

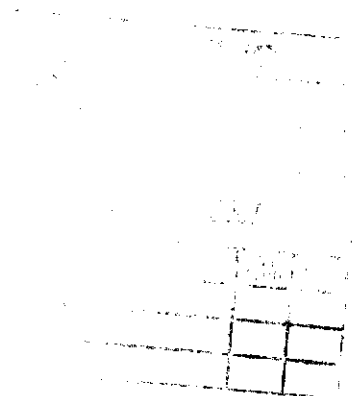


CROSBY LEND LEASE

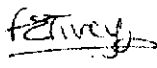
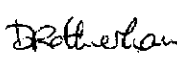
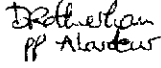
MARKETING SUITE, POTATO WHARF, CASTLEFIELD, MANCHESTER

FLOOD RISK ASSESSMENT

FEBRUARY 2007



CROSBY LEND LEASE**MARKETING SUITE, POTATO WHARF, CASTLEFIELD,
MANCHESTER****FLOOD RISK ASSESSMENT**

Rev	Date	Version	Prepared	Checked	Approved
0	14/02/07	Final			

Disclaimer

This document has been prepared in accordance with the scope of Scott Wilson's appointment with its client and is subject to the terms of that appointment. It is addressed to and for the sole use and reliance of Scott Wilson's client. Scott Wilson accepts no liability for any use of this document other than by its client and only for the purposes, stated in the document, for which it was prepared and provided. No person other than the client may copy (in whole or in part) use or rely on the contents of this document, without the prior written permission of the Company Secretary of Scott Wilson Ltd. Any advice, opinions, or recommendations within this document should be read and relied upon only in the context of the document as a whole. The contents of this document are not to be construed as providing legal, business or tax advice or opinion.

© Scott Wilson Limited 2006

**Crosby Lend Lease
Crosby House
92 Dunham Road
Altrincham
Cheshire
WA14 4AD**

**Scott Wilson Water
Mansfield i-Centre
Oakham Business Park
Hamilton Way
Mansfield
Nottinghamshire
NG18 5BR**

TABLE OF CONTENTS

1.	INTRODUCTION	1
1.1.	Background	1
1.2.	Study Methodology and Objectives	1
2.	SITE SETTING	2
2.1.	Site Location	2
2.2.	Water Bodies and Hydraulic Structures	2
2.3.	Topographic Information	2
2.4.	Local Hydraulic Structures	2
2.5.	Historical Flooding Information	2
2.6.	Groundwater Levels	3
3.	HYDROLOGY	4
3.1.	Data collection	4
3.2.	Statistical Analysis	5
3.2.1.	Methodology.....	5
3.2.2.	Median Flow (Q_{MED}).....	5
3.2.3.	Flood Frequency Curves.....	6
4.	ASSESSMENT OF FLOOD RISK	7
4.1.	Sources of Potential Flooding	7
4.1.1.	Fluvial.....	7
4.1.2.	Foul Sewer System.....	8
4.1.3.	Groundwater.....	8
4.1.4.	Overland Flow	8
4.2.	Surface Water Flooding	8
4.3.	Local Hydraulic Effects from Structures	8
5.	ASSESSMENT OF EXISTING AND PROPOSED DRAINAGE	9
5.1.	Existing Surface Water Runoff Management	9
5.2.	Proposed Surface Water Runoff Management	9
6.	FLOOD RISK MITIGATION.....	10
6.1.	Finished Floor Levels	10
6.2.	Emergency Access and Egress Routes	10
7.	CONCLUSIONS & RECOMMENDATIONS.....	11
8.	REFERENCES	12
	FIGURES	
	PHOTOGRAPHS	
	APPENDICES	

1. INTRODUCTION

1.1. Background

This Flood Risk Assessment (FRA) relates to the proposed construction of a marketing suite at Potato Wharf, situated in the Castlefield district of Manchester. The site location is shown in Figure 1.

The site is currently undeveloped but the area around the site is undergoing extensive redevelopment and adjacent sites include the offices of the North West Regional Development Agency (NWRDA), a youth hostel and a heritage centre, as well as a residential development on the opposite side of the Bridgewater Canal.

Castlefield is located at the junction of the Bridgewater and Rochdale Canals (Figure 2). This location facilitated extensive industrialisation, which lasted from the industrial revolution to the late 1970s. Following the industrial decline of the area in the 1970s and 1980s there has been considerable growth in residential development in the area surrounding the site with numerous prestigious canal front apartments.

The EA has confirmed that there are no modelled levels available for the River Medlock at this location and also that the River Medlock is not 'main river' adjacent to the site as shown in Figure 3.

1.2. Study Methodology and Objectives

This FRA has been prepared in accordance with PPS25. For the avoidance of doubt some information may be repeated in more than one section.

Information for this FRA has been obtained from the EA and Peel Holdings, (the owners and operators of the Bridgewater Canal). Flood risk to the site from the following sources has been assessed:

- Fluvial
- Canal
- Groundwater
- Surface water runoff
- Overland flow

Additionally, climate change has been considered for this FRA and mitigation measures to minimise the flood risk to the development are proposed.

Surface water attenuation and the viability of sustainable drainage provision are also considered.

2. SITE SETTING

2.1. Site Location

Potato Wharf is located at Castlefield in Manchester (OS NGR 382940, 397650). The location of the site, which is a small triangle of land between Potato Wharf and the River Medlock is shown on Figure 1.

The area around the site is being extensively redeveloped into prestigious offices (including the NWRDA) and residential blocks.

2.2. Water Bodies and Hydraulic Structures

Figure 2 details the main water bodies in the vicinity of the development. These are:

- **The River Medlock**, which flows past the site from northeast to southwest on the boundary of the site. In c1765, the Medlock was culverted from southeast of Deansgate to a point immediately east of the site.
- **The Bridgewater Canal**, which was constructed in the 1750s, overlies the original course of the River Medlock. It was an important commercial shipping route in the years after the industrial revolution, but in recent years it has been largely used by leisure craft. It is owned by the Manchester Ship Canal Company and connects Runcorn and Leigh. It is 39 miles in length, with an additional 7 miles where the Bridgewater Canal connects to the Leeds and Liverpool Canal. It is a contour canal without locks, and the target water level is 25.26 m AOD. Levels in the canal are controlled by sluices, which are opened in response to high water levels transmitted from four measurement locations on the canal.
- **Rochdale Canal** joins the Bridgewater Canal southeast of the site. Flows from the Rochdale Canal are controlled and the Rochdale Canal operator is not permitted to pass water into the Bridgewater Canal. The canal contains a bypass channel, an overflow culvert, and a weir.

2.3. Topographic Information

The site and its immediate environs have been surveyed and the survey information is included in Appendix A.

2.4. Local Hydraulic Structures

There are several hydraulic structures adjacent to the proposed development site: Pomona Lock, the River Medlock and Bridgewater Canal Interface, the Number Five Let Off, the River Medlock culvert and the bridges on Elm Street and Dawson Street.

2.5. Historical Flooding Information

The Manchester Ship Canal Company holds records of key flooding events as shown in Table 1 below. The recorded flood levels were measured at the entrance to the River Medlock culvert; in these events surplus flow was diverted into and accommodated by the Bridgewater Canal via the overflow weir.

Table 1 Recorded Flood Levels

Date	Ft	m AOD
18/10/1944	90.25	27.508
21/09/1946	87.59	26.697

2.6. Groundwater Levels

Following ground investigation, it was discovered that groundwater levels adjacent to the site are between 1.6 and 2.6 m below ground level. Groundwater levels could therefore affect any basement structures, but none are proposed for this development.

3. HYDROLOGY

3.1. Data collection

The Flood Estimation Handbook (FEH) CD-ROM, which includes catchment data for the whole of the UK, was interrogated to determine the catchment characteristics of the River Medlock to the interface with the Bridgewater Canal and the catchment descriptors are shown in Table 2. Also shown are the most hydrologically similar catchments in the database: the Medlock at London Road, the Lagan at Drumiller and the Oonawater at Shanmoy.

Table 2 Catchment Characteristics

Station name	Medlock at Potato Wharf	Medlock at London Road	Lagan at Drumiller	Oonawater at Shanmoy
NGR Easting	382900	384900	323650	278050
NGR Northing	397550	397520	352550	355700
AREA (km ²)	64.57	52.72	84.78	95.62
FARL	0.9940	0.9927	0.9924	0.9840
PROP WET	0.54	0.55	0.53	0.59
ALTBAR	136	154	168	114
ASPBAR	238	233	338	94
ASPVAR	0.450	0.426	0.187	0.169
BFI HOST	0.376	0.388	0.403	0.399
DPLBAR	12.96	12.30	11.73	13.11
DPSBAR	53.90	64.75	88.13	80.04
LDP	23.87	21.42	19.36	24.06
RMED-1Hour	11.1	11.2	10.7	9.0
RMED-1Day	37.0	38.0	40.8	31.3
RMED-2Day	50.2	51.7	52.9	42.9
SAAR	1009	1036	1016	999
SAAR 41-70	1021	1053	1082	1052
SPR HOST	36.0	35.3	44.9	36.0
URBEXT1990	0.3120	0.2518	0.0135	0.0088

3.2. Statistical Analysis

3.2.1. Methodology

The flows at the site were estimated using the FEH statistical method. The method uses an index flood, Q_{median} (the annual maximum flow that is exceeded in 50% of years), and applies growth factors to this to obtain the flow/return period relationship.

The recommended method of assessing the index flood is to calculate the flow from the catchment descriptors obtained from the FEH CD-ROM, then to adjust it by data transfer from a hydrologically similar gauged site. This site is called a donor if it is in the same catchment as, and an analogue if it is remote from, the site of interest.

The growth factors are derived from an analysis of a group of hydrologically similar sites (the pooling group) that is obtained from the WINFAP-FEH software.

3.2.2. Median Flow (Q_{MED})

The WINFAP-FEH software was used to calculate the median flow (Q_{MED}) at the site from the catchment descriptors as 41.94 m³/s.

The WINFAP-FEH database of sites suitable for use in the pooling group was then searched for gauges with similar hydrological characteristics to the site and it was found that there are two gauges that are very hydrologically similar, although they are not in the same catchment as the Medlock. These are the River Lagan at Drumiller and the Oonawater at Shanmoy, the catchment descriptors for these sites are shown in Table 2. The database of sites that are not suitable for use in a pooling group was also searched and a gauge on the Medlock upstream of our site of interest was found. This is gauge 69020, Medlock at London Road and although not suitable for pooling it is considered suitable for adjustment of Q_{MED} .

The Q_{MED} from the catchment descriptors is then used in conjunction with the Q_{MED} from the flow records to adjust the Q_{MED} calculated for the site from the catchment descriptors using the formula below. The calculations are summarised in Table 3.

$$Q_{\text{MED}} (\text{site, adjusted}) = Q_{\text{MED}} (\text{CD, site}) \times Q_{\text{MED}} (\text{data, analogue}) / Q_{\text{MED}} (\text{CD, analogue})$$

Table 3 Calculation of Q_{MED}

	Q_{MED} Medlock at Potato Wharf	69020 Medlock at London Road	205008 Lagan at Drumiller	203043 Oonawater at Shanmoy
From CDs	41.94	33.084	26.92	34.78
From Lagan annual maximum (AM) data	47.40	-	30.43	-
From Oonawater AM data	34.17	-	-	28.33
From Medlock AM data	-	20.21	-	-

It was deduced that the most suitable Q_{MED} would be the value derived from the donor catchment on the Medlock, particularly as our target catchment is highly urbanised.

3.2.3. Flood Frequency Curves

A group of hydrologically similar gauging stations was selected using the WINFAP-FEH software. The selected group was heterogeneous so the data set was reviewed as advised. No sites were identified as obviously unsuitable and therefore candidates for removal, so the pooling group was left unaltered.

Data analysis revealed that only the Generalised Logistic Distribution was suitable for use with this pooling group, and the results are shown in Table 4.

Table 4 Flood Frequency

Return Period	Growth factors	Generalised Logistic distribution
2 yr	1.000	20.21
5 yr	1.223	24.72
10 yr	1.357	27.43
25 yr	1.526	30.84
50 yr	1.658	33.51
100 yr	1.795	36.28
100 yr + 20%	-	43.53
200 yr	1.939	39.19
500 yr	2.144	43.33
1000 yr	2.296	46.40

4. ASSESSMENT OF FLOOD RISK

4.1. Fluvial

There is no direct fluvial flood risk to the site. The development is proposed to be for commercial use and is therefore classified under PPS25 as 'Less Vulnerable', which eliminates the requirement to perform an Exception Test.

The River Medlock flows past the site in a substantial channel. The culvert that conveys the Medlock under the Bridgewater Canal restricts flows in this channel. The 100-year flow in the River Medlock is estimated as 36.3 m³/s whilst the 100-year flow including 20 % for climate change is 43.5 m³/s as detailed in Section 3.2.3. Our calculations estimate that 20.5 m³/s of this flow passes through the culvert, which underlies the Bridgewater Canal. Flows in excess of 20 m³/s will back up behind the wall alongside Deansgate, which separates the Medlock from the Bridgewater Canal, until the level of the overflow weir into the canal is reached, and then the excess flows discharge into the canal.

Canal levels are regulated by weirs and sluices, which are able to take flows from the Medlock except in very extreme circumstances. As detailed in Section 3 the historical and indicative flood maps provided by the EA (Figures 4, 5 and 6) show that flooding does not occur in the vicinity of the site. In addition, based on the information analysed within this report, there has been no known flooding to the site from the canal.

During a 100-year event the excess flow will first fill the available volume in the canal (approximately 550,000 m³, based on the difference between maintained water levels and the edge coping of the canal), whilst at the same time flowing out through the various outlet sluices and weirs, at an estimated rate of 11.5 m³/s as calculated previously by Capita Symonds and accepted by the EA. Once the available volume in the canal has been used, excess flows could then potentially overtop the canal edges and flow past the site and across Potato Wharf discharging back to the River Medlock around the Elm Street Bridge. The downstream channel of the Medlock has a capacity of approximately 60 m³/s, which will comfortably contain the 100-year flow plus 20 % (43.5 m³/s). The above calculations are confirmed by the fact that it is apparent, from the EA floodplain maps (Figures 4, 5 and 6), that the theoretical 100-year flow in the Medlock does not flood the site. Overflow from the canal during an extreme event would return to the Medlock via the site and another site on the downstream side of the New Elm Road bridge. The site is therefore at some risk of indirect fluvial flooding during the 100-year event, including climate change, due to this overland flow. It should be noted that the site downstream of New Elm Road is some 300 mm lower than the marketing suite site.

Site levels are such that any flooding would occur across the entire Potato Wharf area with shallow flood depths and low velocities. Floodwaters would flow as sheet flow to the lowest point of the site and return into the River Medlock channel. This point is away from the Marketing Suite, and it is further noted that should any flood flows extend into the vicinity of the Marketing Suite they would immediately return to the Medlock, as there is an open metal parapet and no solid river wall at this point. Photographs 1 - 3 shows this and the rising ground levels across New Elm Road bridge.

4.2. Foul Sewer System

The proposed development will have a foul sewerage system designed in line with modern best practice so there will be negligible risk of flooding by foul sewage. Newly commissioned systems are designed to cope with a 1 in 30 year storm as a minimum.

4.3. Groundwater

Groundwater levels on the site were measured to be between 1.6 and 2.6 m below ground level, and therefore the proposed development will not be at risk of flooding from this source.

4.4. Overland Flow

The site is at slight risk of overland flow flooding between the Bridgewater Canal and the River Medlock as discussed above.

4.5. Surface Water Flooding

At present, the entire site is impermeable and therefore construction of the marketing suite will not increase surface water runoff. According to the current proposals, there is to be green space between the building and the River Medlock, which should reduce runoff from the site. Surface water runoff from the site may exceed the capacity of the proposed drainage, but it is anticipated that the site drainage will be designed to modern standards and thus there will be negligible risk of surface water flooding.

4.6. Local Hydraulic Effects from Structures

From our assessment, it has been concluded that the local hydraulic structures do not adversely affect the site. The River Medlock culvert restricts the flow into the reach adjacent to the site, the Number 5 Let Off weir lowers water levels in the canal whilst the bridges at Elm Street and Dawson Street are clear span structures with no head loss.

5. ASSESSMENT OF EXISTING AND PROPOSED DRAINAGE

5.1. Existing Surface Water Runoff Management

There is no formal surface water drainage on the site and surface water runoff discharges directly into the River Medlock.

5.2. Proposed Surface Water Runoff Management

Sustainable drainage will be considered at an early design stage to reduce runoff from the site. It is anticipated that surplus surface water from the proposed development will discharge directly to the River Medlock after any necessary attenuation. The level of attenuation will be assessed at detailed design stage.

6. FLOOD RISK MITIGATION

6.1. Finished Floor Levels

The proposed finished floor level for the Marketing Suite is 26.25 m AOD. This level is typically 350 mm above surrounding road levels, which are around 25.9 m AOD, and would therefore allow any surface water to flow past the building in an extreme event. This level also provides a 350 mm freeboard above the flood level previously provided by Capita Symonds (and accepted by the EA) in the previous FRA for the site. Owing to the proposed use of the Marketing Suite and the assessed level of flood risk, a 350 mm freeboard is considered acceptable.

6.2. Emergency Access and Egress Routes

The bridge across the River Medlock on Elm Street is situated adjacent to the proposed Marketing Suite and therefore emergency access and egress is readily available. It would be desirable to put an evacuation procedure in place, which could be implemented when water levels in the canal exceed an agreed level, however it should be noted that the Marketing Suite would only be occupied during normal working hours. The onset of flooding would be readily apparent to the occupiers, who would be able to exit the site in a matter of minutes.

7. CONCLUSIONS & RECOMMENDATIONS

This FRA has been prepared in accordance with PPS25.

The site is at negligible risk of flooding (based on conservative calculations) during an extreme fluvial event. The site is not considered to be within the 1 in 100 year floodplain and therefore the proposed development is considered to be compatible with the assessed level of flood risk. Since the site is classed as 'Less Vulnerable' under PPS25, it is not necessary to perform an Exception Test.

Notwithstanding the above, the assessed potential flooding mechanism from very extreme flood events is from the Bridgewater Canal and not from the River Medlock. Site levels are such that any flooding would occur across the entire Potato Wharf area with shallow flood depths and low velocities. Floodwaters would flow as sheet flow to the lowest point of the site and return into the River Medlock channel. This point is away from the Marketing Suite, and it is further noted that should any flood flows extend into the vicinity of the Marketing Suite they would immediately return to the Medlock, as there is an open metal parapet and no solid river wall at this point.

Whilst this flooding mechanism is not predicted to occur in anything other than the most extreme events, the residual risk associated with the Marketing Suite is considered to be negligible, as floodwaters would flow into the River Medlock and would not rise up to threshold levels.

The Marketing Suite would be occupied during the daytime only and is not situated immediately adjacent to the canal, so any overtopping of the canal could be observed. The proximity of the marketing suite to the bridge is such that it could be evacuated in minutes, well in advance of any flood flows and an emergency exit procedure can be developed to ensure this.

This FRA concludes that proposed development of this part of the Potato Wharf site is at a very low risk of flooding and that the residual risk is negligible.

8. REFERENCES

Defra & Environment Agency (2005) Flood Risk Assessment Guidance for New Development. R & D Technical Report FD/2320/TR2. Defra.

Hulme, M et al (2002) Climate Change Scenarios for the United Kingdom: The UKCIP2002 Scientific Report. Tyndall Centre for Climate Change Research, University of East Anglia, Norwich.

Office of the Deputy Prime Minister (2001) Planning Policy Guidance Note 25: Development and Flood Risk.

Office of the Deputy Prime Minister (2005) Consultation on Planning Policy Statement 25: Development and Flood Risk.

Water UK / WRC Plc (2006) Sewers for Adoption. 6th Edition.

DEFRA Website: www.defra.gov.uk

Environment Agency Website: www.environment-agency.gov.uk

Multimap Website: www.multimap.co.uk

Google Search Engine: www.google.co.uk

FIGURES

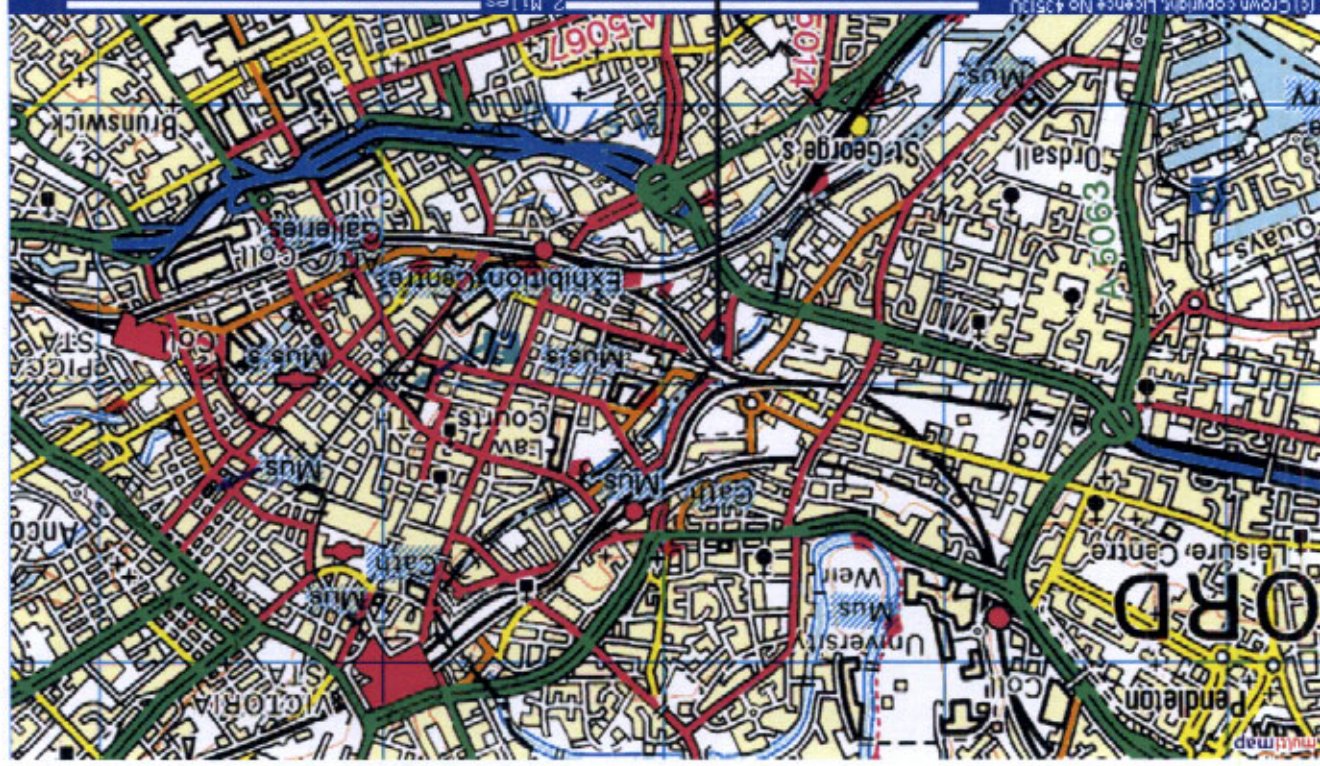
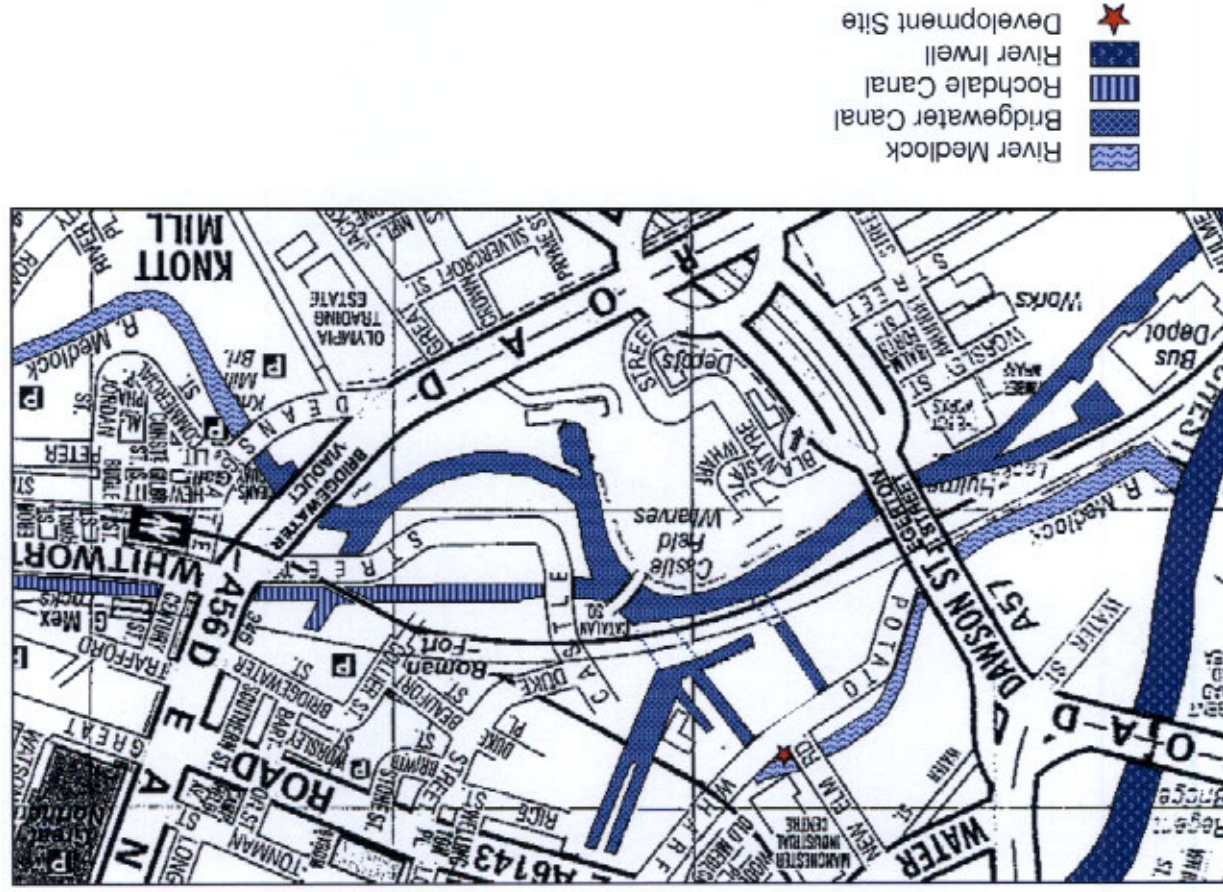


Figure 1 Proposed development site location

Figure 2 Local watercourses



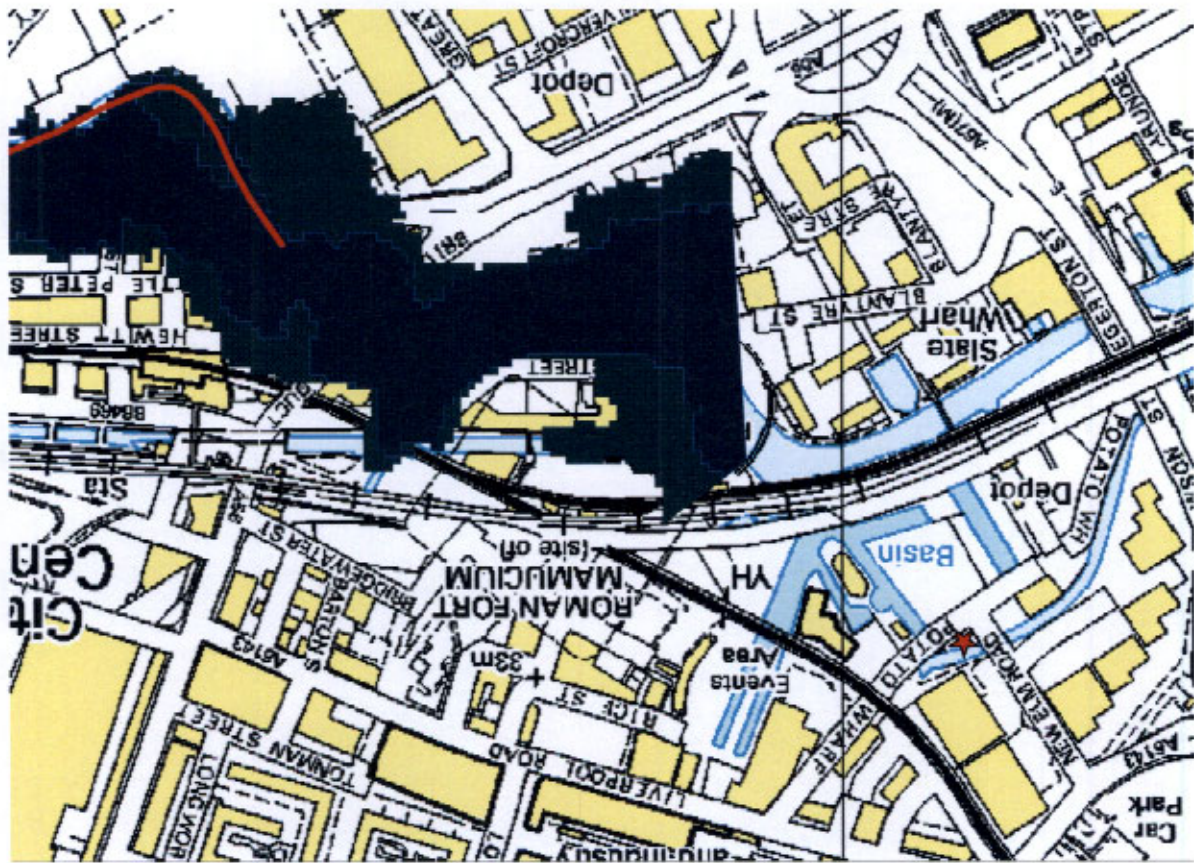


Figure 3 Extent of 'Main River' – shown in red
Source: Environment Agency



Figure 4 Environment Agency flood map
Source: EA Website

Light Blue outline
= indicative
Floodplain

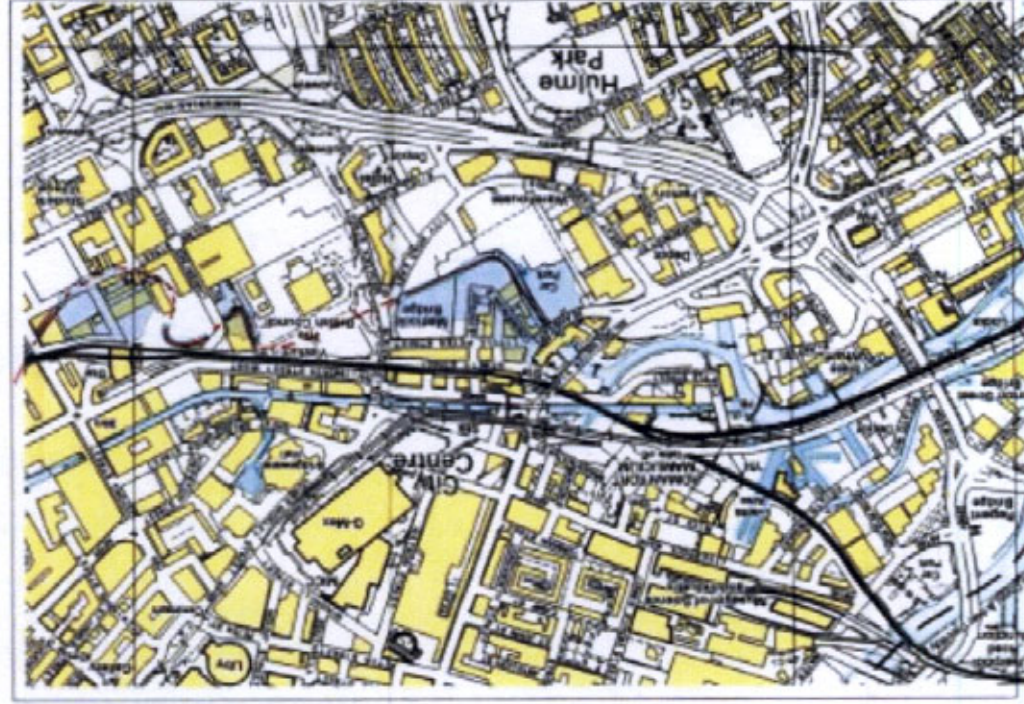


Figure 5 Historic flood map
Source: Environment Agency

PHOTOGRAPHS



Photograph 1: View over New Elm Road bridge over the Medlock. The proposed marketing suite site is to the right.



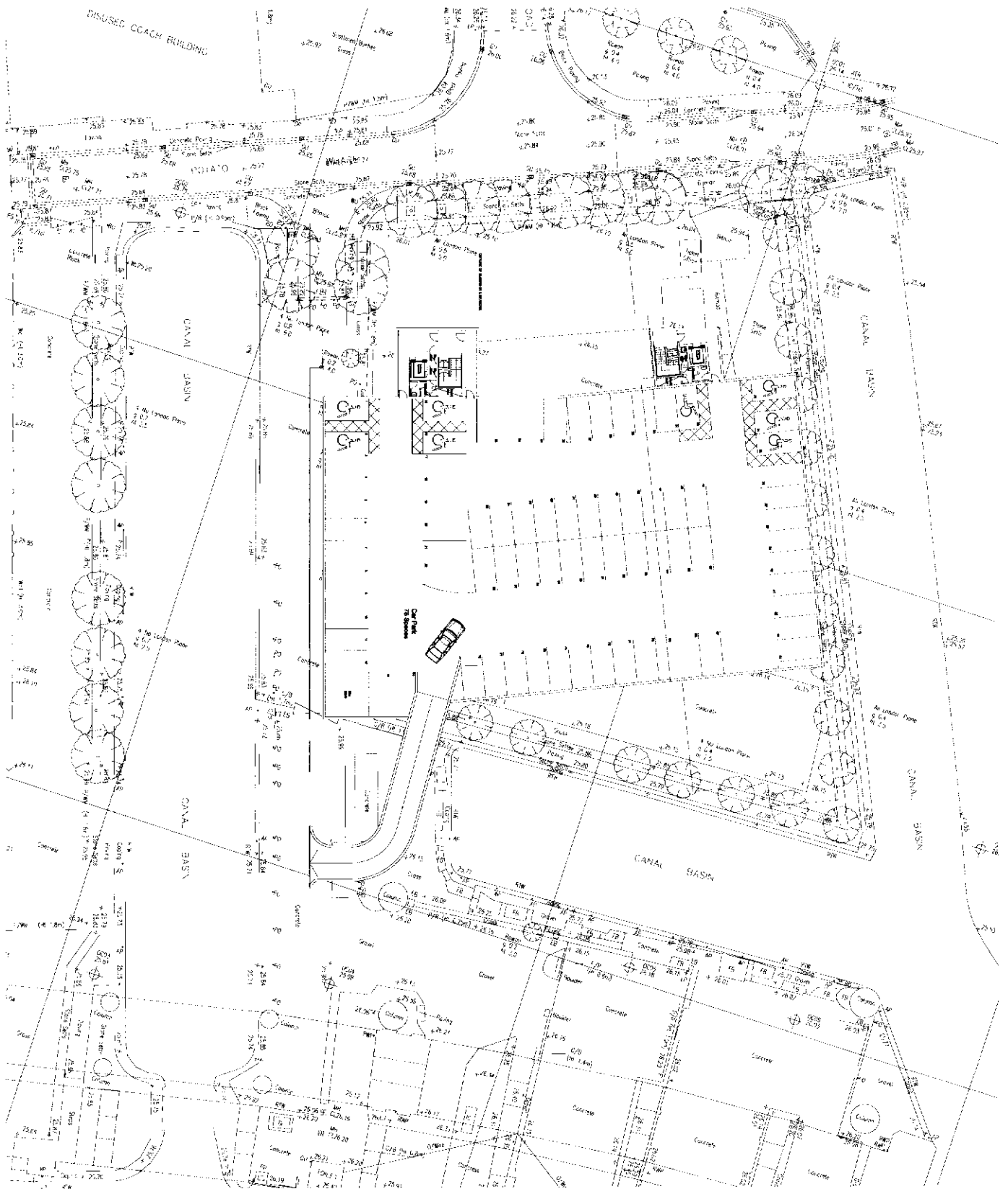
Photograph 2: View of site with Potato Wharf in the foreground and the River Medlock beyond the fencing.



Photograph 3: View across the site looking downstream at the River Medlock and New Elm Road bridge.

APPENDICES

Appendix A
Topographical Survey and Clients Proposals



Note:
Do not build from this drawing. All dimensions are to be in the center of the
Report by dimension to the CA.

A 19/07/06
REVISED CANAL LAYOUT
Details



Architects + Urbanists

10-11 Market Street
P.O. Box 1111
Melbourne VIC 3000
Australia
Phone: (03) 9611 1111
Fax: (03) 9611 1112
www.nla.com.au

Project Title: PRIVATE WAREHOUSE

Client: Cherry-Pines (Bentley) Limited

Location: MANCHESTER

Drawing Title: L & P SITE PLAN

Drawn By: CHAMBERLIN

Reviewed Date: 28/06/2006

Revision: 1/200

Issue Type: PRELIMINARY

City/Town: S.W. 41

Drawing ref: Job No: 2009

Drawing No: D-30-000

Revision: A

Landscapeprojects Landscape Architecture & Design 31 Blackfriars Road, Salford, Manchester, M6 7AA PHONE: 0161 850 8336 FAX: 0161 850 7955 EMAIL: info@landscapeprojects.co.uk		PROJECT POTATO WHARF
DATE 2006-09-19	DRAWN JB	CHECKED NS
STATUS PLANNING		DRAWING NO. LP 294.003
SCALE 1:100 @ A3		DIVISION D

R/W D: 2007-02-14 I.T. of building divided to 26.250
 R/W C: 2007-02-08 Substation retained, building moved
 R/W B: 2007-02-08 Parking area added adjacent to substation.



- 1 Existing pavements paving to Potato Wharf to be carefully retained
- 2 Ruben bonded gravel finish - alternating stripes of buff tones
- 3 Free standing, polished cast stone pavers by Escorial or similar
- 4 Parking space. Small unit worksone sets to areas subject to vehicle overrun
- 5 Low maintenance ground cover planting to be dense, evergreen species i.e. Heder sp.
- 6 Existing coping and railing to wall retained

- 7 Concrete flags reclaimed from site to service area of marketing suite
- 8 Existing sets to Potato Wharf Road to be carefully retained
- 9 New Yorkstone paving extended into site
- 10 Hedge planting pushing out into hard paved area