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BASE Manchester Science Park Supplementary Flood Risk Assessment	
Client:	
Bruntwood SciTech Limited	

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**Manchester Science Park
BASE Building**

Greenheys Lane

Supplementary Flood Risk Assessment

**384288E, 396140N
Postcode M15 6GZ**

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1.0 Introduction

The existing Base Building at Manchester Science Park is to be demolished and a new building constructed. The site is bounded to the East by Greenheys Lane and to the West by Rutherford House.

This report is intended as a supplementary / local update on the previously approved Flood Risk Assessment issued for the Bright Building in 2014/2015 and considers potential flood risk from all sources and the surface water aspects of the proposals.

2.0 Executive Summary

The new BASE building includes an access road with limited car parking together with extensive areas of soft and hard landscaping. It will also include a large cycle store.

The proposed building, roadway and hard landscaping will have more 'hard' surfaced area than existing but surface water runoff rates from the site will not increase.

All foul and surface water from the existing site discharge to the adopted combined sewer in Greenheys Lane.

The proposed BASE Building site and public realm area are within "Flood-zone 1"; above the 1 in 1000 year risk levels from the Corn Brook river culvert which flows underground alongside Greenheys Lane, as advised by The Environment Agency

Sustainable drainage options have been considered but due to the underlying strata, no type of infiltration methods are feasible. Therefore, subject to agreement, as a minimum the surface water run-off from the site will be reduced by 50% from existing or will be taken down to greenfield run-off values.

New foul and surface water drainage will be via separate systems within the site. Foul water will connect into the existing Adopted Combined public sewer within the site.

Surface water will have flows restricted by at least 50% from the existing OR will be restricted to 'greenfield' flows of 5.2 l/s system at a flow rate to be agreed with United Utilities or the riparian owners of Corn Brook where it passes along Greenheys Lane.

Surface water flows from the site will be restricted by a flow restrictor with water attenuation provided with underground storage crates.

Surface water discharge is subject to gaining approval from the riparian owners of Corn Brook as the culvert passes under the buildings to the far side of Greenheys Lane and access to it for discharge may be either not possible or not granted. However, this is the preferred method of discharge and we are ongoing with seeking permission to connect. Should permission not be given to connect to the culverted Corn Brook, surface water will discharge into the existing combined sewer in Greenheys Lane, as the current system.

3.0 Existing site flood zoning and river systems

The existing site is in Manchester Science Parks ownership with car parking, access roads and footpaths and lies between Pencroft Way and the existing Williams House and Kilburn House buildings. The tarmac areas and landscaped areas are to be reorganised around the new Hub Building. Refer to Appendix A for site location.

There is an existing river system next to the site. It is the Corn Brook which is a historic watercourse and a historic map of the old Manchester watercourses is attached in Appendix E.

Corn Brook is shown on the United Utilities sewer records, contained in Appendix F, and is marked as a 'Private' surface water sewer, 3300mm width and 1805mm height next to Greenheys Lane. The Environment agency has a hydraulic river model of the Brook and risk level data has been purchased from the Agency. Risk level data is contained in Appendix C.

The risk levels have been used by the Agency to map flood risk in the area and the issued EA mapping is likely to be based on land levels derived from LIDAR aeroplane surveying. Private land surveys to Ordnance Datum are more accurate and the Agency data plus accurate survey levels have been used to accurately flood-zone the proposals sites. The overall site slopes westwards from the main MSP site towards Greenheys Lane and the Corn Brook culvert line.

The Corn Brook watercourse siphons under the Bridgwater Canal at Cornbrook and outfalls to the Manchester Ship Canal at Pomona Dock. Manchester has many culverted streams and rivers and these have even been the subject of books and papers over the years- in particular the Geoffrey Ashworth book 'The Lost Rivers of Manchester' which is no longer in print. We attach the North West Geography Society's list of historic flooding in Appendix E. The head of the brook is to the west of Ashton Old Road near to the New Smithfield Market and it can be seen in open channel at Pottery Lane in the Gorton area. Its catchment area is much more extensive as public surface water sewers connect to it. Photos of parts of Corn Brook do appear on the internet with websites such as:-

28dayslater
Goneeightyfive.com
Substormflow.blogspot.co.uk

The existing overall MSP site slopes downhill westwards with levels at Charles Halle Road of approx. 33.50m and approx. 35.40m at Lloyd Street North.

The gross area of the BASE building site is approx. 5,180m² (0.518 Ha). Refer to Appendix B for the proposed site layout.

The EA risk level data for Corn Brook gives the following risk levels for the BASE Building site. Refer to Appendix C for the EA flood data.

BASE Building - Node 3 Is on Greenheys Lane next to the site

1 in 100 year risk level – 34.09m
1 in 1000 year risk level – 34.23m

The existing ground levels at the site of the new BASE Building are approx. 35.0m and the site is therefore categorised as Flood-zone 1.

Refer to Topographical Survey in Appendix C.

4.0 Strategic Flood Risk Assessments

The Manchester SFRA documents and maps have been viewed and extracts from the User Guide and the level 2 final are attached in Appendix D. The area is a Critical Drainage Area (CDA) and as such existing run-off rates are to be reduced by 50%. The reports also stress the importance of considering and implementing sustainable urban drainage systems where possible.

5.0 Proposals and drainage and BREEAM

The proposals are for a new BASE Building to replace the existing smaller buildings and car park together with reconfiguring of soft and hard areas as attached proposals plan in Appendix B.

The BASE Building site soft landscape areas will be approx. 1,428m² and the proposals will therefore have less soft area than existing which currently has approx. 2,650m².

New drainage will be separate system and foul water will connect to the public combined system.

Surface water will be restricted to a flow rate to comply with SC030219 requirements but also in accord with the requirements of United Utilities or the riparian owners of Corn Brook. Surface water is to discharge into Corn Brook, if permission for this is granted by the riparian owners (as it passes below the buildings on the far side of Greenheys Lane) or, if permission to connect to Corn Brook cannot be obtained the surface water will discharge into the Adopted combined sewer in Greenheys Lane, as the current situation.

New surface water peak flow rates are to be limited to be well below 50% of the existing site runoff rates or a greenfield rate of approx. 5.2 litres / second, subject to approval with either United Utilities or the riparian owners of Corn Brook..

The Phase 2 site investigation has shown heavy clay soils to underly the site and therefore the use of permeable surfacing and soakaways would not be possible. Therefore, surface water storage may be needed underground utilising Versavoid or Polystorm type unit under the access road / car park area and / or under the hard landscaped boulevard.

6.0 National Planning Policy Framework and Technical Guidance

The proposals are commercial and are classed in the Technical Guidance to the National Planning Policy Framework as 'more vulnerable' in Table 2 and are 'appropriate' in Flood-zone 1 as per Table 3.

All sources of flooding risk are:-

Rivers	– Corn Brook see above
Sea	– no tidal influence
Land	– no un-drained land slopes towards the sites
Groundwater	– no springs or weep areas on site
Sewers	– no reported incidents of on-site sewer flooding
Reservoirs, canals	– no canals nearby.

The EA reservoir risk mapping shows the site as at risk from the Audenshaw reservoirs and Gorton Upper. These reservoirs are all maintained by United Utilities to a 1 in 10,000 year standard which is the high standard required by the Reservoirs Acts and Water Acts and there is little risk to the site.

Pluvial risk - see EA mapping, which is based on a 1 hour, 1 in 200 year storm with all existing drainage assumed full. There is little risk to the site.

Refer to Appendix G for risk of flooding maps for:-

Flooding from Rivers & Sea

Site is shown as being affected by river flooding but the detailed EA data confirms that the site is actually well above the 1 in 1000 year event.

Flooding from Surface Water

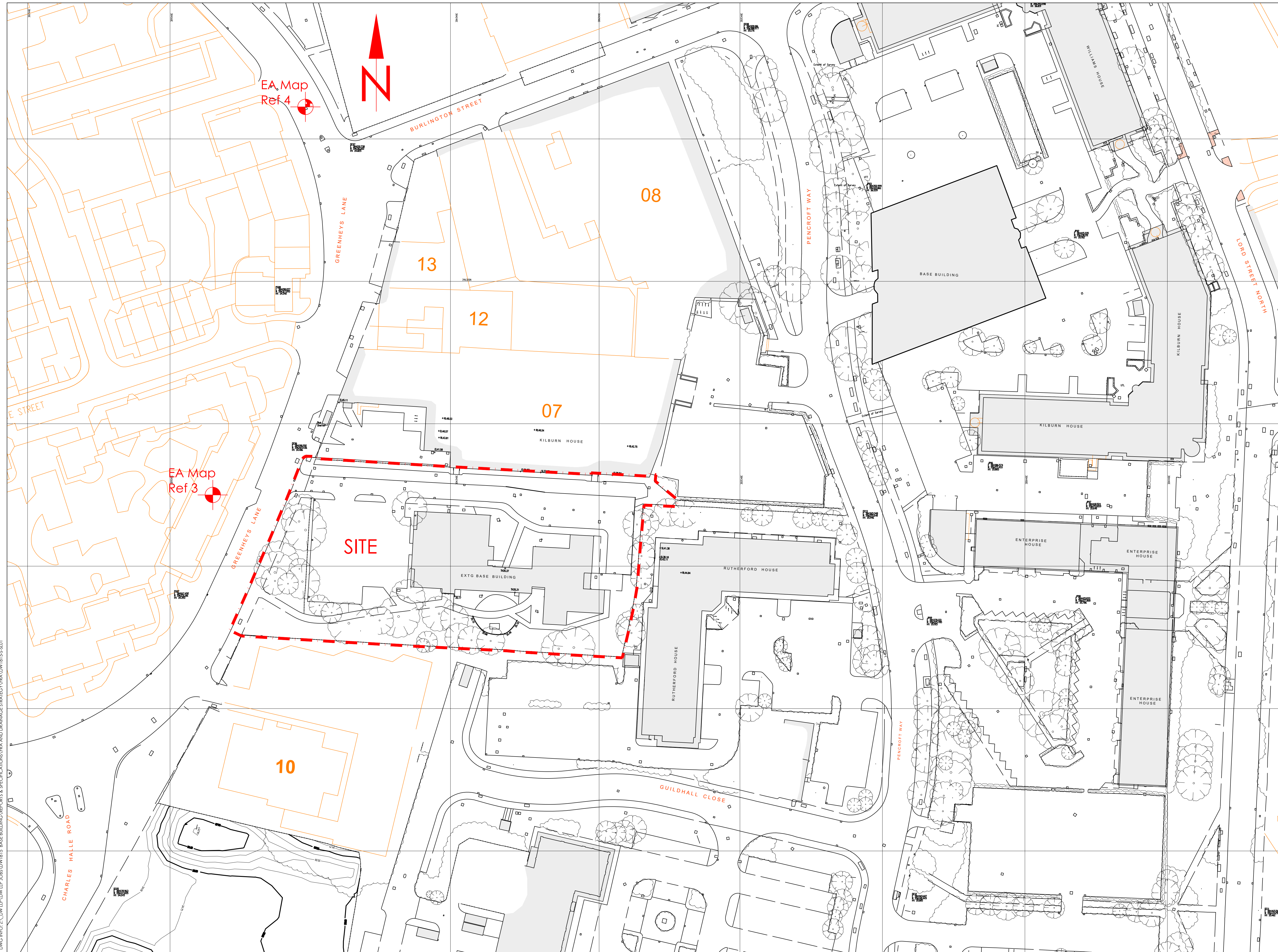
Site is not shown as being affected by Surface Water flooding.

Flooding from Reservoirs

As noted above the site is shown as being at risk but there is actually very little risk to the site.

Appendix A

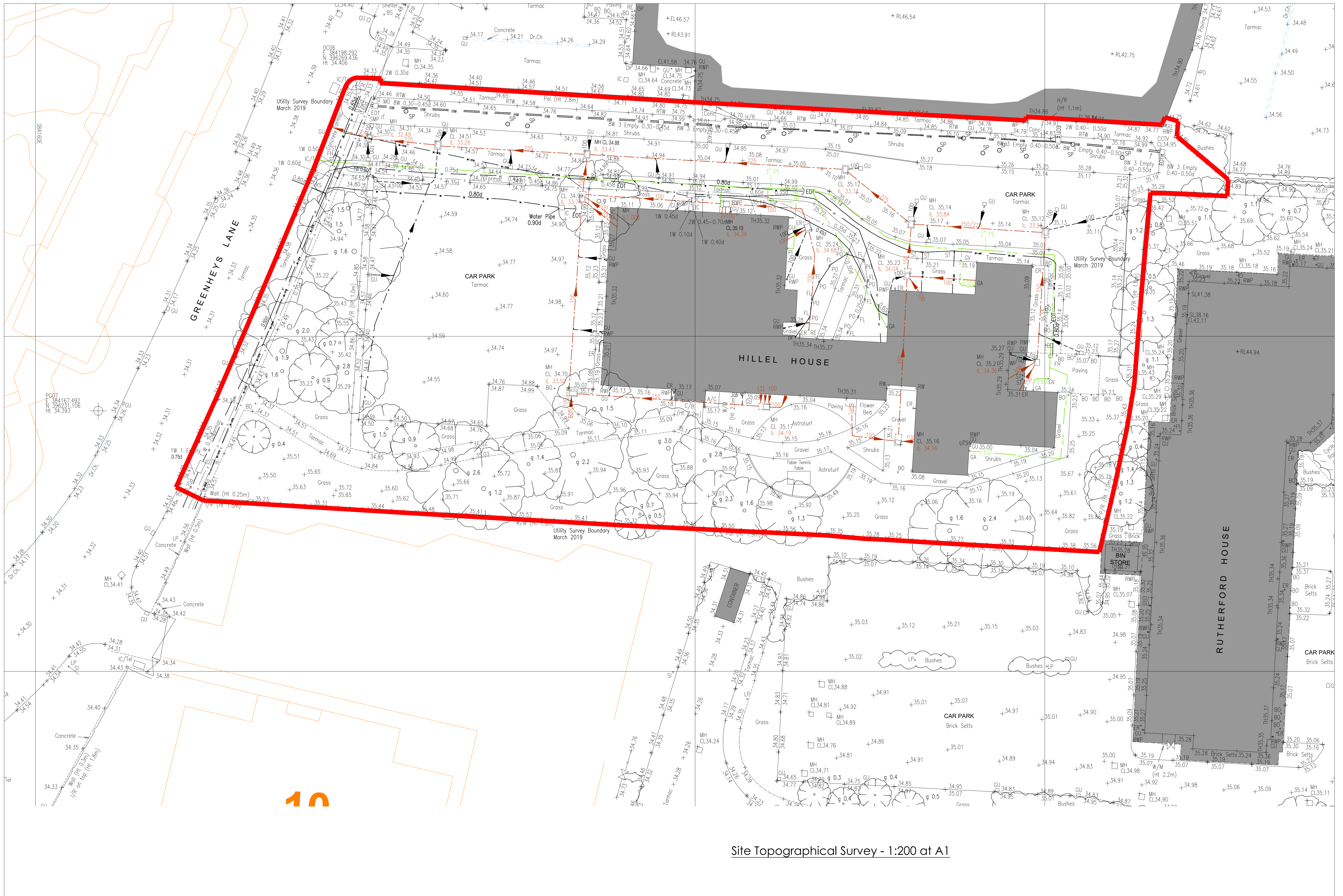
Site Location Plan



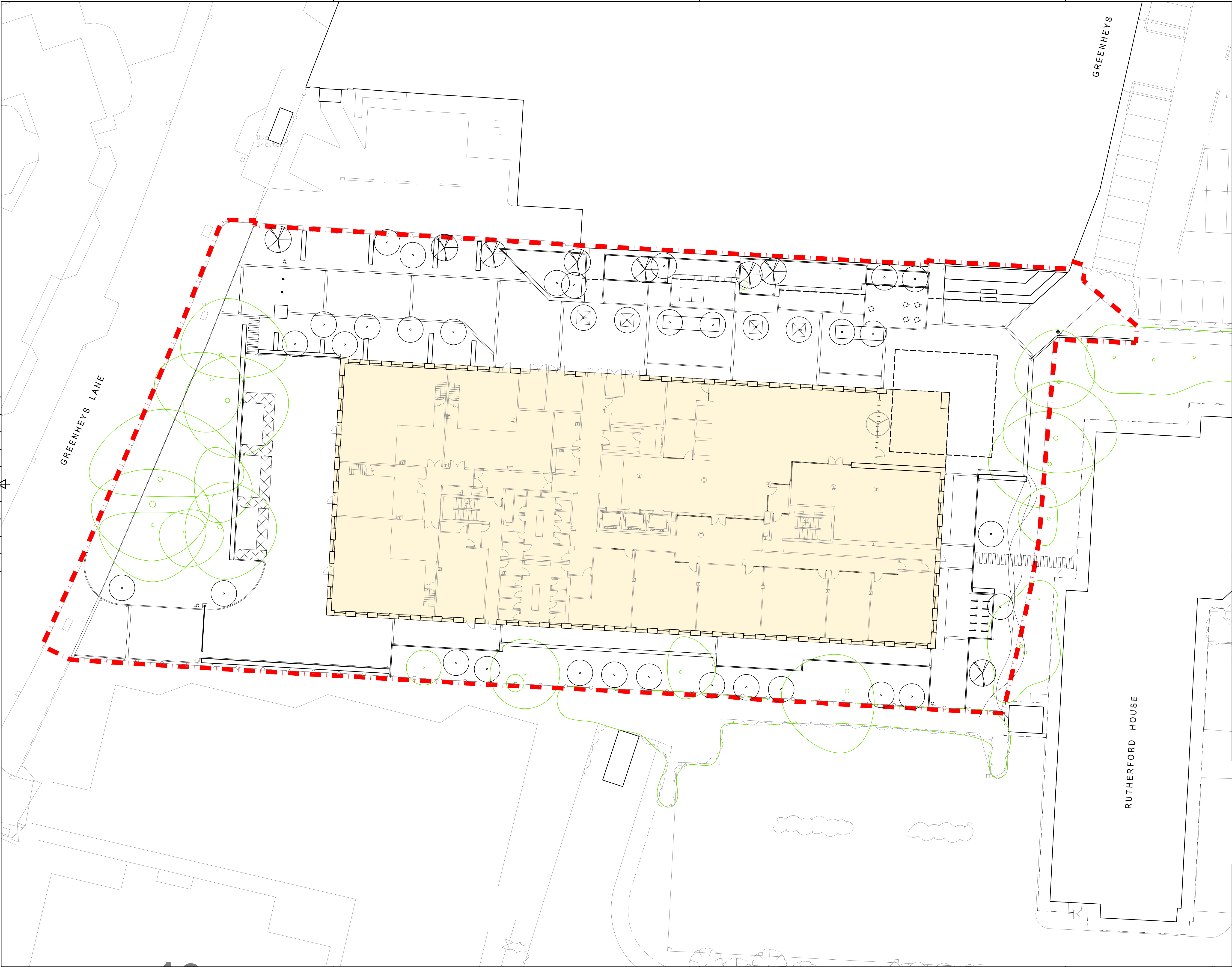
Appendix B

Existing Site Layout – Topographical Survey

Proposed Site Layout



Site Topographical Survey - 1:200 at A1



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NOTES

TO BE READ IN CONJUNCTION WITH:

- (9)-L101 - GENERAL ARRANGEMENT PLAN
- (9)-L001 - STRATEGY PLAN
- (9)-L003 - LANDSCAPE COLOUR MASTERPLAN
- (9)-L004 - PLANTING STRATEGY PLAN
- (9)-L006 - TREE CONSTRAINTS PLAN
- (9)-L301 - DETAIL AREAS SHEET 1 OF 3
- (9)-L302 - DETAIL AREAS SHEET 2 OF 3
- (9)-L303 - DETAIL AREAS SHEET 3 OF 3
- (9)-L401 - TYPICAL CONSTRUCTION DETAILS
- (9)-L402 - TYPICAL CONSTRUCTION DETAILS
- (9)-L601 - LANDSCAPE SECTIONS SHEET 1 OF 2
- (9)-L602 - LANDSCAPE SECTIONS SHEET 2 OF 2
- (9)-L701 - TREE PIT DETAILS

CZ DAW 01.08.19

FIRST ISSUE

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001 PLAN			

001

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PROJECT TITLE

**MSP BASE Building
MANCHESTER SCIENCE PARKS**

DRAWING TITLE

PROPOSED LAYOUT

PROJECT NUMBER

DRAWING NO.

REVISION

SCALE

**@ A1
1:200**

DATE

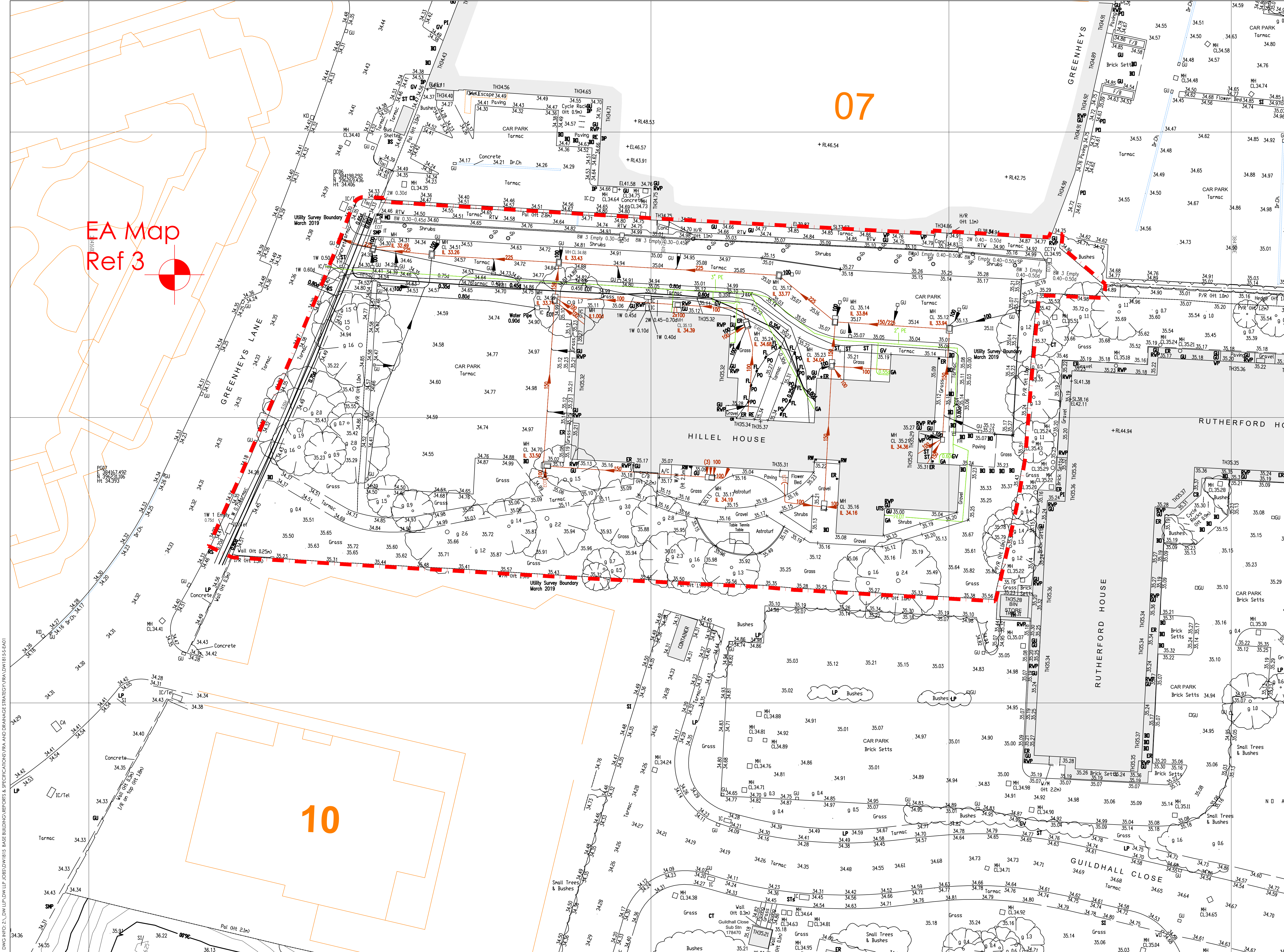
AUG '19

Appendix C

Environment Agency Flood Risk Data

DW1815-S-EA01 - Drawing indicating EA Flood Data Node Locations

EA Flood Levels Data at Node Points on Corn Brook



GENERAL NOTES

Do not scale this drawing.
Contractor to check all dimensions and report all errors and omissions to the Engineer.

Rev	Detail	By	Auth	Date

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Bruntwood SciTech

BASE Building
Manchester Science Park

Part Copy Topo Survey
Indicating EA Node Ref's

info

Project No. DW1815	Discipline S	Drawing No. EA01
Scale 1:250 at A1	Sheet Size A1	Revision
Date	Drawn	Checked

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12th March 2014

PRRSTH1897

					Undefended Levels					
Map Reference	Model Node Reference	Easting	Northing	Data	2 % AEP (1 in 50 year)	1.33 % AEP (1 in 75 year)	1 % AEP (1 in 100 year)	1 % AEP (1 in 100 year) + Climate Change*	0.5 % AEP (1 in 200 year)	0.1 % AEP (1 in 1000 year)
1	ea013_Model_CORN02_00012	384001	396008	Modelled Water Level (m aod)	33.09	33.14	33.17	33.24	33.23	33.46
				Modelled Flow (cumecs)	8.71	8.79	8.84	8.96	8.96	8.85
2	ea013_Model_CORN02_00013	384101	396118	Modelled Water Level (m aod)	33.63	33.67	33.70	33.75	33.75	33.86
				Modelled Flow (cumecs)	8.1	8.11	8.12	8.13	8.15	8.13
3	ea013_Model_CORN02_00014	384172	396260	Modelled Water Level (m aod)	33.96	34.01	34.04	34.09	34.09	34.23
				Modelled Flow (cumecs)	8.18	8.19	8.21	8.23	8.25	8.13
4	ea013_Model_CORN02_00015	384198	396369	Modelled Water Level (m aod)	34.32	34.38	34.41	34.47	34.47	34.63
				Modelled Flow (cumecs)	8.16	8.17	8.18	8.19	8.21	8.1
5	ea013_Model_CORN02_00019	384140	396511	Modelled Water Level (m aod)	34.84	34.89	34.92	34.99	34.98	35.16
				Modelled Flow (cumecs)	8.24	8.27	8.29	8.32	8.34	8.3
6	ea013_Model_CORN02_00022	384237	396664	Modelled Water Level (m aod)	35.72	35.76	35.78	35.84	35.83	35.98
				Modelled Flow (cumecs)	8.3	8.34	8.35	8.36	8.37	8.09

Model data taken from the Corn Brook 2009 study

Notes:

AEP - Annual Exceedence Probability

m aod - metres above ordnance datum

*Climate Change Scenario for fluvial only - 20% increase in flow

Appendix D

Extracts from Manchester City, Salford City & Trafford Councils –
Level 2 Hybrid SFRA Documents



JBA
consulting



Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA

USER GUIDE

**Final
May 2010**

**Trafford Council
Sale Waterside
Sale
M33 7ZF**



MANCHESTER
CITY COUNCIL

Salford City Council



TRAFFORD
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	Appendix A: Links to relevant data sources	I

accommodate such flow paths. Floor levels should always be set a minimum of 300mm above adjacent roads to reduce the consequences of any localised flooding.

3.4 Drainage for new developments

Development has the potential to cause an increase in impermeable area, an associated increase in surface water runoff rates and volumes, and a consequent potential increase in downstream flood risk due to overloading of sewers, watercourses, culverts and other drainage infrastructure. It should be borne in mind that the sewer network in places across the Greater Manchester area was designed to drain less development than exists today. Development (both planned for and urban creep such as windfall development and paving over gardens) has increased the coverage of impermeable surfaces and added flow over time and the network is known to be at capacity in many places. The frequent localised flooding experienced in many parts of Greater Manchester, and Salford in particular in this study area, is testament to this problem.

Managing surface water discharges from new development is therefore crucial in managing and reducing flood risk to new and existing development downstream. Carefully planned development can also play a role in reducing the amount of properties that are directly at risk from surface water flooding. The Planning System has a key role to play in setting standards for sustainable drainage from new developments and ensuring that developments are designed to take account of the risk from surface water flooding. Sustainable drainage plays an important part in reducing flows in the sewer network and in meeting environmental targets, alongside investment in maintenance and new capacity by United Utilities. United Utilities plan their investment on a five year rolling cycle, in consultation with key partners, including the Environment Agency.

Sustainable drainage and the use of Sustainable Drainage Systems (SUDS) is supported by the policy direction in Future Water⁸, Making Space for Water⁹, the Pitt Review¹⁰ and the Flood and Water Management Act¹¹ that provides for more sustainable management of the water cycle, working in partnership across different agencies and new responsibilities for local flood risk management. In particular, the Flood and Water Management Act requires developers to include sustainable drainage in new developments. As part of their new responsibility for local flood risk management, local authorities will be responsible for approving SUDS for new developments and adopting and maintaining them.

Recognising the above, the following order of preference is recommended for drainage from new developments :

- Infiltration
- Discharge to a watercourse
- Discharge to a public sewer

The choice of system will be determined by local ground conditions (including groundwater levels). Whilst infiltration SUDS may be the most suitable for new development, developers must consider the risk of contamination to underlying aquifers.

The guidance below should be used in addition to the Environment Agency Standing Advice¹².

3.4.1 Critical Drainage Areas

⁸ Defra (2008) *Future Water*

⁹ Defra, Department for Transport, HM Treasury and Office of the Deputy Prime Minister (2005) *Making Space for water: Taking forward a new Government strategy for flood and coastal erosion risk management in England; First Government response to the autumn 2004 Making space for water consultation exercise*

¹⁰ The Pitt Review (2008) *Learning lessons from the 2007 floods*

¹¹ Her Majesty's Stationery Office and Queen's Printer of Acts of Parliament (2010) *Flood and Water Management Act* © Crown Copyright

¹² Environment Agency. *Flood Risk Standing Advice for England - PPS25 National Version 2.0*. Can be accessed online at <http://www.environment-agency.gov.uk/research/planning/82584.aspx>

Certain locations are particularly sensitive to an increase in the rate of surface water runoff and/or volume from new development. This can be for a number of reasons, including known local flooding problems associated with these areas. These areas have been defined as Critical Drainage Areas (CDAs) in the SFRA. Specific drainage approaches are recommended in these areas to help reduce local flood risk. The SFRA has designated CDAs as high flood risk areas.

The CDAs provided in the SFRA should be refined over time as more detailed information on flood risk and local flood management assets, including sewer catchments, becomes available.

In these areas, a detailed FRA is advised for all developments over 0.5 hectares, regardless of which Flood Zone the site falls within. This should demonstrate that new development is not at risk from flooding from existing drainage systems or potential overland flow routes. It should also demonstrate that the development will not adversely affect existing flooding conditions by the use of appropriate mitigation measures. The FRA should define and address the constraints that will govern the design of the drainage system and layout of the development site.

The Environment Agency Standing Advice allows developers to screen online for the level of flood risk assessment that is appropriate for a development with regard to the PPS25 Flood Zones. This highlights the need for a FRA in Flood Zones 2 and 3 and in Flood Zone 1 where there are critical drainage problems. The Standing Advice notes that for developments in Flood Zone 1 FRA Guidance Note 1¹³ should be followed 'In areas where the Local Planning Authority has identified drainage problems through a Strategic Flood Risk Assessment or Surface Water Management Plan and they have indicated that a formal flood risk assessment is required'. FRA Guidance Note 1 requires FRAs to provide 'Proposals for surface water management that aims to not increase, and where practicable reduce the rate of runoff from the site as a result of the development (in accordance with sustainable drainage principles, and the Local Planning Authority's published SFRA)'. It is recommended that proposals for development in Critical Drainage Areas, as defined by this SFRA, follow the guidance set out below

Recommended allowable discharge rates for CDAs and other areas

All development should seek to reduce existing local flooding problems and not add to them. The AGMA authorities are currently developing drainage standards for developments within Critical Drainage Areas and for all other areas. Over time, it is envisaged that local authorities will commission drainage strategies (see below) to determine in more detail, and establish the evidence base for, set reductions in surface water runoff from development sites. These will be used to inform the incorporation of targets and standards in Development Plan Documents, supported by Supplementary Planning Documents, as appropriate.

With regard to this, the developer should liaise closely with the Environment Agency, United Utilities and the LPA as soon as possible to determine an appropriate reduction in runoff rate and volume with reference to discharge limits as laid down by any completed SWMP, drainage strategy or local development document for that area. Minimising surface water runoff rates within catchments should be the starting point for negotiations with Developers.

In the interim, and based on the technical work undertaken for the SFRA, the following guidance is provided:

- Development should aim to deliver Greenfield runoff on Greenfield sites up to a 1 in 100 year storm event, considering climate change
- Development should aim for a minimum reduction in surface water runoff rates of 50% for Brownfield sites, with an aim of reducing runoff to Greenfield rates up to a 1 in 100 year storm event, considering climate change

¹³ Environment Agency. Flood Risk Assessment (FRA) Guidance Note 1, Development Greater Than 1 Hectare (ha) in Flood Zone 1 (and Critical Drainage areas less than 1ha) Can be accessed online at <http://www.environment-agency.gov.uk/static/documents/Research/FRAGuidanceNote1.pdf>

- Development should be designed so that there is no flooding to the development in a 1 in 30 year event and so that there is no property flooding in a 1 in 100 year plus climate change event

Wherever possible, this should be achieved through the implementation of SUDS. Source control should be considered first. There may be opportunities to deliver SUDS through integrated solutions for collections of strategic sites. The future ownership and maintenance of SUDS systems should be discussed at the planning application stage with the relevant sections of the LPA (including Highways and Drainage), United Utilities and the Environment Agency. This approach should be taken unless the developer can demonstrate that this is not feasible and that there will be no adverse impact caused by the development elsewhere.

This is supported by Category 4 of the Code for Sustainable Homes, which requires developers to ensure that peak run-off rates and run-off volumes will be no greater than the pre-development conditions as a minimum. However, the code recommends that attenuation of the additional flows caused by development should be related to the degree of flood risk in an area. In 'high flooding risk areas', 100% of the additional volume should be attenuated.¹⁴ Planning Policy Statement 1¹⁵ allows local planning authorities to stipulate high levels of the code where there are local circumstances that allow and warrant it. The SFRA has designated CDAs as high flood risk areas.

The effectiveness of a flow management scheme within a single site is heavily limited by site constraints including (but not limited to) topography, geology (soil permeability), development density, existing drainage networks within the site and surrounding area, adoption issues and available area. The design, construction and ongoing maintenance regime of such a scheme must be carefully defined at an early stage and a clear and comprehensive understanding of the catchment hydrological processes (i.e. nature and capacity of the existing drainage system) is essential.

3.4.2 Integrated drainage

There is the potential for groups of development sites coming forward to share a central and integrated solution for managing surface water runoff. This is best investigated further through a SWMP or a Drainage Strategy, which may or may not be undertaken at the same time as a SWMP. A Drainage Strategy can be used to assess:

- A strategy to manage surface runoff from the development sites to control flood risk to drainage or river systems downstream.
- A strategy to manage surface runoff within development sites to manage flood risk within the development site.
- A strategy to manage flood risk in the development site from surface water runoff entering from outside the development site.

A Drainage Strategy undertaken as part of SWMP has the advantages that it is developed in partnership with others, with access to key datasets and knowledge and the opportunity to agree drainage standards, a programme for delivering any infrastructure required and long term maintenance responsibilities. New development can provide a key opportunity to reduce flood risk to existing communities and a SWMP provides the opportunity to take an overview of all local flood risk management issues in an area and plan for a mix of new drainage and retrofit measures¹⁶.

A Drainage Strategy will be required to be prepared by the developer(s) where an integrated solution is necessary, due to issues of land constraints, geology, connection to public sewers and watercourses.

Integrated solutions can provide great benefits besides water management, including providing Green Infrastructure enhancements, recreational facilities, improving biodiversity and making communities a better place to live. Where there are several sites that would

¹⁴ CLG (2006) Code for Sustainable Homes

¹⁵ CLG (2007) Planning Policy Statement: Planning and Climate Change - Supplement to Planning Policy Statement 1

¹⁶ Defra (2010) Surface Water Management Plan Technical Guidance

Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA

LEVEL 2 SFRA

Final
April 2010

Trafford Council
Sale Waterside
Sale
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River	EA model	Comments
		the Grey Irwell. Under such circumstances there could be backing up of floodwater along the Medlock and more floodwater could flow into the Bridgewater Canal. This could in turn increase flood risk along the canal, especially to the south in Trafford. Again, this highlights the importance of considering flood risk on a cross boundary basis. The River Medlock interacts with the Bridgewater Canal at Medlock Clows (where the Medlock goes into a shaft and culvert in Deansgate). This structure is prone to blockages with debris which could affect water levels upstream. The assumptions in the EA model were carried forward into the SFRA regarding flow between the River Medlock and Bridgewater Canal but further work should consider the variability of flows passing between the river and the canal.
Corn Brook	Atkins (2009) River Medlock and Corn Brook Flood Mapping Study (2D Infoworks CS)	The Environment Agency Infoworks model was converted to Infoworks SD and run using the ground model in the existing model. This produces identical outlines to the Infoworks CS model. The model extends from Railway Street, Gorton to its confluence with the Manchester Ship Canal at Pomona Docks. Key Modelling Assumptions: As in the supplied model, a free outfall to the Manchester Ship Canal is assumed for all events. Key Model Limitations: The sewer system has a finite capacity and hence combined sewer overflow inflows were not factored up for the climate change simulations. Natural catchments inflows were factored up in line with the guidance in PPS25. Urban features (buildings, kerbs, roads etc) are not represented as 'break lines' in the 2D model. This tends to result in a flood outline which is wider spread but with lower depths and velocities than if these features were represented.

2.9.2 Sequence of flooding

In a 1 in 100 year flood event considering climate change, flooding starts at Holt Town and Charles Street, before affecting Palmerston Street and the Hoyle Street Industrial Estate. Flooding would follow a similar pattern in a 1 in 1000 year flood event, but would be more extensive, with flooding overtopping the A665 Pin Mill Brow. Depending on the timing of flood peaks on the different rivers, areas downstream of the Medlock Tunnels may flood first from the Grey Irwell or the River Medlock and may suffer from two flood peaks, one from each watercourse. In such an extreme event, flooding from the Grey Irwell would be deeper and more extensive and cause the River Medlock to back up, resulting in higher flood levels upstream.

Collyhurst Road, followed by the river overtopping its left bank downstream of the confluence with Moston Brook and opposite Hargreave's Street. Flooding becomes more extensive in these areas before the river overtops its right bank onto Roger Street. In a 1 in 1000 year event, the sequence of flooding follows a similar pattern with the flow path from Roger Street extending north and westwards, affecting the Chase Street and Scotland Bridge areas.

2.10 Corn Brook

The Corn Brook drains the urban area south of the River Medlock. The brook is largely culverted and flows from Openshaw in a westerly direction, discharging into the Manchester Ship Canal at Pomona Docks. There are open lengths at the upstream reach (around 750m) and upstream of the siphon under the Bridgewater Canal (around 20m).

The Environment Agency have undertaken a recent detailed flood risk mapping study for the Corn Brook, using the Infoworks software, which is most suitable for heavily culverted watercourses and can route flow overland over a digital elevation model. The modelling shows that the following areas are at risk from flooding (reproduced from the River Medlock SFRM Report⁶):

- A small area around Thorpness Street to the south of Openshaw is at risk of flooding from a 1 in 200 year flood event;
- The depot and industrial estate near to the open channel section along Ambrose Street is at risk in an extreme 1 in 1000 year flood event;
- A depot in West Gorton and housing to the south and east of the railway lines off Bennett Street are at risk during a 1 in 20 year flood event and a school in this area is at risk in an extreme 1 in 1000 year flood event;
- Housing off Kincardine Road and to the east of the University of Manchester is at risk of flooding in a 1 in 25 year flood event. and a school in this area is at risk in a 1 in 100 year flood event;
- Housing in Hulme off Boundary Lane is at risk during a 1 in 50 year flood event; and
- In Moss Side properties to the south of Moss Lane West and to the north of Alexandra Park are at risk in an extreme 1 in 1000 year flood event.

The Infoworks model has been run for the SFRA in order to present flood depths and hazards. The flood depth and hazard maps for all scenarios are presented in the Maps Volume. Approximate flood depths and hazards are presented below. These have been extracted over large areas and for more detailed flood information, the Level 2 SFRA maps should be referred to.

⁶ Environment Agency (2009) River Medlock and Corn Brook Strategic Flood Risk Mapping Study

2.10.1 Corn Brook summary

Manchester Strategic Housing Site - West Gorton M0010

Corn Brook is culverted under the site. There will be localised flooding on the site in the 1 in 25 and 1 in 100 year events, mostly affecting Bennett Street and the depot upstream of the railway viaduct. In the 1 in 100 year flood event water will pond up to 1m deep in the Bennett Street area, with localised areas around the depot that will see flooding up to 2m deep. This will result in hazards of 'danger for most' in places. The 1 in 100 year flood event, considering climate change is significantly more extensive in this area. Flood depths will increase and the area of 'danger for most' will be more widespread.

There is significant residual risk to the site during an extreme 1 in 1000 year flood event, with extensive and deep flooding of over 2m in places in the Bennett Street area, including the depot. There will be widespread 'danger for most' in the Bennett Street area, with patches of 'danger for all', around the depot upstream of the viaduct and Vaughan Street. Climate change will increase the extent, depth and hazard associated with flooding in an extreme 1 in 1000 year flood event.

Manchester Strategic Housing Site - Brunswick M0011

Corn Brook is in culvert under this site. Localised flooding is predicted in a 1 in 25 year event between Whitekirk Close and Brunswick Street and Glenbarry Close.

Flooding becomes more widespread in the 1 in 100 year flood event incorporating areas off Wadeson Road. Flooding depths are generally less than 0.5m with localised depths in excess of 2m in the vicinity of Whitekirk Close to the east of Kincardine Road.

Flooding in the 1 in 100 year plus climate change is similar to the 1 in 100 year event with the general hazard categorisation in both events 'very low' increasing to 'dangerous for most' around Whitekirk Close.

There is some residual risk to the site during an extreme 1 in 1000 year and 1 in 100 year plus climate change event. In these events flooding extends north along Kincardine Road and eastwards towards Wadeson Road. Flooding across the majority of the site is less than 0.5m with Whitekirk Close the exception as discussed above. Flood hazard is hence categorised as 'very low' or 'dangerous for some' in the areas where flooding is shallower increasing to 'dangerous for most' for the Whitekirk Close area.

Manchester Strategic Employment Site - Oxford Road Corridor M0042

The Oxford Road Corridor Site is at risk from flooding from both the Medlock and from Corn Brook. The areas of flood risk do not overlap and as such have been discussed independently. Flood risk for this site from the Medlock is detailed in Section 2.9.

Flooding occurs in the 1 in 100 year event with the majority of flooding predicted around Cambridge Street and Coupland Street to a depth of less than 0.5m and a hazard categorisation of 'very low'. Some localised flooding to the west of Oxford Street is to a depth of up to 1.5m and categorised as 'dangerous for most'.

Flooding in the 1 in 100 year plus climate change event is similar to the 1 in 100 year event with some additional flooding around the dental hospital.

The 1 in 1000 year event flood event shows no significant changes to the west of the site from the 1 in 100 year plus climate change event. The flood extent does increase along Upper Brook Street, Booth Street East and Grosvenor Street. In these locations flood depths are predicted to be less than 0.5m with some localised depths up to 1.5m. Hazard categorisations reflect the flood depths ranging from 'very low' to 'dangerous for most'.

The 1 in 1000 year flood plus climate change event is similar to the 1 in 1000 year event with some additional flooding predicted south of Dover Street to a depth of less than 0.5m.

5.3 Critical Drainage Areas

The Town and Country Planning Order 2006¹¹ defines Critical Drainage Areas as “an area within Flood Zone 1 which has critical drainage problems and which has been notified... [to]...the local planning authority by the Environment Agency”. However, the Environment Agency Standing Advice¹² also recognises the part that SFRA play in identifying areas with drainage problems and in doing so highlighting areas that need a FRA to consider drainage in detail.

Certain locations are particularly sensitive to an increase in the rate of surface water runoff and/or volume from new development. There are generally known local flooding problems associated with these areas. These areas have been defined as CDAs in the SFRA. Specific drainage requirements are required in these areas to help reduce local flood risk. These are areas with complex surface water flooding problems that would benefit from a Surface Water Management Plan and subsequent drainage strategy.

The SFRA has developed Critical Drainage Areas where:

1. There is a high risk of localised flooding from ordinary watercourses, including culverts surcharging and overland surface water flows, including the potential for flooding from the sewer network due to failure/ blockage or exceedance events when the storm return period is greater than the sewer was designed for; or
2. Where there are areas of significant redevelopment planned that could have a significant impact on surface water runoff to local watercourses and the sewer network.

Screening for Critical Drainage Areas (CDAs) within the Manchester City, Salford City and Trafford Council areas was undertaken using data from the following sources:

- An understanding of areas where there is a focus for development, such as in the Conurbation Core
- Local authority incident records
- Discussions with Local Authority Drainage Engineers
- Refined surface water flood maps produced for the Level 2 SFRA.
- An assessment of properties at risk based on the SFRA surface water flood map
- United Utilities sewer records and drainage areas
- United Utilities DG5 register

United Utilities sewer flood risk data was not available in the timescales for this project. The Local Authorities should continue to work in partnership with United Utilities over the availability and use of sewer flood risk data. United Utilities flood risk data should be used in further work following on from this SFRA, including Surface Water Management Plan work.

The sewer network can have a significant impact on the location of surface water and sewer flooding for more frequent events. It can also affect the distribution of water throughout urban catchments during flood events, passing excess flows from the combined network into watercourses through combined sewer overflows. It was agreed that without the detailed UU flood risk data, natural catchments would be combined with UU Drainage Areas (showing where sewer systems are interconnected across the boundaries of natural catchments) to define CDA boundaries. It should be noted that only Drainage Areas that intersect the boundaries of Manchester City, Salford City and Trafford Council areas were made available for this study. The sewered catchments of the CDAs may therefore be larger than those produced for this SFRA.

Using the available data, the following Critical Drainage Areas have been provided as part of the SFRA.

¹¹HMSO (2006) The Town and Country Planning (General Development Procedure) (Amendment) (No. 2) (England) Order 2006

¹² Environment Agency. Flood Risk Standing Advice for England - PPS25 National Version 2.0. Can be accessed online at <http://www.environment-agency.gov.uk/research/planning/82584.aspx>

Appendix E

Extract from North West Geography Society List of Historic Flooding

Historic Map of Old Watercourses

Table 1: Major flood events in Greater Manchester. (Source: Compiled by Ian Douglas and Nigel Lawson from Municipal and Environment Agency records, the press and literature reviews.)

Year	Location	Cause	Effect
1616	Inwell in Salford	No data	No data
1649	Inwell in Salford	No data	No data
1662	Mersey	No data	Cut Chester and London Roads.
1750	Mersey	No data	Cost many lives.
1767	Mersey	No data	Washed away bridge at Stretford.
1799	Mersey	Banks burst	No data
1828	Mersey	No data	No data
1799-1852	Inwell - 10 events	Siltation	No data
1866	Inwell	No data	No data
1868	Inwell	Siltation by urban debris	No data
1871	Inwell	Loss of channel capacity	No data
1880	Inwell	No data	Severe damage to city centre riverbank properties.
1881	Inwell	No data	Severe flooding in Lower Broughton.
1886	Inwell at Salford	Channel capacity exceeded (No raised Defences)	800 ha with crowded tenements in Lower Broughton flooded up to 2m in depth.
1896	Mersey	No data	Floods in many parts, including Stockport.
1923	Mersey and Inwell	No data	Flooding in Lower Broughton and along Mersey.
1930	Mersey	No data	Flooding and severe bank erosion at Ashton in Mersey.
1940	Mersey and Inwell	Snowfall and Snowmelt	Severe flooding.
1946	Inwell	Channel capacity exceeded	Severe flooding in Salford, 5,300 properties and 243 ha in Lower Broughton.
1954	Inwell	Channel capacity exceeded	600 properties in Lower Kersal and Lower Broughton.
1964	Inwell, Mersey and Beal	Overtopping of banks at Northenden and Douglas Green, Salford	350 properties evacuated in Shaw. Didsbury widespread flooding of fields and property.
1965	Roch	No data	No data
1973	Mersey	No data	Flooding in Stockport.
1980	Inwell	Riverine and sewer flooding	Severe flooding, particularly in Lower Kersal.
1981	Chorlton and Sinderland Brooks	South Manchester 75 mm rain over 3 hours in early August	Widespread flooding along the Chorlton and Sinderland Brook catchments.
1995	Inwell, Roch and culverts	No data	60 houses and 21 industrial units flooded.
2000	Mersey, Inwell, Roch and culverts	Banks overtopped, blocked culverts	Widespread flooding.
2002	Inwell, Roch and culverts	Overtopping of Inwell, backing up drains in Rochdale	11 properties flooded in Inwell Vale.
2004	Netherley, Shaw, Cringle and Chorlton brooks. Heywood	2 nd wettest August on record, surface water, blocked culverts (Cringle Brook) pumping station breakdown	Cheadle: 22 properties and 2 industrial units affected. M60 motorway near Whitefield closed for 7 hours. Heywood: back-up sewage flooding in a number of homes.
2006	Heywood	July storm (33.2mm rainfall in 1 hour); culvert and sewer overflows	200 homes flooded, 40 homes evacuated.

Riverine flooding

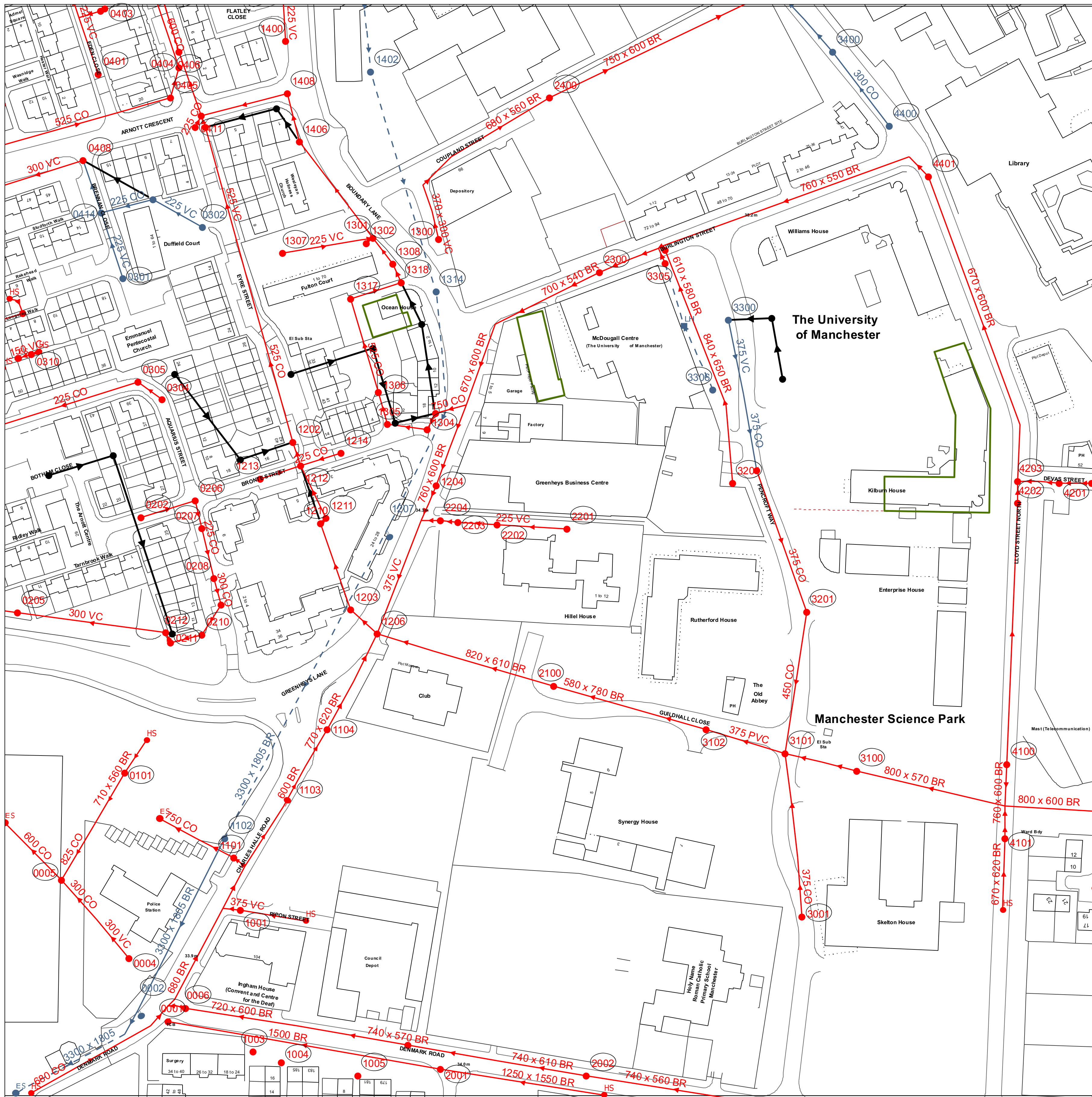
Flood protection from major rivers is the responsibility of the Environment Agency which continuously seeks to reduce the risk of flooding, according to the risk scales expressed in Table 2. In spite of the Agency's efforts, levels of protection to the Mersey, Inwell and Roch, the three major rivers draining Greater Manchester, vary considerably. Much of the Mersey Valley is now low risk with protection to 1:200 years or more

following the development in the 1970s of temporary flood storage basins on park land and golf courses in the natural flood plain. Bypass channels, channel adjustments, bank reinforcements, storm-water tanks and increased drainage and sewerage capacity intend to protect the River Roch in Rochdale and Littleborough to a standard of 1:100 years. However, Lower Kersal and Lower Broughton, the two areas in Greater Manchester to have suffered most from flooding



Appendix F

United Utilities Sewer Records



Refo	Cover	Func	Invert	Size	Shape	Mat	Length	Grad	Refo	Cover	Func	Invert	Size	Shape	Mat	Length	Grad		
0001	33.36	CO	0	3300	1805	EG	BR	12.53	3	0201	33.37	SW	0	3300	1805	EG	BR	12.53	3
0002	33.38	SW	31.09	300		CI	VC	23.43	0	0203	33.9	CO	0	3300	1805	EG	BR	12.53	3
0004	33.33	CO								0204	33.52	CO	0	3300	1805	EG	BR	12.53	3
0005	33.37	CO								0303	34.5	CO	0	3300	1805	EG	BR	12.53	3
0006	33.69	CO								0413	34.34	SW	0	3300	1805	EG	BR	12.53	3
0101	33.37	SW	30.42	710	560	EG	BR	27.78	1	1201	34.34	CO	0	3300	1805	EG	BR	12.53	3
0202	CO		0	225		CI	VC	25.83	17	1215	34.34	CO	0	3300	1805	EG	BR	12.53	3
0205	33.91	CO								1309	34.63	CO	0	3300	1805	EG	BR	12.53	3
0206	CO									1311	33.94	CO	0	3300	1805	EG	BR	12.53	3
0207	CO									1312	33.85	CO	0	3300	1805	EG	BR	12.53	3
0208	CO									1313	34	CO	0	3300	1805	EG	BR	12.53	3
0209	CO									1319		CO	0	3300	1805	EG	BR	12.53	3
0210	CO									1401	34.79	CO	0	3300	1805	EG	BR	12.53	3
0211	CO									1407	CO		0	3300	1805	EG	BR	12.53	3
0212	CO									3302	35.64	SW	0	3300	1805	EG	BR	12.53	3
0301	34.32	SW	32.36	225		CI	VC	31.78	1	3303	35.81	SW	0	3300	1805	EG	BR	12.53	3
0302	34.71	SW	32.55	225		CI	VC	26.09	0										
0304	CO		0	225		CI	VC	13.64	9										
0305	CO																		
0307	CO																		
0310	CO																		
0401	34.42	CO	32.33	225		CI	VC	69.57	2										
0402	34.39	CO	32.72	150		CI	VC	10.44	0										
0403	34.45	CO	32.6	150		CI	VC	2.24	7										
0404	34.63	CO	28.83	600		CI	CO	92.97	4										
0405	34.66	CO	27.12	525		CI	VC	51.24	2										
0406	34.63	CO																	
0407	34.72	CO																	
0408	34.7	CO																	
0410	CO																		
0411	CO		27.55	525		CI	VC	30.84	4										
0412	SW		0	225		CI	CO	6.07	1										
0414	SW		0	225		CI	CO	24.5	16										
1001	33.84	CO	31.11	375		CI	VC	8.06	0										
1002	33.59	CO																	
1003	33.9	CO																	
1004	33.98	CO																	
1005	34.11	CO																	
1101	33.63	CO	0	3300	1805	EG	BR	88.55	22										
1102	33.71	SW	31.76	600		CI	BR	20.59	0										
1103	34.01	CO																	
1104	34.19	CO	28.38	525		CI	CO	74.8	3										
1202	34.62	CO																	
1203	34.28	CO																	
1204	34.08	CO																	
1206	33.73	CO																	
1207	34.3	SW	31.38	3300	1805	HO	BR	159.24											
1210	CO																		
1211	CO																		
1212	CO		28.68	525		CI	CO	11.42	0										
1213	CO		0	225		CI	CO	19.67	13										
1214	CO		0	225		CI	CO	19.3	12										
1300	34.61	CO	32.72	370	300	EG	VC	13.34	0										
1301	34.62	CO																	
1302	34.71	CO	32.22	225		CI	VC	1.89	6										
1304	CO																		
1305	CO																		
1306	CO																		
1307	34.55	CO	32.49	225		CI	VC	38.49	1										
1308	34.88	CO	29.89	525		CI	CO	14.99	0										
1310	34.35	CO																	
1314	34.68	SW																	
1317	CO		0	525		CI	CO	9.33	1										
1318	CO		33.05	525		CI	VC	50.14	1										
1400	35.02	CO	32.6	3300	1805	HO	BR	105.36	3										
1402	34.95	SW																	
1406	CO																		
1408	CO																		
2001	33.8	CO	31.19	1500		CI	BR	126.92	4										
2002	33.85	CO																	
2003	34.69	CO	33.34	225		CI	VC	32.06	1										
2201	34.69	CO																	
2202	34.41	CO																	
2203	34.04	CO																	
2204	33.91	CO																	
2300	34.52	CO																	
2400	34.87	CO	31.41	750	600	EG	BR	57.7	2										
3001	34.73	CO	32.78	375		CI	CO	27.07	0										
3100	34.74	CO	32	800	570	EG	BR	164.9	0										
3101	34.34	CO																	
3102	34.23	CO																	
3201	35.23	CO	32.53	450		CI	CO	65.76	2										
3202	34.84	CO																	
3204	34.72	CO	0	840	650	EG	BR	74.75	30										
3300	35.41	SW	33.13	375		CI	VC	34.71	1										
3304	34.59	CO																	
3305	34.74	CO	31.59	300		CI	VC	7.62	0										
3306	34.36	SW	31.86	300		CI	VC	62.14	2										
3400	35.33	SW	31.86	300		CI	VC	19.85	0										
4100	34.88	CO	32.38	760	600	EG	BR	19.03	0										
4101	34.85	CO	32.79	600	570	EG	BR	8	0										
4200	35.48	CO																	
4201	35.28	CO																	
4202	34.9	CO																	
4203	CO																		
4400	35.1	SW	32.15	300		CI	CO	42.8	1										
4401	35.03	CO	0	670	600	EG	BR	127.3	4										
0007	SW																		
0008	CO		0	680		CI	CO	63.13	24										
0010	CO		0	680		CI	BR	12.04	4										
0011	CO		30.95	300		CI	CO	24.08	0										
0013	CO		0	680	580	EG	BR	4	0										
0102	CO		30.46	625		CI	CO	29.15	1										
0103	CO		0	750		CI	CO	19.24	6										
0105	CO		0	710	560	EG	BR	18.03	1										
0306	CO		150			CI	VC	3.49	9										
0309	CO		0	375		CI	VC	10.29	11										
1006	CO		0	375		CI	VC	30.41	1										
1008	CO		30.99	720	600	FT	BR	51.62	1										
1106	CO		31.53	770	620	UN	BR	19.72	0										

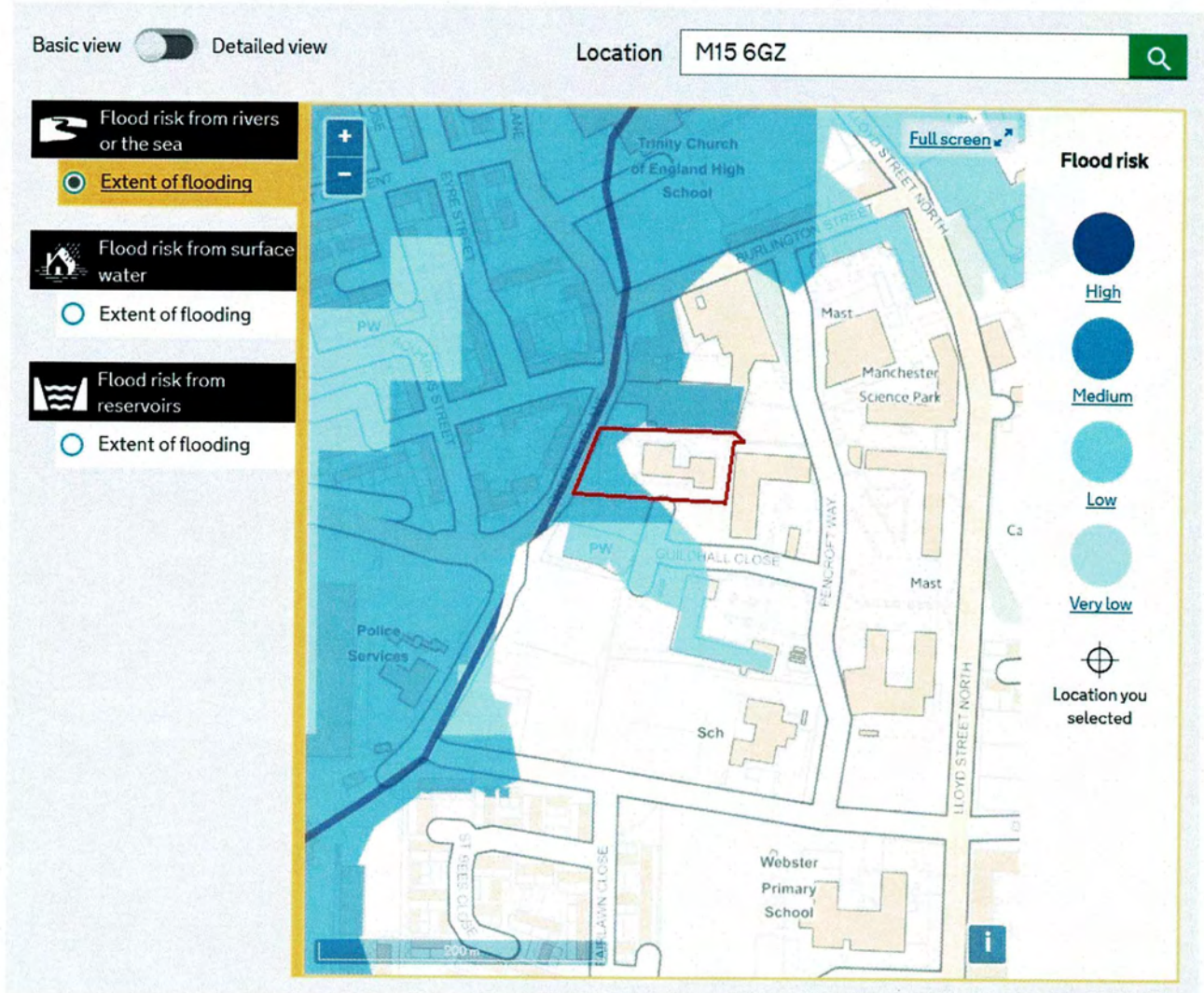
Appendix G

Maps Showing Risk of Flooding From:-

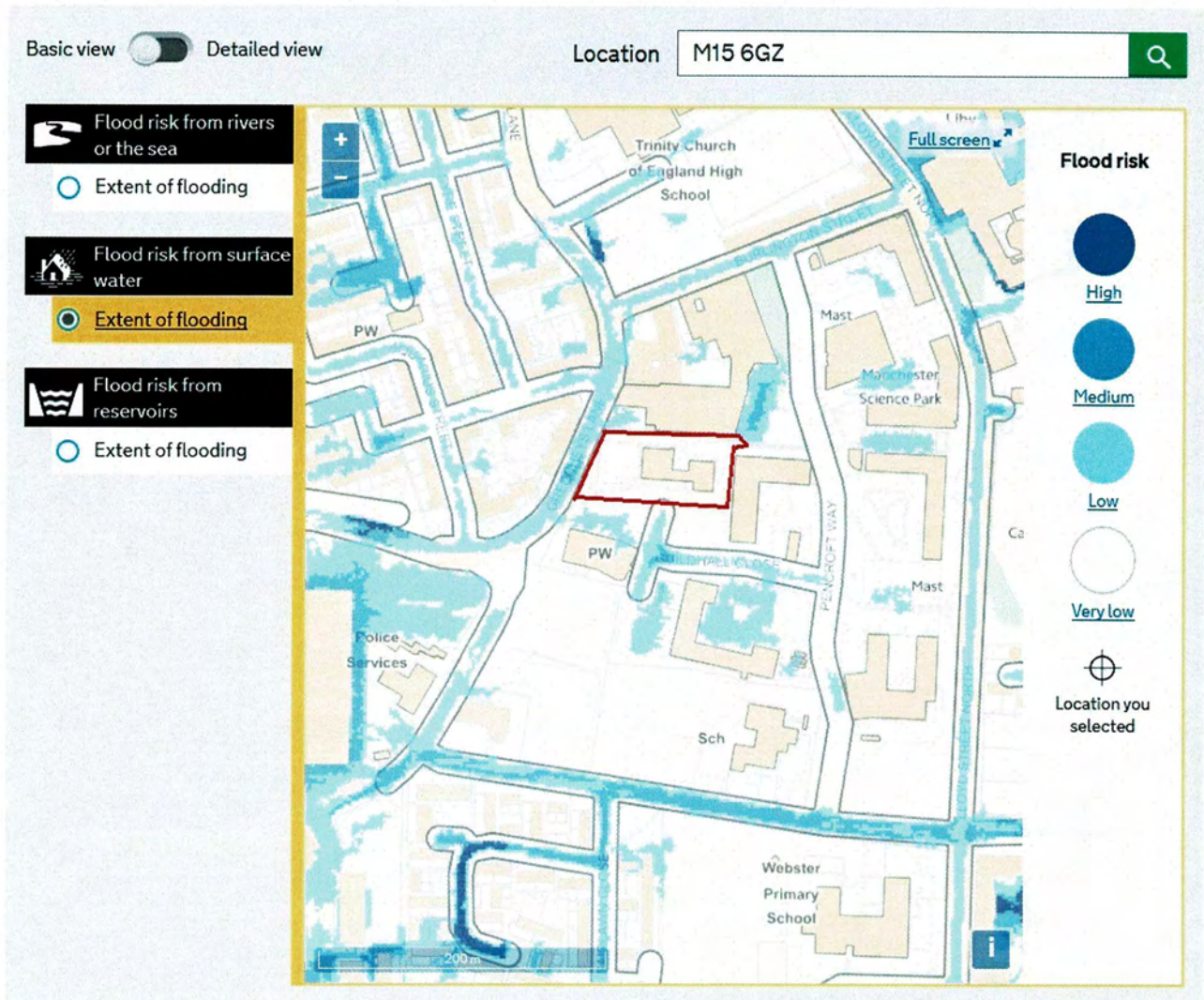
Rivers & Sea

Surface Water

Reservoirs



Flooding from rivers or sea



Flooding from surface water

