flood Defence Ref: 01210PEBR0101R20 from the height of the wall.

The figure overleaf depicts the south banks of the watercourse showing that flood water will firstly overtop the south banks until it flows over Highfields Road backing up towards the north, therefore the flood defences only provide a small amount of protection.

Figure 6.2: South of Flood Defences Viewed on Highfield Road

Source: Google Earth

For purposes of this assessment it is considered that the site is not protected and site levels will be used to undertake a comparison.

6.2.3 Mearley Brook: Modelled Flood Levels

The nearest modelled level to the development site known with the Environment Agency data are located at the head of the culvert on Highfields Road, approximately 50m south.

Table 7: Modelled Flood Data for Mearley Brook

Return Period	River Level mAOD
1 in 25 Year Event	74.49
1 un 50 Year Event	74.71
1 in 100 Year Event	74.85
1 in 200 Year Event	74.97
1 in 1000 Year Event	76.09

6.2.4 Fluvial Overtopping – 1 in 100-year flood level

The Environment Agency modelled flood data indicates that the 1 in 100-year flood level is 74.85m AOD.

The lowest level at the site is at the south east at a level of 74.400m AOD.

As such during the 1 in 100 year event the site will be flooded to a level of 0.45m at the south east.

6.2.5 Fluvial Overtopping – 1 in 100-year flood level plus 70% climate change

The Environment Agency have not provided any flood levels for the 100 year plus climate change event or flows that could be used to calculate the impact of climate change, however the 1 in 200-year level has been provided.

Therefore, for the purposes of this assessment the 200-year event has been used as the 100 year plus climate change event.

The flood level for the 1 in 200 year associated with Mearley Brook is 74.97m AOD.

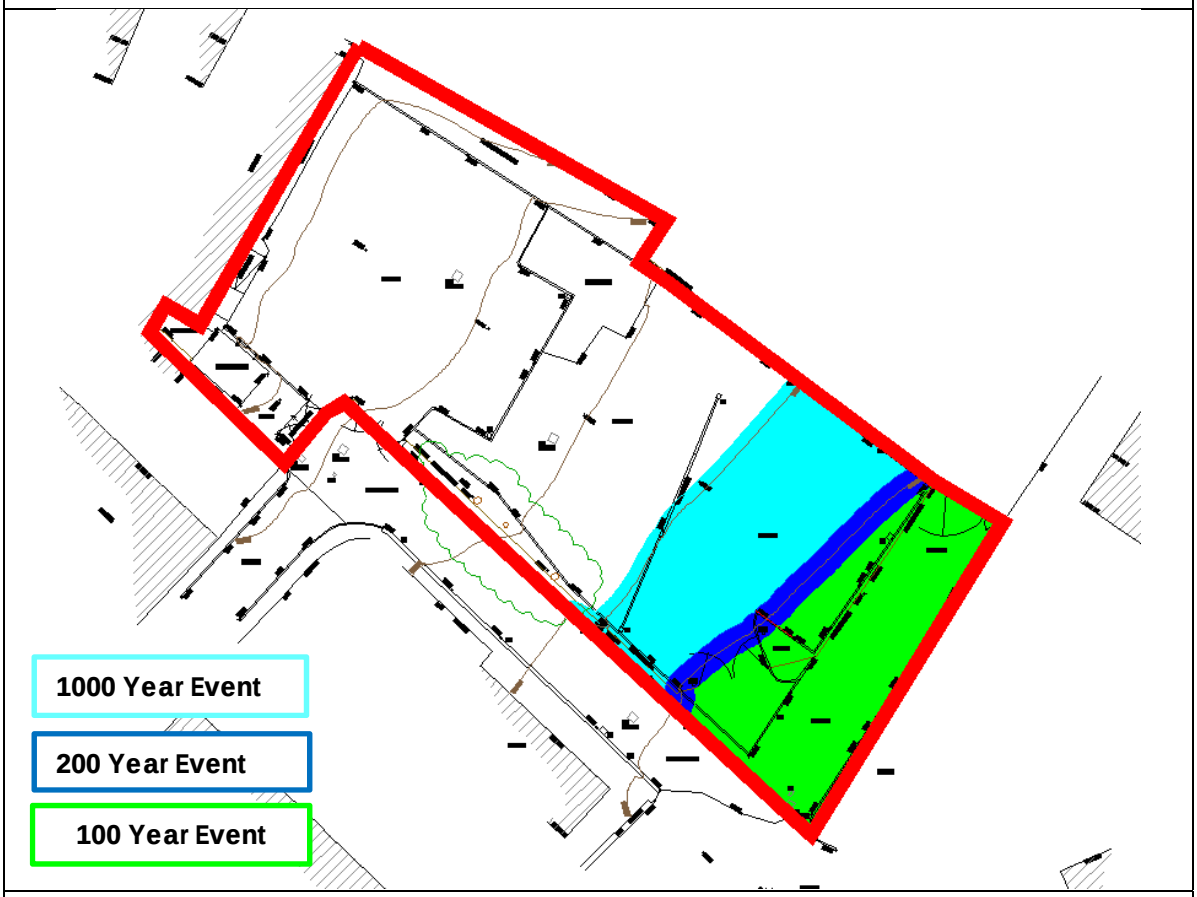
During this event the south east of the site will be flooded to a depth of 0.57m.

6.2.6 Fluvial Overtopping – Extreme 1 in 1000-year flood level

The Environment Agency data suggests the 1 in 1000-year extreme flood level for the development site is 76.09m AOD.

During this event the south east of the site will be flood to a depth of 1.69m.

Figure 6.3: Flood Envelope Using EA Data



Source: Google Earth

6.2.7 Fluvial Overtopping – Conclusion

Following evaluation, it is concluded that the proposed development site is located within Flood Zone 2 and 3 and therefore has a medium and high risk of flooding.

A review of the client's development proposals identifies that the lowest finished floor level onsite is set at 75.8m AOD, this is 0.830m above the 200-year flood event associated with Mearley Brook, as such the risk of properties flooding during such an event is considered to be significantly reduced

Furthermore, residents will be able to achieve dry access and egress during the 1 in 200-year flood event associated with Mearley Brook.

6.3 Surface Water Runoff

6.3.1 General

The total area within the site boundary approximates 0.147Ha and currently comprises of a car parking area.

Proposals for the site include erection of 10No Flats with associated car parking for residents and 16No car parking spaces retained for Clitheroe Mosque.

6.3.2 Existing On-site Drainage Regime

At present, there is no positive drainage network currently serving the site, surface water flows overland south onto Wilkin Square and Bayley Fold where it enters into road gullies serving the highway.

6.3.3 Existing Sewers

Sewer records provided by United Utilities identifies that the closest public sewer to the site is a 225mm diameter combined sewer that flows south down Highfields Road and over Wilkin Bridge where it upsizes to a 300mm diameter sewer.

A site walkover survey identified that a sewer flows south through Wilkin Square onto Bayley Fold, it is anticipated that the Clitheroe Mosque directs flow to this sewer, however this requires further investigation.

It is unknown whether the sewer within Wilkin Square is private or adopted as it is not illustrated within the United Utilities sewer records.

6.3.4 Post Development Drainage

Following development, it has been estimated the impermeable area of the development site will reduce to 0.128 Hectares accounting for 86%

6.3.5 Existing Runoff Rates

Due to the development site being considered to be 100% impermeable with no positive drainage infrastructure, greenfield runoff rates have been used to calculate existing runoff by increasing the size of the site so that of the area is impermeable i.e. 0.128 Hectares

The ICP SUDS Method has been utilised to derive existing runoff rates for a range of return periods, theses are shown below:

Table 8: Existing Surface Water Runoff

Return Period	Discharge Rate l/s
1 Year	3.0
30 Year	4.9
100 Year	5.4

6.3.6 Surface Water Drainage Hierarchy

The hierarchy for disposal of surface water from new developments is outlined within the Building Regulations Approved Document H and specifies the following methods in order of preference:

- Infiltration via soakaway or other suitable infiltration device
- Discharge to watercourse
- Discharge to public surface water sewer
- Discharge to public combined sewer

Infiltration

Infiltration at the Wilkin Square site is considered inappropriate due to the steep nature of site, disposal of surface water via soakaways could result in flows surfacing at a lower level potentially increasing the flood risk to properties on Bayley Fold.

Furthermore, a review of Soilscape maps identifies the site to be located on land which is considered to be Slowly permeable seasonally wet acid loamy and clayey soils.

A review of borehole logs taken from the BGS web service identifies that the site is predominantly underlain by clay.

Watercourse

The nearest watercourse to the proposed development is Mearley Brook located approximately 50m south of the application site.

Conclusion

It is recommended that surface water from the proposed development site is directed to Mearley Brook approximately 50m south east, through Bayley Fold.

6.3.7 Sustainable Urban Drainage Systems (SUDS)

SUDS act to reduce the impact of surface water runoff from the development by limiting runoff volumes and rates from leaving the site.

Undertaking an assessment using the SUDS Planner Module within MicroDrainage Windes revealed that a number of different methods could be retrofitted to the Holme Mill building development. A summary of the results is tabulated below:

Table 9: SUDS Planner

SUDS Criteria	Rank 1	Rank 2	Rank 3
Hydrological	Permeable Pavements	Infiltration Trench/Soakaway	Infiltration Basin
Land Use	Infiltration Trench/Soakaway	Bioretention Area	Infiltration Basin
Site Features	Permeable Pavements	Green Roofs	Filtration Techniques
Community & Environment	Bioretention Area	Grassed Filter Strips	Stormwater Wetlands
Economics & Maintenance	Wet Ponds	Grassed Filter Strips	Dry Detention
Total	**Online/Offline Storage**	**Permeable Pavements**	**Green Roofs**

1. Source Control

The inclusion of source control in SUDS schemes is one of the more important principles of SUDS design, and source control components should be upstream of any pond, wetland or other SUDS component.

Source control can help provide interception storage which can handle and treat some of the more frequent but smaller, polluting events (at least 5mm).
Most source control components will be located within the private properties or highway areas. Their purpose is to manage rainfall close to where it falls, not allowing it to become a problem elsewhere.

The main types of source control include:

- Green roofs
- Rainwater harvesting
- Permeable paving
- Other permeable surfaces

Source control methods look to maximize permeability within a site to promote attenuation, treatment and infiltration, thereby reducing the need for off-site conveyance.

a) Green Roofs

Green roof solutions generally comprise of a multi-layered system that covers the roof of a building with vegetation cover, and/or landscaping over a drainage layer , designed to intercept and retain rainfall.

The incorporation of green roofs is to be decided by the architect/developers during the final design stage and is largely dependent on the final building design.

The likelihood of greenroofs being utilised is considered to be low due to the increase in structural cost of the development.

b) Rainwater Harvesting

Rainwater harvesting provides a source of non-potable water, for purposes such as car washing; and landscaped area irrigation etc… and can be used for some industrial processes to reduce consumption of water from conventional supplies.

This SUDS solution, like green roof technology, is also designed to provide interception storage i.e. acts to reduce the volume of surface water leaving the proposed development; thereby helping to alleviate the current pressures on the receiving watercourse.

Rainwater harvesting can be installed at relatively low costs dependant on the chosen structure providing that the development site has scope.

c) Permeable Paving

Pervious surfaces can be either porous or permeable. The important distinction between the two is:

Porous surfacing is a surface that infiltrates water across the entire surface. Permeable surfacing is formed of material that is itself impervious to water but, by virtue of voids formed through the surface, allows infiltration through the pattern of voids.

Pervious surfaces provide a surface suitable for pedestrian and/or vehicular traffic, while allowing rainwater to infiltrate through the surface and into underlying layers.

The water can be temporarily stored before infiltration to the ground, reused, or discharged to a watercourse or other drainage system. Surfaces with an aggregate sub-base can provide good water quality treatment.

Due to the steep nature of the proposed development site it is recommended that permeable paving is not utilised within the final drainage design.

2. On/Offline Storage

This is a traditional form of surface water attenuation and may be provided via online or offline structures such as oversized pipes; or shallow attenuation structures such as geo-cellular crate systems e.g. Hydro-International's Stormcell System or similar. These structures may be easily placed within either hardstanding or landscaped areas to provide ease of access for maintenance purposes.

Due to the steep nature of the site and the lack of available space incorporating SUDS would be extremely difficult, as such it is recommended that the developer incorporates rainwater planters to provide an element of source control.

Due to the steep nature of the development site the use of on/offline storage is the most appropriate SUDS structure.

6.3.8 Residual Flood Risk

The proposed drainage system should be designed such that attenuation will be provided to accommodate surface water runoff for storms with a return period of up to the 1 in 30 year event incorporating an additional 20-40% to accommodate climate change over the lifetime of the development; in accordance with the LPAs requirements.

Within the on-site drainage system however, the 1 in 100 year plus climate change event is allowed to flood at surface level within the development. However, it is highlighted that the resulting flood water must be retained within the site; and will not be allowed to inundate property within the development; or migrate beyond the boundary of the site, thereby increasing flood risk elsewhere.

6.4 Outline Drainage Strategy

Following development, it is anticipated that the impermeable area will be reduced from 100% of the total site area to 86%.
The preliminary drainage strategy should incorporate the most appropriate ranked SUDS methods resulting from the evaluation detailed within Section 6.3.5 of this report.

It is proposed that surface water from the site will be restricted to greenfield runoff rates or a minimum of 5l./s by means of a Hydrobrake, flows in excess of this will be stored within large dimeter pipes under the driveways of the apartments.

6.4.1 Post Development Runoff Rates

The drainage strategy for the site has been modelled using MicroDrainage software for various return periods, the results are tabulated below:

Table 10: Proposed Surface Water Discharge Rates

Return Period	Discharge Rate (l/s)
1 Year + 40% Climate Change	4.9
30 Year + 40% Climate Change	4.9
100 Year + 40% Climate Change	4.9

6.4.2 Overland Flow Routes

The proposed drainage strategy has been designed to accommodate flows up to and including the 1 in 100 year plus 40% climate change event, as such the risk of flooding onsite and migrating off site is considered to be low.

6.4.3 Maintenance

It is proposed that the drainage network serving the site at Wilkin Square will be adopted by United Utilities by means of a Section 104 Agreement.

Therefore, following development United Utilities will have overall responsibility for maintaining the drainage network

6.5 Foul

It is recommended that investigation is undertaken to determine if the sewer within Wilkin Square is active and to trace its route. It is thought that the sewer once served the factory onsite, however the sewer is not shown on the UU sewer records.

It is anticipated that due to its age the sewer connects to the combined sewer network within Highfield Road, it is therefore recommended that foul flows from site are connected to this sewer.

If it is found that the sewer on Wilkin Square is not active it is recommended that offsite works are undertaken to connect to the 225mm diameter public combined sewer on Highfields Road.

7.0 Mitigation Measures

7.1 Finished Levels

Due to the proposed development being partially located within Flood Zone 3 the NPPF requires that finished floor levels are set to 600mm above the 1 in 100 year + climate change event.

As such using the available information the finished floor levels should be set to no less that 600mm above the 1 in 200-year event i.e.

- 74.97m AOD + 600mm = 75.57m AOD

The lowest finished floor level on site is proposed to be 75.80m AOD, a such this is considered acceptable.

7.2 Flood Resistance/Resilience Measures

In order to provide an extra element of safety it is recommended that flood resilience/resistance measures are set 300mm above the proposed finished floor level in properties at the lower end of the site i.e. No's 4/9 and 5/10.

Flood proofing is a technique by which buildings are designed to withstand the effects of flooding. There are two main categories of flood proofing, which are dry proofing and wet proofing.

Dry proofing methods are designed to keep water out of the building, and wet proofing methods are designed to improve the ability of the property to withstand effects of flooding once the water has entered the building.

In addition, fixtures and fittings should be built to withstand immersion in water or designed to be easily replaced.

The differential pressures across load bearing walls and the flotation effect that will occur during flood events should be taken into account when considering dry proofing techniques.

For most existing properties this means that dry flood proofing should only be considered if the expected flood depth is under 0.9m.

The table below summarises recommendations for flood proofing measures which can be incorporated within the design for the proposed redevelopment works. Such measures are put forward in accordance with 'Development and Flood Risk Guidance for the Construction Industry' CIRIA C624, London 2004.

It would be preferable to avoid external doors as this would remove a potential point of flood inflows. However, since free access and egress into the building will be required, flood resistant doors and/or the use of flood resistant stop logs or flood boards should be considered.

Full details of manufacturer's or suppliers of flood protection equipment may be obtained from the Flood Protection Association (website: www.thefpa.org.uk).

Table 11: Typical Flood Proofing Measures

Feature	Considerations to Improve Flood Proofing
External Walls	Careful consideration of materials: use low permeability materials to limit water penetration if dry proofing required. Avoid using timber frame and cavity walls. Consider applying a water resistant coating. Provide fitting for flood boards or other temporary barriers across openings in the walls.
Internal Walls	Avoid use of gypsum plaster and plasterboards; use more flood resistant linings (e.g. hydraulic lime, ceramic tiles). Avoid use of stud partition walls.
Floors	Avoid use of chipboard floors. Use concrete floors with integrated and continuous damp proof membrane and damp proof course. Solid concrete floors are preferable; if a suspended floor is to be used, provide facility for drainage of sub-floor void. Use solid insulation materials.
Fitting, Fixtures and Services	If possible, locate all fittings, fixtures and services above design floor level. Avoid chipboard and MDF. Consider use of removable plastic fittings. Use solid doors treated with waterproof coatings. Avoid using double-glazed window units that may fill with flood water. Use solid wood staircases. Avoid fitted carpets. Locate electrical, gas and telephone equipment and systems above flood level. Fit anti-flooding devices to drainage systems.

7.3 Flood Protection Equipment

Keeping water out of the building, or limiting the ingress of floodwater, is recommended when considering flood protection measures.

Excluding water will help to reduce damage to the internal fabric of the building and its contents. Such measures are referred to as dry proofing and include:

- Temporary flood barriers.
- Measures to reduce seepage through walls and floors.
- The installation of non-return valves on sewers.

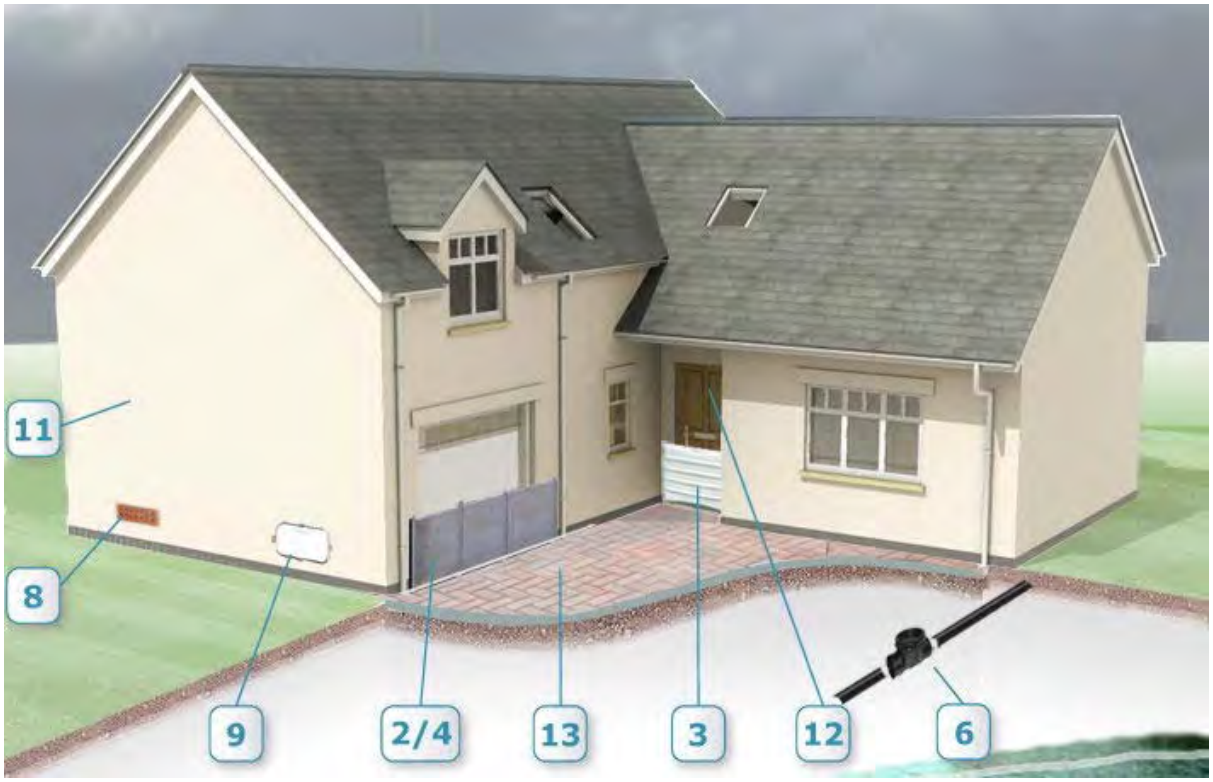
Movable flood barriers can be very effective in preventing or reducing the volume of floodwater entering through doors and other external openings in walls, such as windows and airbricks, as long as a good quality product is installed in accordance with the manufacturer's instructions.

Although barriers may not totally prevent the ingress of water into a building, they can provide valuable time in which to move people, vehicles, expensive equipment and other essential items to higher levels before floodwater rises inside the building.

Flood barriers on wall openings can also reduce the amount of contaminated silt and debris entering the property. Water that seeps through the ground or walls is likely to be filtered to some extent and therefore is usually cleaner than floodwater entering larger openings such as gaps around doors and airbricks.

There are many suppliers and various types of flood doors, barriers and other flood protection equipment which may be utilised at the development site. A few examples of typical products are provided below.

Figure 7.1: Typical Flood Protection Measures for Residential Buildings



2/4	Mountable/demountable flood protection for large opening such as doors and windows
3	Floodguard door barrier
6	Non-return Valve – prevents backflow of sewage which can occur during flood conditions.
8	Smart airbrick – 'fit and forget' solution, requiring minimum maintenance
9	Air Brick Cover – covers are clipped to custom fitted frames, which are sealed to the wall. Covers must be removed once the danger of flooding has passed.
11	Wall Treatments – repointing mortar joints in brickwork; water resistant sealants; water proofing treatment etc…
12	Flood Alarm – notifies key holders of a potential flood
13	Porous Ground Surfacing

Source: www.floodsense.co.uk

7.4 Flood Storage Compensation

Due to the development being partially located within Flood Zone 3 the Environment Agency may require that flood storage compensation is provided for any are a within the 100-year flood envelope.

Calculations indicate that the footprint of the building located within Flood Zone 3 is approximately 106m^2.

The difference between the lowest level within the footprint i.e. 74.6m AOD and the 100-year river level i.e. 74.85m AOD = 0.25m.

Due to the steep nature of the site, the depth has been halved i.e. 0.25/2 = 0.125, this is then multiplied by the footprint area i.e. 0.125 x 106 = 13.25m^3.

It is suggested that the ground levels of the rear gardens of the properties may be reprofiled to accommodate the additional storage volume taken up by the development on a level by level basis.

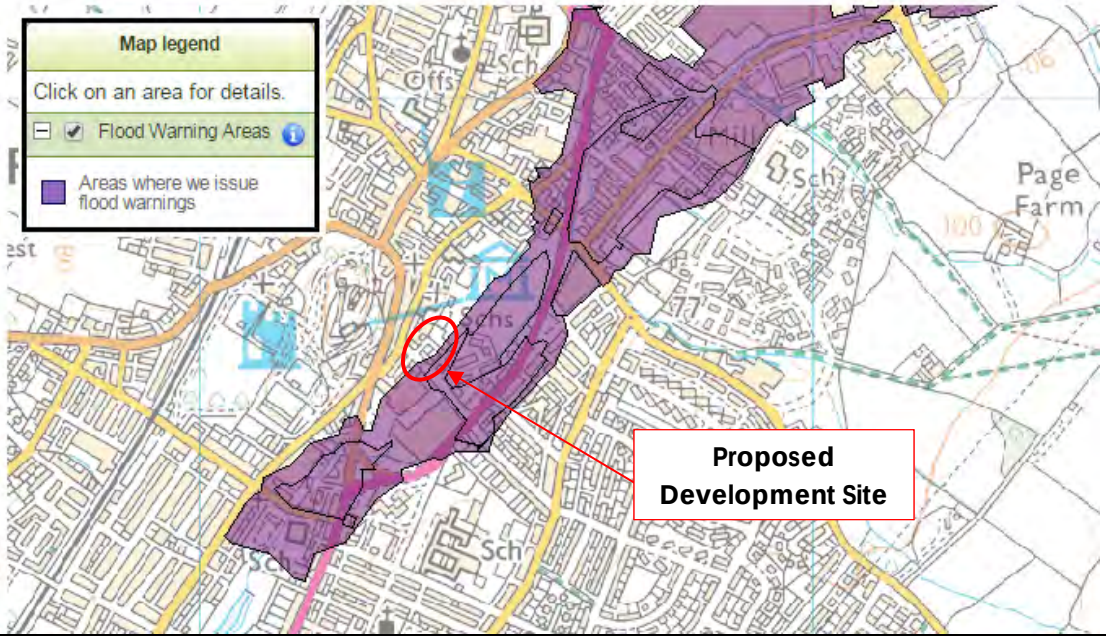
7.5 Flood Warning

The development site at Moore Lane is situated within an area covered by the Environment Agency's Flood Warning's Direct Service.

Due to the close proximity of Mearley Brook, it is advised that managers are advised to sign up to receive flood warnings.

The Flood Warning's Direct Service is a free service which enables the Environment Agency to send a direct message when flooding is expected and may affect the development. Flood warnings are designed to provide businesses the time to prepare for flooding. Flood warnings can be sent by telephone, mobile, email SMS text message or fax.

Figure 7.2: Environment Agency Flood Warning Coverage Map



Source: www.environment-agency.gov.uk

The Environment Agency also provides the **Floodline 0845 988 1188** service, where occupants can listen to recorded flood warning information for the area or speak to an operator for advice 24 hours a day.

Should a flood event reach the level where development is at risk of inundation, then the Environment Agency will issue a Severe Flood Warning.

Using the latest available technology, the Environment Agency is able to monitor rainfall, river levels and sea conditions 24 hours a day and use this information to forecast the possibility of flooding.

If flooding is forecast, they are able to issue warnings using a set of three different warning types.

Table 12: Environment Agency Flood Warning Codes

Flood Warning Code	What it means	When it's used	What to do
	Flooding is possible. Be prepared.	2 hours – 2 days in advance of flooding.	• Be prepared to act on you flood plan • Prepare a flood kit • Monitor local water levels and the flood forecast of the EA website
	Flooding is expected. Immediate action is required.	½ hour – 1 day in advance of flooding.	• Move people to a safe place • Turn of gas, electricity and water supplies if safe to do so • Put flood protection equipment in place
	Severe flooding. Danger to life.	When flooding poses a significant threat to life.	• Stay in a safe place with means of escape • Be ready to evacuate • Co-operate with the emergency services • Call 999 if you are in immediate danger
Warnings no longer in force	No further flooding is currently expected in your area	When river or sea conditions begin to return to normal	• Be careful as flood water may still be around for several days • If you have been flooded, ring your insurance company as soon as possible

How are Flood Warnings issued?

- **Direct to you –** receive warnings by phone , text, email or fax. Sig n up for the Environment Agency's **FREE** Floodline Warnings Direct service via this website link: https://fwd.environment-agency.gov.uk/app/olr/register or by calling Floodline on **0845 988 1188.**
- **On the flood warnings website** – view up-to-date information about flood warnings in force, monitor the river or sea levels in your area and check out the latest flood risk forecast for your county.

- **By calling Floodline on 0845 988 1188** – you can listen to recorded information on the latest warnings and predictions or speak to an operator for more general information 24 hours a day. Environment Agency operators can also provide a quick dial number which gives you faster access to information for your area.
- **Through the media** – you may see or hear Environment Agency warnings on television and in radio broadcasts. You can also view the latest warnings on Digital Ceefax page 405.
- **Flood Wardens** – in some areas Flood Wardens are there to alert and support their local community when a flood warning is issued. Call Floodline on 0845 988 1188 to find out if this service is available in your area.
- **Sirens/loudhailers** – in some areas the Environment Agency uses loudhailer or siren systems to warn people that a flood warning has been issued. Call Floodline on 0845 988 1188 to find out if this type of service operates in your area.
- **Flood warning feeds** – Flood warning (RSS) feeds shows national and regional flood warnings in force and are updated every 15 minutes. The feeds contain a brief summary and link to the full information on the Environment Agency website.

8.0 Conclusions & Recommendations

The Environment Agency flood map indicates that the proposed development site is located within Flood Zones 2 and 3, and as such is considered to have a medium to high risk from fluvial flooding.

The primary source of flood risk to the development site is identified to be from Mearley Brook which is located 50m south east of the application site.

Modelled flood data provided by the Environment Agency has determined that the site will become partially inundated during all events from the 1 in 100 year event up to and including the 1 in 1000 year event inline with the EA Flood Map.

Finished floor levels have been set in excess of NPPF requirements as such it is considered that the flood risk onsite can be significantly reduced.

Surface water from the site is attenuated within large diameter pipes locate at the front and rear of the properties, restricted to greenfield runoff rates with a minimum discharge rate of 5l/s to prevent siltation of the flow control device.

The attenuation has been sizes so that there is no surface flooding up to and including the 1 in 100 year plus 40% climate change event, as such there are no exceedance routes.

Although not specifically required for the site, the developer and/or architect may consider retro-fitting suitable SUDS (Sustainable Drainage Systems) elements if deemed appropriate, such methods may include rainwater harvesting.

Following detailed appraisal of secondary flood sources i. e. pluvial; groundwater; infrastructure failure; blockage; overland flow; and ponding; it is concluded that overall they present a low risk to the development site.

Advisory mitigation measures include:

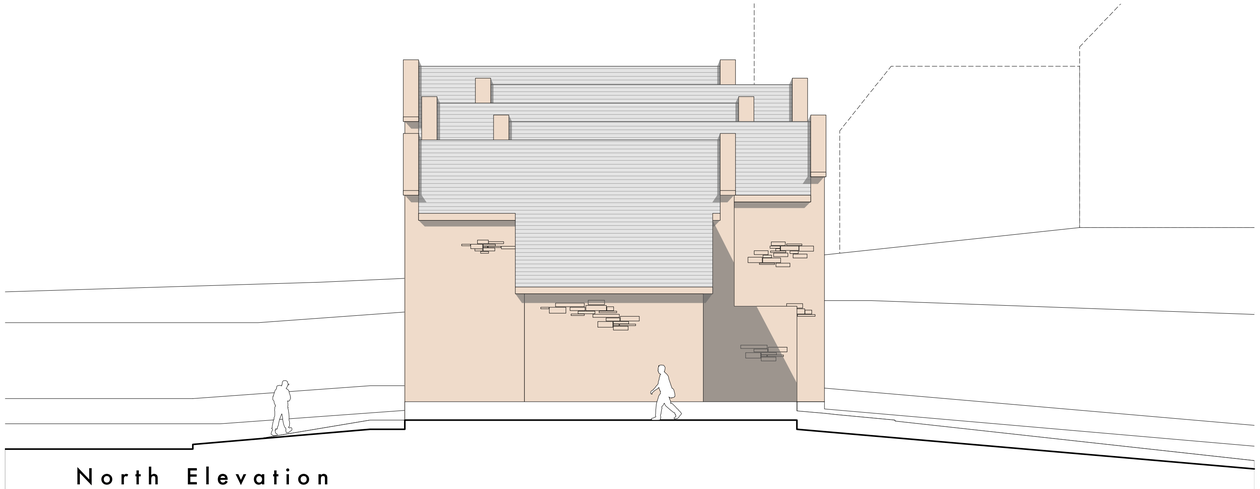
- Finished floor levels set to no less than 75.57m AOD
- Flood resilience/resistance should be set to 300mm above finished floor levels especially in properties at the lower end of the site.
- The residents should sign up to the Environment Agency's free Flood Warning's Direct Service.
- Provide flood storage compensation within rear garden of properties at lower levels where possible.
- Additional investigation concerning the sewer within Wilkin Square
- Drainage S104 Adoptable Standards (United Utilities).

APPENDICES

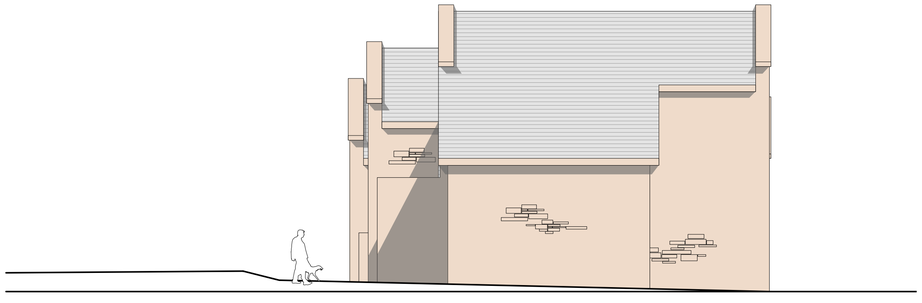
Appendix A: - Development Proposals

West Elevation

East Elevation



North Elevation



South Elevation

0m 10m scale

stanton andrews
architects

44 york street
clitheroe
BB7 2DL

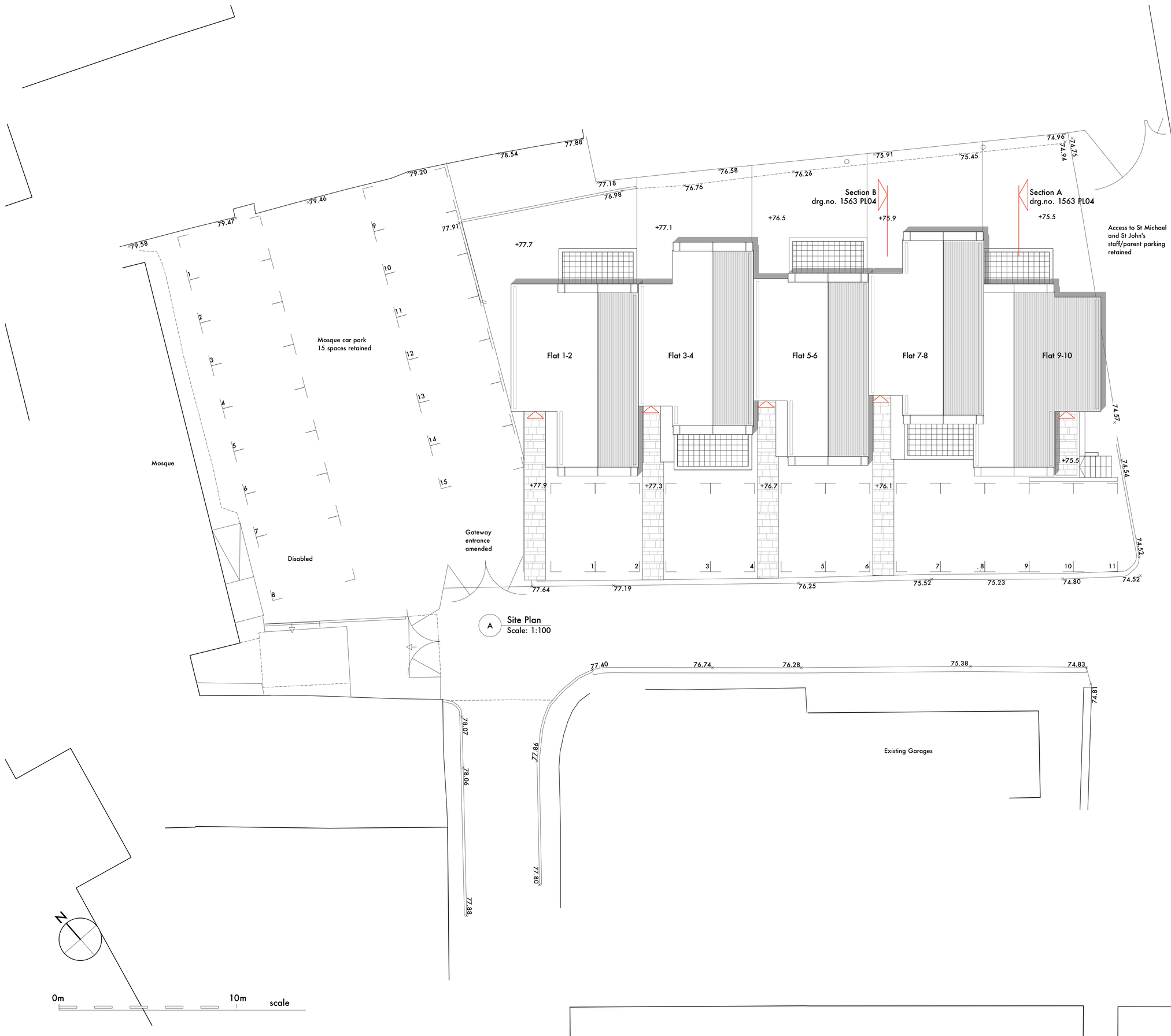
t 01200 444490
e mail@stantonandrews.co.uk
w stantonandrews.co.uk

Wilkin Square
Clitheroe

Proposed Elevations

drg.no. 15.63/PL03 rev. -

drawn. cs date. jan 2017 scale. 1 to 100 @A1



A Site Plan
Scale: 1:100

- Issued for Information Jan 2017

stanton andrews
architects

44 york street
clitheroe
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t 01200 444490
e mail@stantonandrews.co.uk
w stantonandrews.co.uk

Wilkin Square
Clitheroe

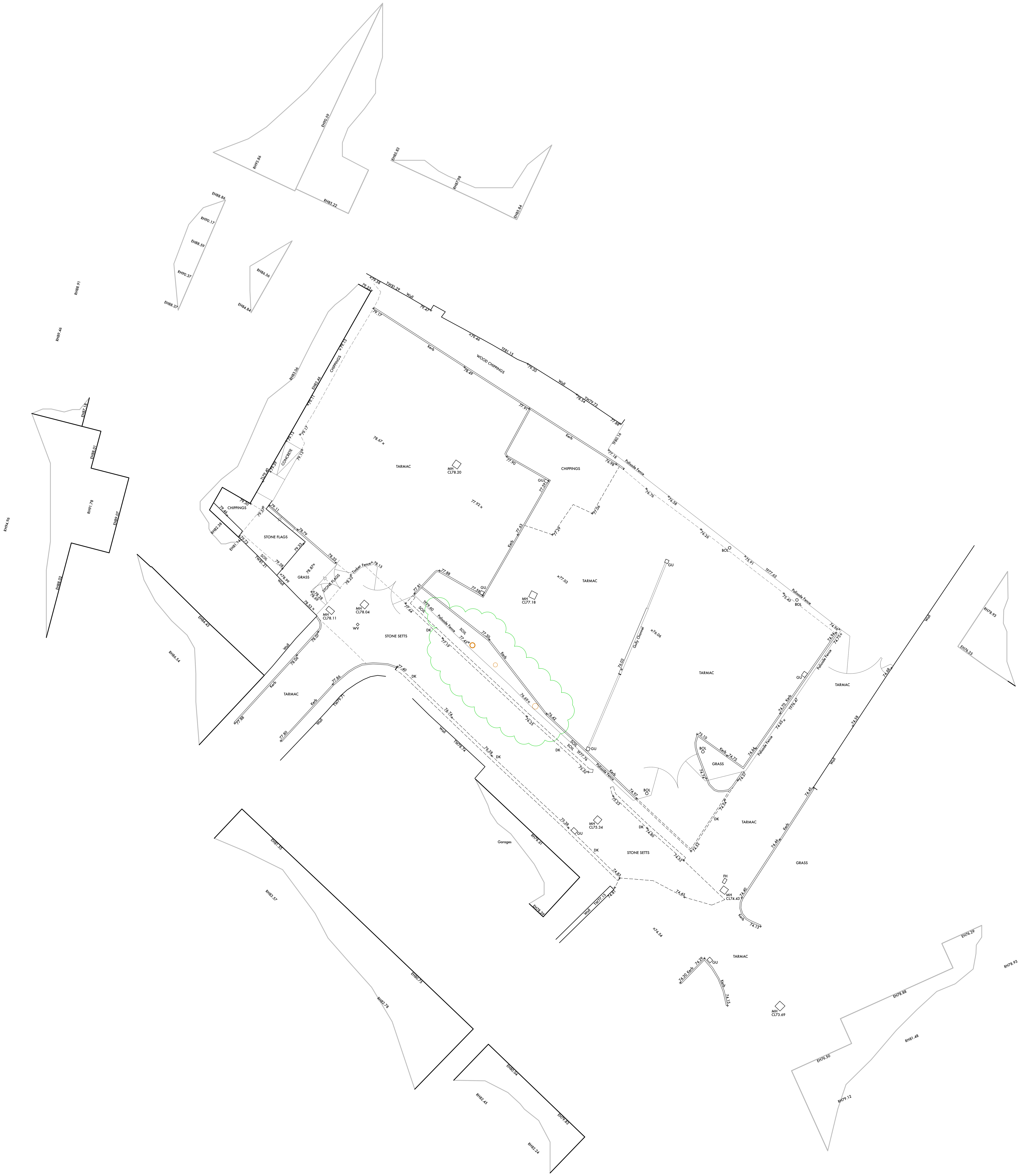
Proposed Site Plan

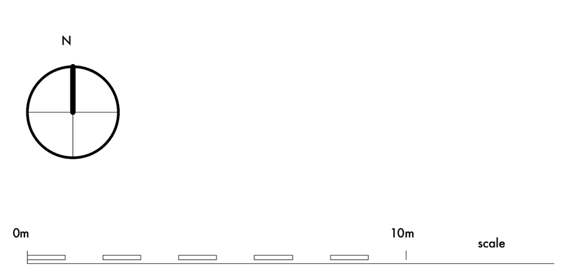
drg.no. 15.63/PL01 rev. -

drawn. cs date. jan 2017 scale. 1 to 100 @A1

Appendix B: - Topographical Survey

this drawing is to be read in conjunction with all relevant consultants and specialists drawings.
the architect is to be notified of any discrepancies before proceeding.
do not scale from this drawing.
all dimensions are to be checked on site.





-	Issued for Information	Jan 2017

stanton andrews
architects

44 york street
clitheroe
BB7 2DL

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e mail@stantonandrews.co.uk
w stantonandrews.co.uk

Wilkin Square
Clitheroe

Existing Site

drg.no. 15.63/EX01 rev. -

drawn. cs date. jan 2017 scale. 1 to 200 @A1

Appendix C: -EA Data

Site Location	Walkin Square, Clitheroe	CL34082

Fluvial Defences

Asset Ref.	National Grid Reference	Asset Type	Protection Type	Location	Maintained By	Design Standard (Return Period)	Overall Condition Grade (Excellent 1- 5 Very Poor)	Effective Crest Level (m)		E.C.L Data Quality (Reliable 1-4 Unreliable)	Length (m)	Height (m)
								UCL (mAOD)	DCL (mAOD)			
01210PEBR0101R25	SD 74633 41909	Wall	Fluvial	Holden Street to Downstream of Shawbridge Street	Environment Agency	5	3	75.45	76.64	2	202.9	-
01210PEBR0101R24	SD 74608 41734	High Ground	Fluvial	Downstream of Shawbridge Street to Waterloo Road	Environment Agency	10	3	-	-	-	39.4	-
01210PEBR0101R23	SD 74595 41698	High Ground	Fluvial	Waterloo Road to Downstream of Waterloo Road	Environment Agency	10	3	-	-	-	72.7	-
01210PEBR0101R22	SD 74542 41648	High Ground	Fluvial	Downstream of Waterloo Road to End of Bayley Fold	Environment Agency	10	3	-	-	-	90.5	-
01210PEBR0101R41	SD 74440 41616	Embankment	Fluvial	Rear of Bayley Fold Estate	Environment Agency	50	3	74.47	73.79	2	65.4	-
01210PEBR0101R20	SD 74486 41577	Wall	Fluvial	End of Bayley Fold to Culvert Inlet at Highfield Road	Environment Agency	100	3	75.76	74.95	2	97.7	-

Consent is REQUIRED for any works undertaken within 8 metres of these defences

Site Location	Walkin Square, Clitheroe	CL34082

Fluvial Structures

Asset Ref.	National Grid Reference	Asset Type	Protection Type	Location	Maintained By	Design Standard (Return Period)	Overall Condition Grade (Excellent 1- 5 Very Poor)	Length (m)	Height (m)
01210PEBR0101R20001	SD 74485 41577	Outfall	Fluvial	End of Bayley Fold	Private	-	3	-	-

CL34082 Walkin Square, Clitheroe Overview Map

January 13, 2017

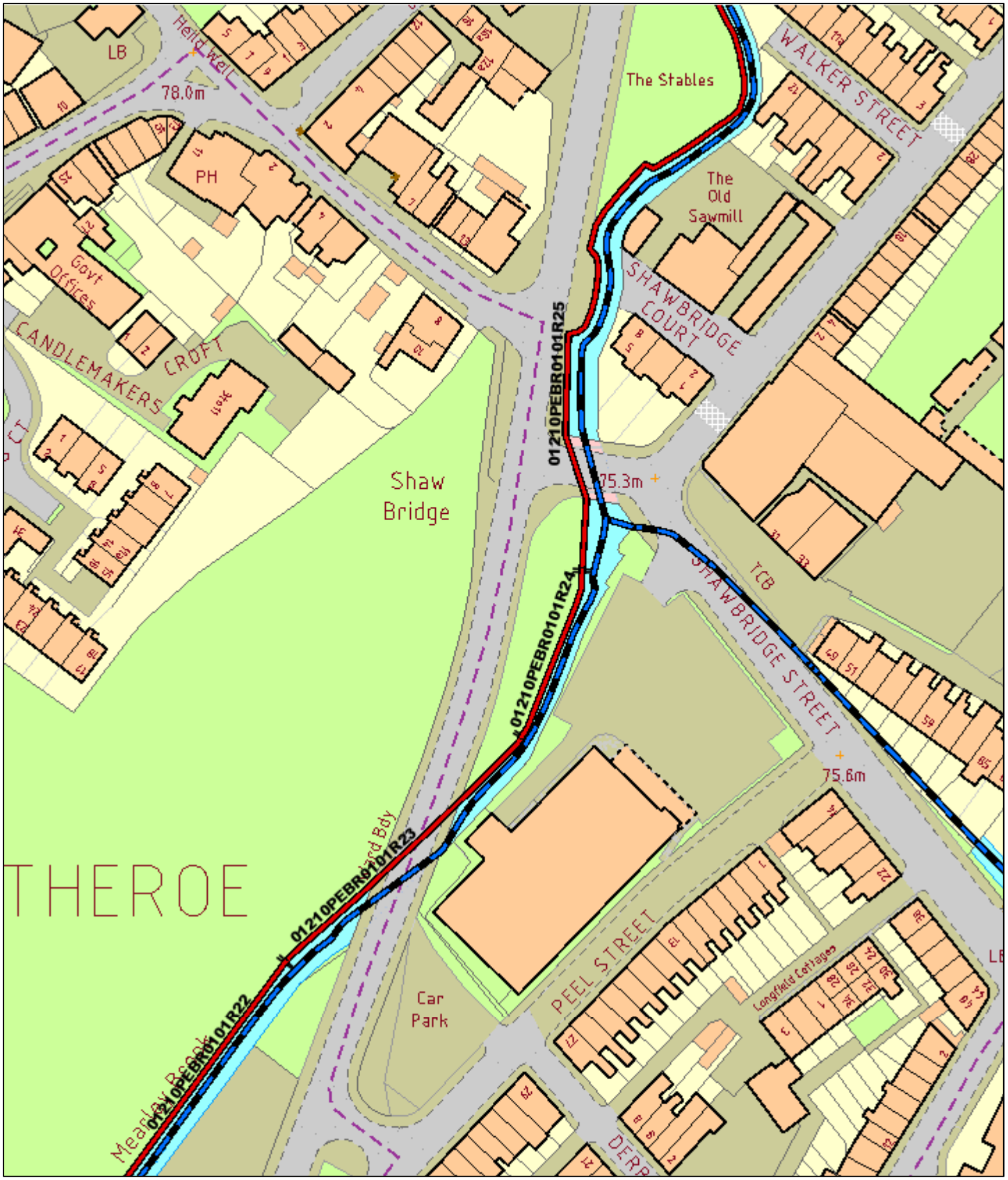
- Structures
- Channels
- Defences

1:2,402

0 0.02 0.04 0.08 mi

0 0.0325 0.065 0.13 km

CL34082 Walkin Square, Clitheroe Map 1



January 13, 2017

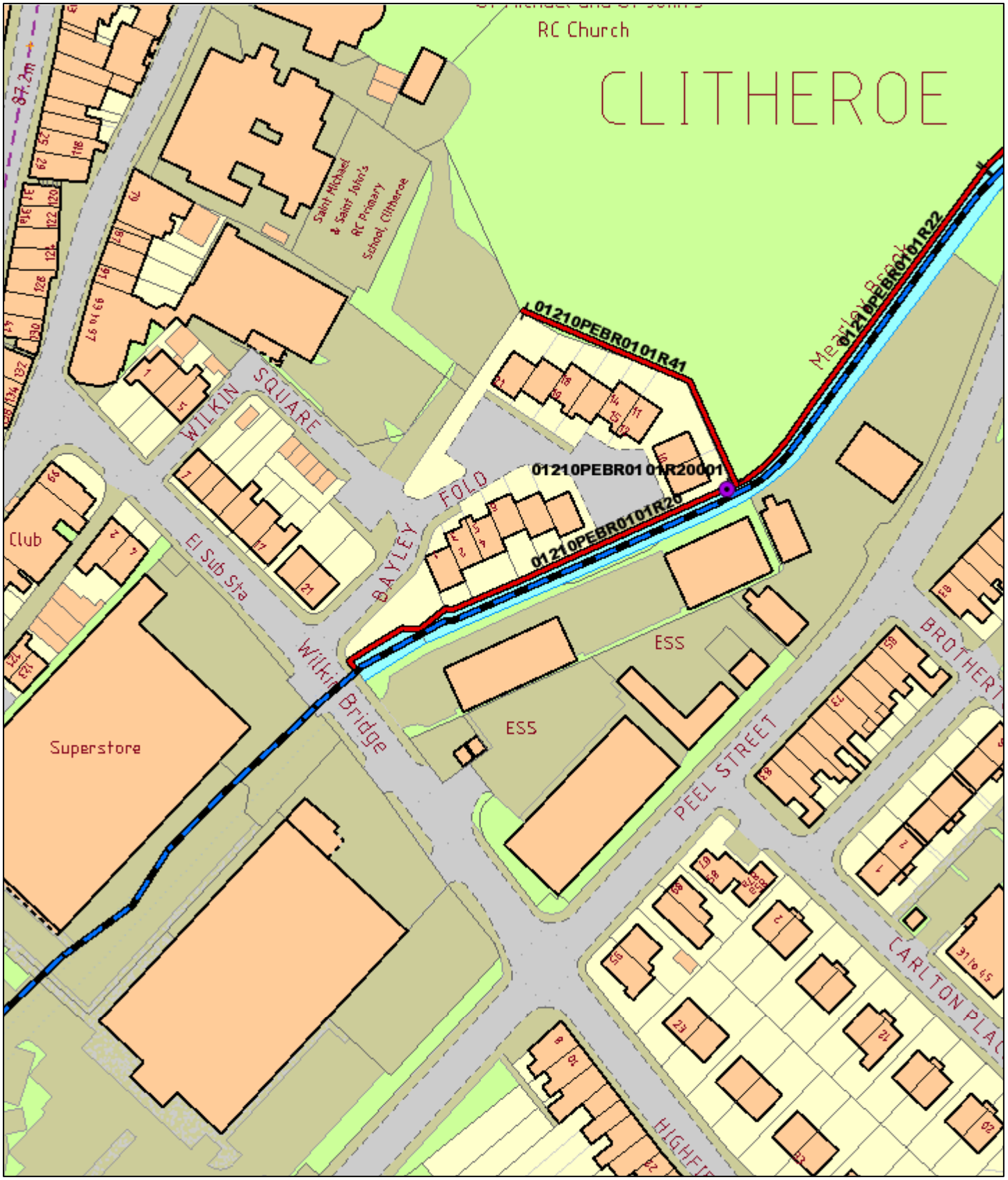
1:1,168

0 0.0075 0.015 0.03 mi

0 0.015 0.03 0.06 km

- Structures
- Channels
- Defences
- CARTO_TEXT

CL34082 Walkin Square, Clitheroe Map 2



January 13, 2017

1:1,168

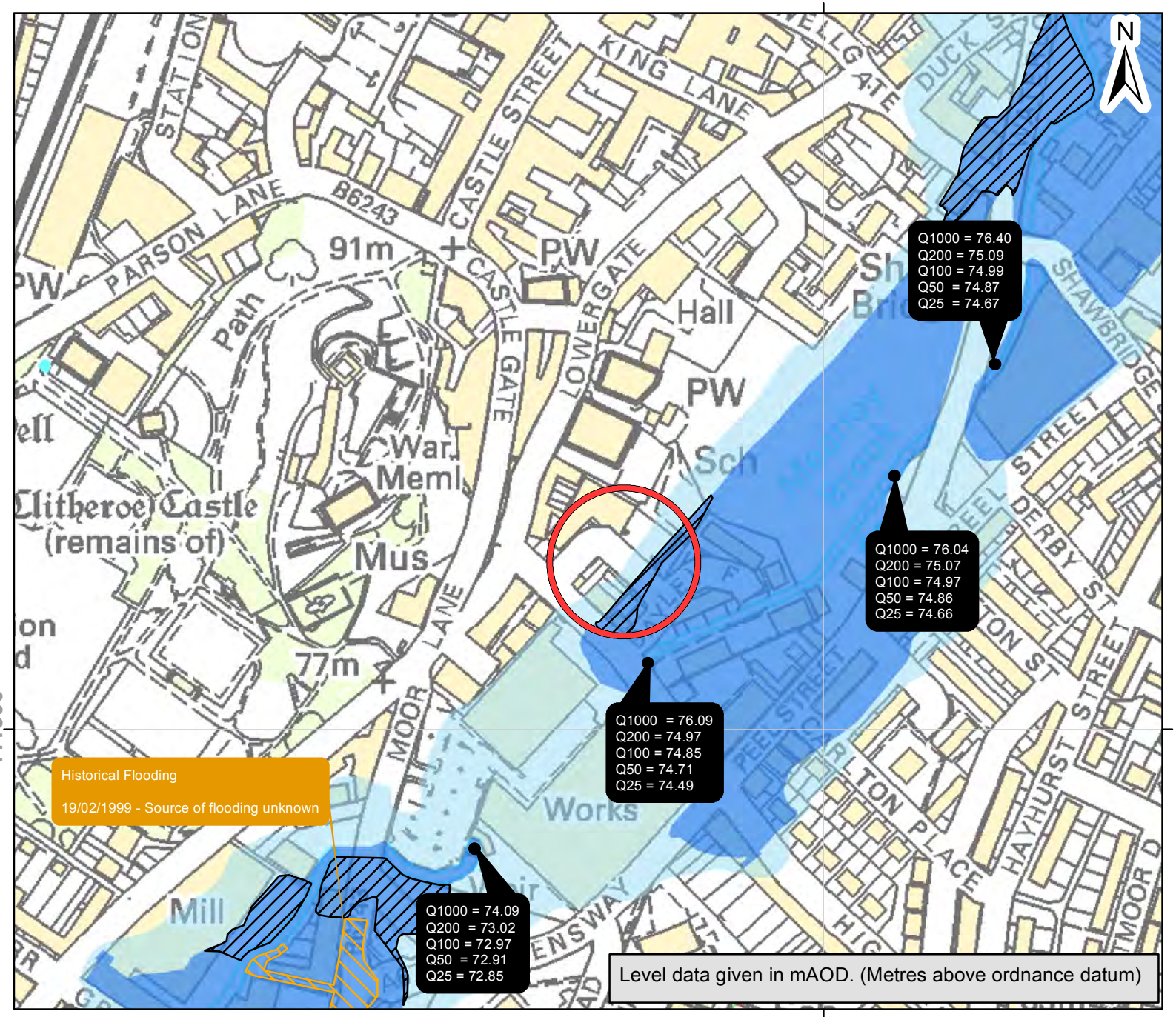
0 0.0075 0.015 0.03 mi

0 0.015 0.03 0.06 km

- Structures
- Channels
- Defences
- CARTO_TEXT

Fluvial Flood Level Map: Wilkin Square, Clitheroe, BB7 1AD

Produced:19 January 2017
Our Ref: CL34082
NGR: SD 74390 41586



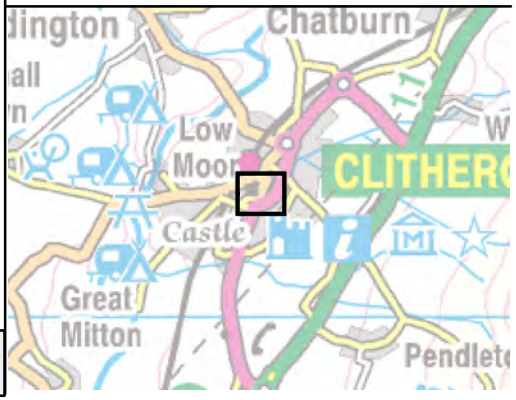
Key

- Historic Flooding
- Areas Benefitting from Defences
- Flood Zone 3
- Flood Zone 2

Flood Zone 3 shows the area that could be affected by flooding:
- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

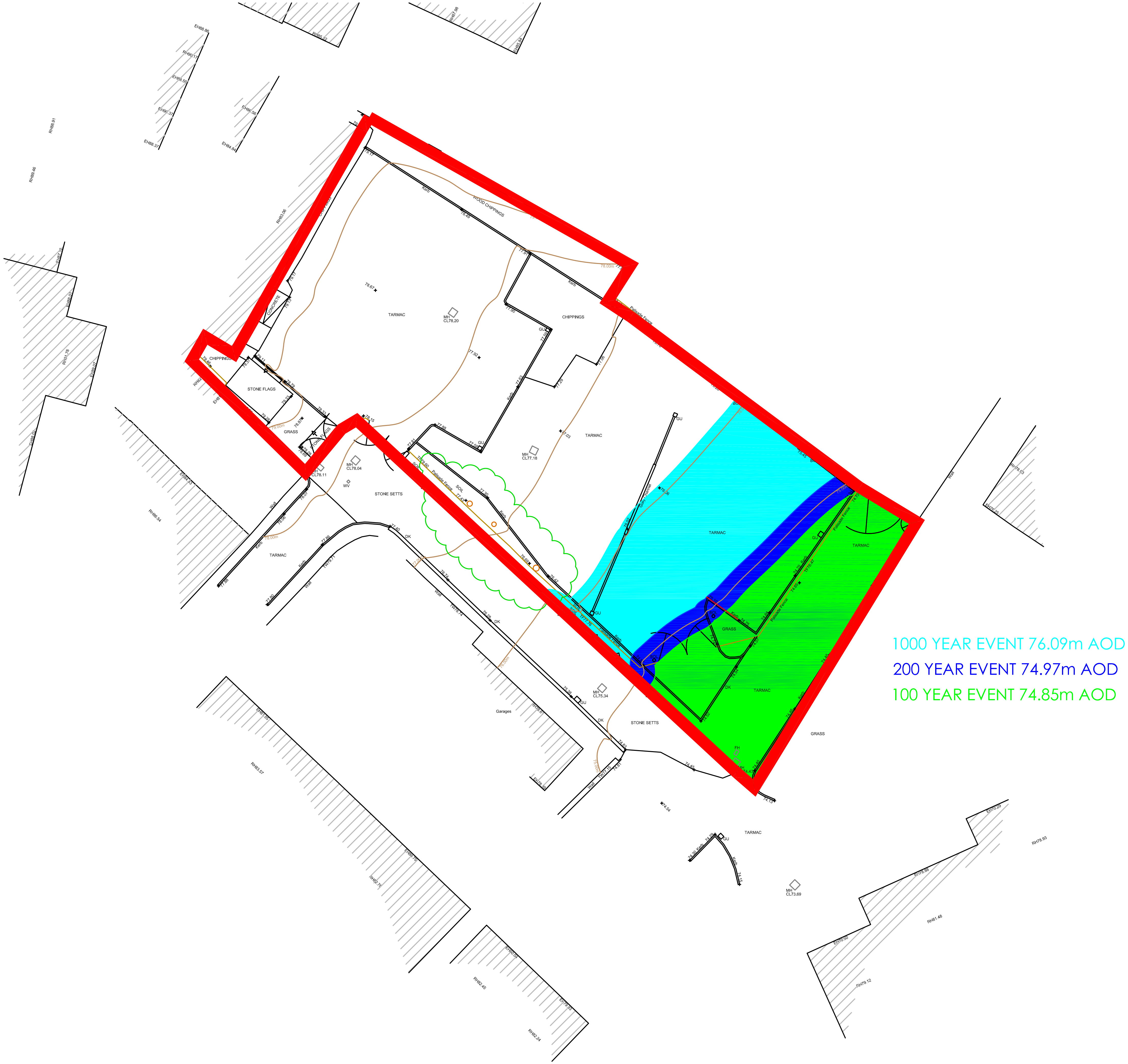
Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

ABDs (Areas Benefiting from Defences) show the area benefiting from defences during a 1 in 200 tidal, or 1 in 100 fluvial flood event.



Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Appendix D: - Flood Envelopes


1000 YEAR EVENT 76.09m AOD
200 YEAR EVENT 74.97m AOD
100 YEAR EVENT 74.85m AOD
TARMAC
CHIPPINGS
WOOD CHIPPINGS
STONE FLAGS
GRASS
STONE SETTS
SOIL
Garages

Appendix E: - Greenfield Runoff Rates

ICP SUDS Mean Annual Flood

Input

Return Period (years)	1	SAAR (mm)	1178	Urban	0.750
Area (ha)	0.184	Soil	0.450	Region Number	Region 10

Results l/s

QBAR Rural	1.5
QBAR Urban	3.4
Q1 year	3.0
Q1 year	3.0
Q30 years	4.9
Q100 years	5.4

Appendix F: - SUDS Planner

SUDS Planner

Hydrological

	Total	Pollution Removal	Water Quantity Control	Flow Rate Control	Groundwater Recharge		Total	Pollution Removal	Water Quantity Control	Flow Rate Control	Groundwater Recharge
Weighting		0. N/A	2. Essential	2. Essential	0. N/A	Infiltration Trench / Soakaway	18	3	5	4	5
Pervious Pavements	18	5	5	4	5	Filter Drains	14	3	3	4	1
Green Roofs	16	5	4	4	1	Infiltration Basin	18	3	5	4	5
Bioretention Area	8	5	2	2	5	Dry Detention	14	3	4	3	2
Filtration Techniques	8	4	2	2	1	Wet Ponds	16	4	5	3	2
Grassed Filter Strip	8	2	2	2	3	Stormwater Wetlands	12	5	3	3	2
Grassed Swales	14	4	3	4	3	Online / Offline Storage	16	1	5	3	1

SUDS Planner

Land Use

	Total	Dense Urban	Car Park	Road	Housing	Stormwater Hotspot
Weighting		0. N/A	0. N/A	0. N/A	2. Essential	0. N/A
Pervious Pavements	6	5	5	3	3	3
Green Roofs	6	5	1	1	3	1
Bioretention Area	8	3	4	4	4	3
Filtration Techniques	4	4	4	4	2	5
Grassed Filter Strip	4	1	4	5	2	4
Grassed Swales	6	2	4	5	3	3

	Total	Dense Urban	Car Park	Road	Housing	Stormwater Hotspot
Infiltration Trench / Soakaway	10	4	4	4	5	1
Filter Drains	4	3	4	5	2	4
Infiltration Basin	8	1	4	4	4	1
Dry Detention	8	1	4	5	4	4
Wet Ponds	8	1	4	5	4	4
Stormwater Wetlands	8	1	4	5	4	4
Online / Offline Storage	8	5	5	5	4	5

SUDS Planner

Site Features

	Total	Sub-Catchment Area			Site Slope			Limited Space	Infiltration Rate			Water Table Depth	
	Total	< 2 ha	2 - 8 ha	> 8 ha	< 10%	10% - 15%	> 15%	Limited Space	Low	Medium	High	< 1m	> 1m
Weighting		2. Essential	0. N/A	0. N/A	0. N/A	0. N/A	2. Essential	2. Essential	2. Essential	0. N/A	0. N/A	0. N/A	0. N/A
Pervious Pavements	32	5	5	5	5	2	1	5	5	5	5	4	5
Green Roofs	40	5	5	5	5	5	5	5	5	5	5	5	5
Bioretention Area	30	5	1	1	5	3	2	3	5	5	5	3	5
Filtration Techniques	34	5	3	1	5	5	2	5	5	5	5	5	5
Grassed Filter Strip	26	5	1	1	5	2	1	2	5	4	3	5	5
Grassed Swales	28	5	1	1	5	3	2	2	5	4	3	3	5
Infiltration Trench / Soakaway	24	5	3	1	5	1	1	5	1	5	2	1	5
Filter Drains	30	5	3	1	5	3	2	3	5	3	2	3	5
Infiltration Basin	20	5	2	1	5	3	3	1	1	5	2	1	5
Dry Detention	20	1	2	5	5	3	3	1	5	4	3	3	5
Wet Ponds	16	1	2	5	5	2	1	1	5	4	3	3	5
Stormwater Wetlands	16	1	2	5	5	3	1	1	5	4	3	4	4
Online / Offline Storage	36	5	5	5	5	4	3	5	5	5	5	5	5

SUDS Planner

Community & Environment

	Total	Safety	Pond Premium	Aesthetic	Wildlife Habitat	Community Acceptance
Weighting		0. N/A	0. N/A	0. N/A	0. N/A	2. Essential
Pervious Pavements	6	5	1	2	1	3
Green Roofs	4	5	1	3	3	2
Bioretention Area	8	5	1	4	3	4
Filtration Techniques	6	5	1	2	1	3
Grassed Filter Strip	8	5	1	3	3	4
Grassed Swales	8	4	1	3	2	4

	Total	Safety	Pond Premium	Aesthetic	Wildlife Habitat	Community Acceptance
Infiltration Trench / Soakaway	6	5	1	1	1	3
Filter Drains	6	5	1	1	1	3
Infiltration Basin	6	3	1	2	2	3
Dry Detention	6	3	1	3	3	3
Wet Ponds	8	3	5	4	4	4
Stormwater Wetlands	8	3	5	5	5	4
Online / Offline Storage	10	5	1	1	1	5

SUDS Planner

Economic & Maintenance

	Total	Life Span	Initial Cost	Maintenance Burden		Total	Life Span	Initial Cost	Maintenance Burden
Weighting		2. Essential	2. Essential	2. Essential	Infiltration Trench / Soakaway	20	4	3	3
Pervious Pavements	22	5	3	3	Filter Drains	18	3	3	3
Green Roofs	24	5	3	4	Infiltration Basin	20	4	3	3
Bioretention Area	18	3	4	2	Dry Detention	24	4	4	4
Filtration Techniques	14	3	2	2	Wet Ponds	26	5	4	4
Grassed Filter Strip	24	4	4	4	Stormwater Wetlands	22	4	3	4
Grassed Swales	22	5	3	3	Online / Offline Storage	20	4	2	4

SUDS Planner

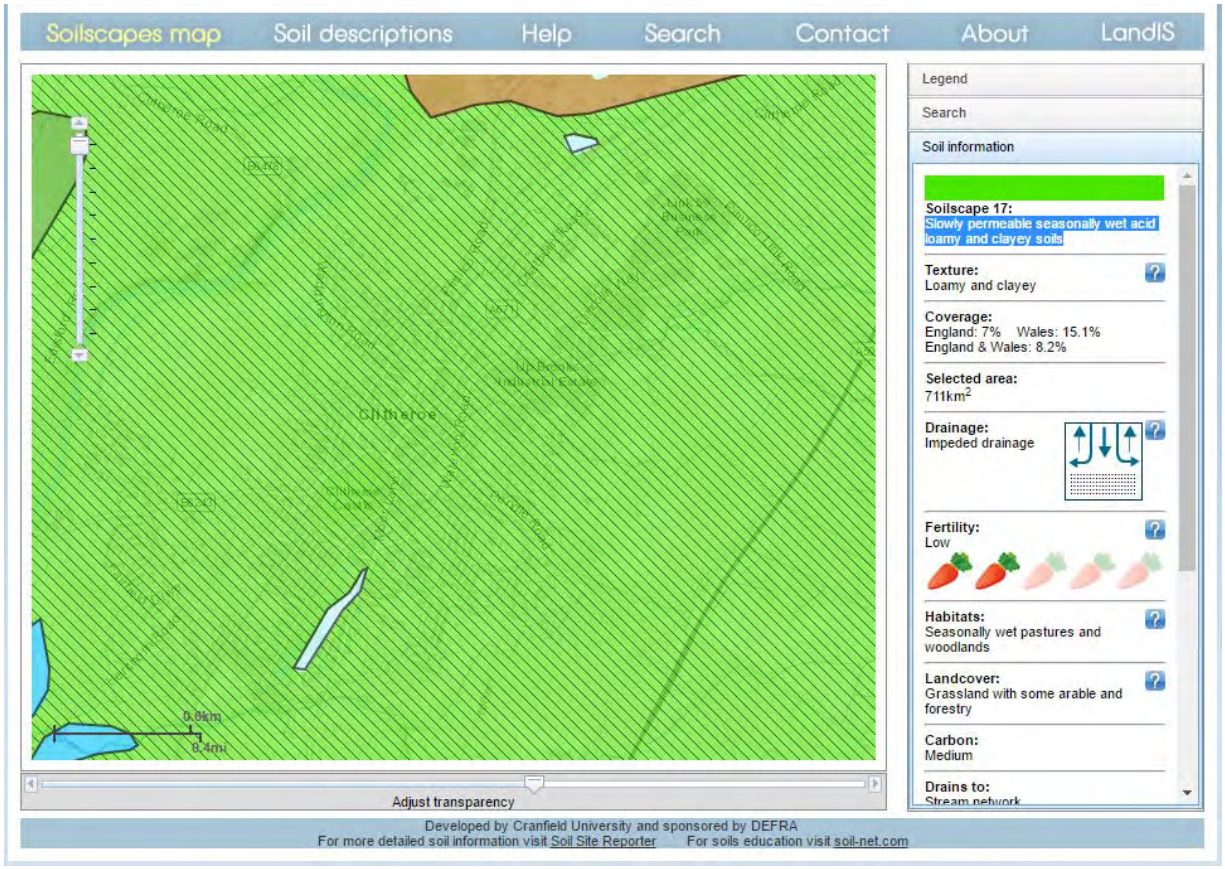
Results

Ordered By Total

	Quick Rank View	Hydrological	Land Use	Site Features	Total	Community and Environment	Economics and Maintenance
Green Roofs	(1, 13, 2)	16 (4th)	6 (8th)	40 (1st)	62 (1st)	4 (13th)	24 (2nd)
Online / Offline Storage	(2, 1, 8)	16 (4th)	8 (2nd)	36 (2nd)	60 (2nd)	10 (1st)	20 (8th)
Pervious Pavements	(3, 7, 5)	18 (1st)	6 (8th)	32 (4th)	56 (3rd)	6 (7th)	22 (5th)
Infiltration Trench / Soakaway	(4, 7, 8)	18 (1st)	10 (1st)	24 (9th)	52 (4th)	6 (7th)	20 (8th)
Filter Drains	(5, 7, 11)	14 (7th)	4 (11th)	30 (5th)	48 (5th)	6 (7th)	18 (11th)
Grassed Swales	(5, 2, 5)	14 (7th)	6 (8th)	28 (7th)	48 (5th)	8 (2nd)	22 (5th)
Bioretention Area	(7, 2, 11)	8 (11th)	8 (2nd)	30 (5th)	46 (7th)	8 (2nd)	18 (11th)
Infiltration Basin	(7, 7, 8)	18 (1st)	8 (2nd)	20 (10th)	46 (7th)	6 (7th)	20 (8th)
Filtration Techniques	(7, 7, 13)	8 (11th)	4 (11th)	34 (3rd)	46 (7th)	6 (7th)	14 (13th)
Dry Detention	(10, 7, 2)	14 (7th)	8 (2nd)	20 (10th)	42 (10th)	6 (7th)	24 (2nd)
Wet Ponds	(11, 2, 1)	16 (4th)	8 (2nd)	16 (12th)	40 (11th)	8 (2nd)	26 (1st)
Grassed Filter Strip	(12, 2, 2)	8 (11th)	4 (11th)	26 (8th)	38 (12th)	8 (2nd)	24 (2nd)
Stormwater Wetlands	(13, 2, 5)	12 (10th)	8 (2nd)	16 (12th)	36 (13th)	8 (2nd)	22 (5th)

Appendix G: - Borehole Logs & Soilscape Map

Soilscape


Soilscapes map
Soil descriptions
Help
Search
Contact
About
LandIS
Legend
Search
Soil information
Soilscape 17:
Slowly permeable seasonally wet acid loamy and clayey soils
Texture:
Loamy and clayey
Coverage:
England: 7% Wales: 15.1%
England & Wales: 8.2%
Selected area:
711km2
Drainage:
Impeded drainage
Fertility:
Low
Habitats:
Seasonally wet pastures and woodlands
Landcover:
Grassland with some arable and forestry
Carbon:
Medium
Drains to:
Stream network
Gilthorpe
0.8km
0.4mi
Adjust transparency
Developed by Cranfield University and sponsored by DEFRA
For more detailed soil information visit Soil Site Reporter
For soils education visit soil-net.com

CLIENT	JOB NO	LOCATION	BOREHOLE NO
SANDERSON WATTS ASSOC.	C8840	SUN STREET, CLITHEROE.	BH3
DATE: JANUARY 1997 — SCALE: 1 to 50	BORING METHOD: CABLE PERCUSSIVE		Sheet: 1

Drilling & Casing Progress	SAMPLE/TEST Type & No.	SAMPLE/TEST Depth(M)	SPT N – value or COHESION	DESCRIPTION	O D LEVEL	LEGEND	DEPTH
28TH							0.0
	B 1	0.20 – 0.60		MADE GROUND – Concrete.			0.15
	S 2	0.60 – 1.05	29	MADE GROUND – Dense stone and ash subbase.			
	B 3	1.20 – 1.60					1.20
	B 3	1.20 – 1.60		MADE GROUND – Loose fine to coarse stone and ash subbase with much clay.			
	S 4	1.60 – 2.05	6				1.90
	U 5	2.20 – 2.65	48.60	Soft to firm medium to dark brown and grey mottled very silty sandy CLAY.			
	D 6	3.00					
	S 7	3.50 – 3.95	8				3.80
	B 8	4.50 – 5.00		Soft to firm dark brown sandy CLAY with some to much fine to coarse gravel.			
	S 9	5.00 – 5.45	6				
	C 10	6.50 – 6.95	7				
	S 11	7.50 – 7.95	21	Firm to firm to stiff medium to dark brown and grey silty sandy CLAY with some to much fine to coarse gravel and occasional cobbles.			7.00
28TH	D 12	8.80		Subrounded dark grey and black PEBBLES and COBBLES of mudstone, sandstone and limestone.			8.10
28TH	S 13	8.80 – 8.85	60	Medium dense fine to coarse gravel – Possibly transition to rock?			8.70
				Light grey very slightly weathered strong micritic, slightly shelly carboniferous LIMESTONE, with occasional mica flecks.			8.80 8.90

DUNELM DRILLING COMPANY
TEL0191-526-2534 FAX0191-517-0085

BOREHOLE LOGSHEET

Water Observations, Remarks, Etc

Water struck at 6.80m and 8.40m.
No standing level recorded, due to collapse of borehole side walls on removal of temporary casing.

Chiselling initial concrete – 0.5 hr.
Chiselling in rock from 8.80m to 8.90m – 0.75 hr.

Appendix H: - United Utilities Sewer Records

United Utilites Water Limited
Property Searches
Ground Floor Grasmere House
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP
DX 715568 Warrington
Telephone 0370 751 0101

Property.searches@uuplc.co.uk

Your Ref: WILKIN SQUARE
Our Ref: 16/ 1264585
Date: 26/1/2017

THE FLOOD RISK CONSULTANCY

c54 Northbridge House
Elm Street Burnley
Lancashire
BB10 1PD

FAO:

Dear Sirs

Location: 1 BAYLEY FOLD CLITHEROE BB7 1AN

I acknowledge with thanks your request dated 26/01/17 for information on the location of our services.

Please find enclosed plans showing the approximate position of our 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 our 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 you requirements and look forward to hearing from you should you need anything further.

If you have any queries regarding this matter please telephone us on 0370 7510101.

Yours Faithfully,

Karen McCormack
Property Searches Manager

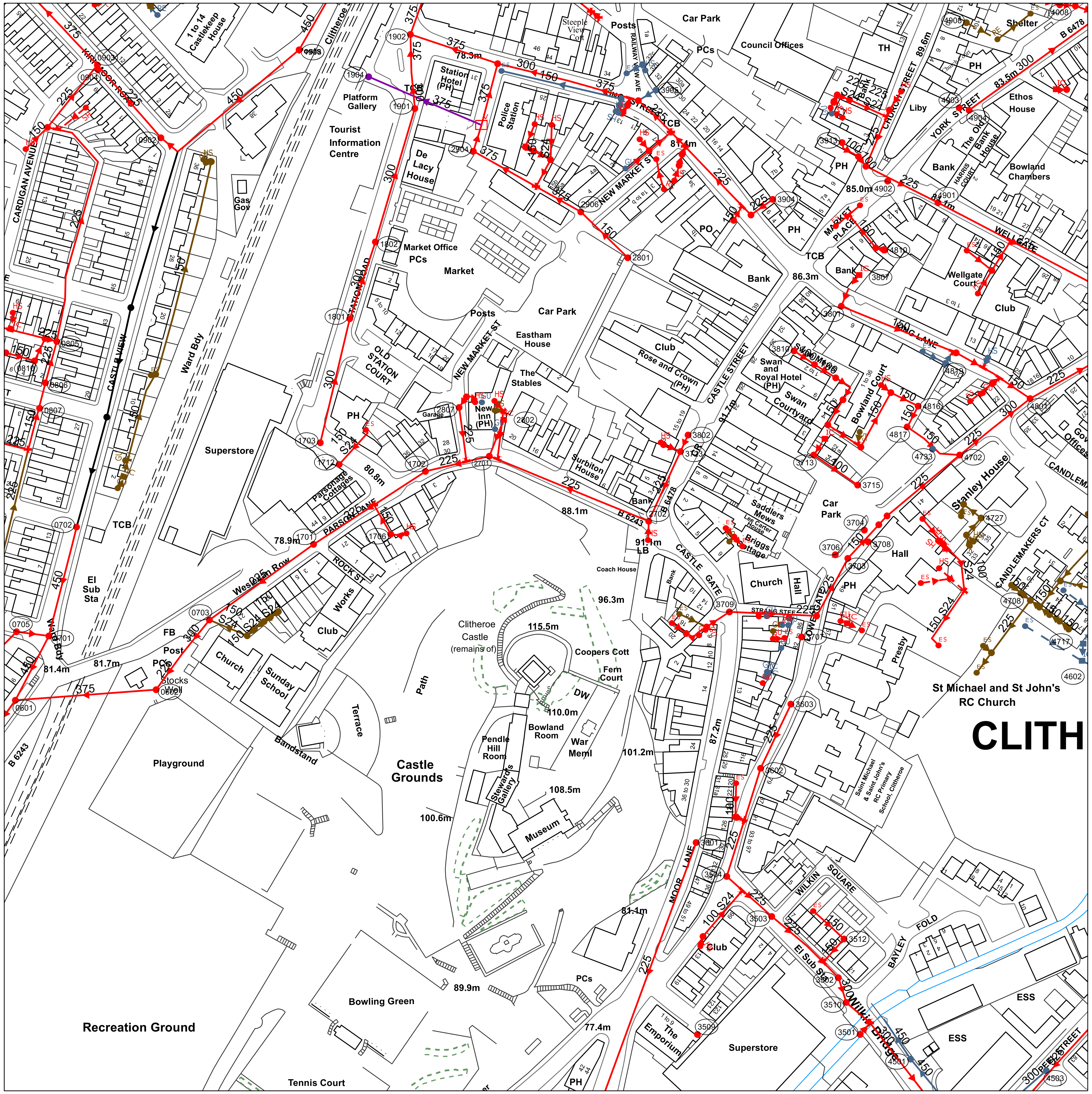
United Utilities Water Limited
Registered in England & Wales No. 2366678
Registered Office: Haweswater House,
Lingley Mere Business Park, Lingley Green Avenue,
Great Sankey, Warrington, WA5 3LP

TERMS AND CONDITIONS - WASTERWATER & 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:

1. 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.
2. 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.
3. In particular, the position and depth of any UUWL apparatus shown on the Map are approximate only and given in accordance with the best information available. The nature of the relevant system and/or its actual position may be different from that shown on the plan and UUWL is not liable for any damage caused by incorrect information provided save as stated in section 199 of the Water Industry Act 1991. 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.
4. 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.
5. 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.
6. 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.
7. 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.
8. 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.
9. 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.



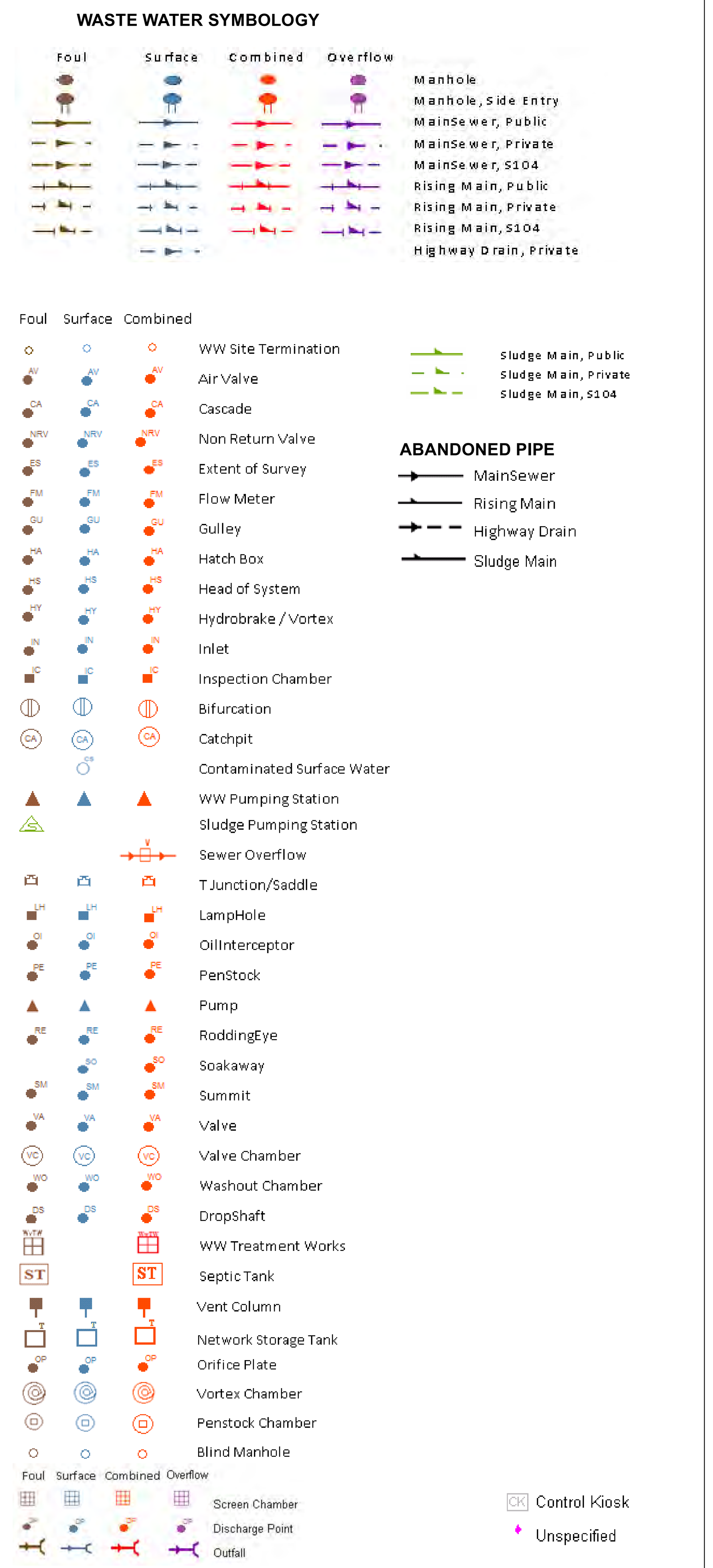
Refno	Cover	Func	Invert	Size.x	Size.y	Shape	Matl	Length	Grad
0601	77.99	CO	73.88	150		CI	VC	16.21	
0602	76.87	CO							
0701	81.39	CO	73.94	450		CI	CO	33.48	837
0702	80.71	CO	74.04	450		CI	CO	51.89	649
0703	77.89	CO	75.43	300		CI	VC	20.08	44
0705		CO							
0709		FO							
0802		CO							
0805	80.95	CO	79.14	225		CI	VC	114.86	38
0806	81.48	CO	79.73	225		CI	VC	19.79	35
0807	81.73	CO							
0808		FO		150		CI	VC	101.46	
0810		CO		150		CI	VC	11.35	
0811		CO		150		CI	VC	13.75	
0812		CO							
0902	78.07	CO	0	225		CI	VC	44.57	
0903	77.46	CO							
0904	77.42	CO							
0905	78.06	CO							
0912		FO							
0914		FO							
1701	79.66	CO	0	225		CI	VC	59.39	
1702	81.53	CO	0	225		CI	VC	61.66	
1703	79.42	CO	76.1	300		CI	VC	58.81	
1706		CO							
1707		FO		150		CI	VC	4.33	
1708		FO		150		CI	VC	3.66	
1709		FO		150		CI	VC	5.53	
1710		FO		150		CI	VC	4.65	
1711		FO		150		CI	VC	18.89	
1712		CO							
1801		CO							
1802	78.26	CO							
1901	78.04	CO	75.24	300		CI	VC	16.84	120
1902	78.4	CO	74.95	375		CI	VC	61.16	
1903		CO							
1904	78.18	OV							
2701	83.11	CO							
2702	90.83	CO							
2801		CO	0	150		CI	VC	30.27	
2802		CO		100		CI	VC	18.02	
2807		CO		225		CI	VC	25.2	
2808		CO							
2901	78.32	CO	75.17	375		CI	VC	42.43	212
2902	80.28	CO	77.45	375		CI	VC	33.26	29
2904		CO	0	375		CI	VC	12.65	
2906		CO							
2908		SW	0	939		CI	CO	8.29	
2911		CO							
2914		CO							
2915		CO	0	150		CI	VC	8.72	
2918		CO							
2926		CO							
2930		SW		150		CI	VC	56.64	
2931		SW							
3501	74.24	CO	0	150		CI	VC	7.01	
3502	74.54	CO							
3503	77.56	CO							
3504	79.92	CO							
3506		CO		100		CI	VC	27.96	
3509		CO							
3510		CO							
3512		CO							
3601	83.75	CO							
3602	82.28	CO	80.78	225		CI	VC	52.38	20
3603	82.5	CO							
3605		CO							
3607		SW							
3608		SW							
3701		CO							
3702		CO	0	225		CI	VC	30.2	
3703		CO							
3704		CO							
3705		CO							
3706		CO							
3707		CO							
3708	83.09	CO							
3709	89.24	CO							
3712		CO							
3713		CO		100		CI	VC	24.54	
3715		CO							
3718		CO							
3718		CO							
3722		CO		100		CI	VC	8.41	
3723		CO		225		CI	VC	35.35	
3724		CO							
3729		CO							
3734		CO							
3801	85.91	CO	84.18	150		CI	VC	57.26	14
3802		CO		225		CI	VC	8.41	
3803		CO		150		CI	VC	18.33	
3804		CO		150		CI	VC	13.57	
3807		CO							
3810		CO		100		CI	VC	11.33	
3811		CO		100		CI	VC	11.53	
3812		CO		150		CI	VC	7.88	
3901	85.71	CO							
3902	84.94	CO							
3904	86.12	CO	84	225		CI	VC	12.41	
3905		SW	0	375		CI	CO	9.51	
3909		CO							
3910		CO							
3911		CO		100		CI	VC	5.73	
3913		CO		100		CI	VC	10.72	
3914		CO		150		CI	VC	3.76	
3915		CO							
3916		CO							
3919		CO		150		CI	VC	7.7	
4501	73.91	SW	72.4	450		CI	CO	22.4	1120
4503	73.88	SW	72.32	300		CI	VC	47.44	99
4602		SW							
4701	83.13	CO	81.54	225		CI	VC	43.72	32
4702	81.78	CO							
4703	83.34	CO							
4706		FO		225		CI	VC	11.46	
4707		FO		225		CI	VC	30.1	
4708		FO							
4709		FO		150		CI	VC	5.64	
4710		FO		150		CI	VC	5.21	
4711		FO		150		CI	VC	5.84	
4712		FO		150		CI	VC	5.53	
4713		FO		150		CI	VC	5.53	
4714		FO		150		CI	VC	15.53	
4717		SW							
4725		FO		100		CI	VC	10.46	
4726		FO							
4727		FO		100		CI	VC	10.31	
4733		SW							
4734		CO							
4735		CO							
4801	80.12	CO	78.41	225		CI	VC	54.01	
4802	81.78	CO	80.1	225		CI	VC	20.07	24
4805		CO							
4806		CO							
4809		CO							
4810		CO		150		CI	VC	4.29	
4811		CO							
4816		CO		150		CI	VC	10.79	
4817		CO		150		CI	VC	28.75	
4819		SW							
4901	81.83	CO							
4902	84.03	CO							
4903	83.64	CO							
4904	83.65	CO	82.14	300		CI	VC	95.56	
4905	86.65	CO	85.07	225		CI	VC	28.16	19
4907		CO		150		CI	VC	12.51	
4908		FO							
4912		CO							
4913		CO							
0706		CO	74.98	225		CI	VC	20.45	44

Refno	Cover	Func	Invert	Size.x	Size.y	Shape	Matl	Length	Grad
0707		FO							
0710		FO							
0711		FO							
0801		CO							
0804		CO							
0906		CO	0	150		CI	VC	14.23	
0908		CO							
0909		CO	0	450		CI	VC	10.06	
0913		FO							
0915		FO							
1704		CO		150		CI	VC	7.56	
1905		CO	75.1	375		CI	VC	17.43	124
2703		CO	0	225		CI	VC	8.73	
2803		FO							
2804		CO							
2806		SW							
2809		CO							
2810		CO							
2811		SW							
2905		SW	0	939		CI	CO	3	
2907		CO	76.32	300		CI	VC	33.96	30
2910		CO	0	150		CI	VC	16.09	
2913		CO	0	150		CI	VC	11.39	
2916		CO							
2917		CO	0	150		CI	VC	6.83	
2919		CO		100		CI	VC	2.11	
2920		CO		100		CI	VC	2.28	
2923		CO		225		CI	VC	4.49	
2924		SW		225		CI	VC	3.53	
2929		SW		150		CI	VC	3.27	
2932		SW		100		CI	VC	0.86	
3507		CO							
3511		CO							
3609		CO							
3610		SW							
3710		CO							
3714		CO		100		CI	VC	6.62	
3716		CO							
3716		CO		100		CI	VC	1.52	
3717		CO							
3719		CO							
3720		CO		100		CI	VC	1.32	
3727		FO							
3728		CO		100		CI	VC	1.56	
3730		CO							
3732		FO							
3733		SW							
3735		SW							
3736		SW							
3737		SW							
3805		CO		150		CI	VC	6.84	
3808		CO							
3907		CO	0	150		CI	VC	7.31	
3918		CO							
3923		SW							
4505		SW	0	450		CI	CO	15.97	
4704		CO							
4715		FO		150		CI	VC	8.6	
4722		CO							
4728		FO							
4729		FO							
4730		FO							
4731		FO							
4736		CO							
4737		CO							
4738		CO							
4740		CO							
4803		CO							
4804		CO							
4808		CO		150		CI	VC	12.35	
4812		CO							
4822		SW		150		CI	VC	5.28	
4823		CO							
4906		CO	0	225		CI	VC	10.03	
4914		CO							
0704		CO							
0708		FO		150		CI	VC	41.93	
0803		CO							
0907		CO							
0916		FO							
1705		CO							
2705		CO							
2706		CO							
2805		CO		150		CI	VC	22.39	
2912		CO							
2921		CO		100		CI	VC	4.38	
2922		CO		100		CI	VC	43.59	
2925		CO							
2927		CO							
3505		CO							
3508		CO							
3514		CO							
3604		CO							
3711		CO							
3717		CO							
3906		CO	0	225		CI	VC	20.91	
3908		CO							
3920		CO							
3921		CO							
4719		CO		150		CI	VC	31.02	
4720		CO							
4739		CO							
4807		CO							
4814		CO							
4815		CO							
4818		CO							
4821		CO							
4911		CO							
0801	80.08	CO							
0802	79.39	CO							
2903		CO	0	375		CI	VC	56.57	

Printed By: Property Searches

OS Sheet No: SD7441NW

Scale: 1:1250 Date: 26/01/2017



LEGEND

MANHOLE FUNCTION

FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIAL

AC	Asbestos Cement	DI	Ductile Iron
BR	Brick	PVC	Polyvinyl Chloride
PE	Polyethylene	CI	Cast Iron
RP	Reinforced Plastic Matrix	SI	Spun Iron
CO	Concrete	ST	Steel
CSB	Concrete Segment Bolted	VC	Vitrified Clay
CSU	Concrete Segment Unbolted	PP	Polypropylene
CC	Concrete Box Culverted	PF	Pitch Fibre
PSC	Plastic/Steel Composite	MAC	Masonry, Coursed
GRC	Glass Reinforced Concrete	MAR	Masonry, Random
GRP	Glass Reinforced Plastic	U	Unspecified

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.

OS Sheet No: SD7441NW

Scale: 1:1250 Date: 26/01/2017

261 Nodes

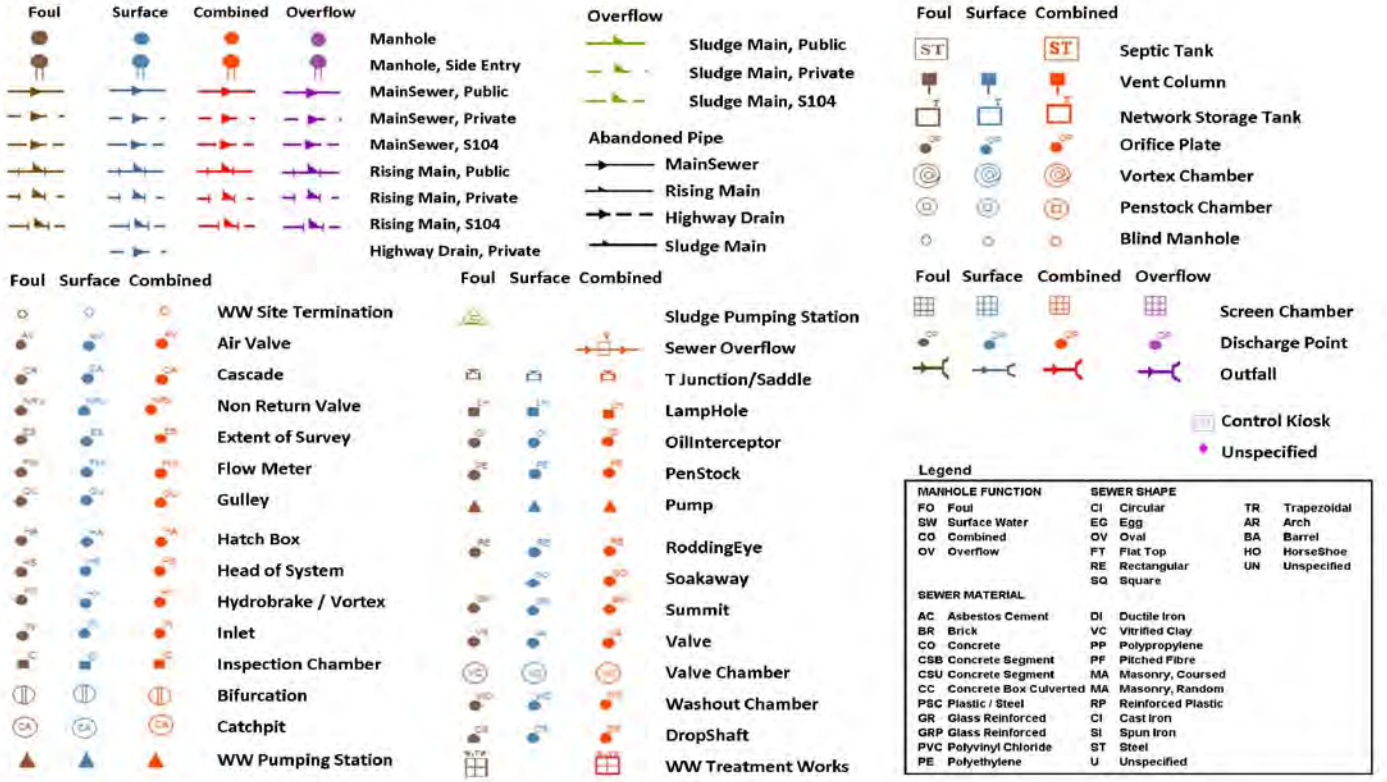
Sheet 1 of 1

United Utilities helping life flow smoothly

SEWER RECORDS

United Utilities

WASTE WATER SYMBOLOGY



Legend

MANHOLE FUNCTION		SEWER SHAPE			
FO	Foul	CI	Circular	TR	Trapezoidal
SW	Surface Water	EG	Egg	AR	Arch
CO	Combined	OV	Oval	BA	Barrel
OV	Overflow	FT	Flat Top	HO	HorseShoe
		RE	Rectangular	UN	Unspecified
		SQ	Square		

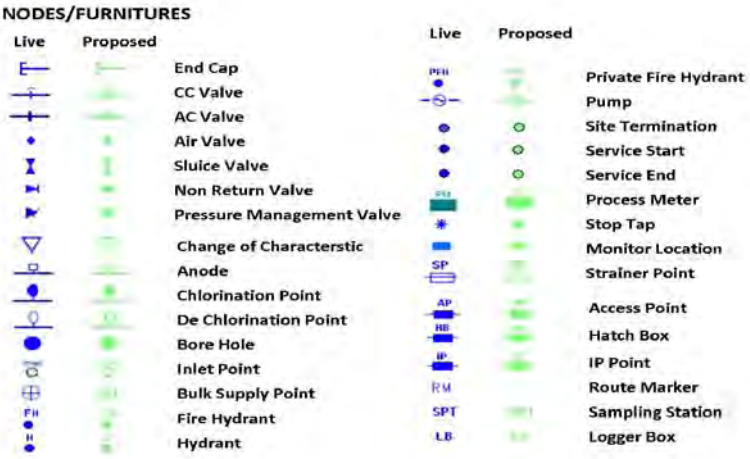
SEWER MATERIAL			
AC	Asbestos Cement	DI	Ductile Iron
BR	Brick	VC	Vitrified Clay
CO	Concrete	PP	Polypropylene
CSB	Concrete Segment	PF	Pitched Fibre
CSU	Concrete Segment	MA	Masonry, Coursed
CC	Concrete Box Culverted	MA	Masonry, Random
PSC	Plastic / Steel	RP	Reinforced Plastic
GR	Glass Reinforced	CI	Cast Iron
GRP	Glass Reinforced	SI	Spun Iron
PVC	Polyvinyl Chloride	ST	Steel
PE	Polyethylene	U	Unspecified

CLEAN WATER SYMBOLOGY

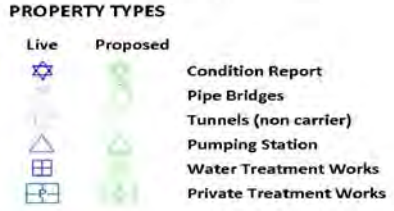
PIPE WORK

ABANDONED PIPE

NODES/FURNITURES



PROPERTY TYPES



Legend

MATERIAL TYPES		LINING TYPES	
AC	ASBESTOS CEMENT	CL	CEMENT LINING
CI	CAST IRON	TB	TAR OR BITUMEN
CU	COPPER	ERL	EPOXY RESIN
CO	CONCRETE		
DI	DUCTILE IRON	INSERTION TYPES	
GI	GALVANISED IRON		
GR	GREY IRON	DD	DIE DRAWN
OT	OTHERS	DR	DIRECTIONAL DRILLING
PB	LEAD	MO	MOLING
PV	uPVC	PI	PIPELINE
SI	SPUN IRON	SL	SLIP LINED
ST	STEEL		
UN	UNKONWN		
PE	POLYETHYLENE		

Appendix I: - Preliminary Drainage Design and MD Calcs

NOTES:

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3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS & ENGINEERS DRAWINGS & SPECIFICATIONS.
4. ALL DIMENSIONS ARE SHOWN IN MILLIMETRES UNLESS OTHERWISE STATED.
5. NO DIMENSIONS TO BE SCALED FROM THIS DRAWING.
6. UN-ADOPTED FW & SW DRAINAGE IS TO BE CONSTRUCTED IN ACCORDANCE WITH CURRENT BUILDING REGULATIONS, INCLUDING APPROVED DOCUMENT H (UPDATED 2015); BS EN 752:2008 AND OTHER RELEVANT STANDARDS AND AGREEMENT CERTIFICATES.
7. THE LOCATION AND LEVELS OF EXISTING DRAINAGE PIPES AND CULVERTS MUST BE CHECKED ON-SITE PRIOR TO CONSTRUCTION.
8. ALL EXISTING SERVICES TO BE LOCATED PRIOR TO THE COMMENCEMENT OF ANY DRAINAGE WORKS, AND WHERE NECESSARY PROTECTION OR DIVERSIONS ARE TO BE UNDERTAKEN TO AVOID CONFLICT WITH THE PROPOSED WORKS.
9. DRAINS ARE TO BE CONSTRUCTED USING FLEXIBLY JOINTED VITRIFIED CLAY PIPES TO BS 65 (1991) AND BS EN 295 (2012/2013); OR UPVC BUILDING DRAINAGE SYSTEM PIPEWORK TO BS 4660 (2000), BS EN 13598-1 (2010) & BS EN 1401-1 (2009); BEDDED & BACKFILLED IN ACCORDANCE WITH THE MANUFACTURERS INSTRUCTIONS.
10. BACKFILLING OF DRAIN TRENCHES ADJACENT TO DWELLINGS OR OTHER STRUCTURES TO BE IN ACCORDANCE WITH BS EN 1610 (1998).
11. ACCESS FITTINGS & INSPECTION CHAMBERS <1.2m DEEP ARE TO BE CLAYWARE OR PRE-FORMED POLYPROPYLENE AS APPROPRIATE TO THE NUMBER OF CONNECTIONS. POLYPROPYLENE CHAMBERS CAN BE USED UP TO 3.0m DEEP BUT REQUIRE A MAX 350mm DIAMETER REDUCED COVER TO PREVENT MAN ENTRY. INSPECTION CHAMBER SIZES ARE TO BE CONSTRUCTED IN ACCORDANCE WITH BS EN 752 (2008).
12. MANHOLE CHAMBERS ARE TO BE OF PRECAST CONCRETE CONSTRUCTION WITH 150mm INSITU CONCRETE SURROUND WITH A CLEAR OPENING OF 600mm.
13. COVER LEVELS INDICATED ON THE DRAWING OR WITHIN THE MANHOLE SCHEDULE ARE NOMINAL AND MAY BE ADJUSTED TO SUIT FINISHED LEVELS AS NECESSARY. INSPECTION CHAMBER COVERS SHOULD BE GRADE A15 FOR PEDESTRIAN AREAS ONLY; B125 FOR AREAS WITH OCCASIONAL VEHICLE ACCESS; AND D400 WITHIN THE PUBLIC HIGHWAY.
14. WHERE DRAINS PASS THROUGH FOUNDATIONS OR OTHER RIGID STRUCTURES, A LINTEL OR SLEEVE IS TO BE USED & PROVISION FOR FLEXIBILITY IS TO MADE WITH ROCKER PIPES.
15. ANY EXISTING LAND DRAINS SEVERED BY SITE OPERATIONS SHOULD BE DIVERTED AROUND ANY PROPERTIES/BUILDINGS AND RECONNECTED TO THE EXISTING LAND DRAINAGE SYSTEM VIA A SILT TRAP.
16. GULLIES SITUATED IN AREAS ACCESSIBLE TO WHEELED VEHICLES ARE TO BE OF A SUITABLE CONSTRUCTION (e.g. CPM GROUP CONCRETE GULLY POTS TO BS 5911:6 (2010) OR HEPWORTH CODE RGR3 GULLY POT, WITH INSITU CONCRETE BED AND SURROUND, FITTED WITH DRAINAGE CASTINGS CODE TD651 GRATING AND FRAME TO BS EN 124).
17. DRAINS WITHIN AREAS OF MADE GROUND TO BE CONSTRUCTED BY FIRST MAKING UP THE AREA TO APPROXIMATE FINISHED LEVEL AND THEN EXCAVATING THROUGH THE FILL MATERIAL INTO UNDISTURBED GROUND. THE DRAIN TRENCH IS THEN TO BE BACKFILLED TO FORMATION LEVEL USING SUITABLE GRANULAR FILL MATERIAL. WELL COMPACTED IN LAYERS NOT EXCEEDING 225mm.
18. CONCRETE PROTECTION TO PIPES WHERE DEPTH OF PIPE FROM GROUND LEVEL TO BARREL IS <0.35m WITHIN NON-TRAFFICKED AREAS; <0.5m WITHIN DOMESTIC DRIVEWAYS; <0.9m PARKING AREAS; AND <1.2m WITHIN THE PUBLIC HIGHWAY , OTHERWISE SEWERS TO BE LAID IN CLASS S BEDDING (150mm GRANULAR BED & SURROUND).
19. SEWERS MUST HAVE 5m CLEARANCE FROM TREES AND HEDGES.
20. BEDDING AND BACKFILL TO CONFORM TO THE REQUIREMENT OF THE WATER INDUSTRY SPECIFICATION 4-08-02 (TABLE A2).
21. THE CHAMBER SIZE OF MANHOLES WITH MORE THAN ONE CONNECTION MAY NEED TO BE INCREASED AN INCREMENT TO ACCOMMODATE THE CONNECTIONS AND BENDS.
22. THE POSITIONS OF SVP'S, STUB-STACKS, WC OUTLETS AND RAINWATER DOWNPIPES ARE TO BE ACCURATELY LOCATED FROM THE ARCHITECTS DRAWINGS.
23. CATCHPIT CHAMBERS ARE REQUIRED TO HAVE A MINIMUM 300mm SUMP.

KEY

- PROPOSED SURFACE WATER MANHOLE
- PROPOSED FOUL MANHOLE
- PROPOSED COMBINED MANHOLE
- EXISTING COMBINED MANHOLE TBC
- PROPOSED SURFACE WATER SEWER
- PROPOSED FOUL SEWER
- EXISTING COMBINED SEWER TBC
- ACO CHANNEL
- G GULLY
- 78.90 PROPOSED LEVELS

ITEM	RECOMMENDATION
1. EXCAVATION ADJACENT TO BOUNDARIES	CARE TO BE TAKEN WITH DEEP EXCAVATIONS IN ORDER TO PREVENT SIDEWALL COLLAPSE / SLIPPAGE. CONTRACTOR TO PROVIDE METHOD STATEMENTS WHERE NECESSARY. EXCAVATIONS TO BE SAFELY CORDONED OFF AND ENSURE SAFE PEDESTRIAN AND VEHICLE ACCESS IS MAINTAINED TO ADJACENT BUILDINGS. ENSURE EXCAVATIONS/PLANT AND MACHINERY ARE MADE SECURE OUTSIDE WORKING HOURS TO PREVENT INJURY TO THE PUBLIC.
2. CONSTRUCTING NEW M.H'S AND ALTERATIONS TO EXISTING MANHOLES	CONTRACTOR TO PROVIDE METHOD STATEMENT FOR SAFE CONSTRUCTION WHEN WORKING IN CONFINED SPACES. ALL PERSONNEL AFFECTED TO BE TRAINED AND BRIEFED ON THE RELEVANT METHOD STATEMENT.
3. PLACING AND HANDLING CUT AND BENT REINFORCEMENT	CONTRACTOR TO ENSURE WEIGHTS OF MATERIALS ARE INLINE WITH CURRENT REGULATIONS. NO PROJECTING BARS DETAILED. LENGTH OF BARS LIMITED TO MANAGEABLE SECTIONS.
4. EXCAVATION NEAR TO EXISTING SERVICES.	NEW CAVITY WALL LEAVES TO BE CONSTRUCTED SIMULTANEOUSLY THROUGHOUT CONSTRUCTION TO REDUCE RISK OF COLLAPSE AND PREVENTS EXPOSURE OF PROTRUDING WALL TIES. WALLS TO BE CONSTRUCTED IN SUITABLE LIFTS TO MAINTAIN FRESH MORTAR STABILITY. ISSUE AVAILABLE SERVICE RECORDS TO THE CONTRACTOR.
5. WORKING NEAR TO LIVE TRAFFIC.	CONTRACTOR TO PROVIDE METHOD STATEMENT FOR TRAFFIC MANAGEMENT/TEMPORARY WORKS. CONTRACTOR TO PROVIDE APPROPRIATE PROTECTION BARRIERS IF REQUIRED. WORKERS TO WEAR HIGH VISIBILITY CLOTHING TO AVOID BEING STRUCK BY PASSING VEHICLES OR PLANT.
6. GENERAL PUBLIC; EXISTING RESIDENTS; OR CHILDREN ON SITE.	ENSURE THAT THE SITE IS PROPERLY SECURE TO PREVENT INJURY FROM SLIPS, TRIPS, FALLS, FALLING FROM HEIGHT, UNCOVERED MANHOLES/TRENCHES. PROVIDE ADVANCE WARNING TO RESIDENTS REGARDING THE START OF CONSTRUCTION. IDENTIFY DIVERSIONS TO PUBLIC RIGHTS OF WAY, ESTABLISHED AND CLEARLY SIGNED IF REQUIRED.
7. NOISE, DUST AND VIBRATION RESULTING FROM CONSTRUCTION WORKS	METHOD STATEMENT TO BE PROVIDED. SITE STAFF TO BE PROVIDED WITH APPROPRIATE PPE. WORK MAY HAVE TO BE UNDERTAKEN AT SPECIFIC TIMES IN SENSETIVE AREAS TO MINIMISE DISRUPTION TO ADJACENT PROPERTIES.
8.0 WORKING NEAR WATER	CONTRACTOR TO PROVIDE DETAILED METHOD STATEMENT IN ACCORDANCE WITH THE APPROVED LAND DRAINAGE CONSENT, TO ENSURE SAFE WORKING ARRANGEMENTS AROUND AREAS OF OPEN OR FLOWING WATER; AND TO ENSURE THAT SUITABLE SITE OPERATION PROCEDURES ARE IN PLACE TO ELIMINATE THE RISK OF POLLUTION TRANSFER TO THE WATER ENVIRONMENT FROM PLANT & SITE MATERIALS.

SAFETY HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARDS, RISKS NORMALLY ASSOCIATED WITH THE TYPE OF CONSTRUCTION WORK OR RELATED STRUCTURAL WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING SIGNIFICANT RISKS AND INFORMATION.

RISKS LISTED HERE ARE SIGNIFICANT, AND ASSOCIATED WITH THE CONSTRUCTION WORK OR RELATED STRUCTURAL WORK.

HAZARDOUS SUBSTANCE - SKIN CONTACT WITH HOT BITUMEN AND CONTENTIOUS

DUST - AIRBORNE DUST PARTICLES FROM GRANULAR SUB BASE AND CUTTING OF CONCRETE .

PUBLIC - STRUCK BY MOVING PLANT.

FOR INFORMATION RELATING TO END USE, MAINTENANCE DEMOLITION, SEE HEALTH AND SAFETY FILE.

IT IS ASSUMED THAT ALL WORK WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT.

THE TABLE BELOW IDENTIFIES IN MORE DETAIL THE POTENTIAL RISKS ASSOCIATED WITH DIFFERENT TASKS

REVISION	COMMENT	DATE	BY
..	..	..	..

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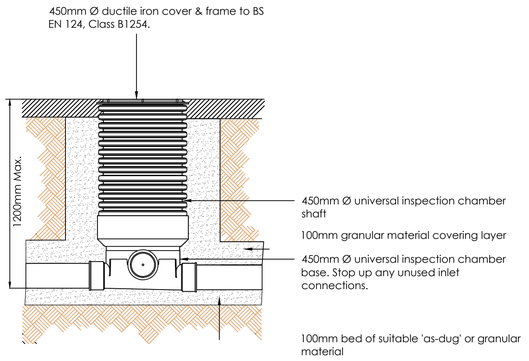
Stanton Andrews Architects

Walkin Square, Clitheroe

Proposed Drainage Layout Surface Water

DRAWING REFERENCE: 2016 - 128 -01

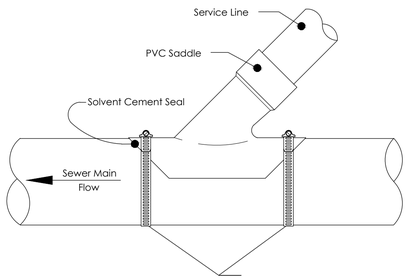
DATE: 28.01.17
DRAWN BY: CV
SCALE: 1:100
SIZE: A1
REVISION: /



Inlet/Outlet & 4 branch connections for 100Ø pipes
Inlet/Outlet & 2 branch connections for 150Ø pipes
Note: Chambers in lightly trafficked areas to have to have 150mm ST4 concrete surround.

Typical Polypropylene Inspection Chamber Max. 1.2m Deep
Scale 1:20

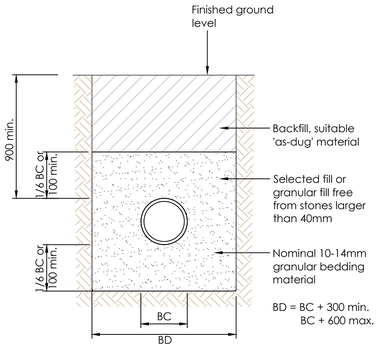
(for use in soft areas, driveways and parking bays only)



PVC Main

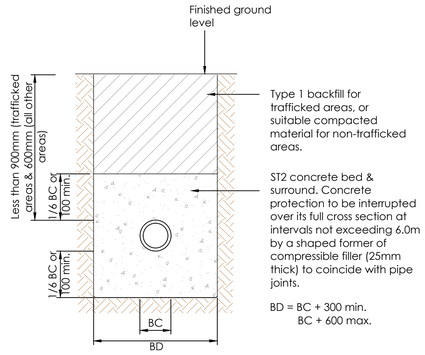
Notes:
1) PVC solvent cement shall be used for saddle.
2) Truss saddle shall be used with truss pipe.
3) li-line WYE fitting to be provided with new construction.

Saddle Connection
Scale 1:10



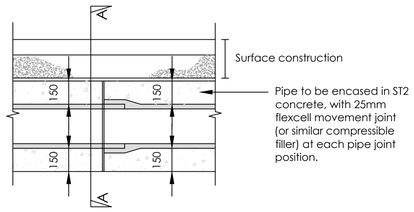
Typical Trench Detail
Scale 1:10

NOTE: To be used where cover depth:
- >0.6m fields & gardens
- >0.9m lightly trafficked areas e.g. light roads & drives



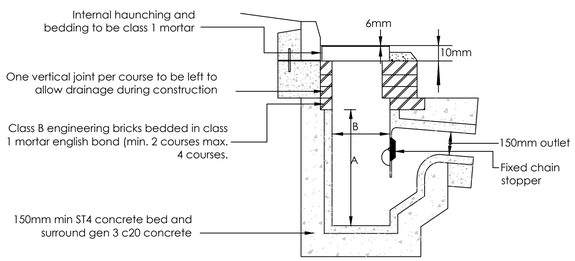
Shallow Trench Detail
Scale 1:10

NOTE: To be used where cover depth:
- <0.6m fields & gardens
- <0.9m lightly trafficked areas e.g. light roads & drives



Joints for Concrete Encased Pipes
Scale 1:10

Typical Catch Pit
Scale 1:20



Gully grated to be BS EN 124 class 250.

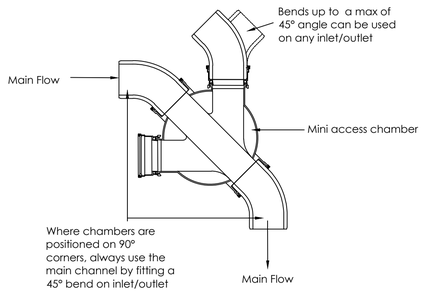
Ductile iron with captive hinge size 325 x 312mm clear opening.

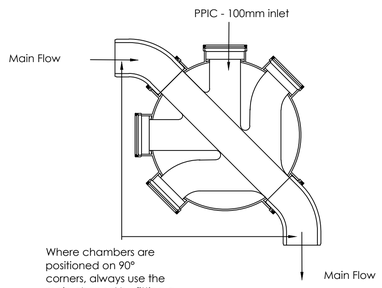
Pedestrian friendly mesh type gravel to be fitted in shared access ways.

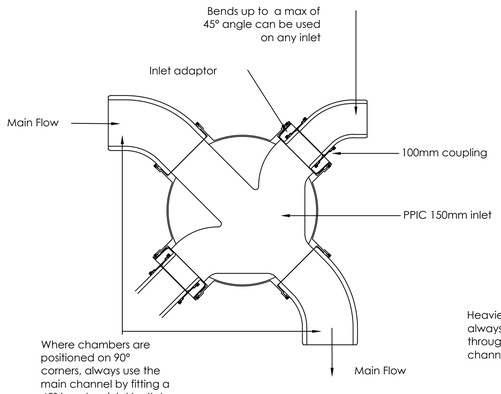
Gully Dimensions:
A = 750mm B = 375mm

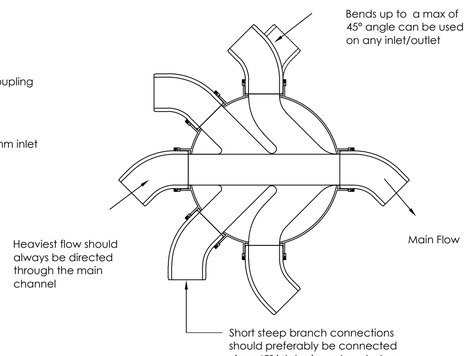
Trapping p.conc gully pot to BS 5911 PA4-2

Pre-Cast Concrete Road Gully (1:20)

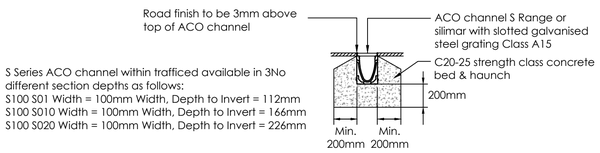








Mini Access Chamber & PPIC Installation Details
Scale 1:10



S Series ACO channel within trafficed available in 3No different section depths as follows:
S100 S01 Width = 100mm Width, Depth to Invert = 112mm
S100 S010 Width = 100mm Width, Depth to Invert = 166mm
S100 S020 Width = 100mm Width, Depth to Invert = 226mm

Typical Aco Channel
Scale 1:20

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10. BACKFILLING OF DRAIN TRENCHES ADJACENT TO DWELLINGS OR OTHER STRUCTURES TO BE IN ACCORDANCE WITH BS EN 1610 (1998).
11. ACCESS FITTINGS & INSPECTION CHAMBERS <1.2m DEEP ARE TO BE CLAYWARE OR PRE-FORMED POLYPROPYLENE AS APPROPRIATE TO THE NUMBER OF CONNECTIONS. POLYPROPYLENE CHAMBERS CAN BE USED UP TO 3.0m DEEP BUT REQUIRE A MAX 350mm DIAMETER REDUCED COVER TO PREVENT MAN ENTRY. INSPECTION CHAMBER SIZES ARE TO BE CONSTRUCTED IN ACCORDANCE WITH BS EN 752 (2008).
12. MANHOLE CHAMBERS ARE TO BE OF PRECAST CONCRETE CONSTRUCTION WITH 150mm INSITU CONCRETE SURROUND WITH A CLEAR OPENING OF 600mm.
13. COVER LEVELS INDICATED ON THE DRAWING OR WITHIN THE MANHOLE SCHEDULE ARE NOMINAL AND MAY BE ADJUSTED TO SUIT FINISHED LEVELS AS NECESSARY. INSPECTION CHAMBER COVERS SHOULD BE GRADE A15 FOR PEDESTRIAN AREAS ONLY; B125 FOR AREAS WITH OCCASIONAL VEHICLE ACCESS; AND D400 WITHIN THE PUBLIC HIGHWAY.
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15. ANY EXISTING LAND DRAINS SEVERED BY SITE OPERATIONS SHOULD BE DIVERTED AROUND ANY PROPERTIES/BUILDINGS AND RECONNECTED TO THE EXISTING LAND DRAINAGE SYSTEM VIA A SILT TRAP.
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17. DRAINS WITHIN AREAS OF MADE GROUND TO BE CONSTRUCTED BY FIRST MAKING UP THE AREA TO APPROXIMATE FINISHED LEVEL AND THEN EXCAVATING THROUGH THE FILL MATERIAL INTO UNDISTURBED GROUND. THE DRAIN TRENCH IS THEN TO BE BACKFILLED TO FORMATION LEVEL USING SUITABLE GRANULAR FILL MATERIAL, WELL COMPACTED IN LAYERS NOT EXCEEDING 225mm.
18. CONCRETE PROTECTION TO PIPES WHERE DEPTH OF PIPE FROM GROUND LEVEL TO BARREL IS <0.35m WITHIN NON-TRAFFICKED AREAS; <0.5m WITHIN DOMESTIC DRIVEWAYS; <0.9m PARKING AREAS; AND <1.2m WITHIN THE PUBLIC HIGHWAY , OTHERWISE SEWERS TO BE LAID IN CLASS S BEDDING (150mm GRANULAR BED & SURROUND).
19. SEWERS MUST HAVE 5m CLEARANCE FROM TREES AND HEDGES.
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21. THE CHAMBER SIZE OF MANHOLES WITH MORE THAN ONE CONNECTION MAY NEED TO BE INCREASED AN INCREMENT TO ACCOMMODATE THE CONNECTIONS AND BENDS.
22. THE POSITIONS OF SVP'S, STUB-STACKS, WC OUTLETS AND RAINWATER DOWNPIPES ARE TO BE ACCURATELY LOCATED FROM THE ARCHITECTS DRAWINGS.
23. CATCHPIT CHAMBERS ARE REQUIRED TO HAVE A MINIMUM 300mm SUMP.

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..	..	..	..

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CLIENT:	Stanton Andrews Architects
PROJECT:	Walkin Square, Clitheroe
DRAWING TITLE:	Drainage Details Sheet 1 of 2
DRAWING REFERENCE:	2016 - 128 -02
DATE:	28.01.17
DRAWN BY:	CV
SCALE:	AS SHOWN
SIZE:	A1
REVISION:	/

Extract from Table A2 WIS 4-08-02

Processed granular bedding & sidefill materials for flexible pipes

Pipe nominal bore (mm) (see note D)	Nominal Maximum particle size (mm)	Materials specified in British Standards (see note A)
100	10	10mm nominal single size
Over 100 to 150	15	10 or 14mm nominal single size or 14mm to 5mm graded
Over 150 to 300	20	10-14mm or 20mm nominal single size or 14-5mm graded or 20-5mm graded
Over 300 to 500	20	14 or 20mm nominal single size or 14-5mm graded or 20-5mm graded
Over 500	40	14 or 20mm or 40mm nominal single size or 14-5mm graded or 20-5mm graded or 40-5mm graded

Notes:
- A. Processed granular materials to include aggregates and air cooled blast furnace slag to BS EN 12620:220 + A1:2008; and lightweight aggregates to BS EN 13101:2002.
- B. -
- C. For the purpose of this table, PE pipe of 630mm OD can be regarded as having nominal bores of over 550mm, irrespective of wall thickness.
- D. Nominal bore is used in preference to DN because of the different nominal size classifications for flexible pipes.

Minimum Recommended Trench Widths for Structured Wall Pipes in Poor Ground Conditions.

Native soil modulus between 3 & 4 MPA
Typical soil Classifications: Very loose gravel, loose sand, medium dense clayey silty sand, firm clay

Nominal pipe diameter (mm)	150	225	300	375	450	525	600	750	900
Minimum trench width (mm)*	450	525	600	750	900	1050	1200	1500	1800

* A vertical trench face has been assumed to allow a modulus of 7MPA to be achieved for the pipe bedding and sidefill material.

Other assumed values:
Depth of cover = 6m (max)
Traffic loading = main road
Pipe stiffness = SN8

Note: Where the native soil modulus is below 3MPA or the depth of cover exceeds 6m, guidance should be sought from the pipe manufacturer regarding structural design and installation details.

MIN. DIMENSIONS FOR ACCESS FITTINGS & INSPECTION CHAMBERS					
TYPE	DEPTH TO INVERT FROM COVER LEVEL (m)	INTERNAL SIZES		COVER SIZES	
		RECTANGULAR LENGTH & WIDTH	CIRCULAR DIAMETER	RECTANGULAR LENGTH & WIDTH	CIRCULAR DIAMETER
RODDING EYE		AS DRAIN BUT MIN. 100mm			SAME SIZE AS PIPE (SEE NOTE 1)
ACCESS FITTINGS					
SMALL 150Ø 150x100	0.6 OR LESS, EXCEPT WHERE SITUATED IN A CHAMBER	150x100	150	150x100 (SEE NOTE 1)	SAME SIZE AS ACCESS FITTING
LARGE 225x100		225x100	225	225x100 (SEE NOTE 1)	
INSPECTION CHAMBER					
SHALLOW	0.6 OR LESS	225x100	190 (SEE NOTE 2)		190 (SEE NOTE 1)
	1.2 OR LESS	450x450	450	MIN. 430x430	430
DEEP	>1.2 BUT <3.0	450x450	450	MAX. 300x300 (SEE NOTE 3)	ACCESS RESTRICTED TO MAX. 350 (SEE NOTE 3)

NOTES:
1. THE CLEAR OPENING MAY BE REDUCED BY 20mm IN ORDER TO PROVIDE PROPER SUPPORT FOR THE COVER & FRAME.
2. DRAINS UP TO 150mm
3. A LARGER CLEAR OPENING MAY BE USED IN CONJUNCTION WITH RESTRICTED ACCESS. THE SIZE IS RESTRICTED FOR HEALTH & SAFETY REASONS TO DETER ENTRY.

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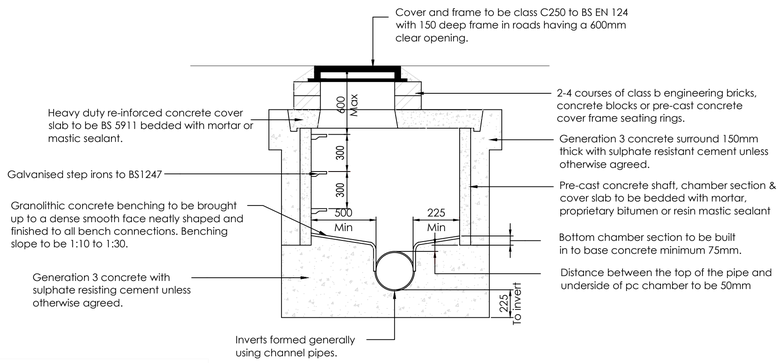
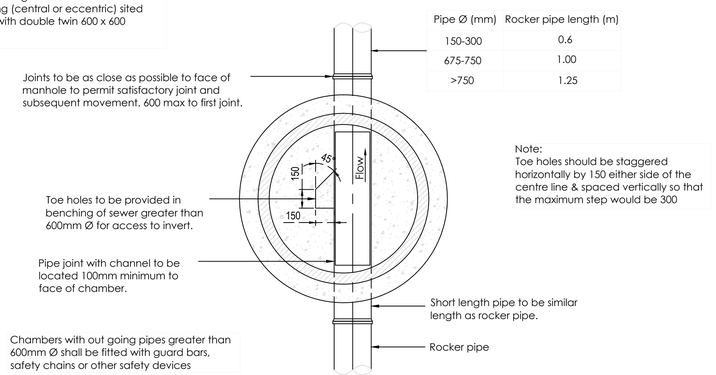


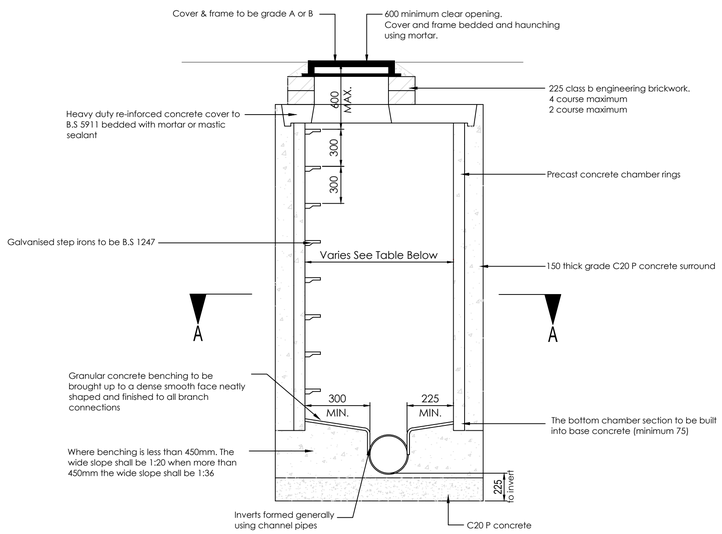
Note:
Manholes less than 1.5m to soffit with 1500Ø chamber size or larger should have a 1200 x 675mm opening (central or eccentric) sited over channel with double twin 600 x 600 covers.



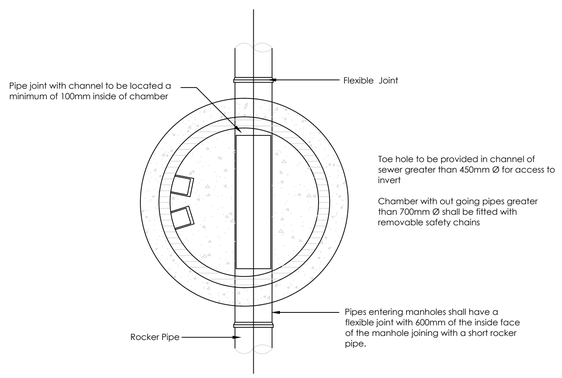
Pipe Ø (mm)	Rocker pipe length (m)
150-300	0.6
675-750	1.00
>750	1.25

Note:
Toe holes should be staggered horizontally by 150 either side of the centre line & spaced vertically so that the maximum step would be 300

Type B1/E Shallow Manhole
Depth of Cover To Pipe
1-1.5m
Scale 1:25



Type B Manhole Detail (1.35m - 3m Deep)
(with Step Irons)
Scale 1:25



Section A-A
Scale 1:25

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CLIENT:	Stanton Andrews Architects
PROJECT:	Walkin Square, Clitheroe
DRAWING TITLE:	Drainage Details Sheet 2 of 2
DRAWING REFERENCE:	2016 - 128 -03
DATE:	28.01.17
DRAWN BY:	CV
SCALE:	AS SHOWN
SIZE:	A1
REVISION:	/

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	Add Flow / Climate Change (%)	0
M5-60 (mm)	20.200	Minimum Backdrop Height (m)	0.200
Ratio R	0.262	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	150	Min Design Depth for Optimisation (m)	1.200
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	1.00
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500
Volumetric Runoff Coeff.	0.750		

Designed with Level Soffits

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	5.000	0.050	100.0	0.039	4.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	2.000	0.020	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	38.000	0.076	500.0	0.049	0.00	0.0	0.600	o	1200	Pipe/Conduit	
2.000	37.000	3.700	10.0	0.017	4.00	0.0	0.600	o	150	Pipe/Conduit	
2.001	17.000	0.170	100.0	0.015	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	5.000	0.050	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	47.98	4.08	74.794	0.039	0.0	0.0	0.0	1.00	17.8	5.1
1.001	47.85	4.12	74.744	0.039	0.0	0.0	0.0	1.00	17.8	5.1
1.002	46.40	4.50	72.176	0.088	0.0	0.0	0.0	1.67	1884.5	11.1
2.000	47.55	4.19	77.020	0.017	0.0	0.0	0.0	3.20	56.6	2.2
2.001	46.48	4.47	73.320	0.032	0.0	0.0	0.0	1.00	17.8	4.0
1.003	46.10	4.58	72.100	0.120	0.0	0.0	0.0	1.00	17.8	15.0

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	77.900	3.106	Open Manhole	1200	1.000	74.794	150				
S2	77.900	3.156	Open Manhole	1200	1.001	74.744	150	1.000	74.744	150	
S3	77.900	5.724	Open Manhole	2100	1.002	72.176	1200	1.001	74.724	150	1498
S4	77.700	0.680	Open Manhole	600	2.000	77.020	150				
S5	74.500	1.180	Open Manhole	1200	2.001	73.320	150	2.000	73.320	150	
S6	74.500	2.400	Open Manhole	2100	1.003	72.100	150	1.002	72.100	1200	
								2.001	73.150	150	1050
	74.500	2.450	Open Manhole	0		OUTFALL		1.003	72.050	150	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	150	S1	77.900	74.794	2.956	Open Manhole	1200
1.001	o	150	S2	77.900	74.744	3.006	Open Manhole	1200
1.002	o	1200	S3	77.900	72.176	4.524	Open Manhole	2100
2.000	o	150	S4	77.700	77.020	0.530	Open Manhole	600
2.001	o	150	S5	74.500	73.320	1.030	Open Manhole	1200
1.003	o	150	S6	74.500	72.100	2.250	Open Manhole	2100

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	5.000	100.0	S2	77.900	74.744	3.006	Open Manhole	1200
1.001	2.000	100.0	S3	77.900	74.724	3.026	Open Manhole	2100
1.002	38.000	500.0	S6	74.500	72.100	1.200	Open Manhole	2100
2.000	37.000	10.0	S5	74.500	73.320	1.030	Open Manhole	1200
2.001	17.000	100.0	S6	74.500	73.150	1.200	Open Manhole	2100
1.003	5.000	100.0		74.500	72.050	2.300	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.003		74.500	72.050	0.000	0	0

Simulation Criteria for Storm

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

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	20.200	Cv (Summer)	0.750
Return Period (years)	1	Ratio R	0.262	Cv (Winter)	0.840
Region	England and Wales	Profile Type	Summer	Storm Duration (mins)	30

Online Controls for Storm

Hydro-Brake Optimum® Manhole: S6, DS/PN: 1.003, Volume (m³): 49.2

Unit Reference	MD-SHE-0099-6300-2400-6300	Sump Available	Yes
Design Head (m)	2.400	Diameter (mm)	99
Design Flow (l/s)	6.3	Invert Level (m)	72.100
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	150
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.400	6.3	Kick-Flo®	0.883	4.0
Flush-Flo™	0.435	4.9	Mean Flow over Head Range	-	4.9

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.2	0.800	4.4	2.000	5.8	4.000	8.0	7.000	10.4
0.200	4.5	1.000	4.2	2.200	6.0	4.500	8.5	7.500	10.8
0.300	4.8	1.200	4.6	2.400	6.3	5.000	8.9	8.000	11.1
0.400	4.9	1.400	4.9	2.600	6.5	5.500	9.3	8.500	11.5
0.500	4.9	1.600	5.2	3.000	7.0	6.000	9.7	9.000	11.8
0.600	4.8	1.800	5.5	3.500	7.5	6.500	10.1	9.500	12.1

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 20.200 Cv (Summer) 0.750
Region England and Wales Ratio R 0.263 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 1.0 DTS Status ON Inertia Status OFF
Analysis Timestep Fine DVD Status OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	40, 40, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
1.000	S1	15 Summer	1	+40%	30/15 Summer				74.870	-0.074	0.000	0.51
1.001	S2	15 Summer	1	+40%	30/15 Summer				74.834	-0.060	0.000	0.66
1.002	S3	60 Winter	1	+40%					72.440	-0.936	0.000	0.01
2.000	S4	15 Winter	1	+40%					77.043	-0.127	0.000	0.06
2.001	S5	15 Winter	1	+40%	100/15 Summer				73.378	-0.092	0.000	0.32
1.003	S6	60 Winter	1	+40%	1/15 Summer				72.440	0.190	0.000	0.35

PN	US/MH Name	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1		7.2	OK	
1.001	S2		7.2	OK	
1.002	S3		8.1	OK	
2.000	S4		3.1	OK	
2.001	S5		5.3	OK	
1.003	S6		4.9	SURCHARGED	

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 20.200 Cv (Summer) 0.750
Region England and Wales Ratio R 0.263 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 1.0 DTS Status ON Inertia Status OFF
Analysis Timestep Fine DVD Status OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	40, 40, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
1.000	S1	15 Winter	30	+40%	30/15 Summer				75.022	0.078	0.000	1.24
1.001	S2	15 Winter	30	+40%	30/15 Summer				74.944	0.050	0.000	1.58
1.002	S3	120 Winter	30	+40%					72.918	-0.458	0.000	0.01
2.000	S4	15 Winter	30	+40%					77.057	-0.113	0.000	0.14
2.001	S5	15 Winter	30	+40%	100/15 Summer				73.428	-0.042	0.000	0.87
1.003	S6	120 Winter	30	+40%	1/15 Summer				72.918	0.668	0.000	0.35

PN	US/MH Name	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1		17.3	SURCHARGED	
1.001	S2		17.1	SURCHARGED	
1.002	S3		13.2	OK	
2.000	S4		7.6	OK	
2.001	S5		14.4	OK	
1.003	S6		4.9	SURCHARGED	

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

Simulation Criteria

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

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	M5-60 (mm)	20.200	Cv (Summer) 0.750
Region	England and Wales		Ratio R	0.263	Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 1.0 DTS Status ON Inertia Status OFF
Analysis Timestep Fine DVD Status OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	40, 40, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
1.000	S1	15 Winter	100	+40%	30/15 Summer				75.125	0.181	0.000	1.59
1.001	S2	15 Winter	100	+40%	30/15 Summer				74.995	0.101	0.000	2.02
1.002	S3	120 Winter	100	+40%					73.273	-0.103	0.000	0.01
2.000	S4	15 Winter	100	+40%					77.063	-0.107	0.000	0.18
2.001	S5	15 Winter	100	+40%	100/15 Summer				73.504	0.034	0.000	1.09
1.003	S6	120 Winter	100	+40%	1/15 Summer				73.273	1.023	0.000	0.35

PN	US/MH Name	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1		22.2	SURCHARGED	
1.001	S2		21.9	SURCHARGED	
1.002	S3		17.3	OK	
2.000	S4		9.9	OK	
2.001	S5		18.0	SURCHARGED	
1.003	S6		4.9	SURCHARGED	