

Flood Risk Assessment & Drainage Strategy
232-236 Palatine Road, Didsbury

Prepared on behalf of
Marco Living 3 Ltd

Project No: 1/21724
Date: 09/09/2026
Rev: 03
Ref: 21724-CCL-XX-XX-RP-C-02500

Carl Dawson
Principal Civil Engineer
[redacted]

enquiries@clancy.co.uk
www.clancy.co.uk

Clancy Consulting Engineering Ltd (CCE Ltd)
4th Floor,
Windmill Green,
24 Mount Street,
Manchester,
M2 3NX

Caveat

"This document has been prepared for the titled project, or named part thereof, and should not be relied upon or used for any other project, or part, without an independent check being made on it. Clancy Consulting Engineers (CCE Ltd) shall not be liable for the consequences of using this document other than for the purpose for which it was commissioned, and any user and any other person using or relying on this document for such other purpose, agrees and will be such use or reliance be taken to confirm this agreement to indemnify Clancy Consulting Engineers (CCE Ltd) for all loss or damage resulting therefrom".

Document Revisions

Revision	Date	Revision Description	Author	Reviewer	Auditor
00	22.05.26	Issue for Planning	CN	KE	KE
01	11.06.26	Issue for Planning	HB	CN	KE
02	04.09.26	Updated following LLFA/Comments.	C.Dawson	S.Higginson	D.Singh
03	09.09.26	Issued to LLFA.	C.Dawson	S.Higginson	D.Singh

© Clancy Consulting 2026

Contents

1. EXECUTIVE SUMMARY 5
1.1. Summary 5
2. INTRODUCTION 8
2.1. Commission 8
2.2. Project Overview 8
2.3. Objective 8
3. SITE CHARACTERISTICS 9
3.1. Location 9
3.2. Boundaries & Usage 10
3.3. Topography 10
3.4. Hydrology 11
3.5. Existing Drainage Public 11
3.6. Existing Drainage – Private 11
3.7. Geology 11
3.8. Hydrogeology 12
3.9. Site Specific Constraints 12
4. FLOODING 14
4.1. Types of Flooding 14
4.2. Fluvial (River) 14
4.3. Environment Agency (EA) Consultation 16
4.4. Tidal (Sea) 19
4.5. Surface Water 19
4.6. Ground Water 20
4.7. Historical/Artificial/Sewer 21
4.8. Summary 22
5. PROPOSED DEVELOPMENT 23
5.1. Development & Use 23
5.2. Development Constraints 24
6. SEQUENTIAL TEST 25
6.1. National Planning Policy Framework (NPPF) 25
6.2. Sequential Testing Overview 25
6.3. Sequential Test Overview 25
6.4. Application of the Sequential Test 26
7. EXCEPTION TEST 26
7.1. Exception Test (ET) Overview 26
7.2. Criterion 1 – Wider Sustainability Benefits 27
7.3. Criterion 2 – Safety Throughout the Development Lifetimes 28
7.4. Criterion 3 – Flood Risk Elsewhere 30
7.5. Exception Test Conclusion 30
8. SUDS HIERARCHY/ Standard 1 32
8.1. OVERVIEW 32
8.2. Priority 1 – Collected For Non-potable Use 32
8.3. Priority 2 – Infiltrated to Ground 32
8.4. Priority 3 – Discharged To an Above Ground Surface Water Body 33
8.5. Priority 4 – Discharged To a Surface Water Sewer, or Another Piped Surface Water Drainage System 33
8.6. Priority 5 - Discharge to a Combined Sewer 34
8.7. Summary of above Priorities 34
9. Management of Everyday Rainfall/ Standard 2 35
9.2. Rainwater Harvesting 35
9.3. SuDS Pillar/ Standard 4 – Water Quality 35
9.4. SuDS Pillar/ Standard 5 – Amenity 37
9.5. SuDS Pillar/ Standard 6 – Biodiversity 37
9.6. Summary of above Tiers 37
10. PROPOSED SURFACE WATER DRAINAGE STRATEGY 39
10.1. Policy 39
10.2. Climate Change 39
10.3. Strategy Overview 39
10.4. Discharge Rates 41

© Clancy Consulting 2026

10.5. Discharge Volume 41
10.6. Attenuation 42
10.7. Post-Development Flooding 42
11. PROPOSED FOUL WATER DRAINAGE STRATEGY 44
11.1. Policy 44
11.2. Strategy Overview 44
11.3. Capacity Check 44
12. CONCLUSION 45
12.1. Existing Site 45
12.2. Existing Constraints 45
12.3. Existing Flood Risks 45
12.4. Proposed Development & Constraints 45
12.5. Sequential Test 45
12.6. Exception Test & Mitigation Measures 46
12.7. SuDS Hierarchy 47
12.8. Surface Water Drainage Design 47
12.9. Foul Water Strategy 47
12.10. Overall Conclusion 48
13. Appendices 49
13.1. Appendix A – Site Location Plan 49
13.2. Appendix B – Topographical and Sewer Information 50
13.3. Appendix C – Ground Investigation Extracts 51
13.4. Appendix D – EA Flood Mapping, Including Product 4 and Product 8 52
13.5. Appendix E – Proposed Development & Drainage Plans 53
13.6. Appendix F Drainage Related Drawings 54
13.7. Appendix G1 Flood Plain Compensation and Hydraulic Assessment 55
13.8. Appendix G2 Surface Water Drainage Calculations and Model 56
13.9. Appendix G3 Existing Drainage Assessment 57
13.10. Appendix H Drainage Maintenance & Management Plan (O&M) 58
13.11. Appendix I Sequential Test 59
13.12. Appendix J Flood Warning and Evacuation Plan 60

© Clancy Consulting 2026

1. EXECUTIVE SUMMARY

1.1. Summary

1.1.1. Clancy Consulting Engineers (CCE LTD) has been commissioned by Marco Living 3 Ltd to prepare a Flood Risk Assessment & Drainage/SuDS Strategy for the proposed redevelopment of 232-236 Palatine Road, Didsbury.

1.1.2. This revised FRA/DS should be read in conjunction with the site-specific Flood Warning and Evacuation Plan (FWEP), report reference 21724-CCL-XX-XX-RP-C-02501, included in Appendix J. The FWEP sets out the operational response to residual flood risk at the site, including the appointment of a Site Flood Response Manager by the building management organisation, registration for Environment Agency flood warnings, resident notification and actions, early evacuation to a defined Flood Zone 1 transfer point, raised internal refuge, procedures for vulnerable and mobility-impaired residents, vehicle management, restrictions on access to floodable lower-level areas, isolation of flood-sensitive services, and post-flood inspection and recommissioning requirements. Permanent passive flood-protection measures are incorporated where required; any temporary or demountable measures are secondary and are not fundamental to the safety of the development.

1.1.3. The Environment Agency's consultation feedback provided in a letter dated 10th July 2026 are addressed through the combined mitigation measures and supporting evidence contained within this FRA, the floodplain compensation and hydraulic assessment in Appendix G1, the flood depth, velocity and hazard information in Appendix D, the proposed development drawings in Appendix E, the drainage calculations and modelling in Appendix G2, and the FWEP in Appendix J. These documents should be read together when considering compliance with the Exception Test and the management of residual flood risk associated with the development.

Table 1.1-1 Executive Summary

Existing Site Usage & Constraints	The existing three buildings, comprising 22 residential dwellings, are to be demolished and replaced by 88 residential units comprising 5 townhouses and 83 apartments within three residential blocks, together with associated parking, access, gardens and landscaped areas. The site is already in established residential use and the redevelopment does not introduce a different flood-risk vulnerability classification. Principal constraints include the site's location within Flood Zone 3a, its proximity to the River Mersey, existing ground levels, the requirement to raise habitable accommodation above the adopted design flood level, and the need to accommodate parking, plant and infrastructure at lower levels.
Existing Site Area & Impermeable Area (not infiltrating or stored for reuse)	5,963 m² (0.596 ha) and 2,257 m² (0.226 ha), respectively.
Topography	The topographical survey for the site indicates that the levels fall from approximately 29.280m AOD where the access road meets the public footway on the Southeastern boundary to approximately

© Clancy Consulting 2026

	29.000m AOD at the end of the existing hardstanding. Levels then generally fall toward the northwestern boundary, where they are approximately 28.000m AOD.
Hydrology (Nearby Watercourse and/or Bodies of Water)	The site is located approximately 100 m southeast of the River Mersey and lies within its associated floodplain.
Geology (Surface, Superficial strata, Bedrock strata)	BGS mapping indicates superficial geology in the local area is quite varied with deposits of Diamicton, Alluvium, Clay, Silt, Sand and Gravel, with bedrock consisting of Wilmslow Sandstone.
Hydrogeology (Source Protection Zone, Water table, Infiltration testing)	Available BGS borehole information does not provide reliable groundwater-level data for the site. Groundwater levels are therefore presently unconfirmed and should be established through on-site monitoring before detailed design. Infiltration is not relied upon within the proposed drainage strategy.
Drainage (Public & private)	The existing site is served by a private drainage network. United Utilities asset information identifies a public dedicated surface-water sewer and a public combined sewer within Palatine Road. The proposed surface-water drainage strategy is based on restricted discharge to the public dedicated surface-water sewer, while foul water is proposed to discharge to the public combined sewer. The existing connection arrangements and proposed points of connection remain subject to confirmation and approval by United Utilities before detailed design.
Flood Risk – Fluvial (River)	The site is located within Flood Zone 3a and is at an elevated risk of fluvial flooding from the River Mersey. The adopted defended 0.1% AEP design flood level is 30.090 m AOD. Residential finished floor levels are proposed no lower than 30.690 m AOD, providing 600 mm freeboard above the adopted design flood level.
Flood Risk – Tidal, Surface Water (Overland), Ground Water, Artificial, Sewer and/or Historical	The River Mersey is none tidal at the site and tidal flood risk is low. Environment Agency mapping generally identifies a low risk of surface-water flooding across the developed part of the Site, with localised areas of higher risk near the northern and western boundaries. Groundwater levels are currently unconfirmed, although groundwater flooding is considered a potential residual risk due to the Site's low elevation and proximity to the River Mersey. Flood risk from artificial sources and the public sewerage system is considered low, subject to confirmation of the proposed drainage connections, available capacity, discharge rates and any required improvement works with United Utilities.
Proposed site Usage & Constraints	The proposed development comprises 88 residential units, including 5 townhouses and 83 apartments within three residential blocks, together with associated undercroft and external parking, access, gardens and landscaped areas. The principal development constraints are the site's location within Flood Zone 3a, the adopted design flood level, existing and proposed ground levels, the need to maintain flood-flow routes, the provision of level-for-level compensatory flood storage, and the protection of lower-level parking, plant and infrastructure.
Sequential Test	Sequential test has been carried out by AshtonHale and is included in Appendix I. It concludes that there are no reasonably available alternative sites within the defined search area that are suitable for the proposed development and at a lower risk of flooding.
Exception Test / Mitigation	The site is located within Flood Zone 3a and the proposed residential use is classified as more vulnerable. Following completion of the Sequential Test, the Exception Test has been

© Clancy Consulting 2026

	applied in accordance with the current NPPF. The mitigation strategy includes residential finished floor levels no lower than 30.690 m AOD, providing 600 mm freeboard above the adopted design flood level of 30.090 m AOD; raised residential accommodation and internal refuge; a hydraulically open and floodable undercroft that is not counted as compensatory storage; separate level-for-level and volume-for-volume floodplain compensation; flood-resistant and resilient construction; protection and isolation of critical infrastructure; controlled surface-water discharge; and the site-specific FWEP. The assessment demonstrates that the development can remain safe for its lifetime without increasing flood risk elsewhere.
Proposed Surface Water & SuDS Strategy	The proposed foul-water drainage network will discharge via a pumped system to the existing public combined sewer within Palatine Road. The pumped system will transfer flows to a demarcation manhole at the Site boundary, from which a gravity connection to the public combined sewer will be made. The proposed connection, discharge rate and any required improvement works remain subject to United Utilities approval following completion of the pre-development enquiry.
Existing discharge rates for the 1-year, 30-year and 100-year events, and existing volume	20.8 l/s, 47.4 l/s and 54.9 l/s, respectively, with a volume of 93.1 m³ for the 6-hour 100-year event.
Greenfield Discharge Rates [Qbar, 1yr, 30yr & 100yr events]	1.2 l/s (Qbar), 1.1 l/s (1-year), 2.3 l/s (30-year) and 3.0 l/s (100-year).
Design Rates [1yr, 30yr, 30yr + CC, 100yr & 100yr +CC events] & Volume	5.0 l/s for the 1-year, 30-year, 30-year plus climate-change, 100-year and 100-year plus climate-change events. The required attenuation volume is approximately 108 m³ for the critical 6hr, 100-year plus 45% climate-change event.
Climate change to be applied	45% applied to the surface-water drainage assessment.
Proposed Foul Water Strategy	The proposed foul-water drainage network will discharge via a pumped system to the United Utilities sewer within Palatine Road, potentially reusing the existing connection. The proposed connection and discharge rate remain subject to United Utilities approval following completion of the pre-development enquiry.
Flood Warning and Evacuation Plan	A site-specific FWEP is included in Appendix J. It defines responsibility for flood-warning monitoring and implementation of the plan, registration for Environment Agency flood warnings, resident notification and actions, early evacuation to a defined Flood Zone 1 transfer point, raised internal refuge, procedures for vulnerable and mobility-impaired residents, vehicle removal, closure of floodable lower-level areas, isolation of flood-sensitive services, liaison with the emergency services, and post-flood inspection and reoccupation. Permanent passive flood-protection measures are identified where required; temporary or demountable measures are secondary and are not relied upon as the principal means of making the development safe.

© Clancy Consulting 2026

2. INTRODUCTION

2.1. Commission

2.1.1. Clancy Consulting Engineers (CCE LTD) has been commissioned by Marco Living 3 Ltd to prepare a Flood Risk Assessment & Drainage/SuDS Strategy for the proposed redevelopment of 232-236 Palatine Road, Didsbury.

2.1.2. Within this report, the land and buildings in their pre-development form are referred to as the "Site". The site together with the proposed redevelopment works is referred to as the "Development". A site location plan is provided in Appendix A.

2.2. Project Overview

2.2.1. The Development comprises the demolition of the existing buildings and the construction of 88 residential units, comprising 5 townhouses and 83 apartments within three residential blocks, together with associated undercroft and external parking, access, gardens, landscaping, drainage and other infrastructure.

2.2.2. The Site is located within Flood Zone 3a and is at an elevated risk of fluvial flooding from the River Mersey. The Development therefore incorporates raised residential accommodation, a hydraulically open undercroft, separate level-for-level and volume-for-volume compensatory flood storage, flood-resistant and flood-resilient construction, controlled surface-water drainage and a site-specific Flood Warning and Evacuation Plan.

2.3. Objective

2.3.1. This report has been prepared with reference to the National Planning Policy Framework (NPPF), the Planning Practice Guidance for Flood Risk and Coastal Change, the National Standards for Sustainable Drainage Systems (SuDS), relevant Environment Agency guidance and the applicable Lead Local Flood Authority guidance.

2.3.2. The objective of this Report is to

- Assess the existing characteristics and development constraints of the Site;
- Identify and assess the existing and future risks of flooding from all relevant sources, including the effects of climate change;
- Review the findings of the Sequential Test and assess the Development against the flood-risk requirements of the current NPPF, including Policies F4 to F8 where applicable;
- Apply the Exception Test and demonstrate the wider sustainability benefits of the Development, that it will remain safe for its lifetime, and that it will not increase flood risk elsewhere and, where possible, will reduce flood risk overall;
- Establish the adopted fluvial design flood level and the minimum finished floor levels for habitable accommodation;

© Clancy Consulting 2026

- Identify appropriate measures for managing residual flood risk, including raised accommodation, internal refuge, flood-resistant and resilient construction, protection of critical infrastructure, vehicle management and emergency planning;
- Assess the hydraulic effect of the Development and demonstrate the provision of level-for-level and volume-for-volume compensatory flood storage without reliance upon the open undercroft as compensatory storage;
- Apply the local LLFA SuDS hierarchy and the National Standards for Sustainable Drainage Systems to manage the rate, volume and quality of surface-water runoff while considering climate-change allowances in accordance with current Environment Agency guidance;
- Establish a surface-water and foul-water drainage strategy that does not increase flood risk on or off the Site and provides a reduction in surface-water discharge compared with the existing development; and
- Cross-reference the site-specific Flood Warning and Evacuation Plan, report reference 21724-CCL-XX-XX-RP-C-02501, included in Appendix J, which sets out the flood-warning, resident-notification, early-evacuation, internal-refuge, vulnerable-resident, vehicle-management, service-isolation and post-flood recovery procedures for the Development.

3. SITE CHARACTERISTICS

3.1. Location

3.1.1. The Site is located at Palatine Road, Didsbury, Manchester, M20 2WF, as shown on Figure 3.1-1 and the site location plan in Appendix A. The approximate central grid reference is E 383557, N 390984. Manchester City Council is the Local Planning Authority and Lead Local Flood Authority for the Development.



Figure 3.1-1 Location Plan
(Source: UK StreetMap)

3.2. Boundaries & Usage

3.2.1. Fig 3.2.2 shows an aerial view of the Site (indicate by the red boundary) and the surrounding area.

3.2.2. The Site is bounded by the grounds of the adjacent Britannia Country House Hotel to the North and Northwest of the site. The site is also bounded by an existing residential apartment building and car parking area to the Southwest, and Palatine Road to the Southeast.

3.2.3. The Site currently plays host to 3 large, detached buildings subdivided into 22 residential units with associated access road, and soft landscaped area to the rear.

3.2.4. A detailed catchment plan for the existing site is provided in Appendix F. The planning application boundary is 5,963m^2 (0.596ha), with the extent of existing hardstanding accounting for 2,257m^2 (0.226ha) of the total area.

3.2.5. The existing site utilises a piped gravity combined network, with a discharge to the combined water United Utilities sewer within Palatine Road utilised as the outfall location.

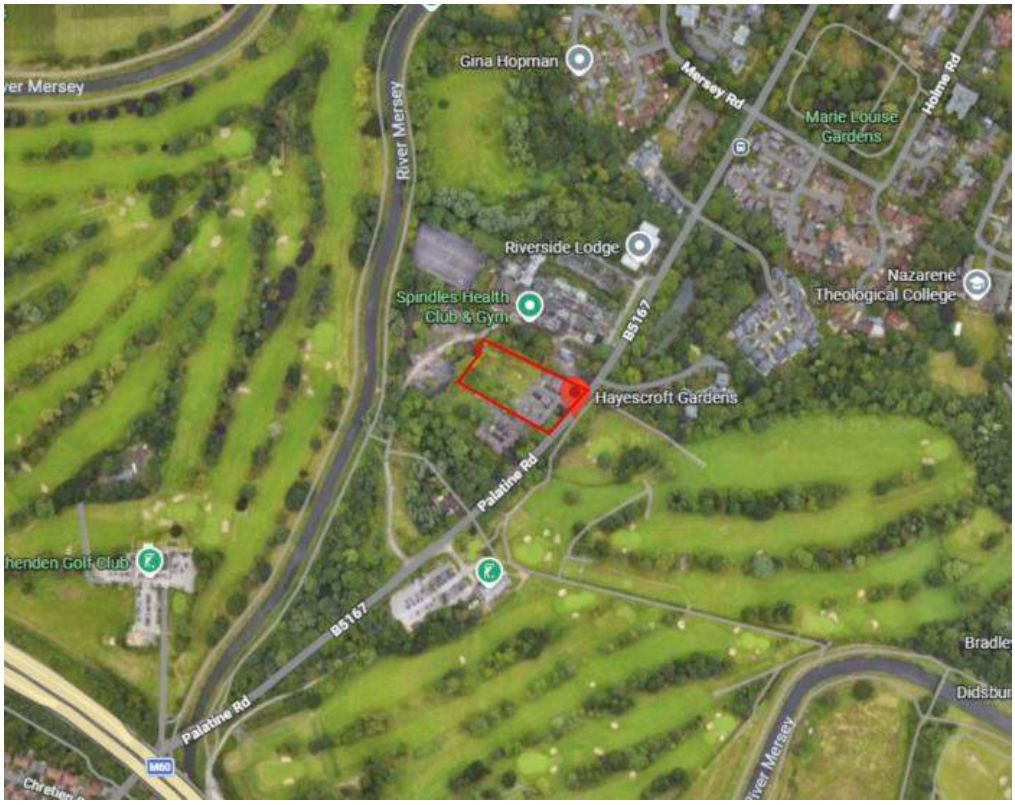


Figure 3.2-2 Existing Aerial View
(Source: Bing Maps)

3.3. Topography

3.3.1. A topographical survey has been completed and is provided in Appendix B.

3.3.2. The topographical survey indicates that levels fall from approximately 29.280m AOD where the access road meets the public footway on the south-eastern boundary, to

© Clancy Consulting 2026

approximately 29.000m AOD at the end of the existing hardstanding. Levels then generally fall towards the north-western corner of the Site, where levels are approximately 28.000m AOD.

3.4. Hydrology

3.4.1. The principal hydrological feature influencing the site is the River Mersey, located approximately 100m to the north-west of the site. The site is located within the River Mersey catchment and is influenced by defended fluvial flood risk associated with the River Mersey and its tributaries.

3.4.2. The site is shown to benefit from existing flood defences; however, residual flood risk remains in the event of overtopping, breach, exceedance of the defended standard of protection, or blockage/reduced performance of the drainage network during extreme rainfall events. The hydrological setting has therefore informed the selection of the adopted design flood level, finished floor levels, flood-resilience measures, flood-warning procedures and surface-water drainage strategy.

3.5. Existing Drainage Public

3.5.1. United Utilities is the incumbent sewerage undertaker for the area and copies of the available asset records are provided in Appendix B. The records indicate the following:

- A dedicated 600 mm diameter public surface-water sewer is located within Palatine Road and runs broadly north to south. This sewer is considered viable for a proposed surface-water connection, either through a new manhole on the public sewer or via a saddle connection, subject to United Utilities approval.
- No separate public foul-water sewer has been identified in close proximity to the Site that would provide a practicable foul-water connection.

3.6. Existing Drainage – Private

3.6.1. The existing private drainage has been surveyed. Based on the available survey information, the existing Site appears to utilise a private gravity drainage network serving both foul and surface-water flows, with final discharge to the existing public combined sewer within Palatine Road. The existing connection arrangement should be confirmed with United Utilities before detailed design.

3.7. Geology

3.7.1. A site investigation has not yet been carried out for the development.

3.7.2. Desktop study conducted through review of the online BGS mapping data indicates that the site is underlain by superficial deposits of Alluvium consisting of Clay, Silt, Sand and Gravel, and River Terrace deposits consisting of Sand and Gravel. The bedrock geology of the site consists of Wilmslow Sandstone formation Sandstone.

3.7.3. The available BGS borehole records in the vicinity of the Site are classified and therefore do not provide a reliable site-specific indication of ground conditions.

© Clancy Consulting 2026

Ground conditions should be confirmed by a site-specific ground investigation before detailed design.

3.8. Hydrogeology

3.8.1. The site is not located in a Source Protection Zone (SPZ). Site location indicated by the red arrow.

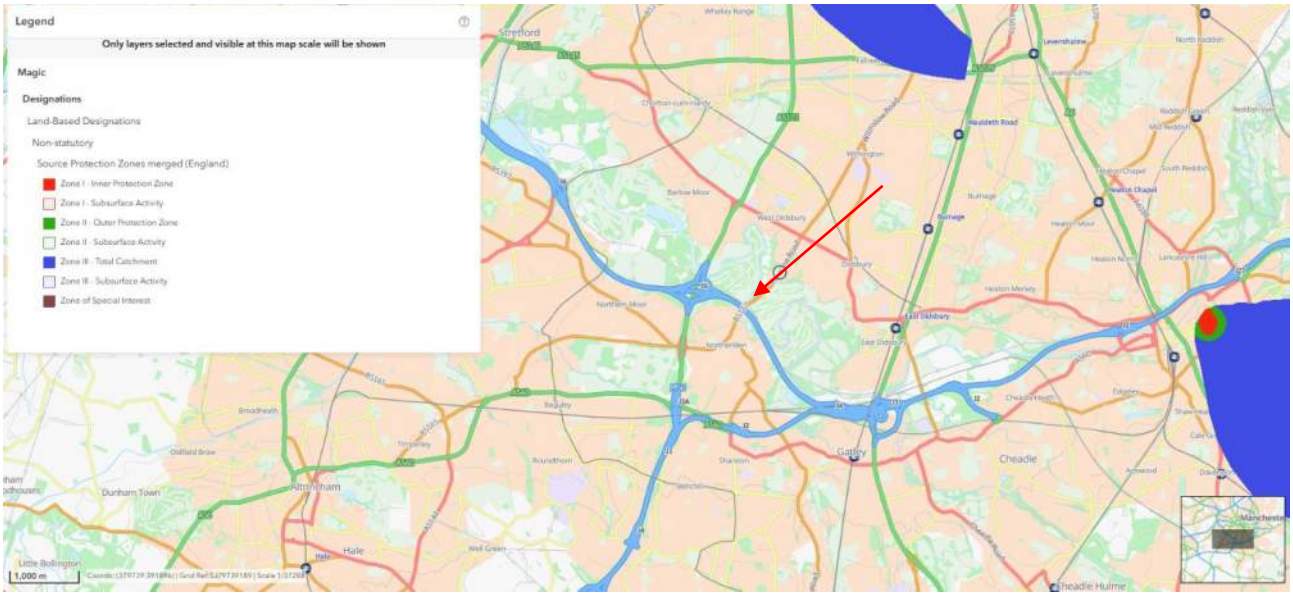


Figure 3.8-1 Source Protection Zones
(Source: Magic Maps)

3.8.2. No reliable site-specific groundwater-level data is currently available. Groundwater levels are therefore presently unconfirmed and should be established through site-specific monitoring before detailed design.

3.8.3. Infiltration testing has not yet been carried out. Given the Site's proximity to the River Mersey, potential elevated groundwater levels, made ground and variable superficial deposits, infiltration drainage is not relied upon within the proposed drainage strategy. This conclusion should be reviewed if subsequent ground investigation, infiltration testing and groundwater monitoring demonstrate that limited infiltration can be safely incorporated.

3.9. Site Specific Constraints

3.9.1. The Site has a number of constraints that affect the selection and design of SuDS features and flood-risk mitigation measures.

3.9.2. The proposed Development provides limited opportunity for open-water SuDS features such as basins because of the proposed layout, available space and flood-risk constraints. Smaller landscape-led SuDS features, including rain gardens, tree pits and soft landscaped drainage features, may be incorporated where they are confirmed on the coordinated landscape drainage proposals.

3.9.3. The direct discharge to the River Mersey would sit higher in the SuDS hierarchy than discharge to a public sewer. However, a direct connection would require works across third-party land and no suitable existing connection, easement or right to

© Clancy Consulting 2026

discharge has been identified. A restricted discharge to the public surface-water sewer within Palatine Road is therefore proposed.

3.9.4. The site is located within Flood Zone 3 and is therefore subject to the flood-risk policy requirements of the current NPPF. The design must demonstrate that the development will remain safe for its lifetime, that residual risk can be safely managed, that safe access / escape and emergency-planning arrangements are provided where practicable, and that flood risk is not increased elsewhere.

3.9.5. The proposed development is subject to the following site-specific flood-risk constraints:

- Requirement to maintain habitable accommodation above the adopted design flood level;
- Requirement to manage residual risk to the undercroft, parking and lower-level floodable areas;
- Critical plant, tank rooms, risers, substation infrastructure, lift installations and EV charging infrastructure located below or close to the adopted design flood level;
- Permanent full-height flood doors to protected plant, tank, riser and substation areas where required
- Demountable flood barriers to selected openings, including lift openings and the front entrance where required;
- Requirement for formal floodplain compensation where required; and
- Requirement for a site-specific FWEP and Site Flood Response Manager.
- Requirement to discharge surface water at a restricted rate to the public dedicated surface-water sewer within Palatine Road, subject to United Utilities approval; and
- Requirement to discharge foul water to the public combined sewer within Palatine Road via a pumped system, subject to United Utilities capacity confirmation and approval.

© Clancy Consulting 2026

4. FLOODING

4.1. Types of Flooding

4.1.1. Flood risk can arise from a range of sources, including rivers, the sea, surface-water runoff, groundwater, artificial sources and sewerage systems. The Development has been assessed against each of the sources listed in Table 4.1-2 using available Environment Agency mapping and model data, the Strategic Flood Risk Assessment (SFRA), Lead Local Flood Authority information, sewer records and available records of historical flooding. The assessment also considers the potential effects of climate change and residual risks associated with the overtopping or failure of flood-defence infrastructure.

Table 4.1-2 Flood Types

Flood Type
A – Fluvial Flooding (River)
B – Tidal Flooding
C - Surface Water Flooding
D - Ground Water Flooding
E – Flooding From Artificial Sources
F - Sewer

4.2. Fluvial (River)

4.2.1. Fluvial flooding occurs when flows within a river or watercourse exceed the capacity of the channel, resulting in the inundation of the surrounding floodplain. Flooding can also occur through the overtopping, breach or failure of flood-defence infrastructure.

4.2.2. The Environment Agency publishes national flood mapping based on hydraulic modelling, surveys, remote-sensing information and historical flood data. This mapping provides an indication of the probability and potential extent of flooding and is supplemented, where available, by more detailed site-specific flood-model information.

4.2.3. For planning purposes, land is classified into the following flood zones:

- Zone 1 - as being Low Probability, comprised of land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any one year. (<0.1%)
- Zone 2 - as being Medium Probability, comprised of land assessed as having between 1 in 100 and 1 in 1000 annual probability of river flooding (1%-0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%) in any year.
- Zone 3a - as being High Probability, comprised of land assessed as having between 1 in 100 or greater annual probability of river flooding (>1%) or a 1

© Clancy Consulting 2026

in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

- Zone 3b - as being Functional Flood Plain, comprised of land where water must flow or be stored in times of flood. SFRA should identify this zone.

4.2.4. The Site identified by the red boundary on Figure 4.2-3, is located within Flood Zone 3a and is therefore classified as having a high probability of fluvial flooding. The principal source of fluvial flood risk is the River Mersey, located approximately 100m northwest of the Site.

4.2.5. The Environment Agency's Upper Mersey model data identifies an adopted defended 0.1% AEP design flood level of 30.090 m AOD at the Site. Residential finished floor levels are therefore proposed no lower than 30.690 m AOD, providing 600mm freeboard above the adopted design flood level.

4.2.6. Residual fluvial flood risk remains from events exceeding the design event and from the potential overtopping, breach or failure of adjacent flood-defence and flood-storage infrastructure. The mitigation strategy therefore incorporates raised residential accommodation, a hydraulically open and floodable undercroft, separate level-for-level and volume-for-volume compensatory flood storage, flood-resistant and flood-resilient construction, protection or safe isolation of critical infrastructure, raised internal refuge and the operational procedures contained within the site-specific FWEP.

4.2.7. The open undercroft is provided to maintain hydraulic connectivity and allow floodwater to pass beneath and recede from the raised Development. It is not relied upon as compensatory flood storage. The proposed compensatory storage and hydraulic effects of the Development are assessed separately in Appendix G1.

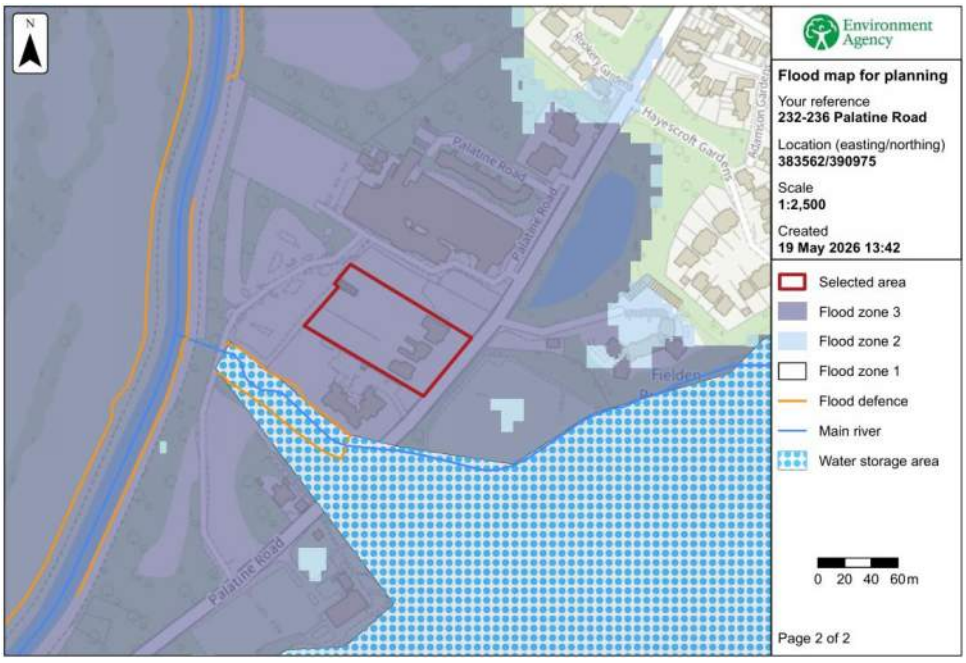


Figure 4.2-3 Fluvial Flood Map
(Source: flood-map-for-planning.service.gov.uk)

© Clancy Consulting 2026

4.3. Environment Agency (EA) Consultation

4.3.1. A previous planning application for the Site was supported by a supplementary flood risk assessment prepared by Fairhurst, reference 159923/01 Rev 3, dated October 2024. That assessment included consultation with the Environment Agency regarding the modelled flood data for the Site and identified measures to reduce flood risk to the Development, make the Site safe for occupants and avoid increasing flood risk elsewhere.

4.3.2. The mitigation measures formed part of the flood-risk strategy submitted in support of the previous planning application. The measures described below have been informed by that strategy but have been reviewed and updated to reflect the current development proposals, the latest available flood-model information and the Environment Agency's comments on the current application.

4.3.3. As part of its consultation response to the current application, the Environment Agency requested additional information concerning flood hazard and velocity, safe access and egress, floodplain compensation, the hydraulic functionality of the undercroft, emergency planning and the protection of critical infrastructure. These matters are addressed within this revised FRA and the associated Flood Warning and Evacuation Plan.

4.3.4. To better understand the nature of fluvial flood risk at the Site, Environment Agency Product 4 data has been obtained. This includes flood model data from the Upper Mersey 2017 model, dated 30 January 2026. The modelled flood levels are broadly consistent with the previous data obtained by Fairhurst. The flood-risk strategy has therefore been reviewed and updated to reflect the current Development proposals and the Environment Agency's latest consultation comments.

4.3.5. Flood data was provided at 27 locations for the 50% AEP, 20% AEP, 10% AEP, 5% AEP, 4% AEP, 3.33% AEP, 2% AEP, 1.33% AEP, 1% AEP, 0.5% AEP and 0.1% AEP events, as shown in the figure below.

© Clancy Consulting 2026

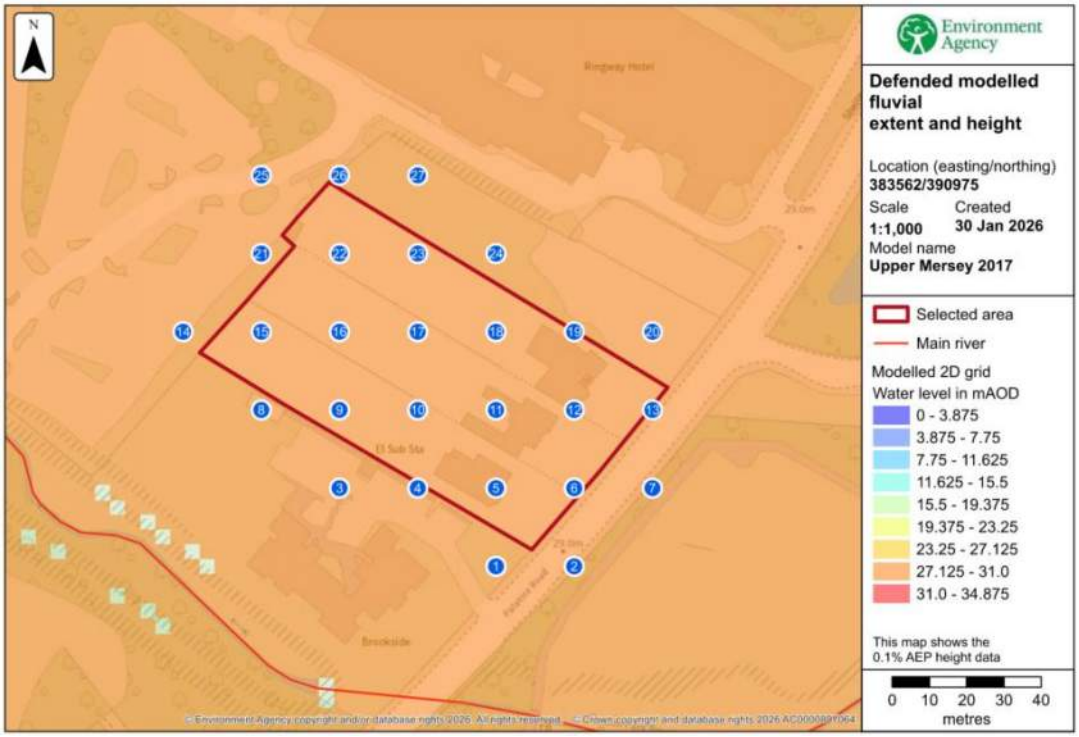


Figure 4.3-4 Defences-removed modelled fluvial extent and height map
(Source: flood-map-for-planning.service.gov.uk)

4.3.6. The figure presents the defences-removed flood extent and should not be interpreted as representing the defended design-event conditions used to establish the proposed finished floor levels.

4.3.7. A review of the Environment Agency flood maps indicates that the Site lies within an area benefitting from flood defences associated with the River Mersey and its tributaries, including an embankment to the south and engineered high ground to the north-west and south-east. The available mapping indicates that the defences generally provide a 75 to 100-year standard of protection. Residual risk nevertheless remains from events exceeding the standard of protection and from the potential overtopping, breach or failure of the defences.

4.3.8. A review of the defended flood model nodes indicates that the Site is not affected by defended events up to and including the 2% AEP event. For finished floor level design, Point 2 records the highest defended 0.1% AEP design flood level at the Site, at 30.090m AOD. Comparable flood levels are recorded at other model locations around the proposed building footprints.

4.3.9. The proposed finished floor level for all habitable dwellings is therefore set no lower than 30.690m AOD, providing 600mm freeboard above the adopted defended design flood level.

4.3.10. Level 00 is raised to provide a lowest habitable finished floor level of 30.690m AOD.

4.3.11. Habitable accommodation is therefore located above the adopted design flood level and provides internal safe refuge for occupants during a flood event, where safe evacuation is no longer possible.

© Clancy Consulting 2026

4.3.12. Floodwater within the lower-level undercroft car park is to be directed away from buildings towards the free-draining landscaped area to the north-west. The undercroft will remain non-habitable, open-sided and capable of flooding during an extreme event. Continuous walls, raised kerbs, storage, landscaping or other obstructions that could materially restrict the entry, passage or recession of floodwater will be avoided as far as practicable. Permeable paving and the proposed undercroft levels will assist with the drainage and recession of floodwater following an event.

4.3.13. The hydraulic functionality of the undercroft is separate from the provision of floodplain compensation. The undercroft voids are not relied upon as compensatory flood storage. Any loss of floodplain storage is addressed separately in Appendix G1 on a level-for-level and volume-for-volume basis using the existing and proposed site levels and the applicable design event, including the relevant climate-change allowance.

4.3.14. Egress routes from the undercroft car park to accommodation above the adopted design flood level are provided via several stair cores. These routes provide access to Level 00 and the upper residential floors above 30.690m AOD. The vehicle access ramp is not relied upon as the primary pedestrian egress route during flood conditions unless the flood hazard and velocity assessment demonstrates that it remains safe.

4.3.15. Flood-depth, velocity and hazard mapping has been used to assess the proposed access and evacuation routes. The off-site evacuation route towards Flood Zone 1, the nominated transfer point and the provisions for vulnerable and mobility-impaired residents are set out within the FWEP. Evacuation should only be undertaken while the identified route remains safe. Once flooding has commenced, residents should not enter floodwater and should instead move to the internal refuge provided above the adopted design flood level.

4.3.16. Vehicles should be removed from the undercroft following receipt of an Environment Agency flood warning only where sufficient time remains, and the access route is safe. Vehicle movements must cease once flooding has commenced or the route has otherwise become unsafe.

4.3.17. Residents will be instructed to register for the Environment Agency flood-warning area “River Mersey at West Didsbury, Northenden Golf Club and Palatine Road”. Resident responsibilities, warning triggers, evacuation procedures and refuge arrangements are set out within the Flood Warning and Evacuation Plan.

4.3.18. Flood-resistant and flood-resilient materials and construction techniques, informed by CIRIA guidance on property flood resilience, will be used for lower-level structures and elements located below the adopted design flood level where appropriate. The undercroft columns, foundations and associated structural elements will also be designed for the applicable hydrostatic, hydrodynamic and debris-loading conditions, including the potential impact of a floating vehicle where relevant.

© Clancy Consulting 2026

4.3.19. Critical electrical and utility infrastructure will be located above the adopted design flood level wherever practicable. Where this cannot be achieved, appropriate flood-resistant or watertight protection and safe-isolation measures will be provided. This includes flood protection to the electrical substation and safe isolation of EV charging equipment and other electrical installations serving the undercroft. EV charging infrastructure is not relied upon during a flood event.

4.3.20. The proposed surface-water drainage system has been designed for the proposed use and the lifetime of the Development, including the relevant climate-change allowance, and provides restricted discharge to the public dedicated surface-water sewer within Palatine Road.

4.3.21. A drainage maintenance plan has been prepared to support the continued operation of the drainage systems throughout the lifetime of the Development.

4.4. Tidal (Sea)

4.4.1. Tidal flooding is caused by rising sea levels overtopping or breaching tidal defences or natural barriers, resulting in the sea water moving inland.

4.4.2. The River Mersey in the vicinity of the site is non-tidal, therefore the Site is therefore not considered to be at risk of Tidal Flooding.

4.5. Surface Water

4.5.1. Surface water flooding occurs as a result of excessive rainfall which exceeds the capacity of local drainage systems. During prolonged periods of rainfall, the ground may become saturated and unable to absorb further water, resulting in overland sheet water flow from adjacent land and/or surcharging of sewers.

4.5.2. The main causes of surface water flooding are excessive rainfall, urbanisation, inadequate drainage infrastructure, ground conditions & climate change. The table below explains the flood risk categories used by the map.

Table 4.5-3 Surface Water Flood Risk Categories

Risk	Description
High	Flooding occurring as a result of rainfall with a greater than 1 in 30 chance in any given year (annual probability greater than 3.3%)
Medium	Flooding occurring as a result of rainfall of between 1 in 30 (3.3%) and 1 in 100 (1%) chance in any given year
Low	Flooding occurring as a result of rainfall of between 1 in 100 (1%) and 1 in 1000 (0.1%) chance in any given year
Very Low	Flooding occurring as a result of rainfall with less than 1 in 1000 (0.1%) chance in any given year

4.5.3. The EA's surface water flood map shows the majority of Site (marked by a black marker) is low risk, with discrete areas of high risk concentrated along the northern and western site boundaries.

© Clancy Consulting 2026

4.5.4. This appears to reflect the topography of the site, which generally falls towards the Northern and Western boundaries. These lower areas appear to form overland flow routes and local collection areas for surface waters.

4.5.5. Although the majority of the Site is mapped at low risk, the areas of high risk along the northern and western boundaries must be accounted for in the proposed levels and drainage strategy. The Site is therefore considered to be at low risk overall, subject to existing overland flow routes being maintained or safely redirected and the proposed drainage strategy being implemented.

4.5.6. The proposed levels and drainage design will maintain or safely redirect overland surface-water flow routes away from building entrances, without increasing flood risk elsewhere. The undercroft drainage, permeable surfaces and associated maintenance requirements are addressed within the proposed drainage strategy and drainage maintenance plan.

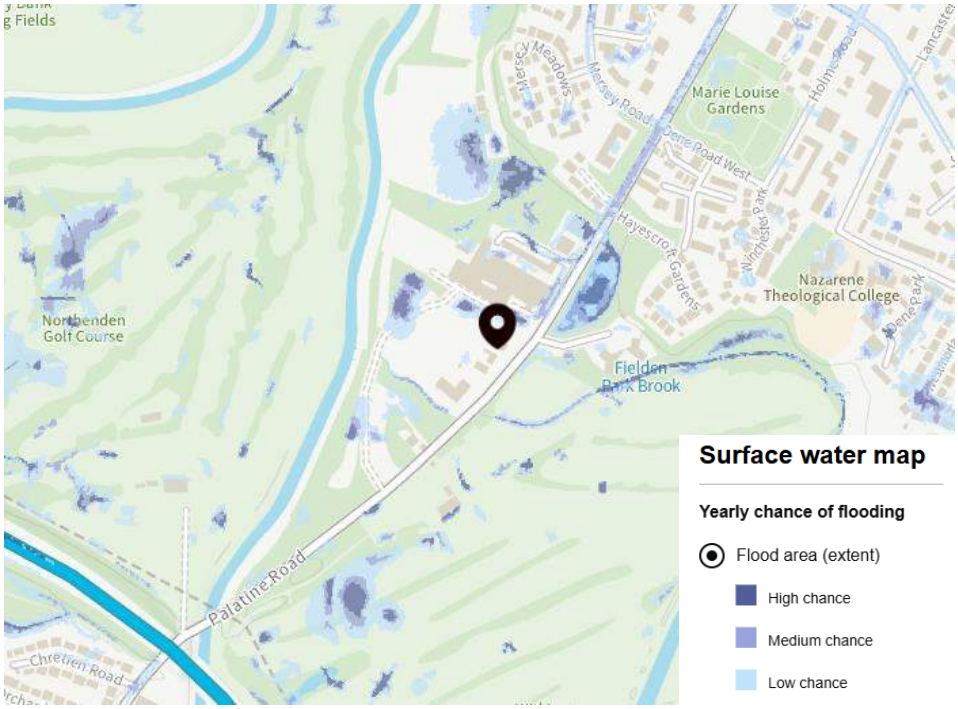


Figure 4.5-5 Surface Water Flood Map
(Source: flood-map-for-planning.service.gov.uk)

4.6. Ground Water

4.6.1. Ground water flooding occurs when the water table rises to, or close to, ground level. This type of flooding originates from water stored underground within aquifers/ permeable soil and rock formations.

4.6.2. Information on historic ground water flooding and the potential for ground water flooding is typically provided in the Strategic Flood Risk Assessment (SFRA) completed by the local authority. However, the available sources provide limited information regarding groundwater flooding at the site. The findings of the site-specific ground investigation, including any groundwater monitoring data, should therefore be reviewed to assess this potential source of flooding.

© Clancy Consulting 2026

4.6.3. The site is located relatively close to the River Mersey and groundwater levels may therefore be influenced by river levels, although no site-specific evidence of groundwater flooding has been identified. On the basis of the available information, the risk of groundwater flooding is currently considered to be low, subject to confirmation through the site-specific ground investigation and groundwater monitoring.

4.7. Historical/Artificial/Sewer

4.7.1. Artificial flooding may occur as a result of the failure or exceedance of artificial water-retaining or water-management infrastructure, including reservoirs, canals, water mains, pumping stations and drainage infrastructure.

4.7.2. Sewer flooding may be caused by heavy rainfall exceeding the capacity of the sewer network, blockages, collapsed or damaged sewers, pumping station failures or other infrastructure defects.

4.7.3. The EA Product 4 information identifies a historic flood event dated 1 January 2025 affecting the Site location and wider Palatine Road area. Available site and project information also indicates that floodwater may have entered the Site during this event. However, the precise extent, depth, duration and mechanism of flooding at the Site are not fully established by the available records. The event is understood to have been associated principally with flooding from the River Mersey and does not provide evidence of flooding from sewer or artificial sources. The proposed flood-mitigation measures described above have therefore been developed using the EA's current flood modelling and product data, supplemented by the available historic flood information.

4.7.4. No site-specific records of flooding from sewer or artificial sources have been identified from the available information. The risk from these sources is therefore considered to be low, subject to implementation of the proposed drainage strategy, appropriate maintenance of the drainage infrastructure and confirmation of the proposed sewer connection arrangements with United Utilities.

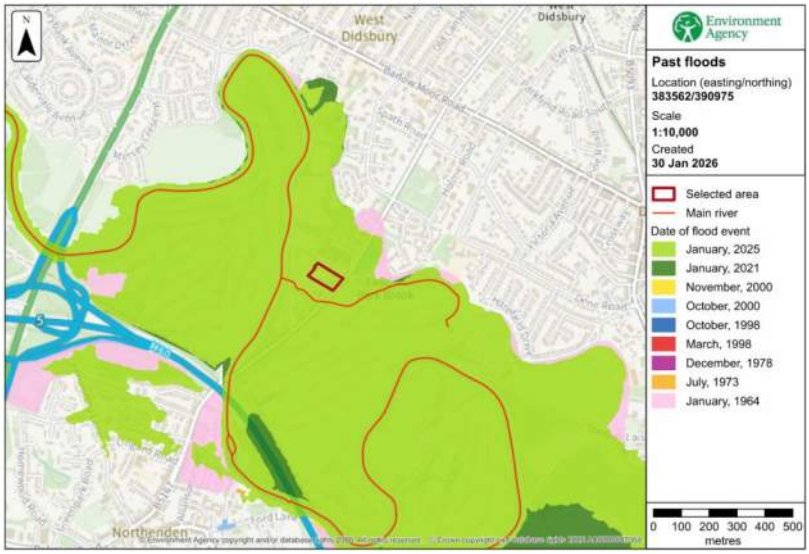


Figure 4.7-6 Past Floods Map
(Source: Environment Agency Product 4 Data)

4.8. Summary

4.8.1. Table 4.8-5 summarises the assessed flood risk from each before implementation of the proposed flood mitigation and SuDS measures. The proposed mitigation measures are described in Section 8 of this report.

Table 4.8-4 Flood Risk Summary

Flood Type	Risk Level
A – Fluvial (River)	HIGH
B - Tidal	VERY LOW
C - Surface Water	LOW
D – Ground Water	LOW
E - Artificial	LOW
F - Sewer	LOW

© Clancy Consulting 2026

5. PROPOSED DEVELOPMENT

5.1. Development & Use

5.1.1. The proposed Development includes lower-level undercroft parking and external areas, with the undercroft remaining open to facilitate the passage and recession of floodwater. No habitable accommodation is proposed at undercroft level. Habitable accommodation within the Development will be set at or above a minimum finished floor level of 30.690m AOD, providing 600mm freeboard above the adopted defended 0.1% AEP design flood level of 30.090m AOD.



Figure 5.1-7 Proposed Undercroft Level Site Plan
(Source: DEP Landscape Architecture Ltd)

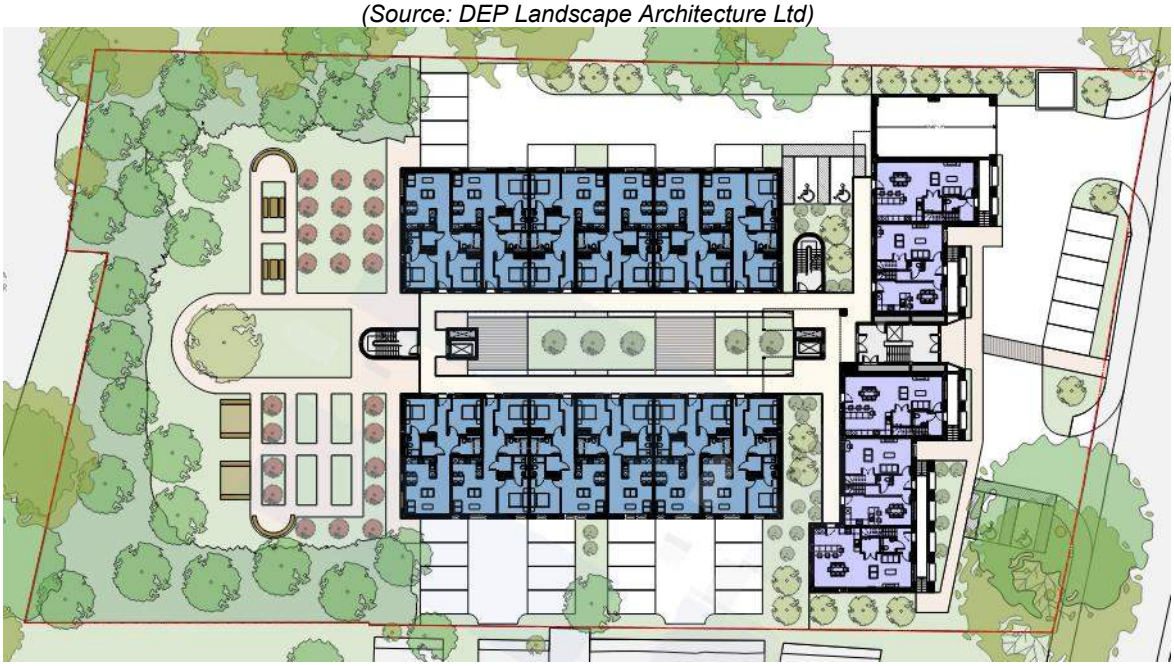


Figure 5.1-8 Proposed Raised Ground Floor Site Plan
(Source: OMI Architects Drg:1459-OMI-ZZ-00-DR-A-L1001)

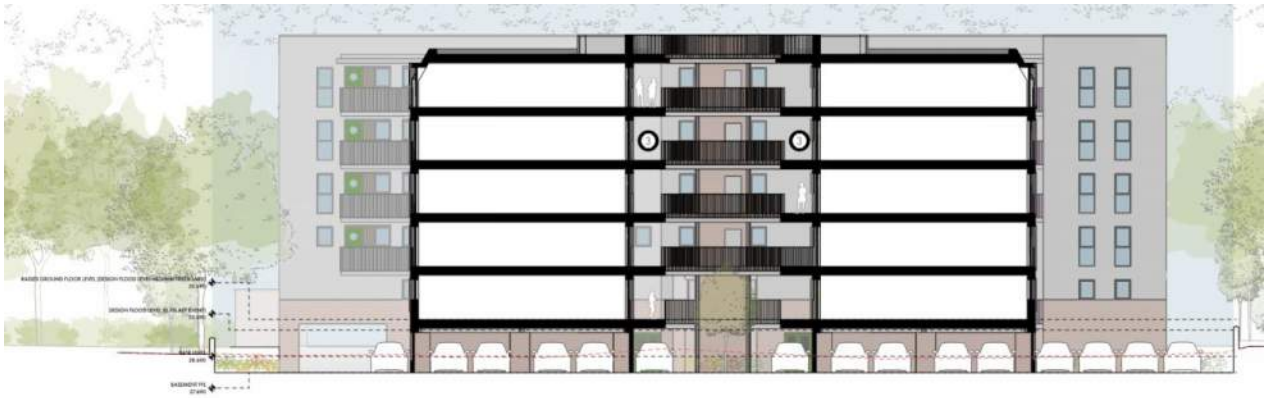


Figure 5.1-9 Proposed Site Section Showing Modelled Floor Lvl & Min Habitable FFL
(Source: OMI Architects Drg:1459-OMI-ZZ-00-DR-A-L1503)

5.1.2. The proposals include an under-croft car parking area and external communal and landscaped areas at low level. A ramp rises from the undercroft to the frontage parking area, which ties into the adjacent highway level. The two eastern apartment blocks are supported on columns, with the undercroft remaining open to facilitate the passage and recession of floodwater. No habitable accommodation is proposed at undercroft level. Habitable accommodation within the development will be set at or above a minimum finished floor level of 30.690m AOD, providing 600mm freeboard above the highest 0.1% AEP defended modelled flood level of 30.090m AOD.

5.2. Development Constraints

5.2.1. The Site comprises previously developed brownfield land occupied by three existing residential buildings containing 22 residential units. Existing utility and drainage infrastructure is therefore present within and around the Site. The existing on-site drainage network will be made redundant and replaced by a new drainage system serving the proposed Development. Surface-water drainage is proposed to discharge at a restricted rate to the public dedicated surface-water sewer within Palatine Road, while foul water is proposed to discharge to the public combined sewer within Palatine Road. Both connections will be subject to detailed design and approval by United Utilities.

5.2.2. The presence of made ground, together with the proposed layout, flood-risk constraints and available space, constrains the use of open-water SuDS features. Infiltration drainage is not relied upon within the proposed drainage strategy because groundwater levels are currently unconfirmed and the Site is close to the River Mersey. The suitability of any limited infiltration should be reviewed following site-specific ground investigation, groundwater monitoring and infiltration testing. The drainage strategy therefore incorporates appropriate source-control and attenuation measures, followed by controlled discharge to the public dedicated surface-water sewer, subject to the necessary approvals.

© Clancy Consulting 2026

6. SEQUENTIAL TEST

6.1. National Planning Policy Framework (NPPF)

6.1.1. The National Planning Policy Framework (NPPF) sets out national planning policy for protecting people and property from flood risk now and in the future. It is supported by the Planning Practice Guidance for Flood Risk and Coastal Change and by consultation with the Environment Agency where the Environment Agency is a statutory consultee.

6.2. Sequential Testing Overview

6.2.1. The NPPF requires a sequential, risk-based approach to the location of development. The objective is to steer new development towards areas with the lowest risk of flooding from any source, taking account of both present-day and future flood risk.

6.3. Sequential Test Overview

6.3.1. Policy F5 of the NPPF states that, where the Sequential Test applies, development should not be located in an area at risk of flooding where reasonably available sites appropriate for the proposed development are available in areas at lower flood risk.

6.3.2. The geographical area over which alternative sites are considered should reflect the anticipated catchment of the proposed development in terms of its likely occupiers or users. The Strategic Flood Risk Assessment covering the area and the Environment Agency Flood Map for Planning should provide the principal evidence used to apply the test.

6.3.3. Annex F, Table 3 of the NPPF identifies the compatibility of each flood risk vulnerability classification with the respective flood zones and establishes the circumstances in which the Exception Test is required.

Table 6.3-5 Flood Risk Vulnerability and Flood Zone Compatibility

Flood Risk Vulnerability Classification					
Flood Zones	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
1	✓	✓	✓	✓	✓
2	✓	ET Required	✓	✓	✓
3a†	ET Required†	×	ET Required	✓	✓
3b*	ET Required*	×	×	×	✓*

✓ Exception Test is not required

✗ Development should not be permitted

† In Flood Zone 3a, essential infrastructure should be designed and constructed to remain operational and safe during a flood.

" * "In Flood Zone 3b (functional floodplain), essential infrastructure that has to be there and has passed the Exception Test, and water-compatible uses, should be designed and constructed to:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;
- not impede water flows; and
- not increase flood risk elsewhere.

© Clancy Consulting 2026

6.4. Application of the Sequential Test

6.4.1. The proposed Development comprises residential dwellings and is therefore classified as “More Vulnerable” development in accordance with Annex F, Table 2 of the NPPF. The Site is located within Flood Zone 3a and the Sequential Test is therefore applicable.

6.4.2. A separate Sequential Test has been undertaken by AshtonHale and is included in Appendix I. The defined search area comprises the West Didsbury Ward, reflecting the anticipated geographical catchment of the proposed residential Development. The assessment considered reasonably available alternative sites capable of accommodating the nature and scale of the proposed Development and concluded that no suitable and reasonably available sites are present within areas at a lower risk of flooding.

6.4.3. The application site is previously developed land and is currently occupied by 22 residential units. Although the established residential use is relevant to the suitability and planning context of the site, it does not in itself remove the requirement to apply the Sequential Test to the proposed redevelopment.

6.4.4. On the basis of the assessment undertaken by AshtonHale, the Sequential Test concludes that there are no reasonably available alternative sites within the West Didsbury Ward that are appropriate for the proposed Development and located at a lower risk of flooding. The Sequential Test is therefore considered to be satisfied, subject to confirmation by the Local Planning Authority.

6.4.5. As the proposal comprises More Vulnerable development within Flood Zone 3a, Annex F, Table 3 of the NPPF requires the Exception Test to be satisfied following application of the Sequential Test. The Exception Test is considered in Section 7.

6.4.6. The Site is previously developed land in established residential use. Redevelopment provides an opportunity to improve the quality of residential accommodation and visual amenity of the area, while incorporating flood-risk mitigation, drainage betterment and operational flood-response measures that are not present in the existing arrangement.

7. EXCEPTION TEST

7.1. Exception Test (ET) Overview

7.1.1. The Sequential Test prepared by AshtonHale, dated May 2026 and reproduced in Appendix I, assesses reasonably available alternative sites within the West Didsbury Ward search area agreed with Manchester City Council. It concludes that no suitable or reasonably available site within an area at lower flood risk can accommodate the proposed Development, either as a single development or through a combination of smaller sites. As the proposed residential Development

© Clancy Consulting 2026

is classified as a “More Vulnerable” use and is located within Flood Zone 3a, the Exception Test is therefore required.

7.1.2. For the Exception Test to be satisfied, it must be demonstrated that:

- The development would provide wider sustainability benefits to the community that outweigh the flood risk;
- The development would be safe for its anticipated lifetime, taking account of the vulnerability of its users; and
- The development would not increase flood risk elsewhere and, where possible, would reduce flood risk overall.

7.2. Criterion 1 – Wider Sustainability Benefits

7.2.1. The wider sustainability benefits associated with the proposed development have been assessed by AshtonHale as part of the Sequential Test reproduced in Appendix I.

7.2.2. The development would regenerate a previously developed residential site currently occupied by 3 detached buildings divided into 22 residential units. It would provide 88 new homes, comprising 83 apartments and 5 townhouses, representing a net increase of 66 residential units.

7.2.3. The site is already in established residential use, comprising three existing residential buildings subdivided into 22 residential units within an area identified as being at risk of flooding. The proposed redevelopment would therefore not introduce residential accommodation into an otherwise undeveloped flood-risk location, but would replace the existing accommodation with a purpose-designed development incorporating a materially improved standard of flood resilience.

7.2.4. The proposed development includes raised finished floor levels, flood-resilient construction measures where required, flood warning and evacuation procedures, safe refuge above the design flood level, floodplain compensation where required, and improved drainage infrastructure. These measures would reduce the vulnerability of future occupants to flooding and provide a substantially higher standard of flood resilience than the existing baseline condition.

7.2.5. The redevelopment would therefore deliver a clear betterment in flood-risk management, drainage performance and occupant safety when compared with the existing residential use of the site.

7.2.6. The site is identified as a housing capacity site within Manchester City Council’s 2025 Strategic Housing Land Availability Assessment. Although the SHLAA identifies an indicative capacity of approximately 35 dwellings, AshtonHale explains that this is a high-level estimate rather than a prescribed development capacity. The proposed development has been informed by a more detailed appraisal of the site’s opportunities and constraints and would make more efficient use of previously developed land within an established and accessible residential area.

© Clancy Consulting 2026

7.2.7. The AshtonHale assessment identifies a high demand for additional housing in South Manchester and a particular need for two- and four-bedroom dwellings. Approximately 94% of the proposed homes would contain two bedrooms and 6% would contain four bedrooms, corresponding with the dwelling mix identified as being required within South Manchester.

7.2.8. The wider sustainability benefits of the development therefore include:

- The regeneration of previously developed residential land;
- The provision of a net increase of 66 homes;
- A significant contribution towards identified housing need;
- The provision of a dwelling mix corresponding with identified local requirements;
- More efficient use of an established and accessible residential site
- A materially improved standard of flood resilience compared with the existing residential baseline condition; and
- Improvements to the quality of the residential accommodation, landscaping and visual amenity of the site.

7.2.9. As concluded by AshtonHale, these benefits are considered to outweigh the residual flood risk associated with the development, subject to the flood risk being appropriately managed through the measures set out in this assessment. The proposed development includes raised finished floor levels, flood-resilient construction measures where required, flood warning and evacuation procedures, safe refuge above the design flood level, floodplain compensation where required, and improved drainage infrastructure. These measures would reduce the vulnerability of future occupants to flooding and provide a substantially higher standard of flood resilience than the existing baseline condition. The final planning balance in relation to this criterion remains a matter for the Local Planning Authority.

7.3. Criterion 2 – Safety Throughout the Development Lifetimes

7.3.1. The flood risk assessment identifies fluvial flooding from the River Mersey as the principal source of flood risk to the site. The assessed risks from the other identified sources of flooding are low or can be managed through the proposed development design and drainage strategy. The flood-safety strategy for the development is based on a hierarchy of measures comprising safe evacuation before the onset of flooding where sufficient warning is available, managed evacuation in accordance with the Flood Warning and Evacuation Plan, and safe refuge above the design flood level where evacuation is not possible.

7.3.2. The adopted defended 0.1% AEP design flood level for the Development is 30.090m AOD. The minimum finished floor level of all proposed residential accommodation is set at 30.690m AOD, providing 600 mm freeboard above the adopted design flood level. This provides safe refuge within the residential accommodation above the design flood level where evacuation cannot be completed before flooding occurs.

© Clancy Consulting 2026

7.3.3. Building elements situated below the proposed residential finished floor level will incorporate appropriate flood-resistant or flood-resilient materials and construction details. The structural design will take account of hydrostatic and hydrodynamic loading, flood-borne debris and floating-vehicle impacts where applicable. These measures support the safe-refuge strategy and reduce the risk of damage to lower-level non-habitable areas during a residual flood event.

7.3.4. Safe refuge is available within the residential buildings above the adopted design flood level. Internal circulation routes provide access from the lower levels to the raised residential accommodation without requiring occupants to enter floodwater. This refuge provision is a secondary measure, to be relied upon where safe evacuation before the onset of flooding is not possible.

7.3.5. The site-specific Flood Warning and Evacuation Plan included in Appendix J. This supports the preferred approach of safe evacuation before the onset of flooding, followed by managed evacuation where warning is available, and safe refuge within the building where evacuation is not possible. The FWEP identifies:

- The applicable Environment Agency Flood Alert and Flood Warning services;
- Arrangements for monitoring warnings and notifying residents;
- The proposed evacuation route towards land within Flood Zone 1, to be used where evacuation can be safely completed before the onset of flooding;
- The circumstances in which early evacuation, managed evacuation or internal safe refuge should be adopted;
- Arrangements for residents requiring additional assistance;
- Procedures for restricting access to flooded lower-level areas; and
- Arrangements for removing vehicles from the undercroft and other lower-level parking areas where sufficient warning time is available and it is safe to do so;
- Safe isolation of flood-sensitive services, including EV charging equipment where applicable; and
- Post-flood inspection, recommissioning and reoccupation procedures.

7.3.6. Critical electrical and mechanical infrastructure will be located above the adopted design flood level wherever practicable. Where equipment cannot be raised, appropriate flood protection, safe isolation and shut-down measures will be incorporated. This includes flood protection to the proposed substation and safe isolation of EV charging equipment and other electrical installations serving the undercroft. EV charging infrastructure is not relied upon during a flood event. These measures support the continued safe refuge of occupants above the design flood level and allow lower-level infrastructure to be inspected and recommissioned following a flood event.

7.3.7. Subject to implementation and ongoing maintenance of these measures, the proposed Development is considered capable of remaining safe throughout its anticipated lifetime, taking account of the residential vulnerability classification and

© Clancy Consulting 2026

the residual risks identified by this assessment. The proposed development would provide a higher standard of flood resilience than the existing residential baseline condition.

7.4. Criterion 3 – Flood Risk Elsewhere

7.4.1. Development within the floodplain must not displace floodwater in a manner that increases flood levels, depths, velocities or hazard on neighbouring land. The effects of the proposed building footprints, columns, external works and changes to existing ground levels are assessed through the floodplain compensation and hydraulic assessment included in Appendix G1.

7.4.2. Any loss of available floodplain storage resulting from the development is offset through level-for-level and volume-for-volume floodplain compensation. The compensation areas must be:

- Provided at equivalent elevations to the floodplain storage being lost;
- Hydraulically connected to the floodplain;
- Capable of filling and draining freely; and
- Retained and maintained for the lifetime of the development.

7.4.3. The open undercroft provides a route through which floodwater can pass beneath and subsequently recede from the raised Development. It is not relied upon as a substitute for the separate level-for-level and volume-for-volume floodplain compensation assessment included in Appendix G1.

7.4.4. The surface-water drainage system is a separate measure from the management of fluvial flood risk and has not been relied upon to reduce the modelled River Mersey flood level. Exceedance flows from the drainage system will be directed away from building entrances, residential accommodation and vulnerable areas.

7.4.5. Groundwater flooding has not been identified as a principal source of risk based on the information currently available. This conclusion should be confirmed through the proposed ground investigation and groundwater monitoring. Where groundwater is identified, below-ground structures and services will be designed to resist the anticipated groundwater pressures and incorporate an appropriate waterproofing strategy. No reliance has been placed on soft landscaping or floodplain compensation as protection against groundwater flooding.

7.4.6. As demonstrated by the floodplain compensation and hydraulic assessment in Appendix G1, the proposed Development will not increase flood risk on neighbouring land. The controlled surface-water discharge also provides a betterment over the existing drainage arrangement.

7.5. Exception Test Conclusion

7.5.1. The redevelopment would deliver wider sustainability benefits through the regeneration and more efficient use of previously developed residential land, the delivery of a net increase of66 homes, improvements to residential quality and landscaping, and the replacement of existing residential accommodation with a

© Clancy Consulting 2026

purpose-designed development incorporating a substantially improved standard of flood resilience.

7.5.2. The proposed residential accommodation is raised 600mm above the adopted defended 0.1% AEP design flood level. The Development also provides a hierarchy of flood-safety measures comprising safe evacuation before the onset of flooding where sufficient warning is available, managed evacuation through the Flood Warning and Evacuation Plan, and safe refuge above the design flood level where evacuation is not possible. These measures are supported by flood-resilient construction and an open, non-habitable undercroft through which floodwater can pass and recede.

7.5.3. Separate level-for-level and volume-for-volume floodplain compensation is provided for any loss of floodplain storage, as assessed in Appendix G1. The surface-water drainage strategy restricts runoff to a controlled rate of 5.0 l/s and provides a betterment over the existing drainage arrangement.

7.5.4. On the basis of the Sequential Test in Appendix I, the floodplain compensation and hydraulic assessment in Appendix G1, the proposed drainage strategy and the FWEP in Appendix J, the proposed Development is considered to satisfy the Exception Test. The Development provides wider sustainability benefits, remains safe for its lifetime taking account of the vulnerability of its users, provides a materially improved standard of flood resilience compared with the existing residential baseline condition, and will not increase flood risk elsewhere.

© Clancy Consulting 2026

8. SUDS HIERARCHY/ Standard 1

8.1. OVERVIEW

8.1.1. The National Standards for Sustainable Drainage Systems establish the preferred hierarchy for surface-water runoff destinations. Runoff should be treated as a resource and managed so that the Development does not increase flood risk on or off the Site.

8.1.2. The surface-water hierarchy is reviewed below, with commentary explaining how each priority has been implemented or why it has been discounted having regard to the Site-specific characteristics, flood-risk constraints, ground conditions, drainage connectivity and coordinated design proposals.

8.2. Priority 1 – Collected For Non-potable Use

8.2.1. Rainwater harvesting and reuse for non-potable purposes has been considered. The proposed residential use may generate limited demand for landscape irrigation, and opportunities for localised rainwater reuse, interception and source-control SuDS will be incorporated where practicable within the final drainage and landscape design.

8.2.2. The collection and reuse of rainwater for non-potable purposes should be considered where there is an appropriate non-potable water demand, a suitable contributing catchment, a requirement for landscape irrigation, or where the Development is located within an area of serious water stress.

8.2.3. Roof runoff will therefore be collected via rainwater pipes and conveyed to the proposed below-ground drainage network. Landscape-led SuDS features, including rain gardens, tree pits or other planted drainage features, may provide localised interception, evapotranspiration and amenity benefits where confirmed on the coordinated landscape and drainage proposals.

8.2.4. Any interception, evapotranspiration or attenuation provided by confirmed landscape-led SuDS features is additional to the principal attenuation storage included within the hydraulic model, unless the drainage engineer confirms otherwise.

8.2.5. Priority 1 has therefore been considered and incorporated where practicable through soft landscaping and any confirmed landscape-led SuDS features, but it is not relied upon as the principal means of surface-water storage, treatment or disposal.

8.3. Priority 2 – Infiltrated to Ground

8.3.1. As noted in Section 3.7 above, the site's geology is largely made up of made ground that is underlain by varying mixtures of Alluvium Clay, Silts, Sands and Gravels and River Terrace deposit Sands and Gravels. This would indicate the local geology is varied and therefore infiltration characteristics cannot be reasonably predicted in the absence of testing.

© Clancy Consulting 2026

8.3.2. Infiltration testing has not been carried out at the development.

8.3.3. Due to the lack of infiltration testing and groundwater monitoring, infiltration drainage is not relied upon within the proposed drainage strategy. This reflects the potential for elevated groundwater levels, the presence of made ground, variable superficial deposits and potential contamination risk.

8.3.4. The drainage strategy therefore does not rely upon infiltration because of the variable ground conditions, presence of made ground, potential contamination and potential for elevated groundwater. This approach avoids increasing groundwater flood risk or mobilising contaminants.

8.3.5. Priority 2 has therefore not been implemented. This conclusion should be reviewed if subsequent ground investigation and groundwater monitoring provide evidence that limited shallow infiltration can be safely incorporated.

8.4. Priority 3 – Discharged To an Above Ground Surface Water Body

8.4.1. The nearest above-ground watercourse is the River Mersey, approximately 100m northwest of the Development.

8.4.2. A direct connection would require the drainage system to cross substantial areas of third-party land. No suitable existing connection, easement or right to discharge directly to the River Mersey has been identified.

8.4.3. A direct watercourse connection is therefore not currently considered reasonably practicable and Priority 3 has not been implemented.

8.5. Priority 4 – Discharged To a Surface Water Sewer, or Another Piped Surface Water Drainage System

8.5.1. United Utilities asset information identifies a dedicated public surface-water sewer within Palatine Road. This sewer is separate from the public combined sewer that is proposed to receive foul water flows from the Development.

8.5.2. Surface-water runoff from the Development will be managed through the proposed SuDS and attenuation system before discharging by gravity to the public surface-water sewer via a flow-control device.

8.5.3. The proposed surface-water discharge is restricted to 5.0 l/s. This compares with the calculated existing 1-year brownfield runoff rate of 20.8 l/s and represents an approximate 76% reduction in the corresponding peak discharge rate.

8.5.4. The proposed surface-water connection location, drainage arrangement and restricted discharge rate are shown on the latest drainage layout contained within Appendix F and remain subject to agreement with United Utilities and the relevant approving authority.

8.5.5. Priority 4 has therefore been implemented.

© Clancy Consulting 2026

8.6. Priority 5 - Discharge to a Combined Sewer

8.6.1. The proposed surface-water drainage system connects to the dedicated public surface-water sewer within Palatine Road. Surface-water runoff will not discharge to the public combined sewer.

8.6.2. The foul-water drainage system is independent of the surface-water drainage system and will discharge separately to the public combined sewer within Palatine Road, subject to agreement with United Utilities.

8.6.3. Priority 5 is therefore not required for the surface-water drainage strategy and has not been implemented.

8.7. Summary of above Priorities

8.7.1. The following table summarises the SuDS hierarchy priorities and whether they have been implemented.

Table 8.7-6 SuDS Hierarchy Implementation Summary

Priority	Implemented	Notes
1 – Collected for non-potable use	Yes	Priority 1 has been considered. Opportunities for rainwater reuse, interception and source-control SuDS will be incorporated where practicable within the final drainage and landscape design. Roof runoff will be collected and conveyed through the proposed drainage network, with attenuation and restricted discharge provided downstream.
2 – Infiltrated to ground	No	Not relied upon because of made ground, variable geology, potential contamination and unconfirmed groundwater levels
3 – Discharged to an above ground surface water body	No	A direct River Mersey connection would require rights and works across third-party land
4 – Discharged to a surface water sewer, or another piped surface water drainage system	Yes	Restricted discharge to the dedicated public surface-water sewer within Palatine Road
5 -Discharged to a combined water sewer	No	Surface-water and foul drainage connect separately to their respective public systems

© Clancy Consulting 2026

9. Management of Everyday Rainfall/ Standard 2

9.1.1. Standard 2 of the National Standards for SuDS requires a SuDS approach to be applied so that, where reasonably practicable, at least the first 5 mm of rainfall for the majority of rainfall events is retained on-site.

9.2. Rainwater Harvesting

9.2.1. Standard 2 can be supported through rainwater harvesting, landscape irrigation, infiltration, interception and other source-control measures that reduce runoff from frequent rainfall events.

9.2.2. A large proportion of runoff from the Development is generated by roof areas. Roof runoff will be collected via rainwater pipes and conveyed to the proposed below-ground drainage network. Where confirmed on the coordinated landscape and drainage proposals, rain gardens, tree pits, soft landscaping or other landscape-led SuDS features may provide localised interception, passive irrigation, evapotranspiration and water-quality benefits.

9.2.3. The principal surface-water drainage strategy also incorporates tanked permeable paving, geocellular attenuation and flow control. These measures provide capture and attenuation of runoff before restricted discharge to the public dedicated surface-water sewer within Palatine Road.

9.2.4. Standard 2 has therefore been addressed where feasible and practicable through a combination of soft landscaping, confirmed landscape-led SuDS features, tanked permeable paving, geocellular attenuation and restricted discharge.

9.3. SuDS Pillar/ Standard 4 – Water Quality

9.3.1. Water quality is defined as “managing the quality of the runoff to prevent pollution.”

9.3.2. Runoff from the Development is generated principally from roof, car parking and external hardstanding areas. The relevant pollution hazard level is therefore low.

9.3.3. The following tables, reproduced from The SuDS Manual (CIRIA C753), set out the pollution hazard indices for relevant land-use classifications and the mitigation indices for typical SuDS components. The applicable classifications and mitigation measures for the Development are identified below.

Table 9.3-7 - Pollution hazard indices for different land use classifications (source: The SuDS Manual 2015)

	Pollution hazard indices for different land use classification			
Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways,	Low	0.5	0.4	0.4

© Clancy Consulting 2026

residential car parks, low traffic roads (e.g., cul-de-sacs, home zones and general access roads) and non-residential car parking with infrequent change (e.g., schools, offices) i.e., < 300 traffic movements/day				
Commercial yard and delivery areas, non-residential car parking with frequent change (e.g., hospitals, retail), all roads except low traffic roads and trunk roads/motorways[1]	Medium	0.7	0.6	0.7
Sites with heavy pollution (e.g., haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used, or manufactured; industrial sites; trunk roads and motorways	High	0.8[2]	0.8[2]	0.9[2]

Table 9.3-9 - Mitigation hazard indices for discharges to surface water (source: The SuDS Manual 2015)

Type of SuDS component	Total suspended solids (TSS)	Metals	Hydro-carbons
Filter Strip	0.4	0.4	0.5
Filter Drain	0.4	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention System	0.8	0.8	0.8
Permeable Paving	0.7	0.6	0.7
Detention Basin	0.5	0.5	0.6
Pond	0.7	0.7	0.5
Wetland	0.8	0.8	0.8
Proprietary Treatment System	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

9.3.4. For the purposes of the simple index approach, runoff from residential car parking and external access areas is treated as a low pollution hazard. This gives pollution hazard indices of 0.5 for total suspended solids, 0.4 for metals and 0.4 for hydrocarbons. Roof runoff presents a lower pollution hazard and will be conveyed to the below-ground drainage network. Landscape-led SuDS features may provide additional treatment where confirmed on the coordinated landscape and drainage proposals.

9.3.5. Landscape-led SuDS features may provide filtration, bioretention-style treatment and localised interception where incorporated within the final drainage and

© Clancy Consulting 2026

landscape design. These measures will support the wider water-quality treatment train alongside permeable paving, proprietary treatment devices where required, below-ground attenuation and flow control.

9.3.6. Tanked permeable paving serving the western car parking area provides mitigation indices of 0.7 for total suspended solids, 0.6 for metals and 0.7 for hydrocarbons, which exceed the required mitigation indices for a low pollution hazard.

9.3.7. For the eastern car parking area, tanked permeable paving was considered but discounted due to constraints associated with root protection zones and the available layout. A vortex separator manhole is therefore proposed to provide appropriate pollution mitigation for runoff from this area, subject to detailed design and product specification demonstrating suitable treatment performance.

9.3.8. On this basis, the water-quality pillar is considered to be satisfied, subject to detailed design of the proposed treatment components.

9.4. SuDS Pillar/ Standard 5 – Amenity

9.4.1. Amenity is defined as “Creating and sustaining better places for ***people***.”

9.4.2. The drainage strategy will be coordinated with the proposed soft landscaping and communal external areas to the rear of the Site. Landscape-led SuDS features will be incorporated where practicable to provide visible planting, localised interception and integration with the external amenity space.

9.4.3. Therefore, this pillar has been satisfied.

9.5. SuDS Pillar/ Standard 6 – Biodiversity

9.5.1. Biodiversity is defined as “Creating and sustaining better places for ***nature***.”

9.5.2. The proposed soft landscaping, planting strategy and landscape-led SuDS features will provide planting and habitat opportunities within the Development and contribute to biodiversity alongside the wider landscape strategy.

9.5.3. Therefore, this pillar has been satisfied.

9.6. Summary of above Tiers

9.6.1. The following table summarises the above pillars / tiers and whether they have been implemented.

Table 9.6-8 SuDS Hierarchy Implementation Summary

Pillar / Tier	Implemented
1a Water Quantity - Infiltration	No
1b Water Quantity – Body of Water	No
1c Water Quantity – Sewer (Surface Water)	Yes
1d Water Quantity – Sewer (Combined Water)	No
2 – Water Quality	Yes

© Clancy Consulting 2026

3 – Biodiversity	Yes
4 - Amenity	Yes

© Clancy Consulting 2026

10. PROPOSED SURFACE WATER DRAINAGE STRATEGY

10.1. Policy

10.1.1. The proposed surface-water drainage strategy has been developed having regard to the National Planning Policy Framework and associated Planning Practice Guidance; the National Standards for Sustainable Drainage Systems; the Greater Manchester Sustainable Drainage Design Guide; the requirements of Manchester City Council in its capacity as Lead Local Flood Authority; the Sewerage Sector Guidance, including the Design and Construction Guidance; and Requirement H3 of Schedule 1 to the Building Regulations 2010.

10.1.2. The strategy follows the surface-water disposal hierarchy. Opportunities for rainwater reuse, infiltration and discharge to a surface-water body have been considered before discharge to the public surface-water sewer. The reasons for selecting the proposed discharge destination are set out in Section 7.

10.1.3. The strategy is intended to control runoff quantity, manage water quality, provide safe exceedance routes and ensure that all drainage components can be inspected and maintained throughout the lifetime of the development.

10.2. Climate Change

10.2.1. Climate change has been taken into account over the minimum 100-year lifetime of the proposed residential development.

10.2.2. Current Environment Agency guidance provides peak-rainfall intensity allowances by management catchment. These allowances apply to site-scale drainage design and replace the former England-wide allowance table.

Table 10.2-9 Climate Change Percentages

Applies across all of England	Total potential change anticipated for 2015 - 2039	Total potential change anticipated for 2040 - 2069	Total potential change anticipated for 2070 - 2115
Upper End	24%	40%	45%
Central	11%	25%	30%

10.2.3. Because the proposed residential development has a lifetime extending beyond 2100, the drainage assessment considers the upper-end allowances for both the 1% and 3.3% AEP rainfall events. The system has been designed so that the upper-end 1% AEP event does not result in flooding of buildings or an increase in flood risk elsewhere.

10.2.4. A climate-change allowance of 45% has been applied to the 1% AEP drainage event [retain only if confirmed against the applicable management-catchment allowance]. The hydraulic calculations are provided in Appendix G.

10.3. Strategy Overview

10.3.1. Surface-water runoff will be managed through a treatment train comprising tanked permeable paving, channel drainage, a hydrodynamic separator where required,

© Clancy Consulting 2026

below-ground pipework, geocellular attenuation and a flow-control chamber. The restricted discharge will connect to the existing public surface-water sewer in Palatine Road, subject to the approval of United Utilities. Landscape-led SuDS features such as rain gardens, tree pits or soft landscaped drainage features may contribute to interception, treatment and amenity where confirmed on the coordinated landscape and drainage proposals.

10.3.2. An extract of the proposed strategy (see Appendix E for the detailed drainage plan & Appendix F for other drainage related drawings) is provided in the image below.

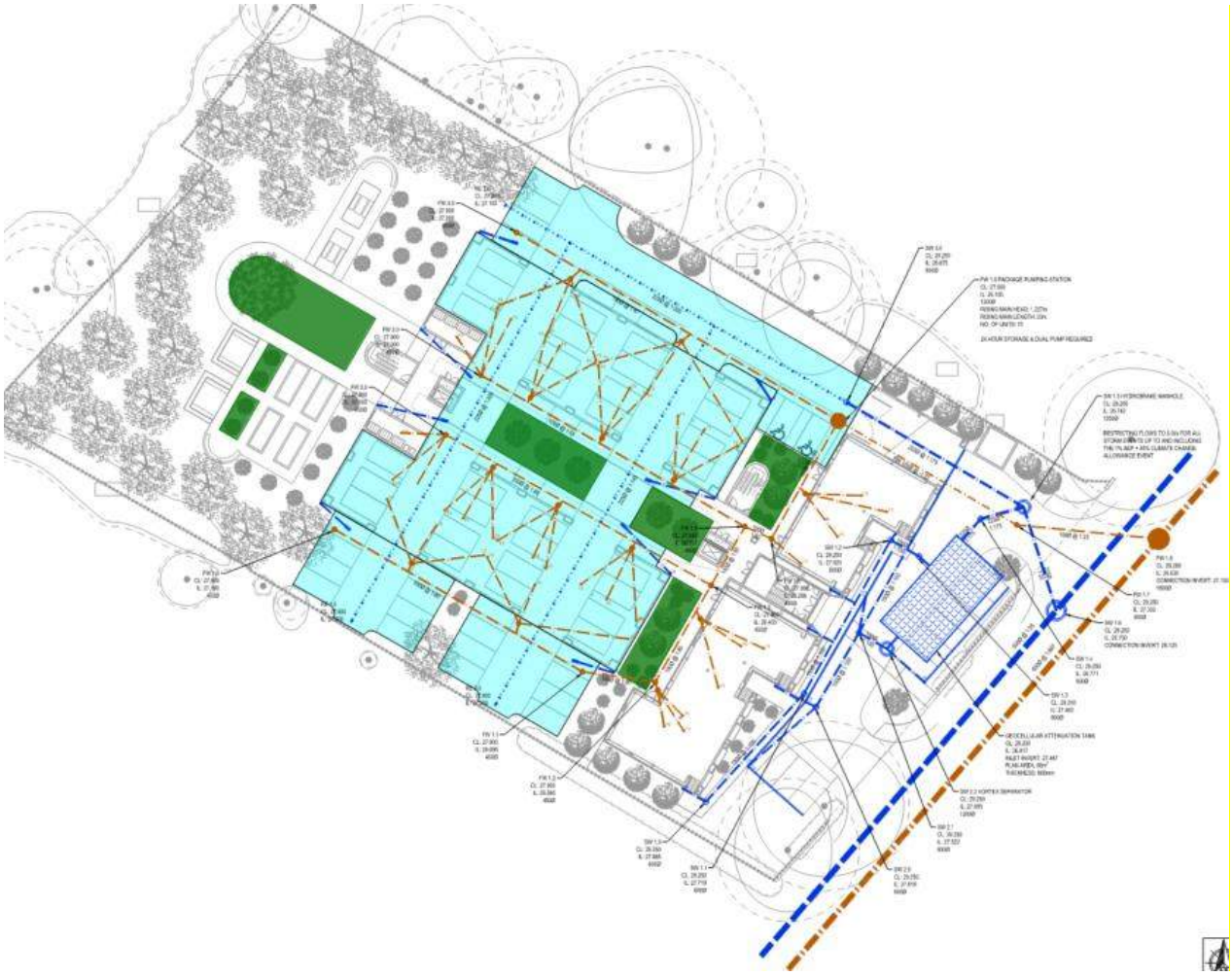


Figure 10.3-8 Proposed Development Plan
(Source: Clancy)

10.3.3. Roof runoff will be collected via rainwater pipes and conveyed to the proposed drainage network. Opportunities for source-control SuDS, localised interception and landscape-led treatment will be incorporated where practicable before runoff enters the wider attenuation and restricted-discharge system.

10.3.4. Runoff from parking and circulation areas will be collected principally through tanked permeable paving. Where channel drains are required, runoff will pass through an appropriately specified hydrodynamic separator before entering the attenuation system. The treatment train has been selected having regard to the anticipated pollution hazard and the water-quality assessment in Section 9.

© Clancy Consulting 2026

10.3.5. Following treatment and attenuation, runoff will be conveyed through a private gravity drainage network to the proposed connection with the public surface-water sewer in Palatine Road.

10.3.6. A flow-control chamber will restrict discharge to a maximum of 5.0 l/s. This represents approximately a 76% reduction against the calculated existing 1-year brownfield rate of 20.8 l/s and exceeds the minimum 50% betterment sought by the LLFA.

10.4. Discharge Rates

10.4.1. Brownfield runoff rates have been calculated using the Wallingford Procedure and are presented in Appendix G. Manchester City Council seeks a minimum 50% reduction in runoff rates from brownfield sites, with an aspiration to approach greenfield rates where practicable. The proposed maximum discharge of 5.0 l/s provides a greater reduction than this minimum requirement.

10.4.2. It is proposed to provide a 75% reduction in flow rate to improve on the required 50% betterment, to ensure that the development is aligned more effectively with SUDS principles.

10.4.3. The following table lists the Greenfield, Brownfield, Design rates and resulting betterment.

Table 10.4-10 Discharge Rates & Betterment

Rate Type	Qbar	1yr	30yr	100yr
Greenfield	1.2l/s	1.1l/s	2.3l/s	3.0l/s
Brownfield	n/a	20.8l/s	47.4l/s	54.9l/s
Design	n/a	5.0l/s	5.0l/s	5.0l/s
Betterment	**n/a**	**76%**	**89%**	**91%**

10.4.1. The 5.0 l/s restriction is a practical minimum rate selected to reduce the risk of blockage while providing substantial betterment over the existing brownfield runoff rates. The final flow-control specification and associated head-discharge relationship are provided in Appendix F.

10.5. Discharge Volume

10.5.1. The discharge volume for the 100yr 6hr event for the proposed development will increase due to the implementation of additional impermeable area, however this will be mitigated through the restriction of flows back into the public sewer network which will provide an overall betterment to discharge volumes from site.

10.5.2. The proposed discharge volume is 108m3.

10.5.3. Attenuation reduces and delays the peak rate of discharge but does not, by itself, eliminate any increase in total runoff volume. Volume reduction may be provided through interception and evapotranspiration within soft landscaping, permeable or tanked permeable paving construction, and any confirmed landscape-led SuDS

© Clancy Consulting 2026

features. Infiltration is not relied upon unless supported by subsequent infiltration testing and groundwater monitoring.

10.5.4. Any remaining increase in runoff volume will be retained within the attenuation system and discharged at no more than 5.0 l/s. The hydraulic assessment demonstrates that this delayed discharge will not increase flood risk within the receiving drainage system or elsewhere. Evidence supporting this conclusion and the existing-versus-proposed volume comparison is provided in Appendix G.

10.6. Attenuation

10.6.1. Attenuation will be provided by geocellular storage serving the eastern part of the site and tanked permeable paving serving the western part.

10.6.2. Refer to the drainage plan provided in Appendix E that states the provided attenuation volumes; Appendix F comprises the other drainage drawings.

10.6.3. The storage volumes have been determined by hydraulic modelling of the critical storm durations, incorporating the relevant climate-change allowance and any agreed urban-creep allowance. The system provides no above-ground flooding during the 3.3% AEP event and no flooding of buildings during the 1% AEP event including climate change.

10.6.4. The geocellular tanks and tanked paving will be designed for the anticipated groundwater and fluvial-flood conditions. Structural design will include checks for flotation, uplift, external loading and the integrity of tanking and pipe connections.

10.7. Post-Development Flooding

10.7.1. The hydraulic calculations report no flooding from the proposed drainage network during the 1% AEP rainfall event including the applicable climate-change allowance.

10.7.2. Levels from the topographical survey indicate that exceedance routes will take surface water away from the buildings towards the rear portion of the site (the western boundary) where if not captured via the permeable paving will accumulate in the soft landscaping and permeate into the ground over time. The levels are incorporated at a relatively flat gradient to ensure surface water flows are given time to permeate into the ground and will not be directed offsite into the neighbouring development, increasing flood risk to the surrounding area.

10.7.3. The exceedance strategy does not rely on infiltration unless supported by site-specific infiltration testing and groundwater assessment. Finished levels will prevent exceedance flows from being directed beyond the site boundary or toward the proposed buildings.

10.7.4. The drainage system should be read alongside the FWEP. Following a fluvial flood, silt, vegetation, litter and other debris may be deposited within permeable paving, channels, inlets, flow-control chambers, attenuation systems and the outfall. These elements will be inspected and, where necessary, cleared before affected areas are returned to normal use.

© Clancy Consulting 2026

10.7.5. Post-flood inspection and clearance will be undertaken by the person or organisation identified in the FWEP and drainage maintenance plan. The inspection will also check for blockage, structural damage, displacement, contamination, backflow and loss of storage capacity. Records of inspection and remedial works will be retained by the responsible management body.

© Clancy Consulting 2026

11. PROPOSED FOUL WATER DRAINAGE STRATEGY

11.1. Policy

11.1.1. The foul-water drainage strategy has been developed with reference to Sewers for Adoption, Building Regulations Part H and United Utilities requirements.

11.2. Strategy Overview

11.2.1. Foul water from the Development is proposed to discharge to the existing public combined sewer within Palatine Road via a pumped system. Flows will be transferred to a demarcation manhole at the Site boundary, from which a gravity connection to the public combined sewer will be made, subject to approval from United Utilities.

11.2.2. The foul-water drainage system will be independent of the surface-water drainage system. Surface water will discharge separately to the public dedicated surface-water sewer within Palatine Road at a restricted rate, as described in the surface-water drainage strategy.

11.2.3. Where foul drainage infrastructure, pumps, controls or associated equipment are located below or close to the adopted design flood level, they should be protected, capable of safe isolation, or subject to post-flood inspection and recommissioning in accordance with the building operation and maintenance information and the FWEP. Any foul drainage equipment affected by floodwater should be inspected by a competent specialist before being returned to service.

11.3. Capacity Check

11.3.1. A capacity check is to be submitted to United Utilities to confirm the available capacity of the public combined sewer, the point of connection and any requirements for improvement works to the existing public sewerage network.

© Clancy Consulting 2026

12. CONCLUSION

12.1. Existing Site

12.1.1. The Site currently comprises three large detached residential buildings, divided into 22 residential units, together with an associated access road and soft landscaped areas to the rear.

12.2. Existing Constraints

12.2.1. A review of the Site has identified limited available space for open-water SuDS features, together with likely unfavourable infiltration conditions associated with made ground and a potential high groundwater table.

12.3. Existing Flood Risks

12.3.1. The Site is located within Flood Zone 3a and is at high risk of fluvial flooding from the River Mersey.

12.3.2. The principal source of flood risk to the Site is fluvial flooding from the River Mersey. Flood risk from all other sources has been assessed as lower, based on the currently available information and subject to implementation of the mitigation measures and drainage strategy set out within this report.

12.3.3. Other sources of flooding are assessed as lower risk based on the currently available information, subject to the mitigation measures and drainage strategy set out within this report.

12.4. Proposed Development & Constraints

12.4.1. The Development comprises 88 new residential units, including 5 townhouses and 83 apartments across three residential blocks, together with associated undercroft and external parking, access, garden and landscaped areas.

12.4.2. The principal constraint affecting the Development is fluvial flood risk, as the Site is located within Flood Zone 3a. The design must therefore demonstrate that the Development will remain safe for its lifetime, will not increase flood risk elsewhere and will manage residual flood risk appropriately. The existing site constraints relating to limited SuDS space, made ground and potential groundwater levels also remain relevant.

12.4.3. The Site is already in established residential use and the proposed Development does not change the flood-risk vulnerability classification of the land use. However, the increase from 22 to 88 residential units represents a material intensification of use. The Development therefore incorporates a comprehensive flood-risk mitigation strategy comprising raised finished floor levels, floodable non-habitable lower-level areas, a hydraulically open undercroft, formal floodplain compensation where required, flood-warning and evacuation procedures, protection or safe isolation of critical infrastructure, and controlled surface-water drainage.

12.5. Sequential Test

12.5.1. The proposed residential use is classified as “more vulnerable” development and the Site is located within Flood Zone 3a. A Sequential Test has therefore been

© Clancy Consulting 2026

undertaken and concludes that there are no reasonably available alternative sites within the defined search area that are suitable for the proposed Development and at a lower risk of flooding. The Sequential Test is therefore considered to be satisfied, subject to confirmation by the Local Planning Authority. The Exception Test has subsequently been applied.

12.6. Exception Test & Mitigation Measures

12.6.1. The Development provides habitable accommodation no lower than 30.690m AOD, which is 600mm above the adopted defended 0.1% AEP fluvial design flood level of 30.090m AOD. This provides raised habitable accommodation and internal safe refuge above the adopted design flood level.

12.6.2. Lower-level undercroft, parking and external areas are non-habitable and are designed to be floodable. The open undercroft is provided to maintain hydraulic connectivity and allow floodwater to pass beneath and recede from the raised Development. It is not relied upon as compensatory flood storage. Any loss of floodplain storage is addressed separately through the level-for-level and volume-for-volume floodplain compensation assessment included in Appendix G1.

12.6.3. Residual flood risk to occupants is managed through a hierarchy of measures comprising safe evacuation before the onset of flooding where sufficient warning is available, managed evacuation in accordance with the Flood Warning and Evacuation Plan, and safe refuge above the design flood level where evacuation is not possible. This is supported by raised habitable accommodation, flood-resistant and flood-resilient construction below the design flood level where appropriate, protected or safely isolatable lower-level services, vehicle-management procedures, restriction of access to lower-level floodable areas, and post-flood inspection and recommissioning requirements.

12.6.4. Critical plant, electrical infrastructure and building services are to be located above the adopted design flood level wherever practicable. Where equipment is located below, or may be affected by, the adopted design flood level, it is to be protected, capable of safe isolation or subject to post-flood inspection and recommissioning before reuse. Non-essential lower-level equipment, including EV charging infrastructure, is not relied upon during a flood event.

12.6.5. The structural design of the lower-level columns, exposed structural elements and relevant enclosing elements will account for the applicable flood actions, including hydrostatic and hydrodynamic loading, flood-borne debris and potential displaced-vehicle impact where relevant. The design will also consider the effects of prolonged inundation, buoyancy and scour or erosion around exposed foundations and external works.

12.6.6. Groundwater flooding is not identified as a principal source of flood risk based on the currently available information. The Development does not rely on basement accommodation or infiltration drainage, reducing the potential sensitivity of the proposals to elevated groundwater levels.

© Clancy Consulting 2026

12.7. SuDS Hierarchy

12.7.1. The SuDS priorities listed in Standard 1 of the national SuDS standards have been reviewed. Priority 1 has been considered through the potential use of rainwater reuse, localised interception, soft landscaping and landscape-led SuDS features where practicable. These measures will support water quality, amenity, biodiversity and source-control benefits, with the principal drainage strategy comprising attenuation and restricted discharge to the public surface-water sewer.

12.7.2. Priority 2, infiltration, is not relied upon due to the presence of made ground, variable ground conditions and potential high groundwater levels. Priority 3, direct discharge to a watercourse, is not considered reasonably practicable because a connection to the River Mersey would require works across third-party land. Priority 4 has therefore been adopted, with surface-water runoff discharged at a restricted rate to the existing public surface-water sewer within Palatine Road, subject to approval from United Utilities and the relevant approving authority.

12.8. Surface Water Drainage Design

12.8.1. Surface-water discharge from the Development will be restricted to a maximum rate of 5.0 l/s for the assessed design events. This represents an approximate 76% reduction relative to the calculated existing 1-year brownfield discharge rate of 20.8 l/s, with greater percentage betterment during the 30-year and 100-year events.

12.8.2. Surface-water runoff is proposed to discharge to the existing public surface-water sewer within Palatine Road, subject to approval from United Utilities and the relevant approving authority.

12.8.3. The surface-water drainage strategy incorporates tanked permeable paving, below-ground attenuation and flow control, together with channel drainage and proprietary treatment where required. Rain gardens, tree pits, soft landscaping or other landscape-led SuDS features may contribute to interception, treatment, amenity and biodiversity where confirmed on the coordinated landscape and drainage proposals. The strategy provides restricted discharge, attenuation for the relevant design rainfall events including climate change, and appropriate water-quality treatment for the proposed roof, parking and external hardstanding areas.

12.8.4. The proposed drainage strategy applies the SuDS hierarchy, incorporates the relevant climate-change allowance, provides appropriate water-quality treatment and restricts the peak surface-water discharge rate. The hydraulic calculations contained in Appendix G2 demonstrate that the proposed drainage system can accommodate the assessed design events without flooding of buildings and without increasing surface-water flood risk elsewhere.

12.9. Foul Water Strategy

12.9.1. Foul water from the Development is proposed to discharge to the existing public combined sewer within Palatine Road via a pumped system. Flows will be transferred to a demarcation manhole at the Site boundary, from which a gravity

© Clancy Consulting 2026

connection to the public sewer will be made, subject to confirmation of the connection arrangement and approval from United Utilities.

12.9.2. A capacity check will be submitted to United Utilities to confirm the available capacity of the public combined-sewer network, the approved point of connection and any requirements for improvement works. Foul-drainage pumps, controls and associated infrastructure located below, or potentially affected by, the adopted design flood level will be protected against floodwater ingress, capable of safe isolation, and subject to post-flood inspection and recommissioning before reuse, in accordance with the building-management procedures and FWEP.

12.10. Overall Conclusion

12.10.1. Subject to implementation of the mitigation, drainage, floodplain-compensation, management and maintenance measures identified within this report and its appendices, the proposed Development is considered capable of remaining safe for its lifetime without increasing flood risk elsewhere.

12.10.2. The Development provides wider sustainability benefits by replacing an existing residential site within Flood Zone 3a with a purpose-designed development incorporating a materially improved standard of flood resilience. The Development locates all habitable accommodation at or above 30.690m AOD; maintains hydraulic connectivity through the open undercroft; provides separate level-for-level and volume-for-volume floodplain compensation where required; restricts surface-water discharge to a maximum of 5.0 l/s; incorporates improved drainage infrastructure; and includes a site-specific Flood Warning and Evacuation Plan based on safe evacuation, managed evacuation and safe refuge. On this basis, and subject to confirmation of the Sequential Test by the Local Planning Authority, the Development is considered to satisfy the requirements of the Exception Test.

© Clancy Consulting 2026

13. Appendices

13.1. Appendix A – Site Location Plan

13.2. Appendix B – Topographical and Sewer Information

Topographical Survey

Public Sewer Records

© Clancy Consulting 2026

United Utilities
Water for the North West

How to contact us:

United Utilities Water Limited
Property Searches
Haweswater House
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP

Telephone: 0370 7510101

E-mail: propertysearches@uuplc.co.uk

Clancy Consulting Ltd

2
Dunham Road, Clancy Consulting
Altrincham, Manchester, Greater Manchester
WA14 4NX

FAO:

Your Ref: 1-21724
Our Ref: UUPS-ORD-612679
Date: 15/11/2024

Dear Sirs

Location: APARTMENT 1 234 PALATINE ROAD, MANCHESTER, M20 2WF

I acknowledge with thanks your request dated 11/11/2024 for information on the location of our services.

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

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

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

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

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

Yours Faithfully,

Karen McCormack
Property Searches Manager

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

Water for the North West

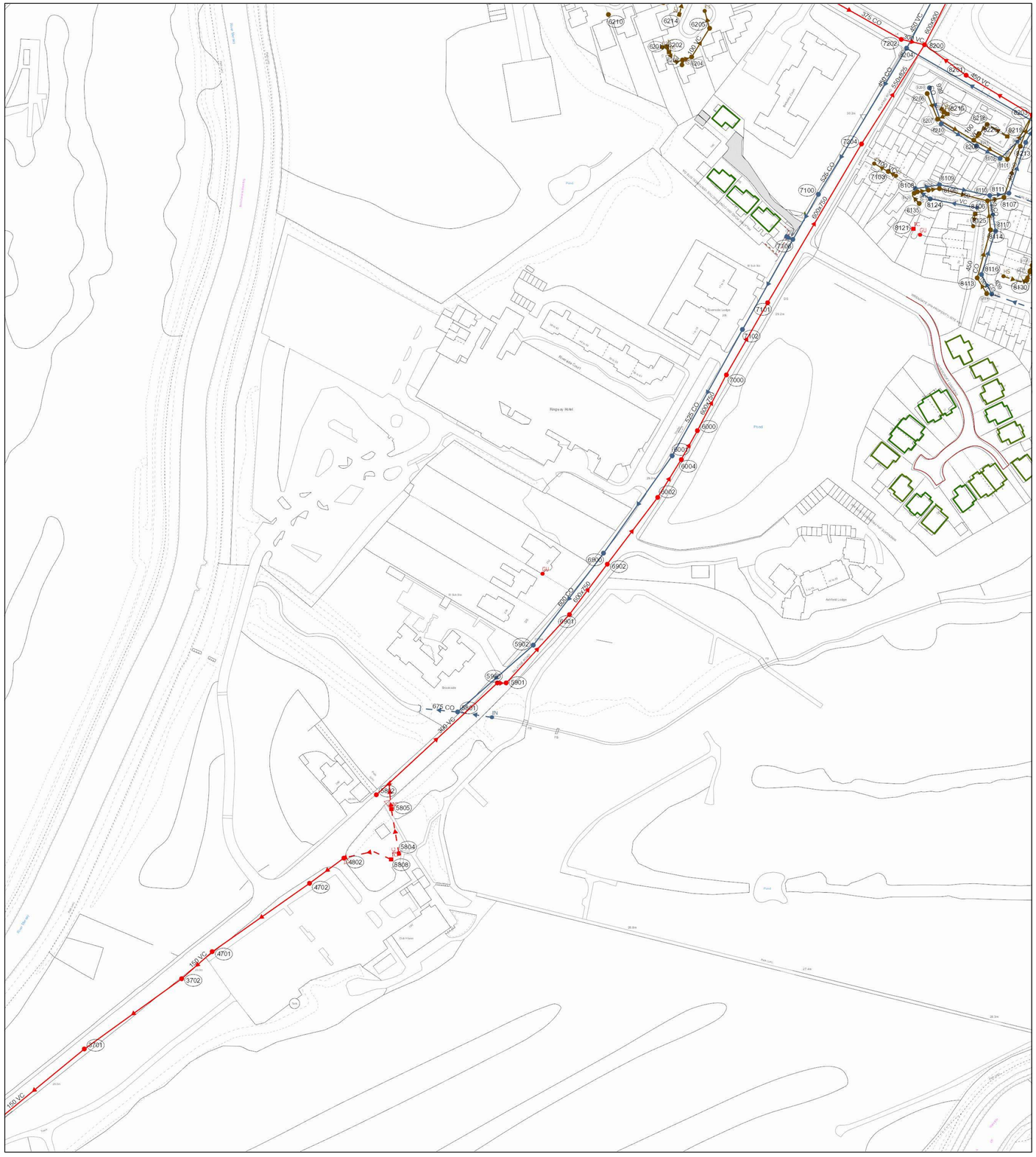
TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

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

TERMS AND CONDITIONS:

- This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.
- This Map and any information supplied with it is provided for general guidance only and no representation, undertaking or warranty as to its accuracy, completeness or being up to date is given or implied.
- In particular, the position and depth of any UUWL apparatus shown on the Map are approximate only. UUWL strongly recommends that a comprehensive survey is undertaken in addition to reviewing this Map to determine and ensure the precise location of any UUWL apparatus. The exact location, positions and depths should be obtained by excavation trial holes.
- The location and position of private drains, private sewers and service pipes to properties are not normally shown on this Map but their presence must be anticipated and accounted for and you are strongly advised to carry out your own further enquiries and investigations in order to locate the same.
- The position and depth of UUWL apparatus is subject to change and therefore this Map is issued subject to any removal or change in location of the same. The onus is entirely upon you to confirm whether any changes to the Map have been made subsequent to issue and prior to any works being carried out.
- This Map and any information shown on it or provided with it must not be relied upon in the event of any development, construction or other works (including but not limited to any excavations) in the vicinity of UUWL apparatus or for the purpose of determining the suitability of a point of connection to the sewerage or other distribution systems.
- No person or legal entity, including any company shall be relieved from any liability howsoever and whensoever arising for any damage caused to UUWL apparatus by reason of the actual position and/or depths of UUWL apparatus being different from those shown on the Map and any information supplied with it.
- If any provision contained herein is or becomes legally invalid or unenforceable, it will be taken to be severed from the remaining provisions which shall be unaffected and continue in full force and affect.
- This agreement shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts, save that nothing will prevent UUWL from bringing proceedings in any other competent jurisdiction, whether concurrently or otherwise.

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



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

Crown copyright and database rights 2023 Ordnance Survey 100022432. Unauthorised reproduction will infringe these copyrights.

Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
4701		CO	0	150			VC	22.67157	
6902		CO	0	600			BR	46.40043	
8117		SW	0	939			CO	19.94022	
4702		CO	0	150			VC	66.0303	
8200	30.57	CO	26.49	600			BR	75.13322	1 in 1073
7101	29.21	CO	26.46	600			BR	102.2155	
6900		SW	0	600			CO	64.2028	
7000	29.1	CO	26.55	600			BR	46.14109	1 in 577
8111		SW	0	450			CO	29.69942	
8130		FO	0	100			PVC	4.99546	
8204		SW	0	450			CO	46.64761	
8101		FO	0	450			VC	28.08454	
6002	28.93	CO	26.56	600			BR	24.69818	
4802		CO	0	150			VC	23.60085	
8209		SW	0	939			CO	21.14463	
6004		CO	0	600			BR	18.35756	
7202	30.64	CO	27.89	300			VC	13.34166	1 in 11
3701		CO	0	150			VC	72.47068	
8115		SW	0	939			CO	12.32053	
8102		SW	0	450			CO	28.05737	
8116		SW	0	939			CO	25.32424	
6204		FO		100			VC	18.81776	
8131		FO		100			PVC	5.543856	
8153		FO	0	450			CO	27.82384	
6000	29.05	CO	26.62	600			BR	34.88553	1 in 581
8105		FO	0	450			VC	27.62754	
8107		FO	0	450			VC	29.79194	
8104		FO	0	450			CO	6.242362	
8114		FO	0	450			VC	16.09216	
6901	29.08	CO	26.98	600			BR	35	
8109		SW	0	939			CO	28.50743	
8106		FO	0	450			VC	9.307706	
5901	29.09	CO	28.01	300			VC	51.66236	1 in 50
8124		SW		150			VC	9.949291	
7102	29.09	SW	27.37	525			CO	80.13114	
8110		SW	0	939			CO	10.67346	
8201	31.22	CO	26.78	450			VC	28.6007	1 in 409
8127		FO		100			PVC	3.888204	
6203		FO		100			VC	5.354337	
7103		FO		100			VC	8.882505	
8108		SW	0	225			CO	13.61899	
5801		SW		675			CO	21.05502	
8203	32.34	CO	26.76	450			VC	42.65927	
7107		SW		150			PVC	0.2601216	
8206		FO	0	450			CO	15.29728	
7100	29.62	SW	28.28	525			CO	28.71651	
8112		FO	0	150			VC	10.00634	
7106		SW		525			CO	57.23978	
5900	29.1	CO	0	300			VC	5	
5802		CO	0	300			VC	91.28527	
6205		FO		100			VC	10.00124	
5902	29.01	SW	25.05	675			CO	55.97321	
8213		FO	0	450			VC	18.66426	
6001	28.98	SW	27.44	525			CO	66.0303	
8212		SW	0	450			CO	12.21548	
7204	29.99	CO	26.52	550			BR	65.19202	1 in 6519
3702		CO	0	150			VC	66.61081	
8218		FO		100			VC	6.83121	
8135		FO		100			VC	7.533705	
8208		FO	0	450			VC	21.43104	
8103		FO	0	150			VC	6.080908	
8211		SW	0	450			CO	14.84454	
8210		SW	0	939			CO	22.96985	
8207		FO	0	450			VC	23.2769	
8120		FO		100			VC	1.969226	
8220		FO		100			VC	4.71564	

Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad

LEGEND

Abandoned	Foul	Surface Water	Combined	
				Public Sewer
				Private Sewer
				Section 104
				Rising Main
				Sludge Main
				Overflow
				Water Course
				Highway Drain

All point assets follow the standard colour convention:

red - combined **blue - surface water**

brown - foul **purple - overflow**

- Manhole
- Head of System
- Extent of Survey
- Rodding Eye
- Inlet
- Discharge Point
- Vortex
- Penstock
- Washout Chamber
- Valve
- Air Valve
- Non Return Valve
- Soakaway
- Gully
- Cascade
- Flow Meter
- Hatch Box
- Oil Interceptor
- Summit
- Drop Shaft
- Orifice Plate
- Side Entry Manhole
- Outfall
- Screen Chamber
- Inspection Chamber
- Bifurcation Chamber
- Lamp Hole
- T Junction / Saddle
- Catchpit
- Valve Chamber
- Vent Column
- Vortex Chamber
- Penstock Chamber
- Network Storage Tank
- Sewer Overflow
- Ww Treatment Works
- Ww Pumping Station
- Septic Tank
- Control Kiosk
- DNM Network Monitoring Point
- Change of Characteristic

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

Address or Site Reference:

APARTMENT 1 234 PALATINE ROAD,
MANCHESTER,
M20 2WF

Scale: 1:1250 **Date:** 15/11/2024

Sheet: 1 of 1

Printed by: Property Searches

SEWER RECORDS

United Utilities
Water for the North West

© Survey & Engineering Projects Ltd. 2024
Reproduction in whole or in part by any means is prohibited without the prior permission of Survey & Engineering Projects Ltd.
T. (0161) 729835 F. (0161) 725566 W. www.sepsurvey.com E. info@sepsurvey.com

N

PLAN GRID NORTH

File Name: 525503-2nd-REV-B.dwg

LEGEND

AV	AIR VALVE	LBY	LIFEBUOY
BB	BELOW BEACON	MH	MANHOLE
BH	BOLLARD	MP	MARKER POST
BH	BORE HOLE	MS	MILE STONE
BM	BM	MP	MOORING POINT
BP	BENCH MARK	OP	OUTFALL PIPE
BS	BUS STOP	OP	OUTFALL POST
BT	BT INSPECTION COVER	PB	POST OFFICE BOX
CCTV	CCTV CAMERA	PB	PB
CCTV	CCTV CAMERA POST	PP	PETROL PUMP
CH	CHIMNEY	PP	PP
COM	COMMUNICATIONS COVER	PCP	PEDESTRIAN CROSSING POINT
CP	CABLE TELEVISION STATION	RL	RODD LEVEL
CTC	CABLE TV CONSTRUCTION	RS	ROSE SEATS
DC	DRAINAGE CHANNEL	RS	ROAD SIGN
DP	DOWN PIPE	RW	RETAINING WALL
DR	DRAIN	SMP	SHANNOCK PIPE
EIC	ELEC. INSPECTION COVER	SMP	SAMPLING
EJB	ELECTRIC JUNCTION BOX	SP	SIGN POST
EJB	ELECTRIC BOX	SP	SIGN POST
ER	EARTH ROD	SPD	SPEED CAMERA
FH	FIRE HYDRANT POST	SV	STOP VALVE
FL	FINISHED FLOOR LEVEL	SV	STOP VALVE
FP	FUEL POINT	TCB	TRAFFIC SIG LAND BOX
FP	FUEL POST	TE	TELEPHONE
GL	GROUND LEVEL	TE	TE INC
GLT	GROUND LIGHT	TJB	TRAFFIC JUNCTION BOX
GP	GATE POST	TJB	TRAFFIC LIGHT BOX
GP	GUARD POST	TP	TELEGRAPH POLE
GSV	GAS VALVE	TP	TELEGRAPH POLE
IC	INSPECTION COVER	VP	VENT PIPE
LP	LAMP POST	WC	WATER COOLER
PAL	PALISADE	WO	WASH OUT
PCW	PARAPET WALL	WOT	WATER STOP TAP
PCW	CONC PANEL	WT	WATER TANK/TOWER
PCW	CONC PANEL/WALL	WT	WATER TANK/TOWER
PCW	POST AND RAIL	WT	TREE GIRTH (2m)
PCW	POST AND WIRE	WT	TREE GIRTH (2m)
PCW	IRON RAIL	WT	TREE MULTI-GIRTH
PCW	RAIL BOARDED	WT	TREE GIRTH
(XX.XX)	CHAIN LINK		
(XX.XX)	TOP OF FEATURE		
(XX.XX)	TOP OF BUILDING ROOF HEIGHT		
	STATION		
	BOREHOLE		
	BATTER		

	WATER COURSE
	FENCE
	FENCE CHANGE
	RAIL
	TOP (Bank)
	BOTTOM (Bank
	BUILDING
	BUILDING CANOPY
	BUILDING OVERHEAD
	OVER HEAD TELECOM
	HEDGE

NOTES:
All levels relate to O.S (Newlyn) Datum, Established using network RTK.
Survey plotted on a plane local grid, orientated to National Grid.
Survey control established from baseline SEP1 - SEP2, SEP3A, SEP10, SEP11

SURVEY STATIONS

Name	Easting	Northing	Height
SEP1	383958.710	391032.589	29.088
SEP2	383814.408	390628.064	29.283
SEP3	383579.701	390913.980	29.280
SEP3A	383579.701	390913.980	29.280
SEP10	383440.812	390989.567	29.855
SEP11	383513.575	391012.808	27.543
SEP12	383534.509	391029.799	28.151
SP1	383583.186	390988.251	29.070
SP2	383583.186	390988.251	28.818
SP3	383558.510	391025.584	26.973

0 2m 4m 8m 12m 16m
SCALE BAR

REV	DATE	DESCRIPTION
A	OCT 24	Re-visit for added level detail
B	OCT 24	Re-visit for added level detail

SURVEY & ENGINEERING PROJECTS

Client
Atzaro Real Estate
Peter House
Oxford Street
Manchester
M1 5AN

Project Title
Topographical Survey of Land at:
232-236 Palatine Rd
Didsbury
M20 2WF

Surveyed	Drawn	Checked
T.Carroll	S.Flanagan	R.Critchley

Scale	Date	Drawing Ref.	No.	Size	Rev
1:200	Sep 24	525503-3dT	1	A0	B

13.3. Appendix C – Ground Investigation Extracts

clancy consulting



Phase 1 Preliminary Risk Assessment Proposed Residential Development on Palatine Road, Didsbury

Prepared for Marco Living

May 2026

10/2500/001 Rev. 01

Phil Hill
Senior Geotechnical Engineer
phil.hill@clancy.co.uk

enquiries@clancy.co.uk
www.clancy.co.uk

Clancy Consulting Limited
4th Floor
Windmill Green
24 Mount Street
Manchester
M2 3NX

Document Control Sheet

Issued by	Clancy Consulting Ltd 4th Floor Windmill Green 24 Mount Street Manchester M2 3NX	**Tel:** 0161 613 6000 **Email:** enquiries@clancy.co.uk **Website:** www.clancy.co.uk
Client	Marco Living Ltd 81 Newton Street Manchester M1 1EX	
Document	Phase 1 Preliminary Risk Assessment	
Project Name	Proposed Residential Development on Palatine Road, Didsbury	
Reference	10/2500/001 Rev. 01	
Date	May 2026	

"This document has been prepared for the titled project, or named part thereof, and should not be relied upon or used for any other project, or part, without an independent check being made on it. Clancy Consulting shall not be liable for the consequences of using this document other than for the purpose for which it was commissioned, and any user and any other person using or relying on this document for such other purpose, agrees and will be such use or reliance be taken to confirm this agreement to indemnify Clancy Consulting for all loss or damage resulting therefrom".

Document Origin

Revision	Date	Revision Description		Name
00	August 2024	Original	Prepared	Phil Hill Senior Geotechnical Engineer phil.hill@clancy.co.uk
01	May 2026	Revised layout	Checked	Phil Edge Associate Director phil.edge@clancy.co.uk
			Approved	Phil Edge Associate Director phil.edge@clancy.co.uk

© Clancy Consulting 2026

Executive Summary

Client	Marco Living
Location	232 to 236 Palatine Road, Didsbury M20 2WF.
Description	The site is approximately 0.60 hectares in area and located to west of Didsbury, approximately 7km to the south of Manchester City Centre at Ordnance Survey (OS) Coordinates 383560, 390980. The site currently comprises three existing buildings, subdivided into 22 residential units with large gardens. Surrounding land comprises apartment buildings, houses and a large hotel with associated access roads and car parking.
Development	The proposed works comprise the demolition of the existing three buildings and the construction of three five storey residential apartment buildings comprising a small number of integral townhouses with lower ground / undercroft car parking and landscaping.
Site History	Historical mapping indicates that the site comprised rural fields until the construction of three residential houses in circa 1893. The site layout has generally remained unchanged, with the inclusion of later extensions to some of the properties. Surrounding land has had a similar history with gradually encroaching residential developments. A large hotel was built to the northeast in the 1980's and a multistorey apartment block to the south of the site around the same time.
Geology	British Geological Survey mapping indicates drift deposits beneath the site comprise Alluvium overlying River Terrace Deposits and Glaciofluvial Deposits. This overlies bedrock comprising the Wilmslow Sandstone Formation. Given the development history of the site, a significant thickness of Made Ground is not anticipated to be present overlying natural strata.
Radon	The radon guidance on protective measures for new dwellings indicates that the site is in a 'low' probability radon area where less than 1% of homes are estimated to be at or above the Action Level. Radon gas protection measures are therefore not required in the construction of new dwellings or extensions.
Mining & Ground Stability	The site is not located in a Coal Authority Reporting Area. Therefore, the risks associated with coal workings are considered to be low and no further action is required.
Flood Risk	According to the Flood Map for Planning, available on the gov.uk website, the site is located within Flood Zone 3, whereby there is a greater than a 1% chance (1 in 100) of flooding from rivers or the sea, annually. A Flood Risk Assessment will therefore be required to support any Planning Application.
Environmental Setting	Alluvium and River Terrace Deposits indicated to be present beneath the site as classified by the Environmental Agency (EA) as Secondary A Aquifer. The underlying Glaciofluvial Deposits are classified as an Undifferentiated Secondary Aquifer. The Wilmslow Sandstone Formation, present at depth, is classified as a Principal Aquifer. However, the site is not located within a groundwater source protection zone (SPZ) and the nearest groundwater abstraction is located

© Clancy Consulting 2026

approximately 583m to the southeast of the site, used for irrigation. Therefore, these aquifers are not considered to represent sensitive groundwater resource receptors.

The nearest surface water feature is located approximately 44m south of the site. This comprises an unnamed stream which feeds into the River Mersey, which at its closest is approximately 90m west of the site. Although there is considered to be potential for contaminants of concern sourced from the site to migrate towards this watercourse, given the site's development history, the risk posed to nearby surface water receptors is not considered to be significant.

UXO

Zetica Bomb Risk Mapping indicates the site to be in an area of moderate UXO risk. Therefore, a Detailed UXO Desk Study and Risk Assessment should be undertaken prior to undertaking any intrusive investigations.

Conclusions and Recommendations

Given the residential development history of the site and surrounding area, the potential for significant concentrations of contaminants of concern to be present in soils beneath the site is considered to be limited. However, it would be prudent to collect a small number of soil samples for chemical laboratory analysis as part of any intrusive geotechnical site investigation in order to confirm the contamination status of the site.

A potentially significant source of ground gas has not been identified as part of this assessment. However, should a significant thickness of Made Ground or putrescible material be recorded during intrusive investigation works, wells should be installed in boreholes to allow monitoring of ground gas concentrations and flow rates.

Based on the above, the following additional assessment is considered to be required to further assess the risks posed by soil contamination and ground gas:

- Undertake a Flood Risk Assessment for the site.
- Undertake a Detailed UXO Desk Study and Risk Assessment for the site prior to undertaking any intrusive investigations.
- Drilling of boreholes to enable collection of soils for chemical laboratory analysis and geotechnical testing to enable foundation design.
- Collection of soil samples for geotechnical laboratory analysis.
- Chemical laboratory analysis of selected soil samples. Samples will be analysed for a broad range of organic and inorganic contaminants of concern.
- Provision of a factual and interpretative site investigation report

© Clancy Consulting 2026

Contents

1.0 Introduction 1
1.1 Background 1
1.2 Objectives 1
1.3 Limitations of the Study 1
2.0 Desk Study 2
2.1 General 2
2.2 Site Setting and Description 2
2.3 Site History 2
2.4 UXO Risk Assessment 3
2.5 Geology 3
2.6 Mining and Ground Stability 3
2.7 Hydrogeology 3
2.8 Hydrology 4
2.9 Soil Geochemistry 4
2.10 Flood Risk 4
2.11 Radon Risk Potential 5
2.12 Landfill Sites 5
2.13 Industrial Land Uses 5
2.14 Sensitive Land Uses 5
2.15 Potential Geotechnical Constraints 5
3.0 Preliminary Conceptual Site Model 7
3.1 General 7
3.2 Guidance 7
3.3 Potential Contaminant Sources 7
3.4 Potential Pathways 7
3.5 Potential Receptors 7
3.6 Preliminary Risk Assessment 8
4.0 Conclusions 10

Drawings

Site Location Plan
Proposed Development Plan

Appendices

Appendix I Drawings
Appendix II Historical Maps
Appendix III Zetica Bomb Risk Mapping
Appendix IV Geological Maps
Appendix V EA Site Sensitivity & Flood Risk Maps
Appendix VI Environmental Datasheets

© Clancy Consulting 2026

1.0 Introduction

1.1 Background

Clancy Consulting Limited has been instructed by Marco Living to carry out a Phase 1 Preliminary Risk Assessment at a site on 232 to 236 Palatine Road, Didsbury M20 2WF.

The proposed works comprise the demolition of the existing three houses and the construction of three five storey residential apartment buildings comprising a small number of integral townhouses with lower ground / undercroft car parking and landscaping.

A proposed development plan is included in Appendix I.

1.2 Objectives

The objectives of this investigation are summarised below:

- Provide a review of the site's land use history by reference to ordnance survey maps of the area.
- Assess the environmental setting, geology, hydrology, hydrogeology, mining and subsidence history of the site and surrounding area.
- Consider the potential risk from unexploded ordnance (UXO).
- Consider the potential risk to end users of the site from hazardous ground gas.
- Develop a preliminary risk assessment and a detailed 'conceptual site model' with regard to potential contamination sources, pathways and receptors.
- Provide recommendations regarding the requirement for further investigations or remedial works, if required, to satisfy the Local Planning Authority and to inform detailed civil and structural design.

1.3 Limitations of the Study

Clancy Consulting Limited cannot be held responsible for any omissions, misrepresentation, errors or inaccuracies with the supplied third-party report information. The report is written in the context of an agreed scope of work and budget and should not be used in a different context. New information or improved practices and changes in legislation may require a reinterpretation of the report in whole or in part.

Clancy Consulting Limited reserves the right to amend either conclusions or recommendations in light of any further information that may become available. The report is provided for the sole use of Marco Living for the objectives discussed previously only and is confidential to them.

The report may not be relied upon by any other party without prior written consent of Clancy Consulting Limited. Those using this information in subsequent assessments or evaluations do so at their own risk.

It must be noted that whilst this investigation aims to characterise the general ground conditions beneath the proposed development site, Clancy Consulting Ltd cannot be held accountable for variations in ground and groundwater conditions, unidentified contamination or the presence of below ground structures present.

© Clancy Consulting 2026

2.0 Desk Study

2.1 General

Background information was sought from the following sources:

- Ordnance Survey historical maps (selected copies included in Appendix II).
- Zetica Bomb Risk Mapping (Appendix III).
- British Geological Survey (BGS) sheets (Appendix IV).
- Environment Agency site sensitivity & flood risk maps (Appendix V).
- Environmental datasheets (Appendix VI).

2.2 Site Setting and Description

The site is approximately 0.60 hectares in area and located to west of Didsbury, approximately 7km to the south of Manchester City centre at Ordnance Survey (OS) Coordinates 383560, 390980. The site currently comprises three residential houses with large gardens.

The Britania Country House Hotel is located to the east of the site with an access road to its rear car park along the site's northern boundary. A multistorey residential apartment block lies to the southwest of the site. The River Mersey is located approximately 90m to the west of the site. A site location plan is included in Appendix I.

2.3 Site History

In order to investigate the development history and previous land uses at the site and surrounding area, historical OS maps were examined. Copies of the maps are presented in Appendix II.

Table 1 below is not intended to provide a comprehensive review of all the changes which have occurred at the site and instead provides a summary of the most salient points relating to the development history of the site. The most significant historical land uses are highlighted in bold text for ease of reference.

Table 1: Site History

Date(s)	Site	Surrounding Land
1848	The site comprised rural fields.	The site was located in a rural area. The River Mersey formed a large meandering loop which at its closest is approximately 90m west of the site. A small stream was present approximately 45m south of the site, flowing towards the River Mersey.
1893 to 1894	Three large residential properties were present at the eastern end of the site, parallel to Palatine Road. Large gardens were present across the remaining site area.	Additional residential properties were present immediately north and south of the site. Large, landscaped gardens were present to the northeast of the site, including three large lakes. A stream issues from one of these lakes to the north, joining up with the River Mersey. To the south the land remained predominantly rural. The town of Didsbury was present approximately 750m to the east.
1907	No significant changes	One of the lakes was no longer indicated and comprised an area of woodland,
1923 to 1938	No significant changes	Didsbury had encroached to within 300m to the north and east of the site. Northenden was present 500m to the southwest.
1955 to 1959	No significant changes	Possible embankment works and/or flood defense works were indicated along the banks of the River Mersey and on land to the north and west of the site. Tennis courts were present approximately 20m to the north of the site.

© Clancy Consulting 2026

Date(s)	Site	Surrounding Land
1966 to 1967	Extensions had been added to the properties on-site.	A large government building was present 250m to the northeast.
1981	No significant changes	A number of large buildings were present approximately 50m to the northeast (in the location of the nearby hotel). The tennis courts were no longer indicated to be present. An 'L' shaped building was present on the plot to the south of the site. The pond to the north has diminished in size and was indicated to be within the grounds of a school and playing fields.
1989 to 1990	No significant changes	Ringway Hotel and car park and Riverside Court were present 50m and 100m to the north, respectively. A large residential apartment building, Brookside, was present to the south, with an associated car park. The government building had been demolished.
1999	No significant changes	An access road and car park were present to the west of the site.
2003 to present	No significant changes.	Houses were shown on the site of the government building to the northeast

2.4 UXO Risk Assessment

Zetica Bomb Risk Mapping indicates the site to be in an area of moderate UXO risk. Therefore, a Detailed UXO Desk Study and Risk Assessment should be undertaken prior to undertaking any intrusive investigations.

Zetica bomb risk mapping for the site is included in Appendix III.

2.5 Geology

British Geological Survey (BGS) mapping indicates drift deposits beneath the site comprise Alluvium overlying River Terrace Deposits and Glaciofluvial Deposits. This overlies bedrock comprising the Wilmslow Sandstone Formation.

Given the development history of the site, a significant thickness of Made Ground is not anticipated to be present overlying natural strata. However, Made Ground and basement level structures may be present beneath the footprint of the current buildings and immediate surrounding area.

Copies of the geological plans are provided in Appendix IV.

2.6 Mining and Ground Stability

The site is not located within a Coal Authority Reporting Area. Therefore, the risks associated with historic coal mining are considered to be low and no further action is required.

The environmental database report indicates that the site represents a low risk with regard to ground stability issues relating to ground dissolution, collapsible ground, landslides, shrinking/swelling clay, and running sand. The site is indicated to represent a moderate risk with regard to compressible ground, likely associated with the Alluvium indicated to be present on BGS mapping.

No BGS recorded mineral sites are indicated to be present within 500m of the site.

2.7 Hydrogeology

The Alluvium and River Terrace Deposits indicated to be present beneath the site are classified by the Environment agency (EA) as Secondary A Aquifers. These are strata which can provide modest quantities of water, but due to the nature of rock or the aquifers structure limits their use. They support water supplies at a local level and remain important for rivers, wetlands and lakes.

© Clancy Consulting 2026

The underlying Glaciofluvial Deposits are classified as an Undifferentiated Secondary Aquifer. These are layers of variable permeability, where it has not been possible to assign a Secondary A or B Aquifer designation.

The underlying Wilmslow Sandstone Formation strata are classified as a Principal Aquifer. These are rocks that provide significant quantities of water and can support water supply and/or baseflow to rivers, lakes and wetlands on a strategic scale. They typically have a high intergranular and/or fracture permeability, meaning they usually provide a high level of water storage.

According to EA data, the site is not located within a groundwater Source Protection Zone (SPZ).

Information provided by the EA indicates that there is one record of a licensed groundwater abstractions within 1km of the site. This is located on a golf course 583m southeast of the site, for spray irrigation.

Groundwater quality beneath the site has been classified as 'poor' under the EA Local River Basin Management Plan for the area.

2.8 Hydrology

The nearest surface water feature is located approximately 44m south of the site. This comprises an unnamed stream which feeds into the River Mersey, which at its closest is approximately 90m west of the site.

Surface water quality in the local area has been classified as 'fail' under the EA Local River Basin Management Plan for the area.

There is one record of a licensed surface water abstractions indicated to be present within 1km of the site. This relates to an abstraction used for dust suppression / general washing during construction, located approximately 852m to the west of the site.

There no records of potential active discharge consents within 500m of the site.

There are no records of significant or major incidents to controlled waters recorded within 500m of the site.

2.9 Soil Geochemistry

According to the BGS National Geoscience Information Service, the following soil concentrations can be expected within urban soils at the site (based on BGS measured concentrations taken within the surrounding site area):

- Arsenic – 15 to 20 mg/kg
- Cadmium - <1.8 mg/kg
- Chromium – 60-90 mg/kg
- Lead – <100 mg/kg
- Nickel – 15-30 mg/kg

These concentrations are not considered to pose a significant risk to human health, based on the proposed development at the site.

2.10 Flood Risk

According to the Flood Map for Planning, available on the gov.uk website, the site is located within Flood Zone 3, whereby there is a greater than a 1% chance (1 in 100) of flooding from rivers or the sea, annually. A Flood Risk Assessment (FRA) would therefore be required to support any planning application for the site.

The environmental database report indicates that there is a potential for groundwater flooding of below ground structures at the site.

© Clancy Consulting 2026

The site may be located within a critical drainage area. The appointed drainage engineer should consult with the Lead Local Flood Authority (LLFA) to confirm this.

Copies of the site sensitivity and flood risk maps are included in Appendix V.

2.11 Radon Risk Potential

The radon guidance on protective measures for new dwellings indicates that the site is in a 'low' probability radon area where less than 1% of homes are estimated to be at or above the Action Level.

Radon gas protection measures are therefore not necessary in the construction of new dwellings or extensions.

2.12 Landfill Sites

One historic landfill site is present within 500m of the site, located approximately 465m west, licenced to accept inert, industrial and household waste and liquid sludge.

There are no Local Authority Landfills present within 500m of the site.

There are no current waste management or waste transfer sites indicated to be present within 500m of the site.

Four potential areas of infilled land (water) associated with former ponds, marsh, river, stream or docks within 500m of the site. The closest of these is located approximately 123m to the northeast of the site. Given its size and distance, this is not considered to pose a significant ground gas risk to the proposed development.

2.13 Industrial Land Uses

There are no active Local Authority Pollution Prevention and Control permits recorded within 500m of the site.

The are no active Contemporary Trade Directory entries recorded within 500m of the site.

Full details of the waste management and industrial land uses are detailed in the environmental database presented in Appendix VI.

2.14 Sensitive Land Uses

Natural England data indicates that there are no ecologically sensitive sites indicated within 500m of the site that constitute environmental receptors as defined within Table 1 of the DEFRA Environmental Protection Act 1990: Part 2A - Contaminated Land Statutory Guidance (2012).

2.15 Potential Geotechnical Constraints

The table below summarises the potential geotechnical hazards associated with the development. The table provides an assessment of whether the site is likely to be affected by the hazard and the possible consequences and engineering considerations.

Table 2: Geotechnical Risk Register

Hazard Description	Is hazard likely to be present / affect the site?	Comments/possible engineering requirements where hazard present
Sudden lateral/vertical changes in ground conditions	M	The site has been developed in the past and localised areas of Made Ground may be present, although these are anticipated to be of limited thickness. Superficial soils beneath the site are indicated to comprise Alluvium overlying River Terrace Deposits and Glaciofluvial Deposits. The thickness and strength characteristics of these layers are likely to vary across the site.

© Clancy Consulting 2026

Hazard Description	Is hazard likely to be present / affect the site?	Comments/possible engineering requirements where hazard present
Highly compressible/low bearing capacity soils, (including peat and soft clay)	M	Made Ground and Alluvium beneath the site would not form suitable bearing layers for traditional foundations. Deeper layers of the River Terrace Deposits or Glaciofluvial Deposits may represent suitably competent soils to support traditional foundations, if present at shallow depth. This would need to be confirmed by an intrusive site investigation.
Ground dissolution features/natural cavities	L	Strata indicated to be present at shallow depth beneath the site are not susceptible to these hazards.
Shrinking and swelling clays	M	Cohesive layers of the Alluvium and Glaciofluvial Deposits may be susceptible to volume change hazards. Investigations should be undertaken to further assess this potential risk.
Slope stability/Retaining wall issues	L	New slopes or retaining structures are not indicated to form part of the proposed development. Any temporary or permanent slopes or retaining walls created as part of the development should be subject to appropriate geotechnical design based on site-specific site investigation information.
High groundwater table (including waterlogged ground)	M/H	The environmental data base indicates there is a potential for ground water flooding to occur in sub-surface structures. Groundwater exclusion and control measures may therefore be required for excavations beneath the site. However, this would need to be confirmed by intrusive ground investigation.
Filled and Made Ground (including embankments)	L/M	The site has been developed in the past and localised areas of Made Ground may be present, although these are anticipated to be of limited thickness.
Obstructions (including foundations, services, basements, tunnels and adjacent sub-structures)	M	The site has been developed in the past and it is considered that buried obstructions may be present. Their removal may require heavy plant in some cases. This should be programmed for.
Underground mining	L	The site is not within an area where underground mining is considered to pose a risk to the development.
Concrete classification	L/M	Made Ground and natural soils beneath the site may contain elevated concentrations of sulphate potential harmful to buried structures.
Seismic Activity	L	The Eurocode 8 seismic hazard zoning maps for the UK (Musson and Sargeant, 2007) indicate that horizontal Peak Ground Acceleration (PGA) values with 10% probability of being exceeded in 50 years (475 year return period) are between 0.00g and 0.02g, which is considered very low.
NOTES: H – High Risk M – Medium Risk L – Low risk		

© Clancy Consulting 2026

3.0 Preliminary Conceptual Site Model

3.1 General

The “suitable for use” approach is adopted for the assessment of contaminated land and remedial measures are only undertaken where unacceptable risk to human health or the environment can be proven when taking into account the proposed use of the site and environmental setting.

A risk assessment process should be carried out to determine potential hazards to human health and the environment and be based on the “source” “pathway” “receptor” principal. For a potential risk to be present there must be a viable pollutant linkage whereby a contamination source may impact upon a receptor. The absence of one or more of these key components (source, pathway or receptor) prohibits a viable pollution linkage being formed.

3.2 Guidance

In accordance with the ‘Land Contamination Risk Management’ (LCRM) guidance on the gov.uk website (updated October 2020) and BSI 10175 “Code of Practice for Investigation of Potentially Contaminated Land” (2011), a Preliminary Conceptual Site Model was developed to identify potential contamination sources, migration pathways and receptors within the study area.

3.3 Potential Contaminant Sources

Given the residential development history of the site and surrounding area, the potential for significant concentrations of contaminants of concern to be present in soils beneath the site is considered to be limited.

Given the development history of the site, a significant thickness of Made Ground considered to represent a potentially significant source of ground gas is unlikely to be present beneath the site. Furthermore, given the size and distance of the nearest potential area of infilled ground (123m to the northeast), this is not considered to pose a significant ground gas risk to the proposed development.

3.4 Potential Pathways

Following the proposed development, the potential risks to future site users via the dermal contact and ingestion pathways in areas of the site comprising building cover and hardstanding will be mitigated. Furthermore, the pathway for the airborne migration of soil/dust from these areas towards off-site receptors would not be active. However, these pathways may remain active in areas of soft landscaping.

There is potential for the on or off-site migration of contaminants of concern within granular layers of the Made Ground and natural strata.

There is potential for ground gas contaminants of concern in soil or groundwater (if present) to impact future site users via the pathway of inhalation within enclosed areas of the proposed development.

There is potential for the downward migration of contaminants of concern towards the underlying Alluvium and River terrace Deposits Secondary A Aquifers, Glaciofluvial Deposits Undifferentiated Secondary Aquifer and Wilmslow Sandstone Formation Principle Aquifer indicated to be present beneath the site.

3.5 Potential Receptors

Potential human health receptors include future site users and neighboring residential/commercial property occupiers.

The underlying Secondary A, Undifferentiated Secondary and Principal Aquifers are considered the main environmental receptors of concern.

© Clancy Consulting 2026

The nearest surface water feature is located approximately 44m south of the site. This comprises an unnamed stream which feeds into the River Mersey, which at its closest is approximately 90m west of the site. There is considered to be potential for contaminants of concern sourced from the site to migrate towards this watercourse.

3.6 Preliminary Risk Assessment

A preliminary risk assessment can be carried out using guidance outlined in Section 6.3 of CIRIA Document C552 "Contaminated Land Risk Assessment – A Guide to Good Practice" (2001). For a risk to be present there must be a viable pollutant linkage whereby a contamination source can impact on a receptor via a pathway. To carry out the risk assessment an estimate must be made of the potential severity of the risk and the likelihood of the risk occurring. The following Tables set out the criteria for this principal.

Table 3: Severity of Risk

Severity	Description
Severe	Acute risk to human health likely to result in 'significant harm' i.e. very high concentrations of contamination or ground gases. Catastrophic damage to building i.e. by explosion from high gassing sites or VOC concentrations. Major pollution of controlled waters i.e. surface watercourses and Principal aquifers, source protection zones. Short term damage to ecosystems.
Medium	Long term risk to human health likely to result in 'significant harm' i.e. elevated concentrations of contaminants or ground gases. Pollution of sensitive controlled watercourses i.e. Principal or Secondary Aquifers. Significant effects on sensitive ecosystems or species.
Mild	Pollution of non-sensitive waters i.e. smaller surface watercourses or unproductive strata. Significant damage to crops, buildings, structures or services i.e. by explosion from sites with medium gassing potential, elevated concentrations of contaminants.
Minor	Non-permanent human health effects i.e. requirement for protective equipment during site works to mitigate health effects. Damage to non-sensitive ecosystems or species. Minor damage to buildings, structures or services.

Table 4: Probability of Risk Occurring

Probability	Description
High Likelihood	Pollutant linkage may be present that appears very likely in the short term and risk is almost certain to occur in long term or evidence of harm to receptor exists.
Likely	Pollutant linkage may be present and is likely that the risk will occur over the long term.
Low Likelihood	Pollutant linkage may be present and there is a possibility of the risk occurring although no certainty that it will do so.
Unlikely	Pollutant linkage may be present but the circumstances under which harm would occur even in the long term are improbable.

Table 5: Comparison of Risk & Probability

Probability	Severity			
	Severe	Medium	Mild	Minor
High Likelihood	Very High	High	Moderate	Moderate/Low
Likely	High	Moderate	Moderate/Low	Low
Low Likelihood	Moderate	Moderate/Low	Low	Very Low
Unlikely	Moderate/Low	Low	Very Low	Very Low

A summary of potential pollutant linkages and perceived risks for this site are outlined in the Table below:

© Clancy Consulting 2026

Table 6: Pollutant Linkages & Perceived Risk

Sources of Contamination	Pathways	Receptors	Severity	Probability	Risk	Justification	Further Action Required
On site: Made Ground	Inhalation, ingestion and dermal contact of soil	Future site users	**Medium** Long term risk to human health	**Unlikely**	**Low**	Given the residential development history of the site and surrounding area, the potential for significant concentrations of contaminants of concern to be present in soils beneath the site is considered to be limited. It is considered likely that potential risks may be mitigated by the provision of clean topsoil cover in new or reworked soft landscaped areas, which will act as a barrier between contaminants in the underlying soil and future site users.	Given the residential development history of the site and surrounding area, the potential for significant concentrations of contaminants of concern to be present in soils beneath the site is considered to be limited. However, it would be prudent to collect a small number of soil samples for chemical laboratory analysis as part of any intrusive geotechnical site investigation in order to confirm the contamination status of the site.
		Construction workers during development	**Minor** Non-permanent human health effects i.e. requirement for protective equipment during site works to mitigate health effects	**Low Likelihood**	**Very Low**	If construction workers come into contact with potential contaminated soils during the construction phase, such contact would be short term, limiting potential exposure. Construction workers are expected to undertake good working practices including regular hand washing and other hygiene techniques which would reduce the likelihood of long-term exposure to any contamination.	
	Acidic ground conditions affecting future site buildings	Building infrastructure	**Minor** Minor damage to buildings	**Low Likelihood**	**Very Low**	Made Ground and natural soils beneath the site may contain elevated concentrations of sulphates and low pH. Chemical testing for water soluble sulphate and pH should be undertaken to inform concrete classification. Chemical testing should be undertaken to assess the requirements for water supply pipelines.	
	Vertical and lateral migration	Neighbouring commercial / residential properties	**Medium** Long term risk to human health	**Unlikely**	**Low**	Given the development history of the site, it is considered unlikely that contamination would be present in sufficient concentrations to adversely affect neighbouring site users.	
		Controlled waters	**Mild** Pollution of non-sensitive controlled water receptors	**Low Likelihood**	**Low**	Alluvium and River Terrace Deposits indicated to be present beneath the site as classified by the EA as Secondary A Aquifer. The underlying Glaciofluvial Deposits are classified as an Undifferentiated Secondary Aquifer. The Wilmslow Sandstone Formation, present at depth, is classified as a Principal Aquifer. However, the site is not located within a groundwater SPZ and the nearest groundwater abstraction is located approximately 583m to the southeast of the site. Therefore, these aquifers are not considered to represent sensitive groundwater resource receptors. The nearest surface water feature is located approximately 44m south of the site. Although there is considered to be potential for contaminants of concern sourced from the site to migrate towards this watercourse, given the site's development history, the risk posed to nearby surface water receptors is not considered to be significant.	
Off site: Hotel and residential developments	Lateral migration onto site with subsequent dermal contact of soils	Future site users	**Medium** Long term risk to human health	**Unlikely**	**Low**	Given the predominantly residential nature of surrounding land use, the potential risk posed to the proposed development from off-site sources of contamination is not considered to be significant.	
Potential hazardous ground gas and vapours from Made Ground and infilled ponds	Migration of ground gas	Future site users	**Severe** Acute risk to human health (asphyxiation)	**Unlikely**	**Low / Moderate**	Given the development history of the site, a significant thickness of Made Ground considered to represent a potentially significant source of ground gas is unlikely to be present beneath the site. Furthermore, given the size and distance of the nearest potential area of infilled ground (123m to the northeast), this is not considered to pose a significant ground gas risk to the proposed development.	A potentially significant source of ground gas has not been identified as part of this assessment. However, should a significant thickness of Made Ground be recorded during intrusive investigation works, wells should be installed in boreholes.
		Building Infrastructure	**Severe** Significant damage to buildings (explosion)	**Unlikely**	**Low / Moderate**		

© Clancy Consulting 2026

4.0 Conclusions

Clancy Consulting Limited was instructed by Marco Living to carry out a Phase 1 Preliminary Risk Assessment at a site on 232 to 236 Palatine Road, Didsbury M20 2WF.

The proposed works comprise the demolition of the existing three houses and the construction of three five storey residential apartment buildings comprising a small number of integral townhouses with lower ground / undercroft car parking and landscaping.

Historical mapping indicates that the site comprised rural fields until the construction of three residential houses in circa 1893. The site layout has generally remained unchanged, with the inclusion of later extensions to some of the properties.

Surrounding land has had a similar history with gradually encroaching residential developments. A large hotel was built to the northeast in the 1980's and a multistorey apartment block to the south of the site around the same time.

British Geological Survey mapping indicates drift deposits beneath the site comprise Alluvium overlying River Terrace Deposits and Glaciofluvial Deposits. This overlies bedrock comprising the Wilmslow Sandstone Formation.

Given the development history of the site, a significant thickness of Made Ground is not anticipated to be present overlying natural strata.

The radon guidance on protective measures for new dwellings indicates that the site is in a 'low' probability radon area where less than 1% of homes are estimated to be at or above the Action Level. Radon gas protection measures are therefore not required in the construction of new dwellings or extensions.

The site is not located in a Coal Authority Reporting Area. Therefore, the risks associated with coal workings are considered to be low and no further action is required.

According to the Flood Map for Planning, available on the gov.uk website, the site is located within Flood Zone 3, whereby there is a greater than a 1% chance (1 in 100) of flooding from rivers or the sea, annually. A Flood Risk Assessment will therefore be required to support any Planning Application.

Alluvium and River Terrace Deposits indicated to be present beneath the site as classified by the EA as Secondary A Aquifer. The underlying Glaciofluvial Deposits are classified as an Undifferentiated Secondary Aquifer. The Wilmslow Sandstone Formation, present at depth, is classified as a Principal Aquifer. However, the site is not located within a groundwater SPZ and the nearest groundwater abstraction is located approximately 583m to the southeast of the site, used for irrigation. Therefore, these aquifers are not considered to represent sensitive groundwater resource receptors.

The nearest surface water feature is located approximately 44m south of the site. This comprises an unnamed stream which feeds into the River Mersey, which at its closest is approximately 90m west of the site. Although there is considered to be potential for contaminants of concern sourced from the site to migrate towards this watercourse, given the site's development history, the risk posed to nearby surface water receptors is not considered to be significant.

Zetica Bomb Risk Mapping indicates the site to be in an area of moderate UXO risk. Therefore, a Detailed UXO Desk Study and Risk Assessment should be undertaken prior to undertaking any intrusive investigations.

Given the residential development history of the site and surrounding area, the potential for significant concentrations of contaminants of concern to be present in soils beneath the site is considered to be limited. However, it would be prudent to collect a small number of soil samples for chemical laboratory analysis as part of any intrusive geotechnical site investigation in order to confirm the contamination status of the site.

© Clancy Consulting 2026

A potentially significant source of ground gas has not been identified as part of this assessment. However, should a significant thickness of Made Ground or putrescible material be recorded during intrusive investigation works, wells should be installed in boreholes to allow monitoring of ground gas concentrations and flow rates.

Based on the above, the following additional assessment is considered to be required to further assess the risks posed by soil contamination and ground gas:

- Undertake a Flood Risk Assessment for the site.
- Undertake a Detailed UXO Desk Study and Risk Assessment for the site prior to undertaking any intrusive investigations.
- Drilling of boreholes to enable collection of soils for chemical laboratory analysis and geotechnical testing to enable foundation design.
- Collection of soil samples for geotechnical laboratory analysis.
- Chemical laboratory analysis of selected soil samples. Samples will be analysed for a broad range of organic and inorganic contaminants of concern.
- Provision of a factual and interpretative site investigation report.

© Clancy Consulting 2026

clancy consulting



Phase 1 Preliminary Risk Assessment
232-236 Palatine Road, Didsbury

Prepared for
Marco Living Ltd

June 2026

2500-CCL-XX-XX-RP-GE-001
Rev. 02

Phil Hill
Senior Geotechnical Engineer
phil.hill@clancy.co.uk

enquiries@clancy.co.uk
www.clancy.co.uk

Clancy Consulting Limited
4th Floor
Windmill Green
24 Mount Street
Manchester
M2 3NX

Document Control Sheet

Issued by	Clancy Consulting Ltd 4th Floor Windmill Green 24 Mount Street Manchester M2 3NX	**Tel:** 0161 613 6000 **Email:** enquiries@clancy.co.uk **Website:** www.clancy.co.uk
Client	Marco Living Ltd 81 Newton Street Manchester M1 1EX	
Document	Phase 1 Preliminary Risk Assessment	
Project Name	Proposed Residential Development on Palatine Road, Didsbury	
Reference	2500-CCL-XX-XX-RP-GE-001 Rev. 02	
Date	June 2026	

"This document has been prepared for the titled project, or named part thereof, and should not be relied upon or used for any other project, or part, without an independent check being made on it. Clancy Consulting shall not be liable for the consequences of using this document other than for the purpose for which it was commissioned, and any user and any other person using or relying on this document for such other purpose, agrees and will be such use or reliance be taken to confirm this agreement to indemnify Clancy Consulting for all loss or damage resulting therefrom".

Document Origin

Revision	Date	Revision Description		Name
00	August 2024	Original	Prepared	Charlie Neville Junior Civil Engineer phil.hill@clancy.co.uk
01	May 2026	Revised layout	Checked	Phil Edge Associate Director phil.edge@clancy.co.uk
02	June 2026	Amended site description	Approved	Phil Edge Associate Director phil.edge@clancy.co.uk

© Clancy Consulting 2026

Executive Summary

Client	Marco Living Ltd
Location	232 to 236 Palatine Road, Didsbury M20 2WF.
Description	The site is approximately 0.60 hectares in area and located to west of Didsbury, approximately 7km to the south of Manchester City Centre at Ordnance Survey (OS) Coordinates 383560, 390980. The site currently comprises three residential buildings subdivided into 22 residential units with large gardens. Surrounding land comprises apartment buildings, houses and a large hotel with associated access roads and car parking.
Development	The proposed works comprise the demolition of the existing three buildings and the construction of three residential apartment buildings comprising 88 new residential units including 5 townhouses and 83 apartment units with lower ground / undercroft car parking and landscaping.
Site History	Historical mapping indicates that the site comprised rural fields until the construction of three residential buildings in circa 1893. The site layout has generally remained unchanged, with the inclusion of later extensions to some of the buildings. Surrounding land has had a similar history with gradually encroaching residential developments. A large hotel was built to the northeast in the 1980's and a multistorey apartment block to the south of the site around the same time.
Geology	British Geological Survey mapping indicates drift deposits beneath the site comprise Alluvium overlying River Terrace Deposits and Glaciofluvial Deposits. This overlies bedrock comprising the Wilmslow Sandstone Formation. Given the development history of the site, a significant thickness of Made Ground is not anticipated to be present overlying natural strata.
Radon	The radon guidance on protective measures for new dwellings indicates that the site is in a 'low' probability radon area where less than 1% of homes are estimated to be at or above the Action Level. Radon gas protection measures are therefore not required in the construction of new dwellings or extensions.
Mining & Ground Stability	The site is not located in a Coal Authority Reporting Area. Therefore, the risks associated with coal workings are considered to be low and no further action is required.
Flood Risk	According to the Flood Map for Planning, available on the gov.uk website, the site is located within Flood Zone 3, whereby there is a greater than a 1% chance (1 in 100) of flooding from rivers or the sea, annually. A Flood Risk Assessment will therefore be required to support any Planning Application.
Environmental Setting	Alluvium and River Terrace Deposits indicated to be present beneath the site as classified by the Environmental Agency (EA) as Secondary A Aquifer. The underlying Glaciofluvial Deposits are classified as an Undifferentiated Secondary Aquifer. The Wilmslow Sandstone Formation, present at depth, is classified as a Principal Aquifer. However, the site is not located within a groundwater source protection zone (SPZ) and the nearest groundwater abstraction is located

© Clancy Consulting 2026

approximately 583m to the southeast of the site, used for irrigation. Therefore, these aquifers are not considered to represent sensitive groundwater resource receptors.

The nearest surface water feature is located approximately 44m south of the site. This comprises an unnamed stream which feeds into the River Mersey, which at its closest is approximately 90m west of the site. Although there is considered to be potential for contaminants of concern sourced from the site to migrate towards this watercourse, given the site's development history, the risk posed to nearby surface water receptors is not considered to be significant.

UXO

Zetica Bomb Risk Mapping indicates the site to be in an area of moderate UXO risk. Therefore, a Detailed UXO Desk Study and Risk Assessment should be undertaken prior to undertaking any intrusive investigations.

Conclusions and Recommendations

Given the residential development history of the site and surrounding area, the potential for significant concentrations of contaminants of concern to be present in soils beneath the site is considered to be limited. However, it would be prudent to collect a small number of soil samples for chemical laboratory analysis as part of any intrusive geotechnical site investigation in order to confirm the contamination status of the site.

A potentially significant source of ground gas has not been identified as part of this assessment. However, should a significant thickness of Made Ground or putrescible material be recorded during intrusive investigation works, wells should be installed in boreholes to allow monitoring of ground gas concentrations and flow rates.

Based on the above, the following additional assessment is considered to be required to further assess the risks posed by soil contamination and ground gas:

- Undertake a Flood Risk Assessment for the site.
- Undertake a Detailed UXO Desk Study and Risk Assessment for the site prior to undertaking any intrusive investigations.
- Drilling of boreholes to enable collection of soils for chemical laboratory analysis and geotechnical testing to enable foundation design.
- Collection of soil samples for geotechnical laboratory analysis.
- Chemical laboratory analysis of selected soil samples. Samples will be analysed for a broad range of organic and inorganic contaminants of concern.
- Provision of a factual and interpretative site investigation report

© Clancy Consulting 2026

Contents

1.0 Introduction 1
1.1 Background 1
1.2 Objectives 1
1.3 Limitations of the Study 1
2.0 Desk Study 2
2.1 General 2
2.2 Site Setting and Description 2
2.3 Site History 2
2.4 UXO Risk Assessment 3
2.5 Geology 3
2.6 Mining and Ground Stability 3
2.7 Hydrogeology 3
2.8 Hydrology 4
2.9 Soil Geochemistry 4
2.10 Flood Risk 4
2.11 Radon Risk Potential 5
2.12 Landfill Sites 5
2.13 Industrial Land Uses 5
2.14 Sensitive Land Uses 5
2.15 Potential Geotechnical Constraints 5
3.0 Preliminary Conceptual Site Model 7
3.1 General 7
3.2 Guidance 7
3.3 Potential Contaminant Sources 7
3.4 Potential Pathways 7
3.5 Potential Receptors 7
3.6 Preliminary Risk Assessment 8
4.0 Conclusions 10

Drawings

Site Location Plan
Proposed Development Plan

Appendices

Appendix I Drawings
Appendix II Historical Maps
Appendix III Zetica Bomb Risk Mapping
Appendix IV Geological Maps
Appendix V EA Site Sensitivity & Flood Risk Maps
Appendix VI Environmental Datasheets

© Clancy Consulting 2026

1.0 Introduction

1.1 Background

Clancy Consulting Limited has been instructed by Marco Living to carry out a Phase 1 Preliminary Risk Assessment at a site on 232 to 236 Palatine Road, Didsbury M20 2WF.

The proposed works comprise the demolition of the existing three buildings and the construction of three residential apartment buildings comprising 88 new residential units including 5 townhouses and 83 apartment units with lower ground / undercroft car parking and landscaping..

A proposed development plan is included in Appendix I.

1.2 Objectives

The objectives of this investigation are summarised below:

- Provide a review of the site's land use history by reference to ordnance survey maps of the area.
- Assess the environmental setting, geology, hydrology, hydrogeology, mining and subsidence history of the site and surrounding area.
- Consider the potential risk from unexploded ordnance (UXO).
- Consider the potential risk to end users of the site from hazardous ground gas.
- Develop a preliminary risk assessment and a detailed 'conceptual site model' with regard to potential contamination sources, pathways and receptors.
- Provide recommendations regarding the requirement for further investigations or remedial works, if required, to satisfy the Local Planning Authority and to inform detailed civil and structural design.

1.3 Limitations of the Study

Clancy Consulting Limited cannot be held responsible for any omissions, misrepresentation, errors or inaccuracies with the supplied third-party report information. The report is written in the context of an agreed scope of work and budget and should not be used in a different context. New information or improved practices and changes in legislation may require a reinterpretation of the report in whole or in part.

Clancy Consulting Limited reserves the right to amend either conclusions or recommendations in light of any further information that may become available. The report is provided for the sole use of Marco Living for the objectives discussed previously only and is confidential to them.

The report may not be relied upon by any other party without prior written consent of Clancy Consulting Limited. Those using this information in subsequent assessments or evaluations do so at their own risk.

It must be noted that whilst this investigation aims to characterise the general ground conditions beneath the proposed development site, Clancy Consulting Ltd cannot be held accountable for variations in ground and groundwater conditions, unidentified contamination or the presence of below ground structures present.

© Clancy Consulting 2026

2.0 Desk Study

2.1 General

Background information was sought from the following sources:

- Ordnance Survey historical maps (selected copies included in Appendix II).
- Zetica Bomb Risk Mapping (Appendix III).
- British Geological Survey (BGS) sheets (Appendix IV).
- Environment Agency site sensitivity & flood risk maps (Appendix V).
- Environmental datasheets (Appendix VI).

2.2 Site Setting and Description

The site is approximately 0.60 hectares in area and located to west of Didsbury, approximately 7km to the south of Manchester City centre at Ordnance Survey (OS) Coordinates 383560, 390980. The site currently comprises three existing buildings subdivided into 22 residential units.

The Britania Country House Hotel is located to the east of the site with an access road to its rear car park along the site's northern boundary. A multistorey residential apartment block lies to the southwest of the site. The River Mersey is located approximately 90m to the west of the site. A site location plan is included in Appendix I.

2.3 Site History

In order to investigate the development history and previous land uses at the site and surrounding area, historical OS maps were examined. Copies of the maps are presented in Appendix II.

Table 1 below is not intended to provide a comprehensive review of all the changes which have occurred at the site and instead provides a summary of the most salient points relating to the development history of the site. The most significant historical land uses are highlighted in bold text for ease of reference.

Table 1: Site History

Date(s)	Site	Surrounding Land
1848	The site comprised rural fields.	The site was located in a rural area. The River Mersey formed a large meandering loop which at its closest is approximately 90m west of the site. A small stream was present approximately 45m south of the site, flowing towards the River Mersey.
1893 to 1894	Three large residential buildings were present at the eastern end of the site, parallel to Palatine Road. Large gardens were present across the remaining site area.	Additional residential properties were present immediately north and south of the site. Large, landscaped gardens were present to the northeast of the site, including three large lakes. A stream issues from one of these lakes to the north, joining up with the River Mersey. To the south the land remained predominantly rural. The town of Didsbury was present approximately 750m to the east.
1907	No significant changes	One of the lakes was no longer indicated and comprised an area of woodland,
1923 to 1938	No significant changes	Didsbury had encroached to within 300m to the north and east of the site. Northenden was present 500m to the southwest.
1955 to 1959	No significant changes	Possible embankment works and/or flood defense works were indicated along the banks of the River Mersey and on land to the north and west of the site. Tennis courts were present approximately 20m to the north of the site.

© Clancy Consulting 2026

Date(s)	Site	Surrounding Land
1966 to 1967	Extensions had been added to the properties on-site.	A large government building was present 250m to the northeast.
1981	No significant changes	A number of large buildings were present approximately 50m to the northeast (in the location of the nearby hotel). The tennis courts were no longer indicated to be present. An 'L' shaped building was present on the plot to the south of the site. The pond to the north has diminished in size and was indicated to be within the grounds of a school and playing fields.
1989 to 1990	No significant changes	Ringway Hotel and car park and Riverside Court were present 50m and 100m to the north, respectively. A large residential apartment building, Brookside, was present to the south, with an associated car park. The government building had been demolished.
1999	No significant changes	An access road and car park were present to the west of the site.
2003 to present	No significant changes.	Houses were shown on the site of the government building to the northeast

2.4 UXO Risk Assessment

Zetica Bomb Risk Mapping indicates the site to be in an area of moderate UXO risk. Therefore, a Detailed UXO Desk Study and Risk Assessment should be undertaken prior to undertaking any intrusive investigations.

Zetica bomb risk mapping for the site is included in Appendix III.

2.5 Geology

British Geological Survey (BGS) mapping indicates drift deposits beneath the site comprise Alluvium overlying River Terrace Deposits and Glaciofluvial Deposits. This overlies bedrock comprising the Wilmslow Sandstone Formation.

Given the development history of the site, a significant thickness of Made Ground is not anticipated to be present overlying natural strata. However, Made Ground and basement level structures may be present beneath the footprint of the current buildings and immediate surrounding area.

Copies of the geological plans are provided in Appendix IV.

2.6 Mining and Ground Stability

The site is not located within a Coal Authority Reporting Area. Therefore, the risks associated with historic coal mining are considered to be low and no further action is required.

The environmental database report indicates that the site represents a low risk with regard to ground stability issues relating to ground dissolution, collapsible ground, landslides, shrinking/swelling clay, and running sand. The site is indicated to represent a moderate risk with regard to compressible ground, likely associated with the Alluvium indicated to be present on BGS mapping.

No BGS recorded mineral sites are indicated to be present within 500m of the site.

2.7 Hydrogeology

The Alluvium and River Terrace Deposits indicated to be present beneath the site are classified by the Environment agency (EA) as Secondary A Aquifers. These are strata which can provide modest quantities of water, but due to the nature of rock or the aquifers structure limits their use. They support water supplies at a local level and remain important for rivers, wetlands and lakes.

© Clancy Consulting 2026

The underlying Glaciofluvial Deposits are classified as an Undifferentiated Secondary Aquifer. These are layers of variable permeability, where it has not been possible to assign a Secondary A or B Aquifer designation.

The underlying Wilmslow Sandstone Formation strata are classified as a Principal Aquifer. These are rocks that provide significant quantities of water and can support water supply and/or baseflow to rivers, lakes and wetlands on a strategic scale. They typically have a high intergranular and/or fracture permeability, meaning they usually provide a high level of water storage.

According to EA data, the site is not located within a groundwater Source Protection Zone (SPZ).

Information provided by the EA indicates that there is one record of a licensed groundwater abstractions within 1km of the site. This is located on a golf course 583m southeast of the site, for spray irrigation.

Groundwater quality beneath the site has been classified as 'poor' under the EA Local River Basin Management Plan for the area.

2.8 Hydrology

The nearest surface water feature is located approximately 44m south of the site. This comprises an unnamed stream which feeds into the River Mersey, which at its closest is approximately 90m west of the site.

Surface water quality in the local area has been classified as 'fail' under the EA Local River Basin Management Plan for the area.

There is one record of a licensed surface water abstractions indicated to be present within 1km of the site. This relates to an abstraction used for dust suppression / general washing during construction, located approximately 852m to the west of the site.

There no records of potential active discharge consents within 500m of the site.

There are no records of significant or major incidents to controlled waters recorded within 500m of the site.

2.9 Soil Geochemistry

According to the BGS National Geoscience Information Service, the following soil concentrations can be expected within urban soils at the site (based on BGS measured concentrations taken within the surrounding site area):

- Arsenic – 15 to 20 mg/kg
- Cadmium - <1.8 mg/kg
- Chromium – 60-90 mg/kg
- Lead – <100 mg/kg
- Nickel – 15-30 mg/kg

These concentrations are not considered to pose a significant risk to human health, based on the proposed development at the site.

2.10 Flood Risk

According to the Flood Map for Planning, available on the gov.uk website, the site is located within Flood Zone 3, whereby there is a greater than a 1% chance (1 in 100) of flooding from rivers or the sea, annually. A Flood Risk Assessment (FRA) would therefore be required to support any planning application for the site.

The environmental database report indicates that there is a potential for groundwater flooding of below ground structures at the site.

© Clancy Consulting 2026

The site may be located within a critical drainage area. The appointed drainage engineer should consult with the Lead Local Flood Authority (LLFA) to confirm this.

Copies of the site sensitivity and flood risk maps are included in Appendix V.

2.11 Radon Risk Potential

The radon guidance on protective measures for new dwellings indicates that the site is in a 'low' probability radon area where less than 1% of homes are estimated to be at or above the Action Level.

Radon gas protection measures are therefore not necessary in the construction of new dwellings or extensions.

2.12 Landfill Sites

One historic landfill site is present within 500m of the site, located approximately 465m west, licenced to accept inert, industrial and household waste and liquid sludge.

There are no Local Authority Landfills present within 500m of the site.

There are no current waste management or waste transfer sites indicated to be present within 500m of the site.

Four potential areas of infilled land (water) associated with former ponds, marsh, river, stream or docks within 500m of the site. The closest of these is located approximately 123m to the northeast of the site. Given its size and distance, this is not considered to pose a significant ground gas risk to the proposed development.

2.13 Industrial Land Uses

There are no active Local Authority Pollution Prevention and Control permits recorded within 500m of the site.

The are no active Contemporary Trade Directory entries recorded within 500m of the site.

Full details of the waste management and industrial land uses are detailed in the environmental database presented in Appendix VI.

2.14 Sensitive Land Uses

Natural England data indicates that there are no ecologically sensitive sites indicated within 500m of the site that constitute environmental receptors as defined within Table 1 of the DEFRA Environmental Protection Act 1990: Part 2A - Contaminated Land Statutory Guidance (2012).

2.15 Potential Geotechnical Constraints

The table below summarises the potential geotechnical hazards associated with the development. The table provides an assessment of whether the site is likely to be affected by the hazard and the possible consequences and engineering considerations.

Table 2: Geotechnical Risk Register

Hazard Description	Is hazard likely to be present / affect the site?	Comments/possible engineering requirements where hazard present
Sudden lateral/vertical changes in ground conditions	M	The site has been developed in the past and localised areas of Made Ground may be present, although these are anticipated to be of limited thickness. Superficial soils beneath the site are indicated to comprise Alluvium overlying River Terrace Deposits and Glaciofluvial Deposits. The thickness and strength characteristics of these layers are likely to vary across the site.

© Clancy Consulting 2026

Hazard Description	Is hazard likely to be present / affect the site?	Comments/possible engineering requirements where hazard present
Highly compressible/low bearing capacity soils, (including peat and soft clay)	M	Made Ground and Alluvium beneath the site would not form suitable bearing layers for traditional foundations. Deeper layers of the River Terrace Deposits or Glaciofluvial Deposits may represent suitably competent soils to support traditional foundations, if present at shallow depth. This would need to be confirmed by an intrusive site investigation.
Ground dissolution features/natural cavities	L	Strata indicated to be present at shallow depth beneath the site are not susceptible to these hazards.
Shrinking and swelling clays	M	Cohesive layers of the Alluvium and Glaciofluvial Deposits may be susceptible to volume change hazards. Investigations should be undertaken to further assess this potential risk.
Slope stability/Retaining wall issues	L	New slopes or retaining structures are not indicated to form part of the proposed development. Any temporary or permanent slopes or retaining walls created as part of the development should be subject to appropriate geotechnical design based on site-specific site investigation information.
High groundwater table (including waterlogged ground)	M/H	The environmental data base indicates there is a potential for ground water flooding to occur in sub-surface structures. Groundwater exclusion and control measures may therefore be required for excavations beneath the site. However, this would need to be confirmed by intrusive ground investigation.
Filled and Made Ground (including embankments)	L/M	The site has been developed in the past and localised areas of Made Ground may be present, although these are anticipated to be of limited thickness.
Obstructions (including foundations, services, basements, tunnels and adjacent sub-structures)	M	The site has been developed in the past and it is considered that buried obstructions may be present. Their removal may require heavy plant in some cases. This should be programmed for.
Underground mining	L	The site is not within an area where underground mining is considered to pose a risk to the development.
Concrete classification	L/M	Made Ground and natural soils beneath the site may contain elevated concentrations of sulphate potential harmful to buried structures.
Seismic Activity	L	The Eurocode 8 seismic hazard zoning maps for the UK (Musson and Sargeant, 2007) indicate that horizontal Peak Ground Acceleration (PGA) values with 10% probability of being exceeded in 50 years (475 year return period) are between 0.00g and 0.02g, which is considered very low.
NOTES: H – High Risk M – Medium Risk L – Low risk		

© Clancy Consulting 2026

3.0 Preliminary Conceptual Site Model

3.1 General

The “suitable for use” approach is adopted for the assessment of contaminated land and remedial measures are only undertaken where unacceptable risk to human health or the environment can be proven when taking into account the proposed use of the site and environmental setting.

A risk assessment process should be carried out to determine potential hazards to human health and the environment and be based on the “source” “pathway” “receptor” principal. For a potential risk to be present there must be a viable pollutant linkage whereby a contamination source may impact upon a receptor. The absence of one or more of these key components (source, pathway or receptor) prohibits a viable pollution linkage being formed.

3.2 Guidance

In accordance with the ‘Land Contamination Risk Management’ (LCRM) guidance on the gov.uk website (updated October 2020) and BSI 10175 “Code of Practice for Investigation of Potentially Contaminated Land” (2011), a Preliminary Conceptual Site Model was developed to identify potential contamination sources, migration pathways and receptors within the study area.

3.3 Potential Contaminant Sources

Given the residential development history of the site and surrounding area, the potential for significant concentrations of contaminants of concern to be present in soils beneath the site is considered to be limited.

Given the development history of the site, a significant thickness of Made Ground considered to represent a potentially significant source of ground gas is unlikely to be present beneath the site. Furthermore, given the size and distance of the nearest potential area of infilled ground (123m to the northeast), this is not considered to pose a significant ground gas risk to the proposed development.

3.4 Potential Pathways

Following the proposed development, the potential risks to future site users via the dermal contact and ingestion pathways in areas of the site comprising building cover and hardstanding will be mitigated. Furthermore, the pathway for the airborne migration of soil/dust from these areas towards off-site receptors would not be active. However, these pathways may remain active in areas of soft landscaping.

There is potential for the on or off-site migration of contaminants of concern within granular layers of the Made Ground and natural strata.

There is potential for ground gas contaminants of concern in soil or groundwater (if present) to impact future site users via the pathway of inhalation within enclosed areas of the proposed development.

There is potential for the downward migration of contaminants of concern towards the underlying Alluvium and River terrace Deposits Secondary A Aquifers, Glaciofluvial Deposits Undifferentiated Secondary Aquifer and Wilmslow Sandstone Formation Principle Aquifer indicated to be present beneath the site.

3.5 Potential Receptors

Potential human health receptors include future site users and neighboring residential/commercial property occupiers.

The underlying Secondary A, Undifferentiated Secondary and Principal Aquifers are considered the main environmental receptors of concern.

© Clancy Consulting 2026

The nearest surface water feature is located approximately 44m south of the site. This comprises an unnamed stream which feeds into the River Mersey, which at its closest is approximately 90m west of the site. There is considered to be potential for contaminants of concern sourced from the site to migrate towards this watercourse.

3.6 Preliminary Risk Assessment

A preliminary risk assessment can be carried out using guidance outlined in Section 6.3 of CIRIA Document C552 "Contaminated Land Risk Assessment – A Guide to Good Practice" (2001). For a risk to be present there must be a viable pollutant linkage whereby a contamination source can impact on a receptor via a pathway. To carry out the risk assessment an estimate must be made of the potential severity of the risk and the likelihood of the risk occurring. The following Tables set out the criteria for this principal.

Table 3: Severity of Risk

Severity	Description
Severe	Acute risk to human health likely to result in 'significant harm' i.e. very high concentrations of contamination or ground gases. Catastrophic damage to building i.e. by explosion from high gassing sites or VOC concentrations. Major pollution of controlled waters i.e. surface watercourses and Principal aquifers, source protection zones. Short term damage to ecosystems.
Medium	Long term risk to human health likely to result in 'significant harm' i.e. elevated concentrations of contaminants or ground gases. Pollution of sensitive controlled watercourses i.e. Principal or Secondary Aquifers. Significant effects on sensitive ecosystems or species.
Mild	Pollution of non-sensitive waters i.e. smaller surface watercourses or unproductive strata. Significant damage to crops, buildings, structures or services i.e. by explosion from sites with medium gassing potential, elevated concentrations of contaminants.
Minor	Non-permanent human health effects i.e. requirement for protective equipment during site works to mitigate health effects. Damage to non-sensitive ecosystems or species. Minor damage to buildings, structures or services.

Table 4: Probability of Risk Occurring

Probability	Description
High Likelihood	Pollutant linkage may be present that appears very likely in the short term and risk is almost certain to occur in long term or evidence of harm to receptor exists.
Likely	Pollutant linkage may be present and is likely that the risk will occur over the long term.
Low Likelihood	Pollutant linkage may be present and there is a possibility of the risk occurring although no certainty that it will do so.
Unlikely	Pollutant linkage may be present but the circumstances under which harm would occur even in the long term are improbable.

Table 5: Comparison of Risk & Probability

Probability	Severity			
	Severe	Medium	Mild	Minor
High Likelihood	Very High	High	Moderate	Moderate/Low
Likely	High	Moderate	Moderate/Low	Low
Low Likelihood	Moderate	Moderate/Low	Low	Very Low
Unlikely	Moderate/Low	Low	Very Low	Very Low

A summary of potential pollutant linkages and perceived risks for this site are outlined in the Table below:

© Clancy Consulting 2026

Table 6: Pollutant Linkages & Perceived Risk

Sources of Contamination	Pathways	Receptors	Severity	Probability	Risk	Justification	Further Action Required
On site: Made Ground	Inhalation, ingestion and dermal contact of soil	Future site users	**Medium** Long term risk to human health	**Unlikely**	**Low**	Given the residential development history of the site and surrounding area, the potential for significant concentrations of contaminants of concern to be present in soils beneath the site is considered to be limited. It is considered likely that potential risks may be mitigated by the provision of clean topsoil cover in new or reworked soft landscaped areas, which will act as a barrier between contaminants in the underlying soil and future site users.	Given the residential development history of the site and surrounding area, the potential for significant concentrations of contaminants of concern to be present in soils beneath the site is considered to be limited. However, it would be prudent to collect a small number of soil samples for chemical laboratory analysis as part of any intrusive geotechnical site investigation in order to confirm the contamination status of the site.
		Construction workers during development	**Minor** Non-permanent human health effects i.e. requirement for protective equipment during site works to mitigate health effects	**Low Likelihood**	**Very Low**	If construction workers come into contact with potential contaminated soils during the construction phase, such contact would be short term, limiting potential exposure. Construction workers are expected to undertake good working practices including regular hand washing and other hygiene techniques which would reduce the likelihood of long-term exposure to any contamination.	
	Acidic ground conditions affecting future site buildings	Building infrastructure	**Minor** Minor damage to buildings	**Low Likelihood**	**Very Low**	Made Ground and natural soils beneath the site may contain elevated concentrations of sulphates and low pH. Chemical testing for water soluble sulphate and pH should be undertaken to inform concrete classification. Chemical testing should be undertaken to assess the requirements for water supply pipelines.	
	Vertical and lateral migration	Neighbouring commercial / residential properties	**Medium** Long term risk to human health	**Unlikely**	**Low**	Given the development history of the site, it is considered unlikely that contamination would be present in sufficient concentrations to adversely affect neighbouring site users.	
		Controlled waters	**Mild** Pollution of non-sensitive controlled water receptors	**Low Likelihood**	**Low**	Alluvium and River Terrace Deposits indicated to be present beneath the site as classified by the EA as Secondary A Aquifer. The underlying Glaciofluvial Deposits are classified as an Undifferentiated Secondary Aquifer. The Wilmslow Sandstone Formation, present at depth, is classified as a Principal Aquifer. However, the site is not located within a groundwater SPZ and the nearest groundwater abstraction is located approximately 583m to the southeast of the site. Therefore, these aquifers are not considered to represent sensitive groundwater resource receptors. The nearest surface water feature is located approximately 44m south of the site. Although there is considered to be potential for contaminants of concern sourced from the site to migrate towards this watercourse, given the site's development history, the risk posed to nearby surface water receptors is not considered to be significant.	
Off site: Hotel and residential developments	Lateral migration onto site with subsequent dermal contact of soils	Future site users	**Medium** Long term risk to human health	**Unlikely**	**Low**	Given the predominantly residential nature of surrounding land use, the potential risk posed to the proposed development from off-site sources of contamination is not considered to be significant.	
Potential hazardous ground gas and vapours from Made Ground and infilled ponds	Migration of ground gas	Future site users	**Severe** Acute risk to human health (asphyxiation)	**Unlikely**	**Low / Moderate**	Given the development history of the site, a significant thickness of Made Ground considered to represent a potentially significant source of ground gas is unlikely to be present beneath the site. Furthermore, given the size and distance of the nearest potential area of infilled ground (123m to the northeast), this is not considered to pose a significant ground gas risk to the proposed development.	A potentially significant source of ground gas has not been identified as part of this assessment. However, should a significant thickness of Made Ground be recorded during intrusive investigation works, wells should be installed in boreholes.
		Building Infrastructure	**Severe** Significant damage to buildings (explosion)	**Unlikely**	**Low / Moderate**		

© Clancy Consulting 2026

4.0 Conclusions

Clancy Consulting Limited was instructed by Marco Living to carry out a Phase 1 Preliminary Risk Assessment at a site on 232 to 236 Palatine Road, Didsbury M20 2WF.

The proposed works comprise the demolition of the existing three buildings and the construction of three new residential apartment buildings comprising 88 new residential units including 5 townhouses and 83 apartment units with lower ground / undercroft car parking and landscaping..

Historical mapping indicates that the site comprised rural fields until the construction of three residential buildings in circa 1893. The site layout has generally remained unchanged, with the inclusion of later extensions to some of the properties.

Surrounding land has had a similar history with gradually encroaching residential developments. A large hotel was built to the northeast in the 1980's and a multistorey apartment block to the south of the site around the same time.

British Geological Survey mapping indicates drift deposits beneath the site comprise Alluvium overlying River Terrace Deposits and Glaciofluvial Deposits. This overlies bedrock comprising the Wilmslow Sandstone Formation.

Given the development history of the site, a significant thickness of Made Ground is not anticipated to be present overlying natural strata.

The radon guidance on protective measures for new dwellings indicates that the site is in a 'low' probability radon area where less than 1% of homes are estimated to be at or above the Action Level. Radon gas protection measures are therefore not required in the construction of new dwellings or extensions.

The site is not located in a Coal Authority Reporting Area. Therefore, the risks associated with coal workings are considered to be low and no further action is required.

According to the Flood Map for Planning, available on the gov.uk website, the site is located within Flood Zone 3, whereby there is a greater than a 1% chance (1 in 100) of flooding from rivers or the sea, annually. A Flood Risk Assessment will therefore be required to support any Planning Application.

Alluvium and River Terrace Deposits indicated to be present beneath the site as classified by the EA as Secondary A Aquifer. The underlying Glaciofluvial Deposits are classified as an Undifferentiated Secondary Aquifer. The Wilmslow Sandstone Formation, present at depth, is classified as a Principal Aquifer. However, the site is not located within a groundwater SPZ and the nearest groundwater abstraction is located approximately 583m to the southeast of the site, used for irrigation. Therefore, these aquifers are not considered to represent sensitive groundwater resource receptors.

The nearest surface water feature is located approximately 44m south of the site. This comprises an unnamed stream which feeds into the River Mersey, which at its closest is approximately 90m west of the site. Although there is considered to be potential for contaminants of concern sourced from the site to migrate towards this watercourse, given the site's development history, the risk posed to nearby surface water receptors is not considered to be significant.

Zetica Bomb Risk Mapping indicates the site to be in an area of moderate UXO risk. Therefore, a Detailed UXO Desk Study and Risk Assessment should be undertaken prior to undertaking any intrusive investigations.

Given the residential development history of the site and surrounding area, the potential for significant concentrations of contaminants of concern to be present in soils beneath the site is considered to be limited. However, it would be prudent to collect a small number of soil samples for chemical laboratory analysis as part of any intrusive geotechnical site investigation in order to confirm the contamination status of the site.

© Clancy Consulting 2026

A potentially significant source of ground gas has not been identified as part of this assessment. However, should a significant thickness of Made Ground or putrescible material be recorded during intrusive investigation works, wells should be installed in boreholes to allow monitoring of ground gas concentrations and flow rates.

Based on the above, the following additional assessment is considered to be required to further assess the risks posed by soil contamination and ground gas:

- Undertake a Flood Risk Assessment for the site.
- Undertake a Detailed UXO Desk Study and Risk Assessment for the site prior to undertaking any intrusive investigations.
- Drilling of boreholes to enable collection of soils for chemical laboratory analysis and geotechnical testing to enable foundation design.
- Collection of soil samples for geotechnical laboratory analysis.
- Chemical laboratory analysis of selected soil samples. Samples will be analysed for a broad range of organic and inorganic contaminants of concern.
- Provision of a factual and interpretative site investigation report.

© Clancy Consulting 2026

13.4. Appendix D – EA Flood Mapping, Including Product 4 and Product 8

Product 4&8 data

EA Flood Map for planning

© Clancy Consulting 2026

Palatine Road – Flood Impact Assessment

2020s0488 – M60 Pillar Repairs

Final Report - Appendices

Date
July 2020

www.jbaconsulting.com

Balvac Ltd
Unit 6
Puma Court
Kings Business Park
Prescot
LIVERPOOL
L34 1PJ

JBA Project Manager

Kevin Frodsham
JBA Consulting
Mersey Bank House
Barbauld Street
Warrington
WA1 1WA

Revision History

Revision Ref/Date	Amendments	Issued to
Draft v1.0 01st July 2020	Draft Report	Andrew Higson, Balvac
Final 23rd July 2020	Final Report (no changes from draft report)	Andrew Higson, Balvac

Contract

This report describes work commissioned by Balvac Ltd, by an email dated 25th March 2020. Balvac Ltd's representative for the contract was Andrew Higson. Ellen Broad and Kevin Frodsham of JBA Consulting carried out this work.

Prepared by ..... Ellen Broad BSc PGCert MCIWEM C.WEM

Analyst

Reviewed by ..... Kevin Frodsham BSc BA MSc PhD

Senior Analyst

Purpose

This document has been prepared as a Final Report for Balvac Ltd and the Environment Agency. JBA Consulting accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

JBA Consulting has no liability regarding the use of this report except to Balvac Ltd and the Environment Agency.

Copyright

© Jeremy Benn Associates Limited 2022.

Contents

A Comparison of EA Defended model and Baseline in this study IV

B Channel Survey Comparison IX

List of Figures

Figure 4-1: Location of Environment Agency defence wall alongside Ford Lane IV
Figure 4-2: Photo of Environment Agency defence wall at Ford Lane V
Figure 4-3: EA defended vs baseline flood extent comparison for the 10% AEP event VI
Figure 4-4: EA defended vs baseline flood extent comparison for the 4% AEP event VI
Figure 4-5: EA defended vs baseline flood extent comparison for the 2% AEP event VII
Figure 4-6: EA defended vs baseline flood extent comparison for the 1.3% AEP event VII
Figure 4-7: EA defended vs baseline flood extent comparison for the 1% AEP event VIII
Figure 4-8: EA defended vs baseline flood extent comparison for the 0.1% AEP event VIII
Figure 4-9: Location of Surveyed Channel Cross Sections X
Figure 4-10: Comparison of river sections at InfoMap section 1.05 XI
Figure 4-11: Comparison of river sections at InfoMap section 1.04 XI
Figure 4-12: Comparison of river sections at InfoMap section 1.03 XII
Figure 4-13: Comparison of river sections at InfoMap section 1.02 XII
Figure 4-14: Comparison of river sections at InfoMap section 1.01u (Palatine Road Bridge) XIII
Figure 4-15: Comparison of conveyance for previous vs updated channel section XIII

Appendices

A Comparison of EA Defended model and Baseline in this study

A.1 Model Updates

Two updates to the Environment Agency's Upper Mersey (2018) defended model scenario were undertaken to develop the baseline (defended) scenario for this study.

A.1.1 Ford Lane Defence Wall

The first change was to include an Environment Agency maintained defence wall that was absent from the existing model. The wall is located alongside Ford Lane in Northenden and ties into the downstream face of the M60 bridge at this location (Figure A-1 and Figure A-2). To include the defence wall in the model, JBA undertook a crest level survey of the defence wall in March 2020. The wall was then added to the 2D model as a TUFLOW Z-Line GIS layer (2d_zln_EA_Defence_FordLn.MIF), which included the surveyed elevation points. The Z-Line was read into the model as a 'THIN' (default) Z-Line to ensure that flow along Ford Lane was still possible in the model; as reading the wall in as 'THICK' in an 8- metre cell size model and would have blocked off any flow route on the road alongside the wall.

The inclusion of the defence wall is now modelled to prevent the flow route into Northenden that was previously simulated for events of 2% AEP and higher magnitudes (as shown in Figure A-3 to Figure A-8).

Figure A-1: Location of Environment Agency defence wall alongside Ford Lane

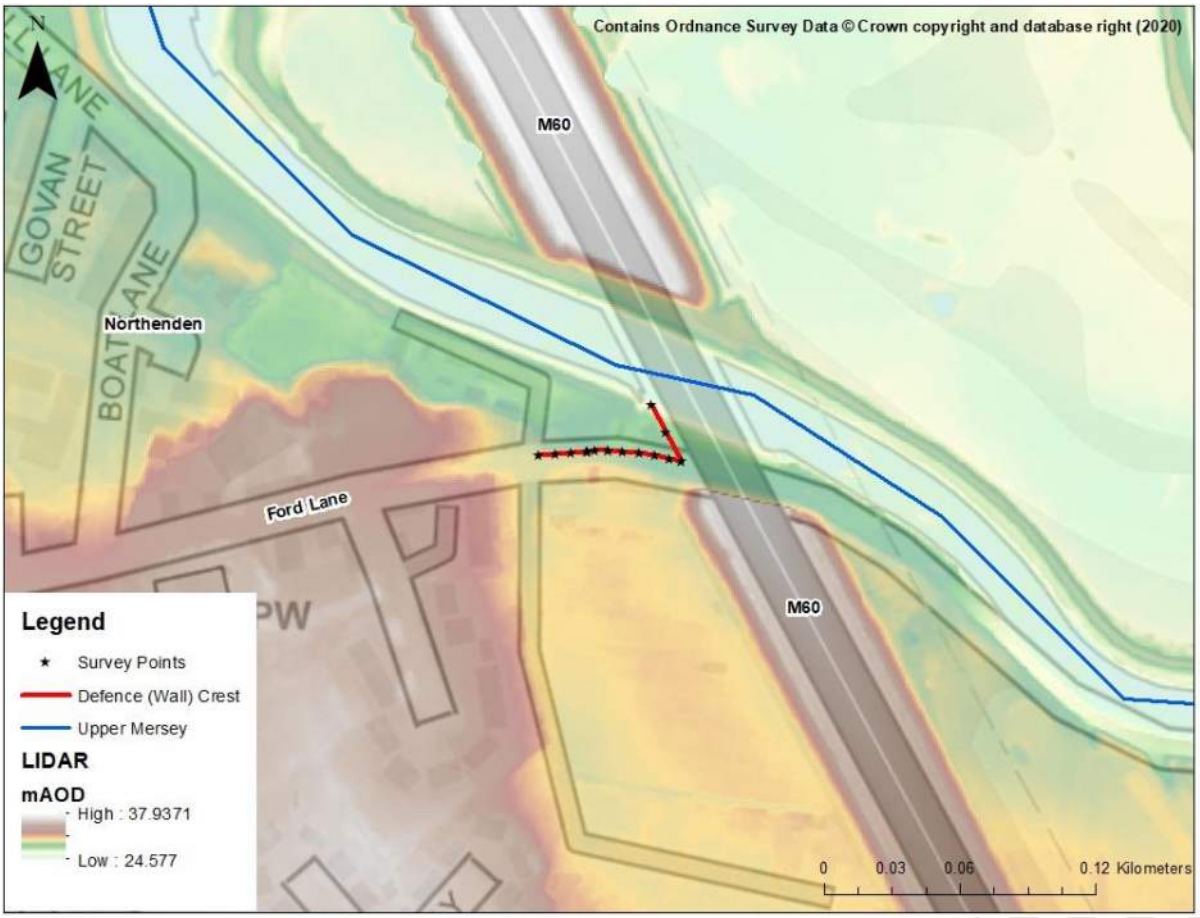


Figure A-2: Photo of Environment Agency defence wall at Ford Lane



A.1.2 Increased Channel Definition

The second update was to remove the erroneous (narrow) river section from the model and update this reach in the vicinity of the proposed cofferdam with the channel cross-sections surveyed by Infomap (2020). InfoMap surveyed five sections in this reach (Appendix B), all of which were added to the existing model. In addition to the errant original section, the section at Palatine Road Bridge was also replaced by the check section collected by Infomap (although there was little difference between old and new sections at this location). A comparison between the new survey and existing model sections, where a direct comparison was possible, is provided in Appendix B.

A.2 Comparison of Model Results

The existing Environment Agency defended Upper Mersey (2018) flood outlines are compared to the updated defended flood outlines, which represent the baseline results described in the main report, in Figure A-3 to Figure A-8. No comparison is provided for the 50% AEP event as the Mersey does not overtop in the vicinity of the proposed cofferdam. The main difference that is evident across these comparisons is that the inclusion of the defence wall on Ford Lane has removed the flow route into Northenden from Ford Lane. However, on closer inspection there is also a subtle reduction in the flood extent across the Didsbury flood basin due to the updates, which can be attributed to the removal of the errant section and inclusion of the Infomap survey[1]. This is because the increased conveyance of the channel leads to less overtopping upstream of the previous constriction. There is, therefore, an accompanying subtle increase in flood extent in the Northenden Golf Course and further downstream (not shown).

[1] This attribution is possible because the defended modelling update was carried out in two stages; first, the inclusion of the defence wall giving rise to an intermediate set of results and then the update of the river sections.

Figure A-3: EA defended vs baseline flood extent comparison for the 10% AEP event

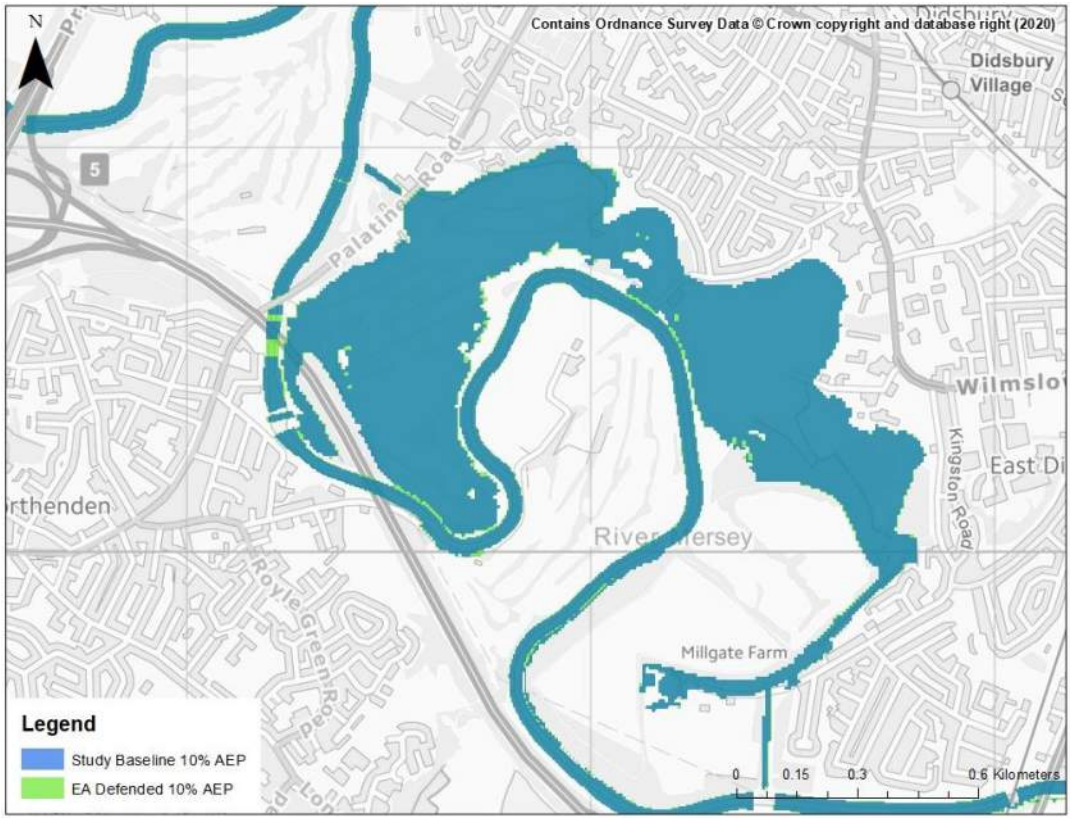


Figure A-4: EA defended vs baseline flood extent comparison for the 4% AEP event

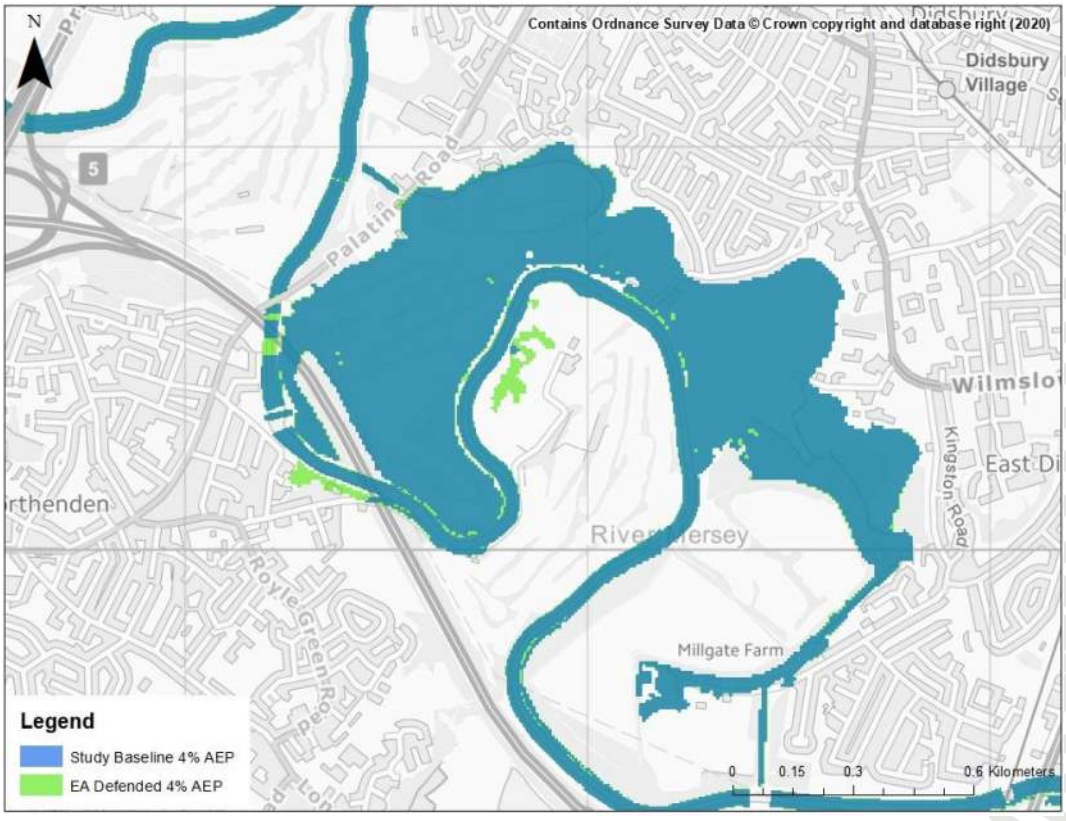


Figure A-5: EA defended vs baseline flood extent comparison for the 2% AEP event

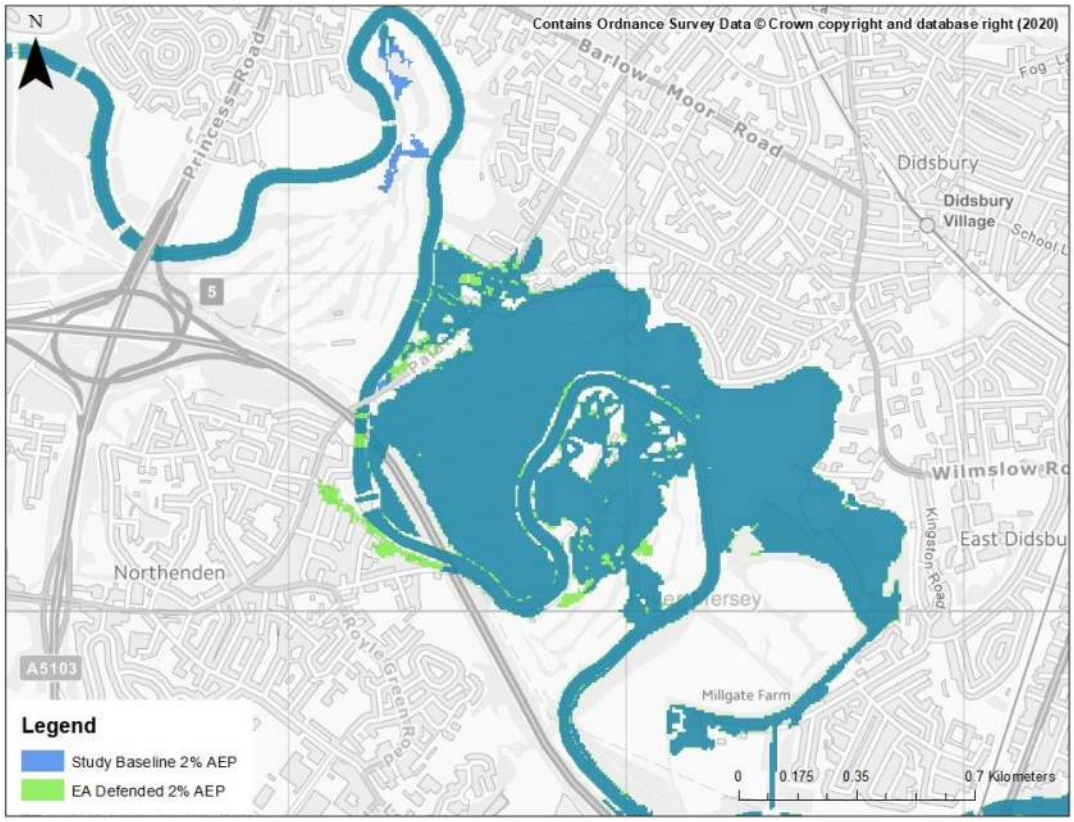


Figure A-6: EA defended vs baseline flood extent comparison for the 1.3% AEP event

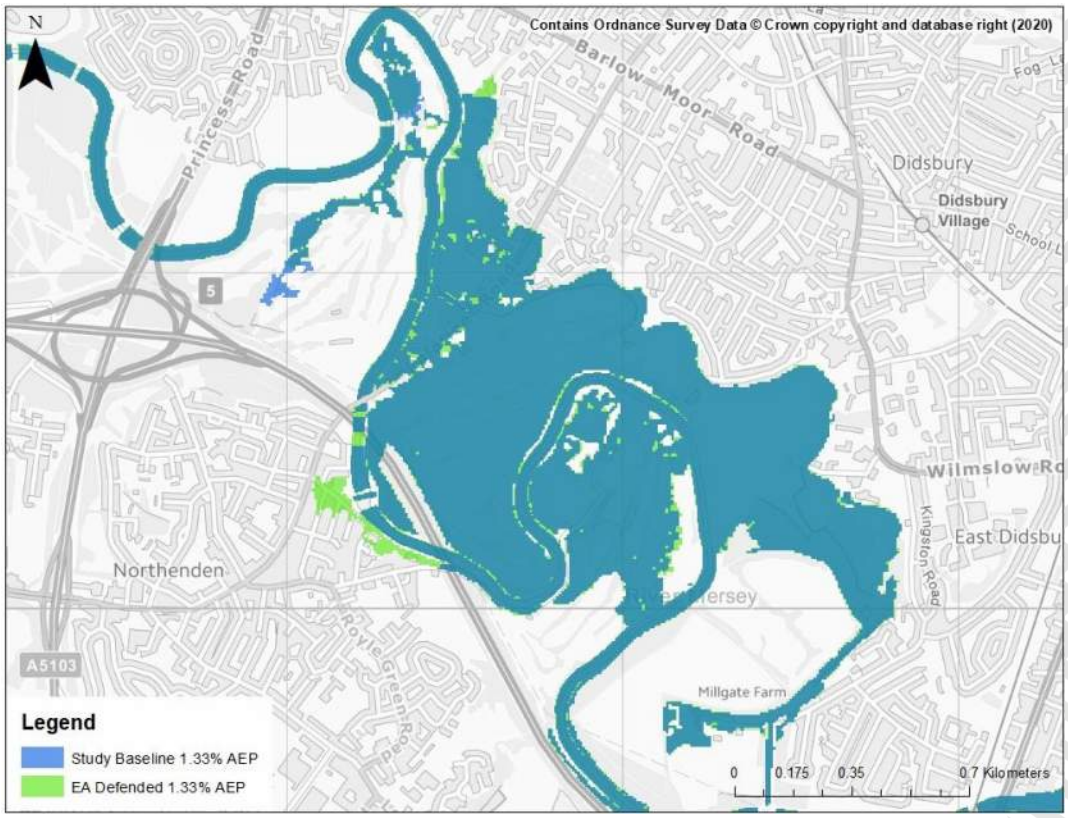


Figure A-7: EA defended vs baseline flood extent comparison for the 1% AEP event

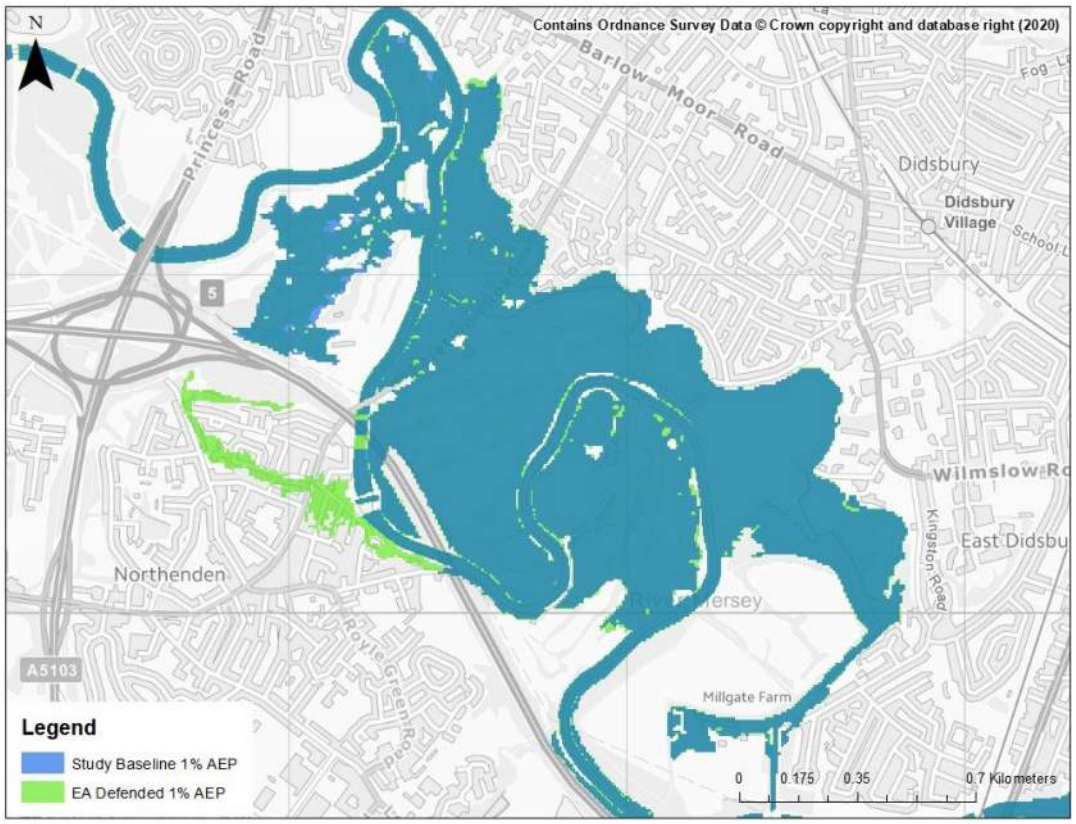
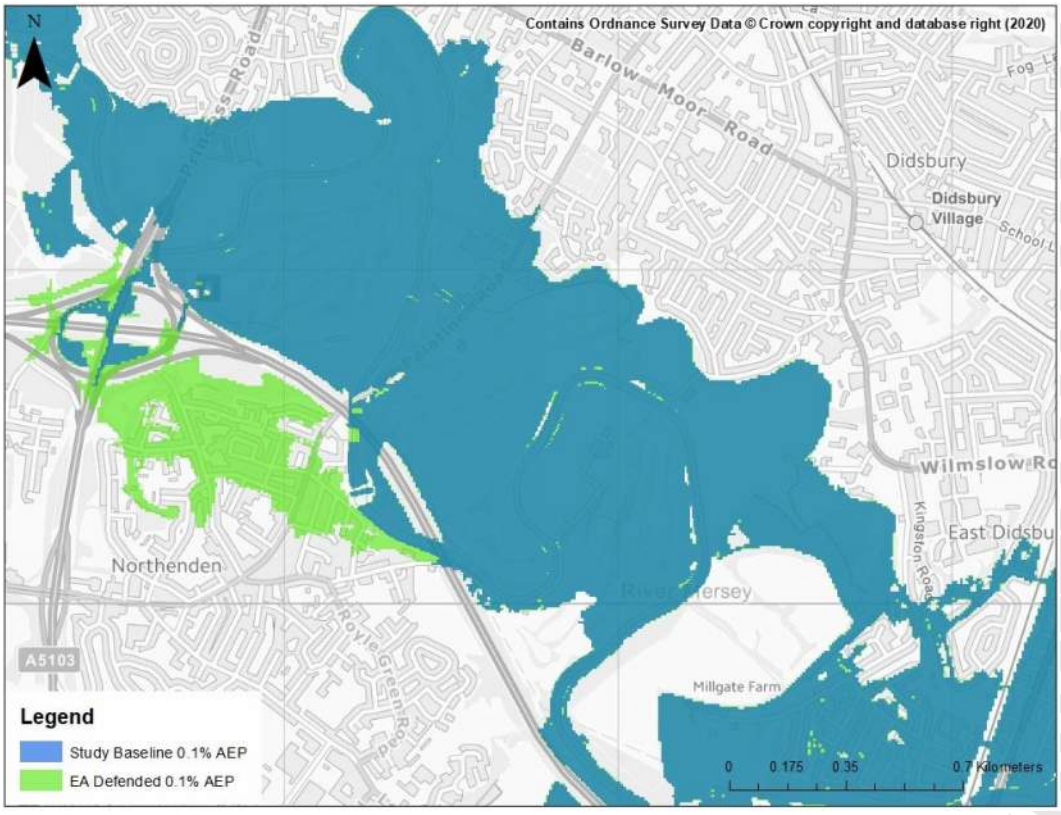


Figure A-8: EA defended vs baseline flood extent comparison for the 0.1% AEP event



B Channel Survey Comparison

The original scope of this study was to use the existing hydraulic model of the Upper Mersey to model the impact of the cofferdam. Although this model was last updated by JBA Consulting as recently as 2018, the channel (1D) component of the model dates from further back (early 2000's) and the origin of some of the channel cross-sections is unclear.

The detailed nature of the cross-sections in the vicinity of the M60 bridge and Palatine Road were investigated when it became apparent that the existing model cross-section at the location of the proposed cofferdam was more restrictive than other nearby cross-sections. A cross-check of this section against some basic channel sections surveyed for the current site works by Balvac also implied that there was no evidence of any restriction in the channel at this location.

The Balvac sections did not extend below the water line so could not easily be used to update the model. Consequently, JBA commissioned InfoMap Surveys and Mapping Ltd to undertake a short channel survey of five cross sections immediately upstream of and beneath the M60 bridge, including a check section at Palatine Road Bridge. The locations of these sections are shown below in Figure A-9 along with the locations of the original model cross sections and Balvac (above water line) sections.

The cross-sections from the InfoMap 2020 survey are compared to the closest Balvac surveyed sections and previous model section in Figure A-10 to Figure A-14; noting that the previous model had only one cross-section beneath the M60 so this section is compared with all three of the central InfoMap sections.

Figure A-10 shows that the most upstream Infomap survey is narrower than the existing model section at MERS03_3662 but this is largely a result of the model section being located around 60 metres upstream from the comparative Infomap section[2]. Of more interest are the section comparisons further downstream that are shown in Figure A-11, Figure A-12 and Figure A-13. Here, the InfoMap cross-sections compare well with the Balvac sections (where a comparison is possible above the water line). However, the existing model section labelled MERS03_3588 is noticeably narrower than both the Balvac and Infomap sections. The fact that two recent surveys depict a larger channel width than the existing model at the proposed cofferdam location provides confidence in the assertion that the original section is too narrow. The difference in conveyance (as calculated by the model software) between the original model section and one based on one of the new survey sections is shown in Figure A-15. This shows that for any given level the updated section exhibits a higher conveyance than the existing model section; about 40% higher at the 28.00m AOD level, which marks the top level of the proposed cofferdam.

There is a close agreement between all surveys at Palatine Road Bridge (Figure Figure A-14). This suggests that there is no obvious systematic difference between the current surveys and the existing model sections. Therefore, the constrictive channel section at MERS03_3588 is likely to have represented an obstruction that no longer exists or was modified in error. No information is available about the origin of this cross-section.

Therefore, it is recommended that this version of the model based on the Infomap (2020) survey is accepted by the Environment Agency as the baseline model for the M60 cofferdam flood impact assessment.

[2] It should be noted that the existing section at MERS03_3662 has been retained within the baseline model, in addition to the most upstream InfoMap section being added.

Figure A-9: Location of Surveyed Channel Cross Sections

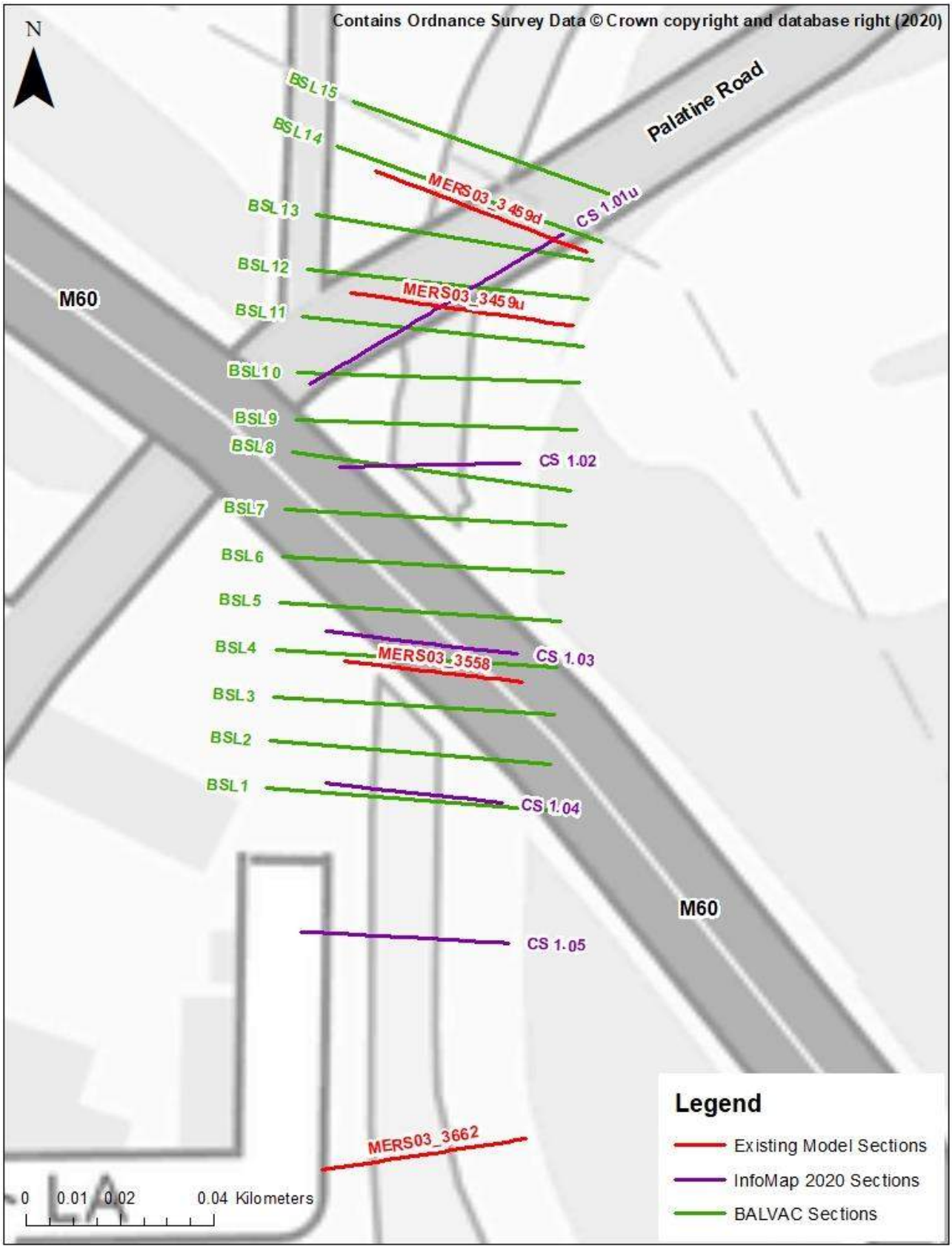


Figure A-10: Comparison of river sections at InfoMap section 1.05

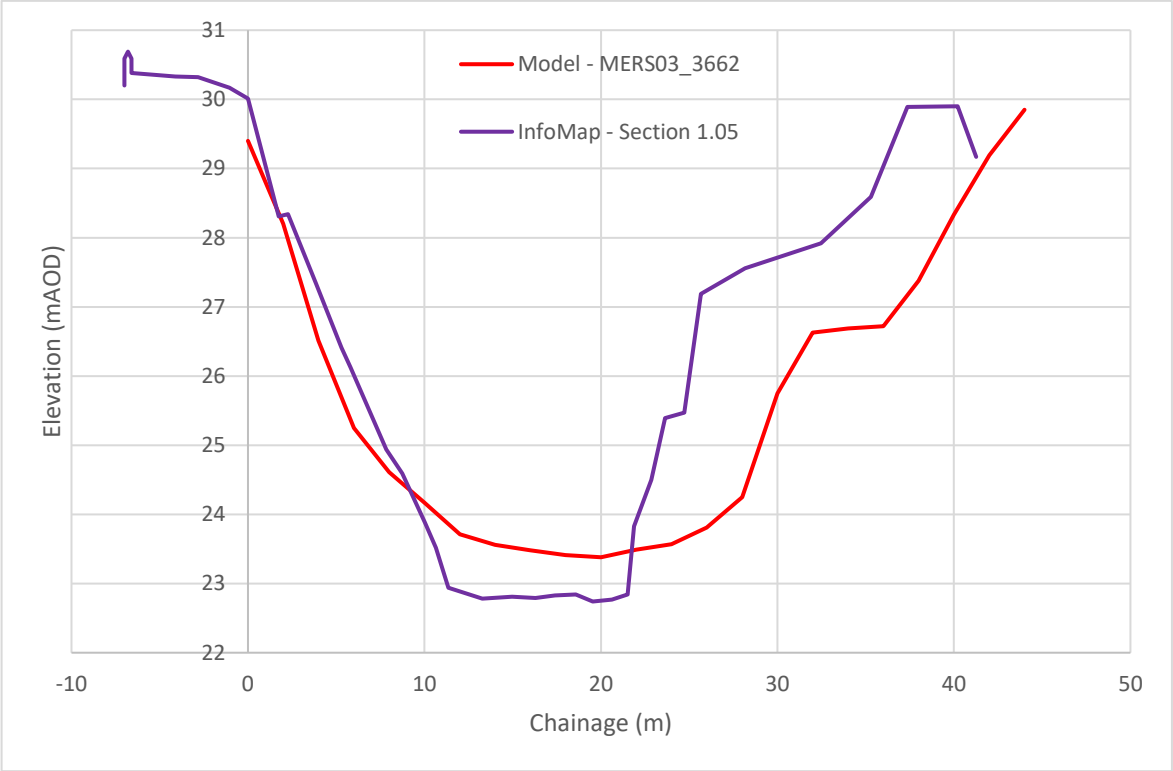


Figure A-11: Comparison of river sections at InfoMap section 1.04

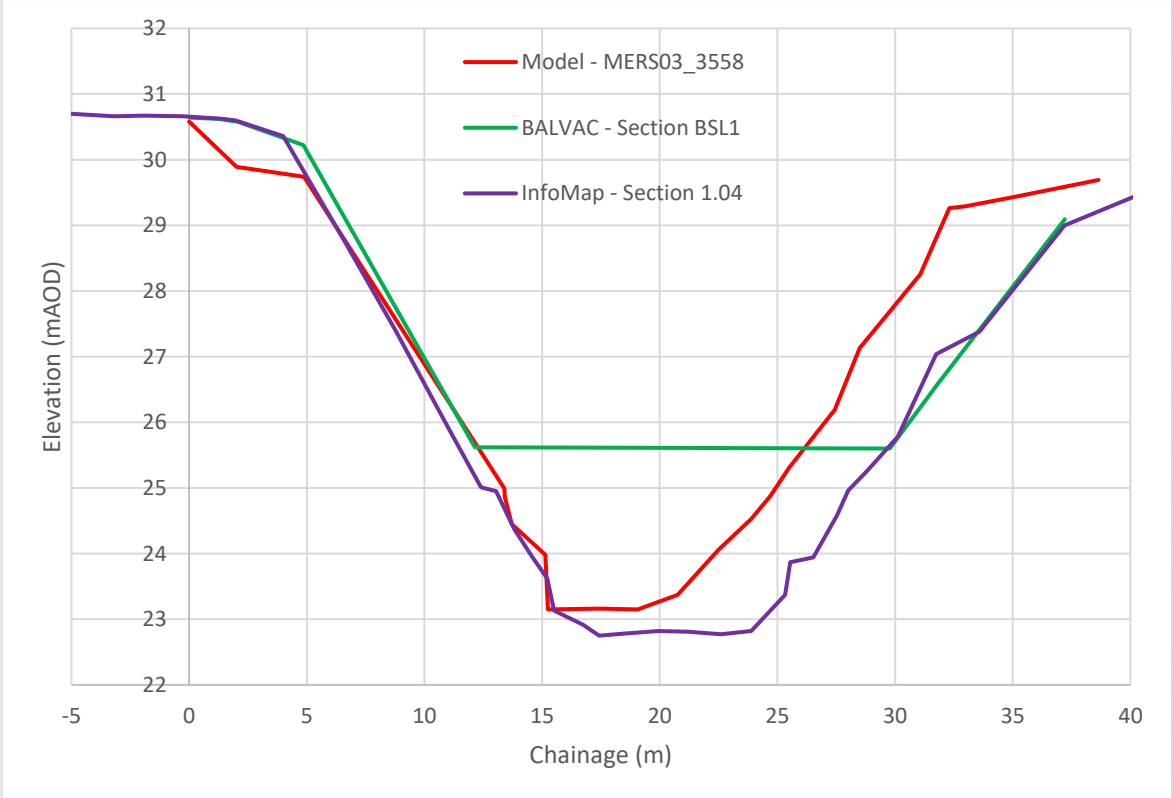


Figure A-12: Comparison of river sections at InfoMap section 1.03

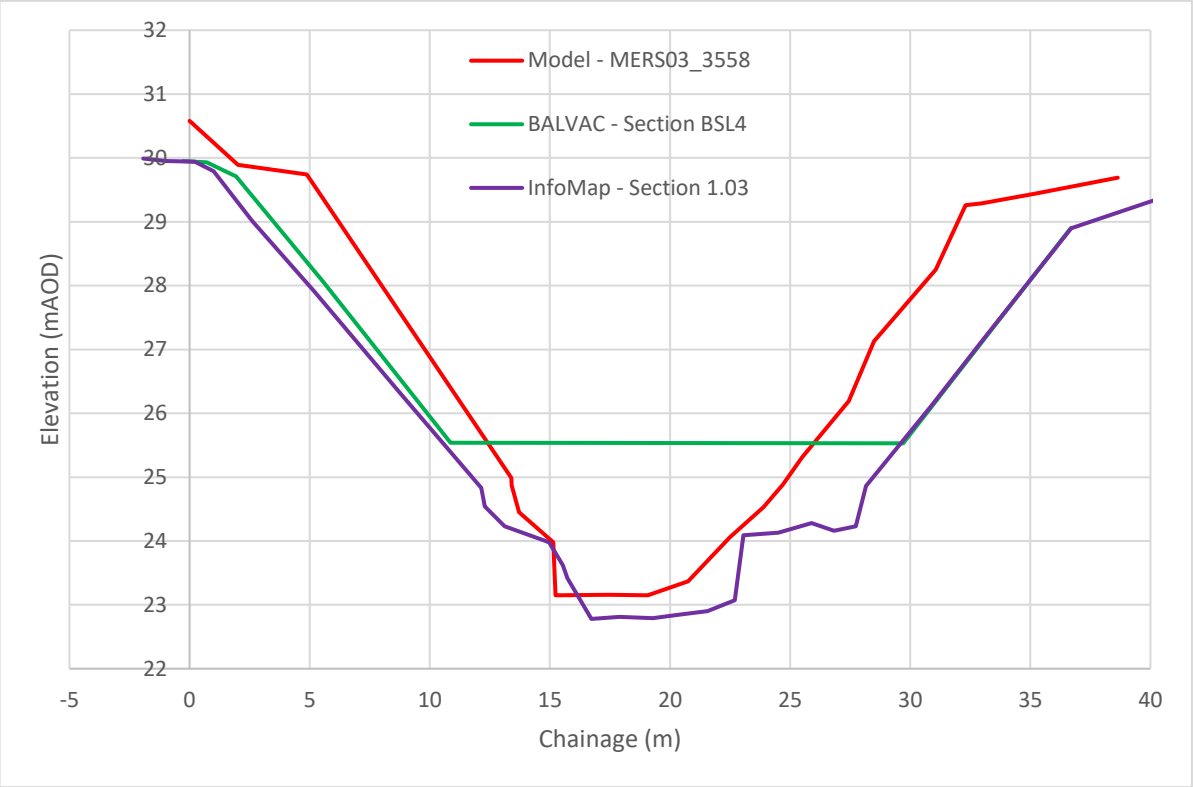


Figure A-13: Comparison of river sections at InfoMap section 1.02

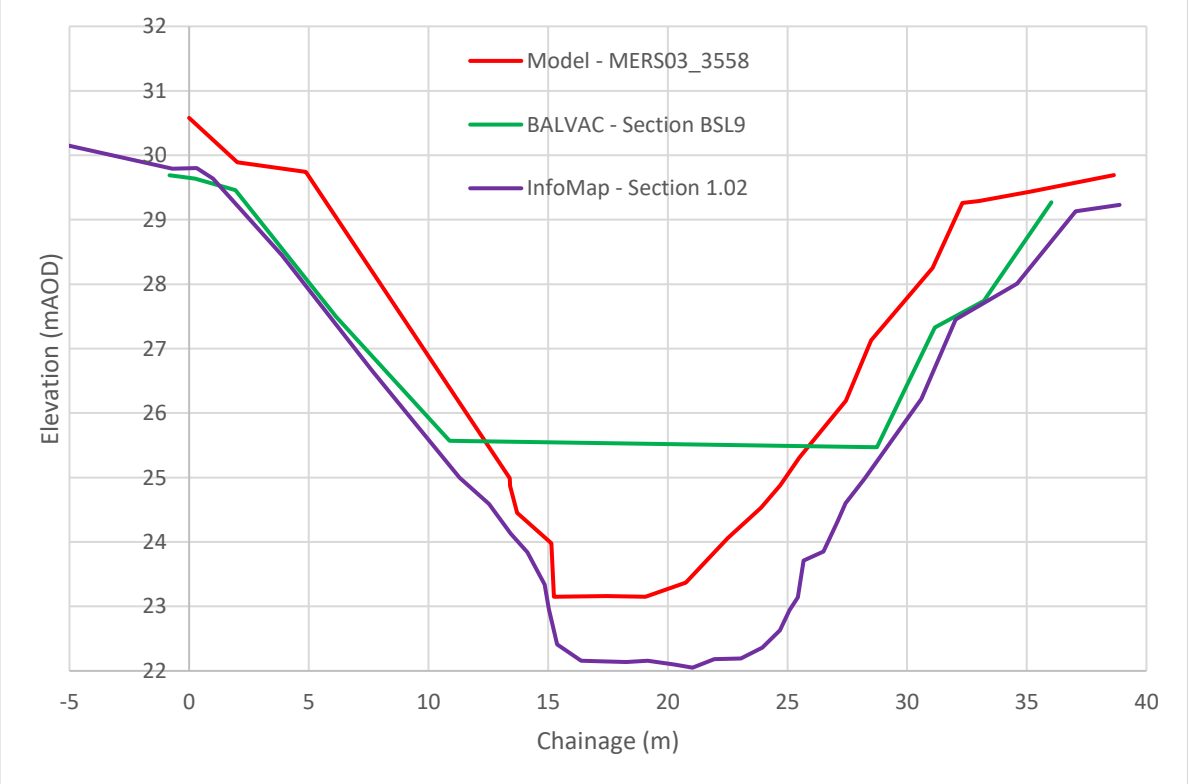


Figure A-14: Comparison of river sections at InfoMap section 1.01u (Palatine Road Bridge)

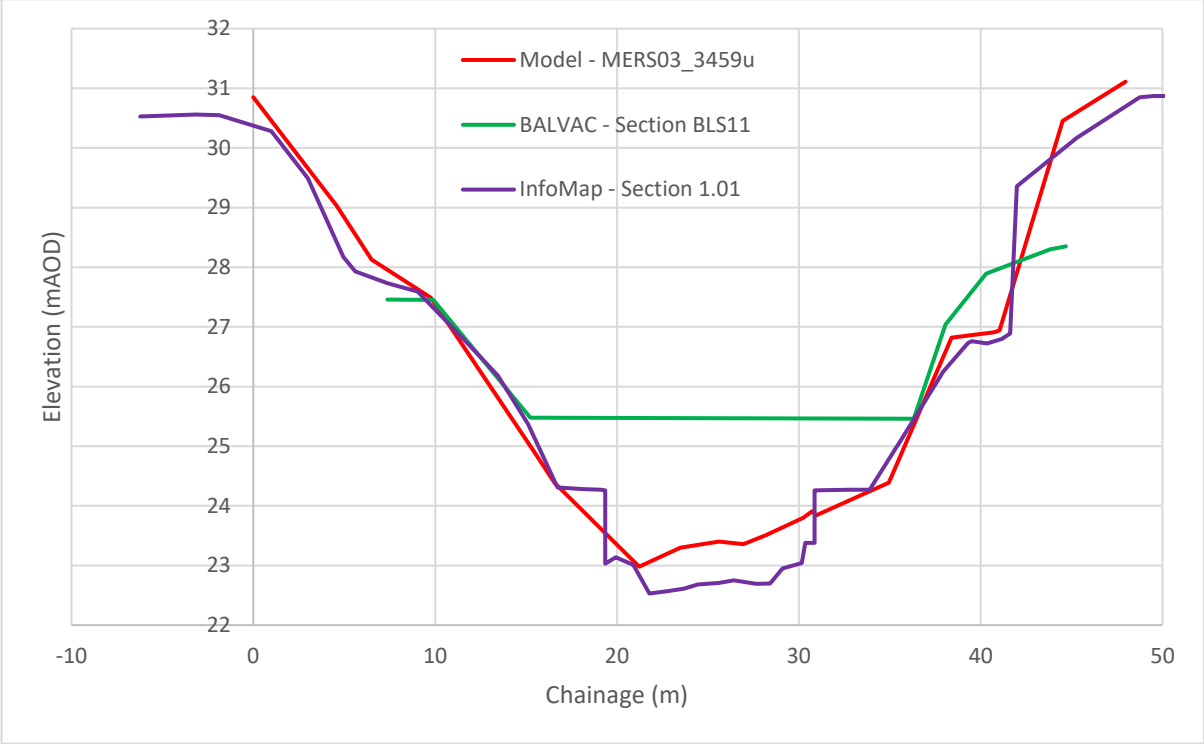
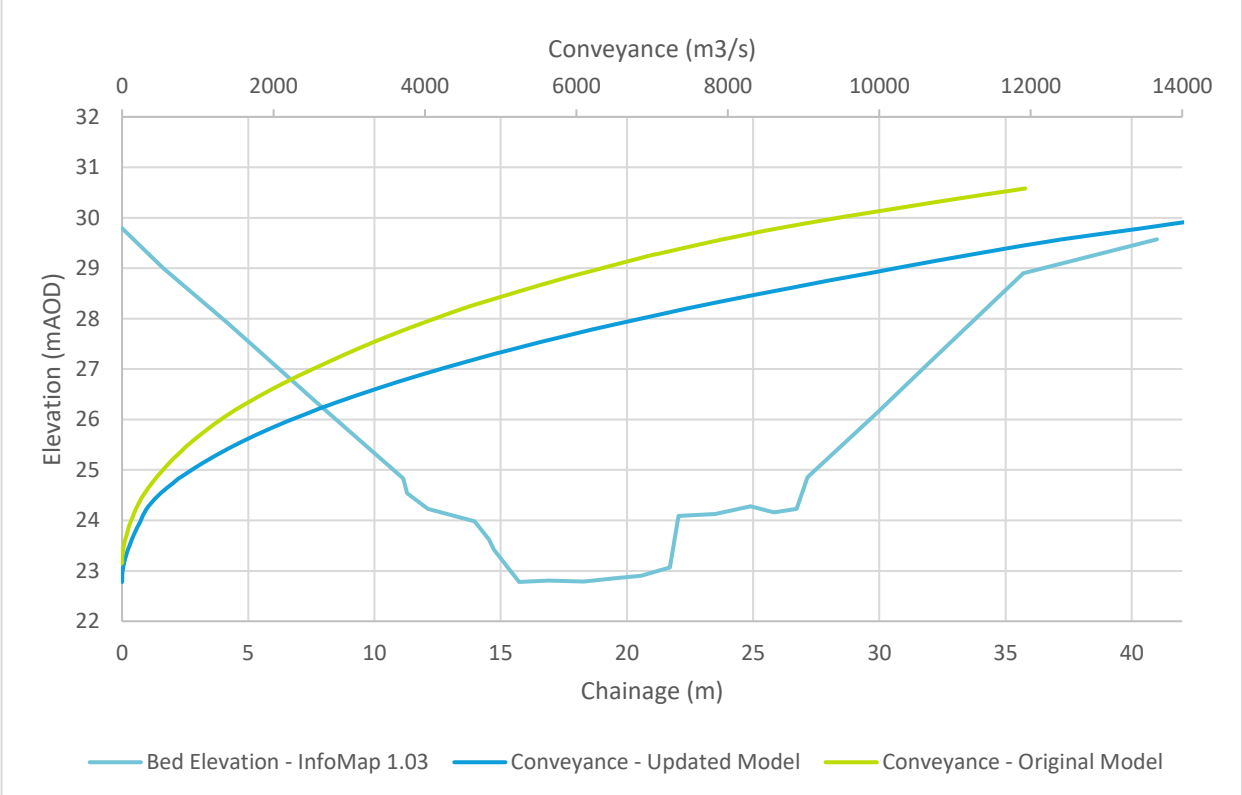


Figure A-15: Comparison of conveyance for previous vs updated channel section



Offices at

Coleshill
Doncaster
Dublin
Edinburgh
Exeter
Glasgow
Haywards Heath
Isle of Man
Limerick
Newcastle upon Tyne
Newport
Peterborough
Saltaire
Skipton
Tadcaster
Thirsk
Wallingford
Warrington

Registered Office
1 Broughton Park
Old Lane North
Broughton
SKIPTON
North Yorkshire
BD23 3FD
United Kingdom

+44(0)1756 799919
info@jbaconsulting.com
www.jbaconsulting.com
Follow us:

Jeremy Benn Associates Limited

Registered in England 3246693

JBA Group Ltd is certified to:
ISO 9001:2015
ISO 14001:2015
OHSAS 18001:2007

Flood risk assessment data

Location of site: 383562 / 390975 (shown as easting and northing coordinates)
Document created on: 30 January 2026
This information was previously known as a product 4.
Customer reference number: CYB653ND68XX

Map showing the location that flood risk assessment data has been requested for.



How to use this information

You can use this information as part of a flood risk assessment for a planning application. To do this, you should include it in the appendix of your flood risk assessment.

We recommend that you work with a flood risk consultant to get your flood risk assessment.

Included in this document

In this document you'll find:

- how to find information about surface water and other sources of flooding
- information on the models used
- definitions for the terminology used throughout
- flood map for planning (rivers and the sea)
- past floods
- flood defences and attributes
- information to help you assess if there is a reduced flood risk from rivers and the sea because of defences
- modelled data
- information about strategic flood risk assessments
- information about this data
- information about flood risk activity permits
- help and advice

Surface water and other sources of flooding

When using the surface water map on the check your long term flood risk service the following considerations apply:

- surface water extents are suitable for use in planning
- surface water climate change scenarios may help to inform risk assessments, but the available data fall short of what is required to assess planned development
- surface water depth information should not be used for planning purposes

To find out about other factors that might affect the flood risk of this location, you should also check:

- reservoir flood risk
- groundwater flood risk - you could use the British Geological Survey groundwater flooding data, groundwater: current status and flood risk and the guide on mining and groundwater constraints for development - further information may be available from the lead local flood authority (LLFA)
- your local planning authority's SFRA, which includes future flood risk

Your Lead Local Flood Authority is Manchester District.

For information about sewer flooding, contact the relevant water company for the area.

About the models used

Model name: Upper Mersey 2017
Scenario(s): Defended fluvial, defences removed fluvial, defended climate change fluvial, defences removed climate change fluvial
Date: 14 April 2022

This model contains the most relevant data for your area of interest.

Terminology used

Annual exceedance probability (AEP)

This refers to the probability of a flood event occurring in any year. The probability is expressed as a percentage. For example, a large flood which is calculated to have a 1% chance of occuring in any one year, is described as 1% AEP.

Metres above ordnance datum (mAOD)

All flood levels are given in metres above ordnance datum which is defined as the mean sea level at Newlyn, Cornwall.

Flood map for planning (rivers and the sea)

Your selected location is in flood zone 3.

Flood zone 3 shows the area at risk of flooding for an undefended flood event with a:

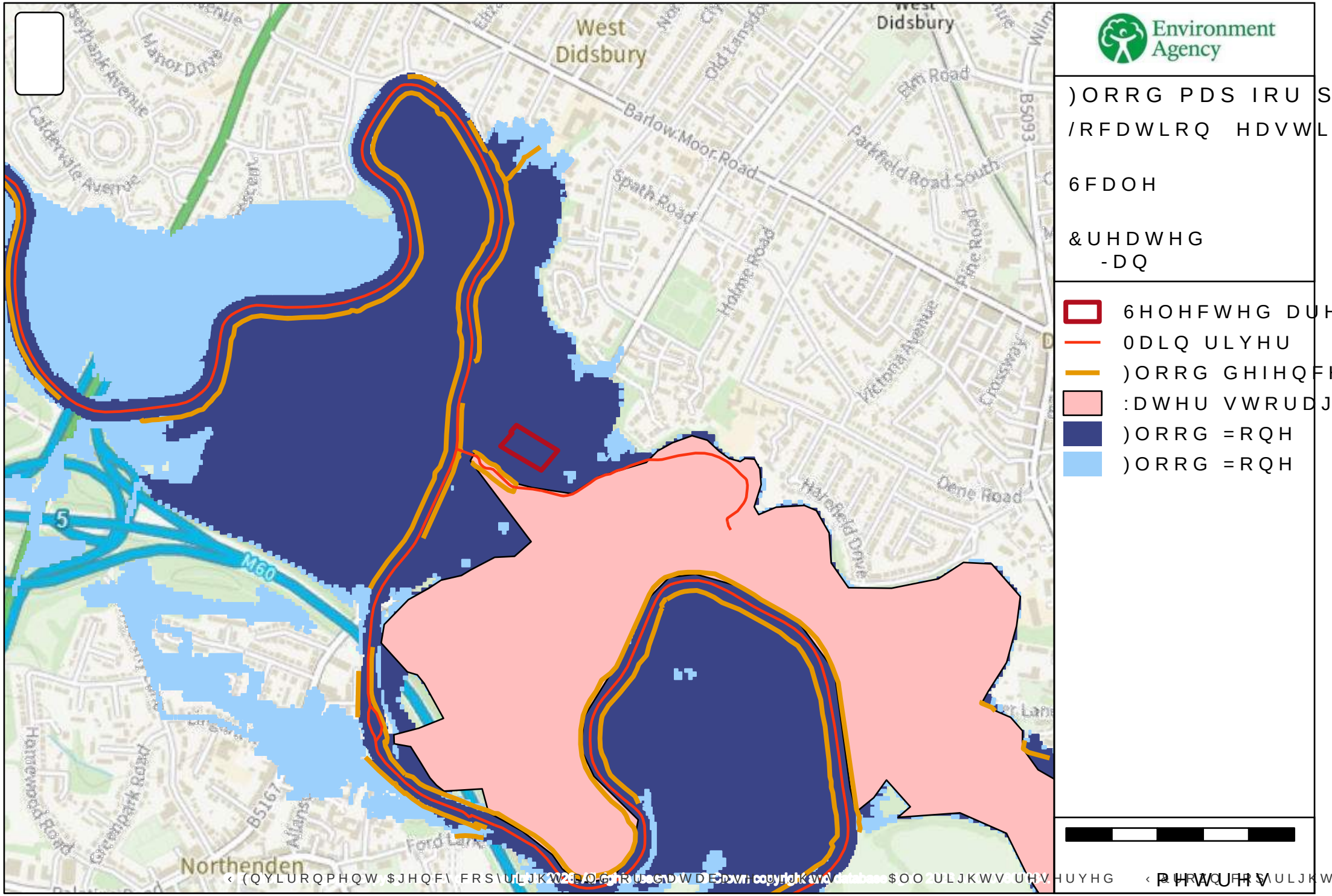
- 0.5% or greater probability of occurring in any year for flooding from the sea
- 1% or greater probability of occurring in any year for fluvial (river) flooding

Flood zone 2 shows the area at risk of flooding for an undefended flood event with:

- between a 0.1% and 0.5% probability of occurring in any year for flooding from the sea
- between a 0.1% and 1% probability of occurring in any year for fluvial (river) flooding

It's important to remember that the flood zones on this map:

- refer to the land at risk of flooding and do not refer to individual properties
- refer to the probability of river and sea flooding, ignoring the presence of defences
- do not take into account potential impacts of climate change


West Didsbury
Barlow Moor Road
Manor Drive
Calderwyle Avenue
Spath Road
Elm Road
Parkfield Road South
Hollins Road
Victoria Avenue
Crossway
Oxford Road
Parkfield Drive
B5093
M60
5
B5167
Greenpark Road
Northenden
Environment Agency
)ORRG PDS IRU S
/RFDWLRQ HDVWLQ
6FDOH
&UHDWHG
-DQ
6HOHFWHG DUHD
0DLQ ULYHU
)ORRG GHIHQFH
:DWHU VWRUDJH
)ORRG =RQH
)ORRG =RQH
FHQWUHV
‹ (QYLURQPHQW $JHQF\ FRS\ULJKW 2SHQ*RYHUQPHQW'DWDEDVH $OO ULJKWV UHVHUYHG ‹ (QYLURQPHQW $JHQF\ FRS\ULJKW

Past floods

Past flood events included in this document

The recorded flood outlines included in this document are for areas of land local to your site location that have been flooded by any of these sources:

- ephemeral water
- main rivers
- ordinary watercourses
- the sea
- unknown

Data limitations

The outlines do not include flooding from:

- drainage where rainfall has led to surface water ponding or overland runoff
- artificial, water-bearing sewer, water supply and wastewater treatment pipelines

Changes to flood defences

The defences (also known as assets) that were in place may also have changed. For example, assets may have been built more recently than the last recorded flood outline.

What the recorded flood outlines dataset is

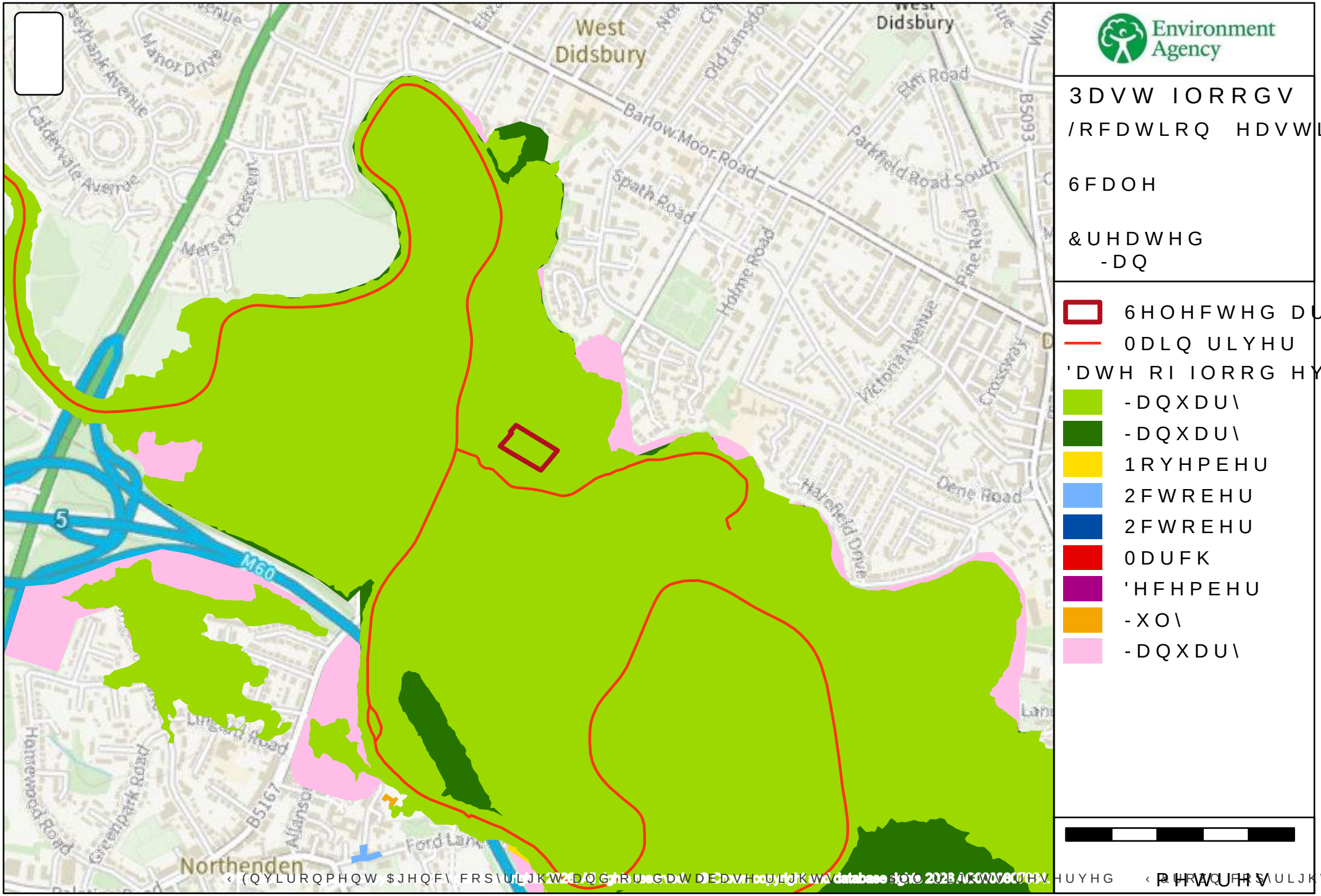
The recorded flood outlines are a geographical information system (GIS) data layer that show our verified records of areas that have flooded in the past from:

- rivers
- the sea
- groundwater
- surface water

Download the complete recorded flood outlines dataset, which includes data quality flags for outlines recorded after April 2020. This indicates the confidence we have in an outline.

Get flood information from other organisations

Contact Manchester District Lead Local Flood Authority (LLFA) and your drainage board to get information about past flooding caused by surface water or drainage systems.


West Didsbury
Barlow Moor Road
Northenden
M60
5
Environment Agency
3DVW IORRGV
/RFDWLRQ HDVWLQ
6FDOH
&UHDWHG -DQ
6HOHFWHG DUH
0DLQ ULYHU
'DWH RI IORRG HYH
-DQXDU\
-DQXDU\
1RYHPEHU
2FWREHU
2FWREHU
0DUFK
'HFHPEHU
-XO\
-DQXDU\
PHWUHV
‹ (QYLURQPHQW $JHQF\ FRS\ULJKW DQG GDWDEDVH ULJKWV
‹ (QYLURQPHQW $JHQF\ FRS\ULJKW

Data on past flood events

Start date	End date	Source of flood	Cause of flood	Affects location
1 January 2025	1 January 2025	main river	overtopping of defences	Yes
20 January 2021	20 January 2021	main river	other	Yes
16 November 2000	17 November 2000	unknown	channel capacity exceeded (no raised defences)	No
10 October 2000	11 October 2000	unknown	other	No
23 October 1998	24 October 1998	unknown	channel capacity exceeded (no raised defences)	No
3 March 1998	4 March 1998	unknown	channel capacity exceeded (no raised defences)	No
27 December 1978	28 December 1978	unknown	channel capacity exceeded (no raised defences)	No
16 July 1973	17 July 1973	unknown	channel capacity exceeded (no raised defences)	No
1 January 1964	2 January 1964	unknown	unknown	Yes

Flood defences and attributes

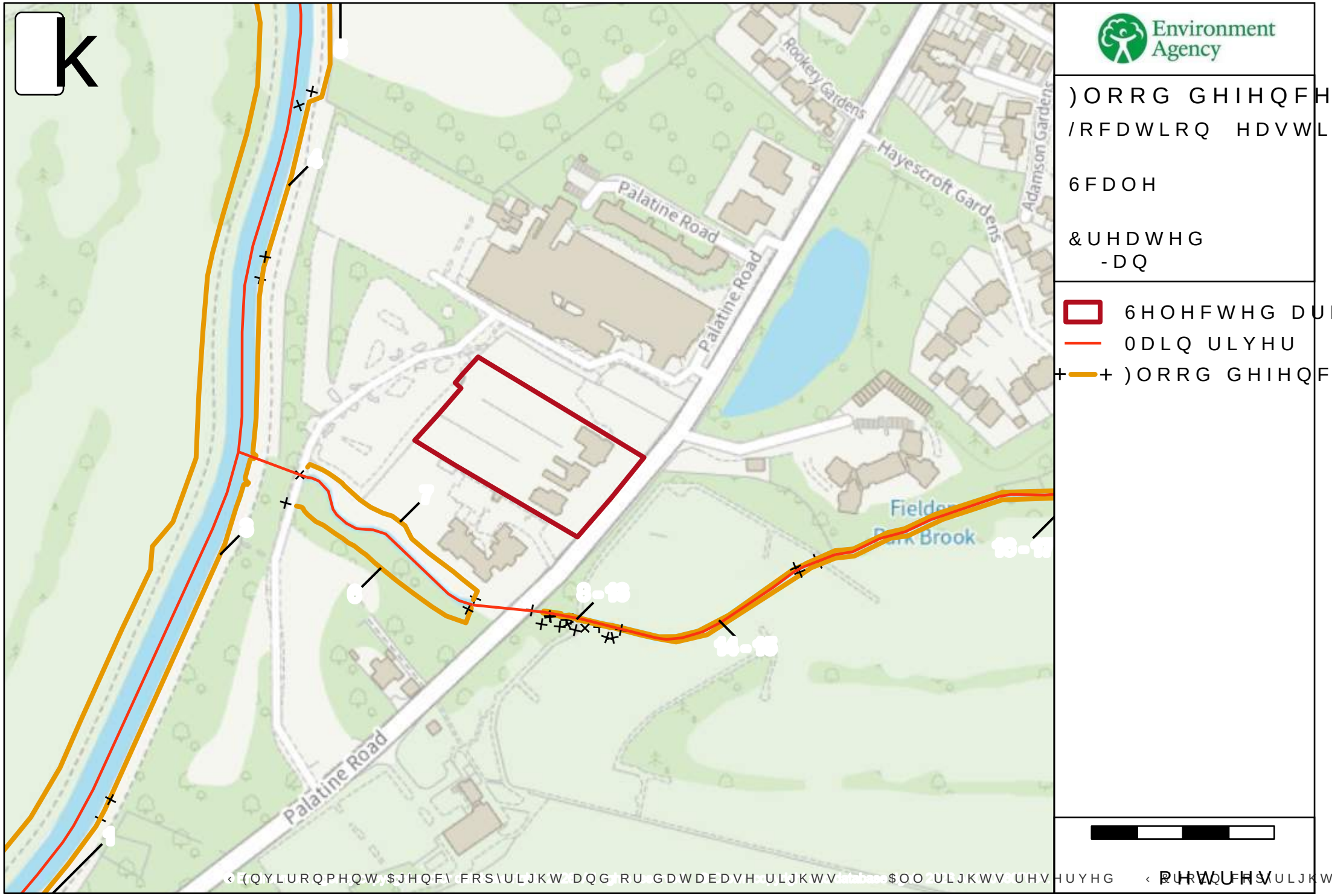
The flood defences map shows the location of the flood defences present.

The flood defences data table shows the type of defences, their condition and the standard of protection. It shows the height above sea level of the top of the flood defence (crest level). The height is In mAOD which is the metres above the mean sea level at Newlyn, Cornwall.

It's important to remember that flood defence data may not be updated on a regular basis. The information here is based on the best available data.

Use this information:

- to help you assess if there is a reduced flood risk for this location because of defences
- with any information in the modelled data section to find out the impact of defences on flood risk


k
Rookery Gardens
Hayescroft Gardens
Adamson Gardens
Palatine Road
Palatine Road
Palatine Road
Fielden
Park Brook
)ORRG GHIHQFH
/RFDWLRQ HDVWL
6FDOH
&UHDWHG
-DQ
6HOHFWHG DUH
0DLQ ULYHU
)ORRG GHIHQFH
PHWUHV

Flood defences data

Label	Asset ID	Asset Type	Standard of protection (years)	Current condition	Downstream actual crest level (mAOD)	Upstream actual crest level (mAOD)	Effective crest level (mAOD)
1	121971	Engineered High Ground	100		31.11	25.26	
2	120551	Embankment	100	Very poor	27.48	29.16	
3	121970	Embankment	100		29.49	29.06	
4	121969	Engineered High Ground	100	Fair	23.64	29.14	
5	121968	Embankment	100	Very poor	28.60	28.96	
6	47387	Embankment	75		29.0	28.33	
7	47388	Embankment	75		29.22	28.45	
8	32462	Engineered High Ground	5		25.46	26.18	
9	32463	Engineered High Ground	5		25.40	26.18	
10	98766	Engineered High Ground	75		26.39	25.46	

Any blank cells show where a particular value has not been recorded for an asset.

Label	Asset ID	Asset Type	Standard of protection (years)	Current condition	Downstream actual crest level (mAOD)	Upstream actual crest level (mAOD)	Effective crest level (mAOD)
11	98767	Engineered High Ground	75		26.02	25.40	
12	47394	Engineered High Ground	75		25.71	26.39	
13	47395	Engineered High Ground	75		25.60	26.02	
14	47125	Engineered High Ground	75		25.60	25.38	
15	47124	Engineered High Ground	75		25.81	25.71	
16	47148	Engineered High Ground	75		25.38	26.07	
17	47126	Engineered High Ground	75		26.21	25.81	

Any blank cells show where a particular value has not been recorded for an asset.

Modelled data

This section provides details of different scenarios we have modelled and includes the following (where available):

- outline maps showing the area at risk from flooding in different modelled scenarios
- modelled node point map(s) showing the points used to get the data to model the scenarios and table(s) providing details of the flood risk for different return periods
- map(s) showing the approximate water levels for the return period with the largest flood extent for a scenario and table(s) of sample points providing details of the flood risk for different return periods

Climate change

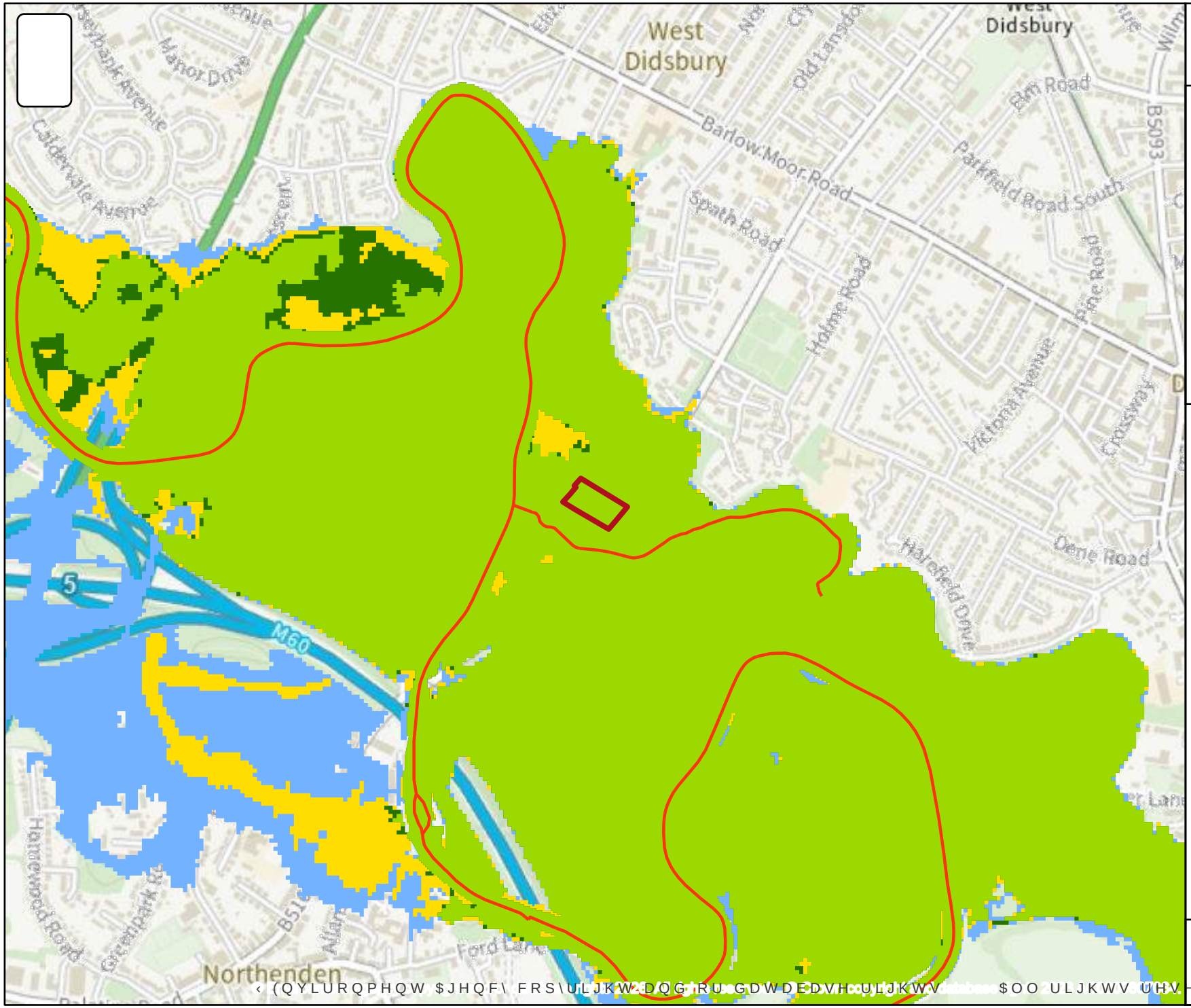
The climate change data included in the models may not include the latest flood risk assessment climate change allowances. Where the new allowances are not available you will need to consider this data and factor in the new allowances to demonstrate the development will be safe from flooding.

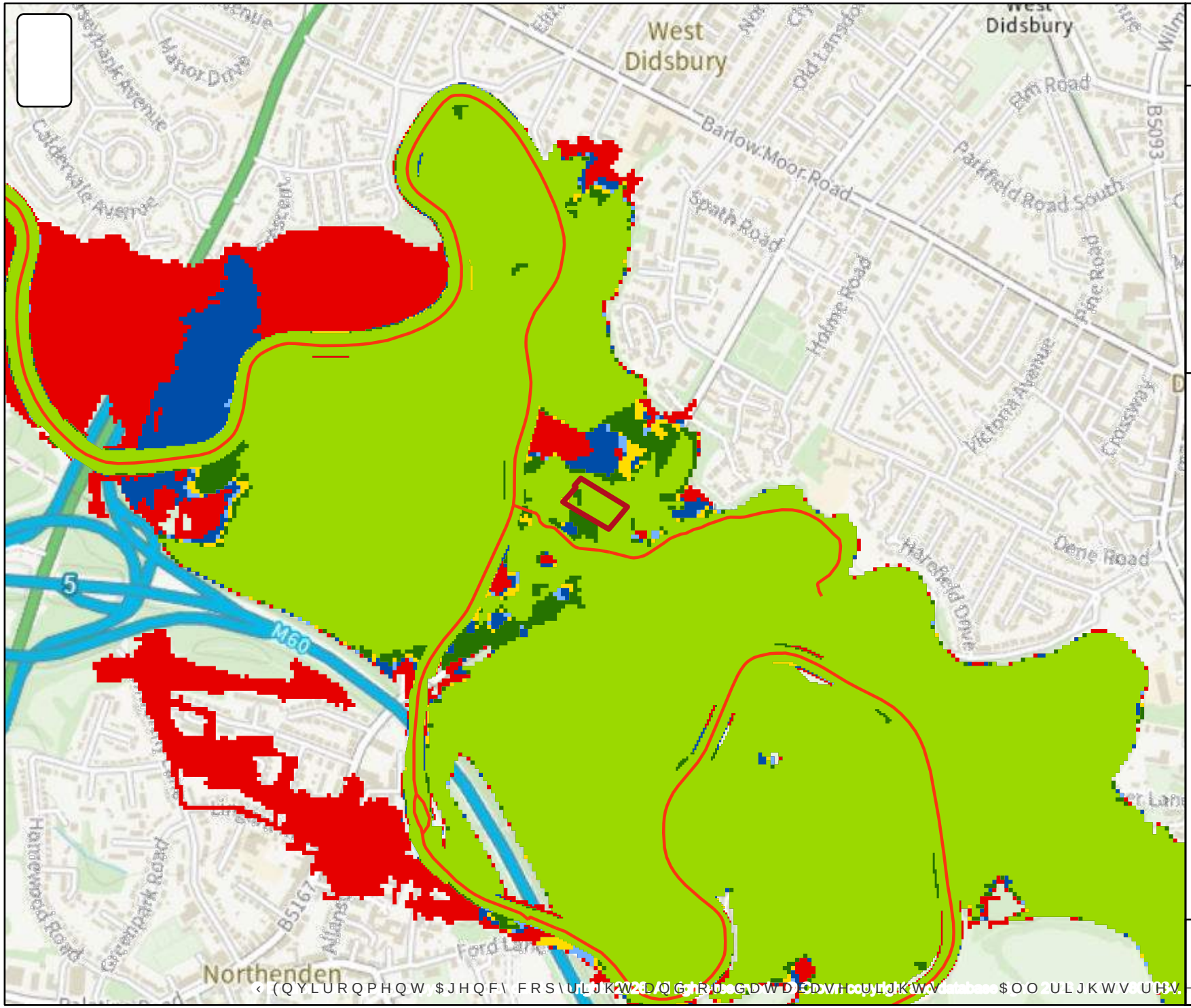
The Environment Agency will incorporate the new allowances into future modelling studies. For now, it's your responsibility to demonstrate that new developments will be safe in flood risk terms for their lifetime.

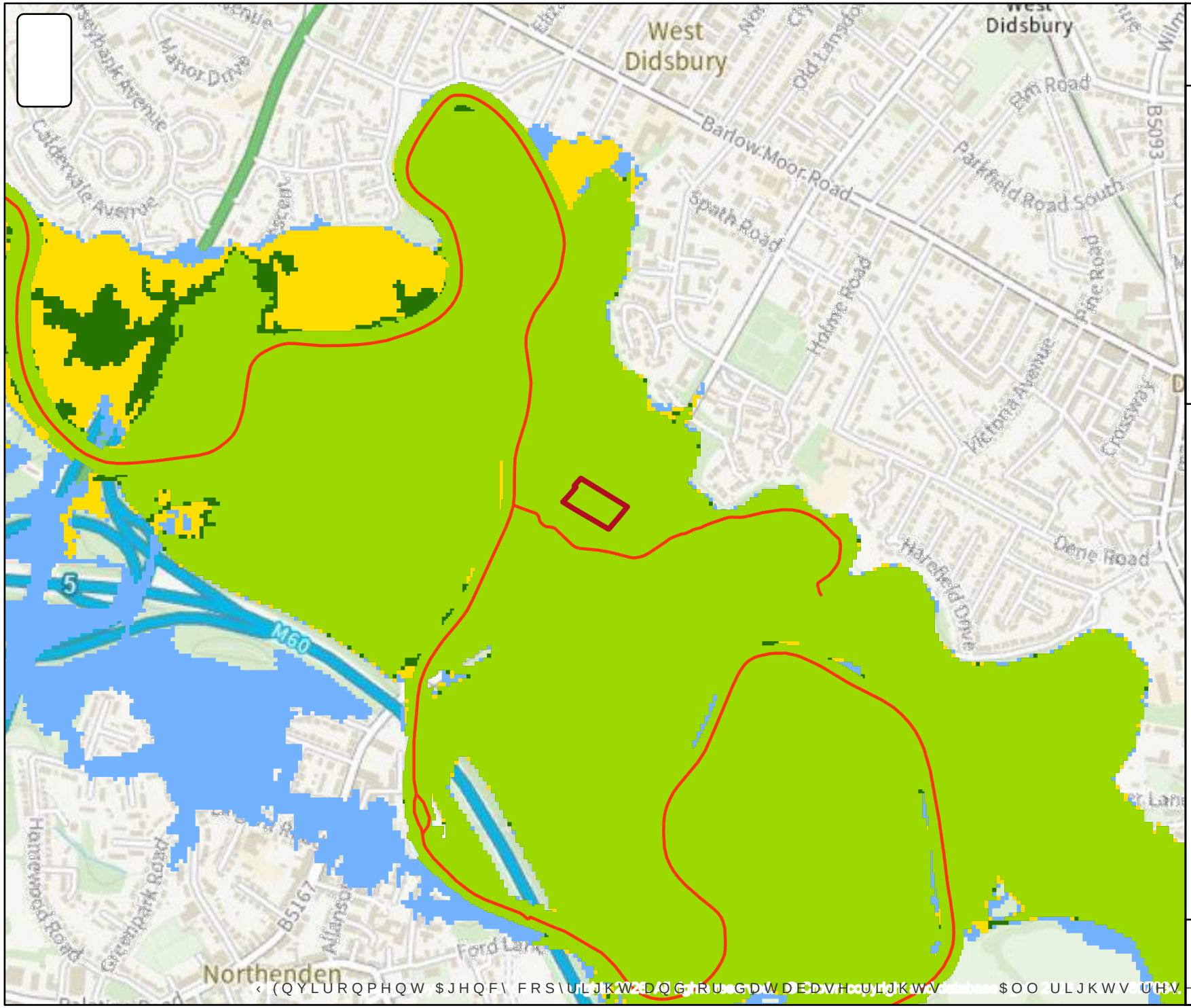
Modelled scenarios

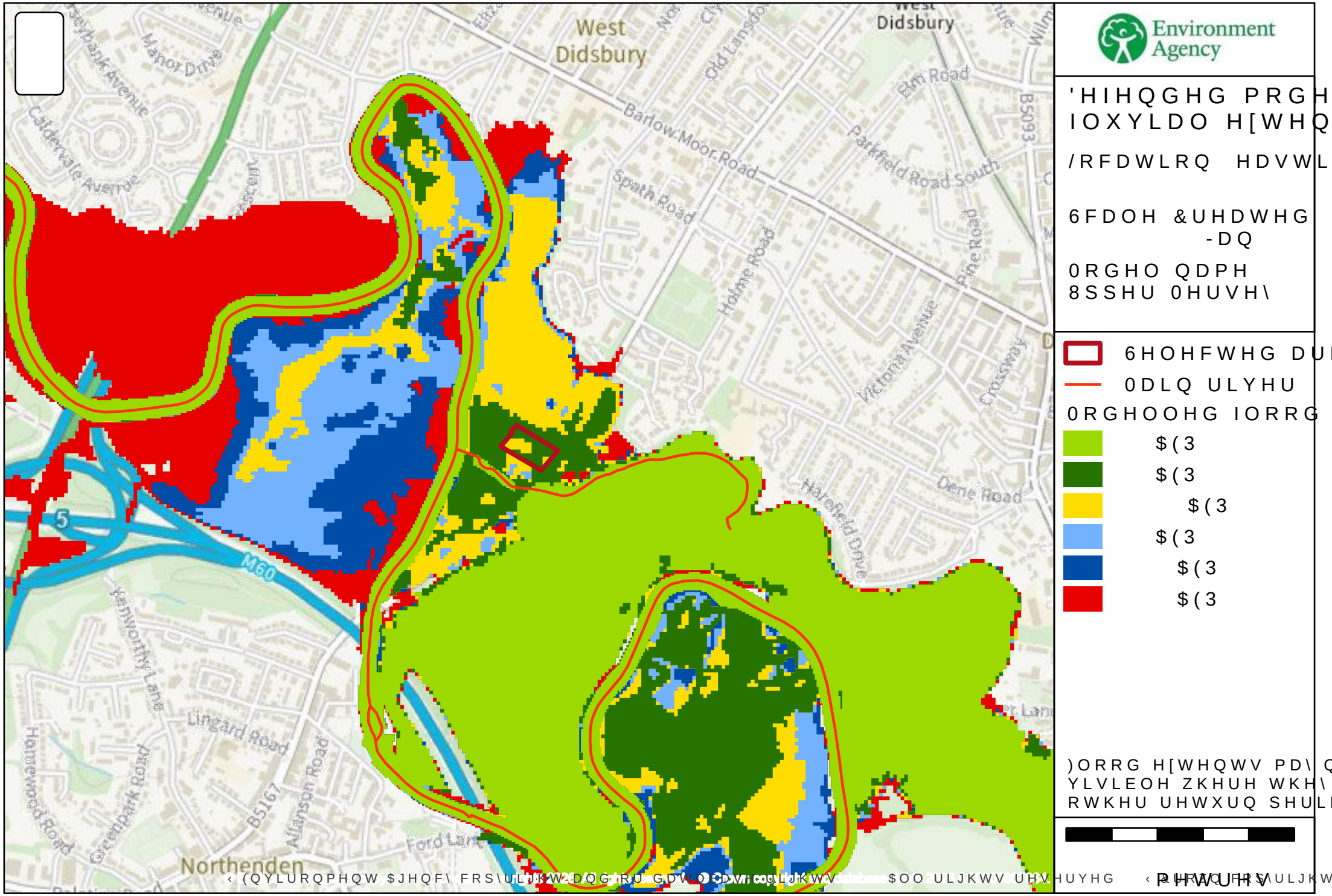
The following scenarios are included:

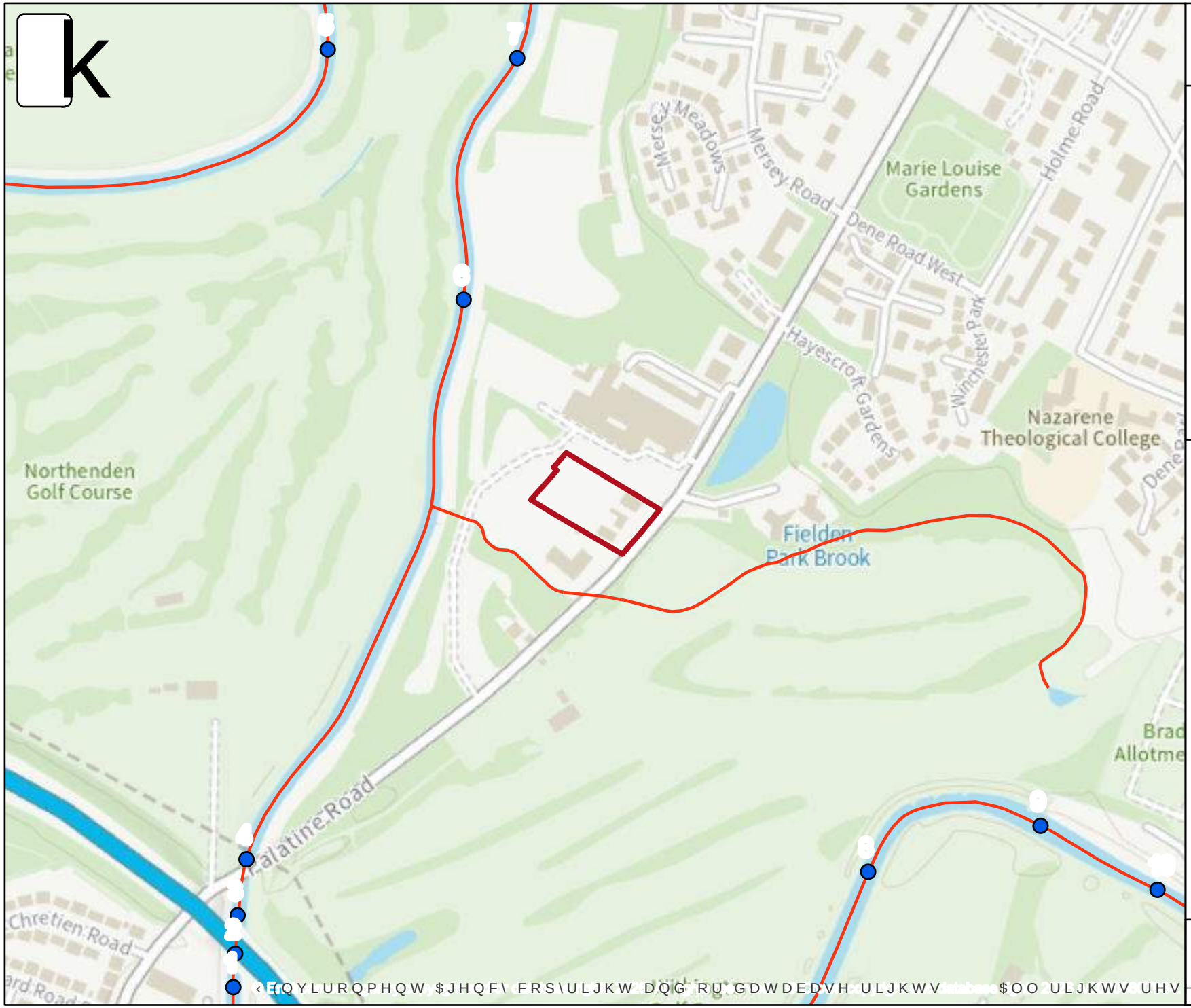
- Defended modelled fluvial: risk of flooding from rivers where there are flood defences
- Defences removed modelled fluvial: risk of flooding from rivers where flood defences have been removed
- Defended climate change modelled fluvial: risk of flooding from rivers where there are flood defences, including estimated impact of climate change
- Defences removed climate change modelled fluvial: risk of flooding from rivers where flood defences have been removed, including estimated impact of climate change


West Didsbury
Barlow Moor Road
Manor Drive
Calderwyle Avenue
Spath Road
Elm Road
Parkfield Road South
Hollins Road
Pine Road
Crossway
Oxford Road
Northenden
M60
B5093
B5117
Environment Agency
'HIHQFHV UHPRY
FOLPDWH FKDQJ
PRGHOOHG IOXY
/RFDWLRQ HDVWLQ
6FDOH &UHDWHG
-DQ
0RGHO QDPH
8SSHU 0HUVH\
6HOHFWHG DUH
0DLQ ULYHU
0RGHOOHG IORRG
$(3
$(3
$(3
$(3
)ORRG H[WHQWV PD\ Q
YLVLEOH ZKHUH WKH\
RWKHU UHWXUQ SHULR
PHWUHV
‹ (QYLURQPHQW $JHQF\ FRS\ULJKW DQG GDWDEDVH ULJKWV $OO ULJKWV UHVHUYHG ‹ &URZQ FRS\ULJKW


West Didsbury
Barlow Moor Road
Manor Drive
Calderwyle Avenue
Spath Road
Parkfield Road South
Elm Road
Hollins Road
Pine Road
Crossway
Oxford Road
Northenden
M60
B5093
B5167
Environment Agency
'HIHQFHV UHPRY
PRGHOOHG IOXY
/RFDWLRQ HDVWLQ
6FDOH &UHDWHG
-DQ
0RGHO QDPH
8SSHU 0HUVH\
6HOHFWHG DUH
0DLQ ULYHU
0RGHOOHG IORRG
$(3
$(3
$(3
$(3
$(3
$(3
)ORRG H[WHQWV PD\ Q
YLVLEOH ZKHUH WKH\
RWKHU UHWXUQ SHULR
PHWUHV
‹ (QYLURQPHQW $JHQF\ FRS\ULJKW DQG GDWDEDVH ULJKWV $OO ULJKWV UHVHUYHG ‹ &URZQ FRS\ULJKW


West Didsbury
Barlow Moor Road
Manor Drive
Calderwyle Avenue
Spath Road
Hahne Road
Parkfield Road South
Elm Road
B5093
Oxford Road
Crossway
Oxford Road
Parkfield Drive
Oxford Road
M60
5
B5167
Northenden
Environment Agency
'HIHQGHG
FOLPDWH FKDQJ
PRGHOOHG IOXY
/RFDWLRQ HDVWLQ
6FDOH &UHDWHG
-DQ
0RGHO QDPH
8SSHU 0HUVH\
6HOHFWHG DUH
0DLQ ULYHU
0RGHOOHG IORRG
$(3
$(3
$(3
$(3
)ORRG H[WHQWV PD\ Q
YLVLEOH ZKHUH WKH\
RWKHU UHWXUQ SHULR
PHWUHV
‹ (QYLURQPHQW $JHQF\ FRS\ULJKW DQG GDWDEDVH ULJKWV $OO ULJKWV UHVHUYHG ‹ &URZQ FRS\ULJKW


West Didsbury
Barlow Moor Road
Manor Drive
Calderwyle Avenue
Spath Road
Parkfield Road South
Elm Road
B5093
Hollins Road
Pine Road
Victoria Avenue
Crossway
Oxford Road
Parkfield Drive
Lingard Road
Greenpark Road
Allanson Road
B5167
Ford Lane
Northenden
M60
5
Environment Agency
'HIHQGHG PRGH
IOXYLDO H[WHQ
/RFDWLRQ HDVWL
6FDOH &UHDWHG
-DQ
0RGHO QDPH
8SSHU 0HUVH\
6HOHFWHG DU
0DLQ ULYHU
0RGHOOHG IORRG
$(3
$(3
$(3
$(3
$(3
$(3
)ORRG H[WHQWV PD\ Q
YLVLEOH ZKHUH WKH\
RWKHU UHWXUQ SHULR
PHWUHV
‹ (QYLURQPHQW $JHQF\ FRS\ULJKW DQG GDWDEDVH ULJKWV
‹ $OO ULJKWV UHVHUYHG



Environment Agency

'HIHQGHG PRGH
IOXYLDO
QRGH ORFDWLR

/RFDWLRQ HDVWL

6FDOH &UHDWHG
-DQ

0RGHO QDPH
8SSHU 0HUVH\

6HOHFWHG DUH
0RGHOOHG ORF
0DLQ ULYHU

‹ (QYLURQPHQW $JHQF\ FRS\ULJKW DQG RU GDWDEDVH ULJKWV $OO ULJKWV UHVHUYHG ‹ &URZQ FRS\ULJKW

Modelled node locations data

Defended

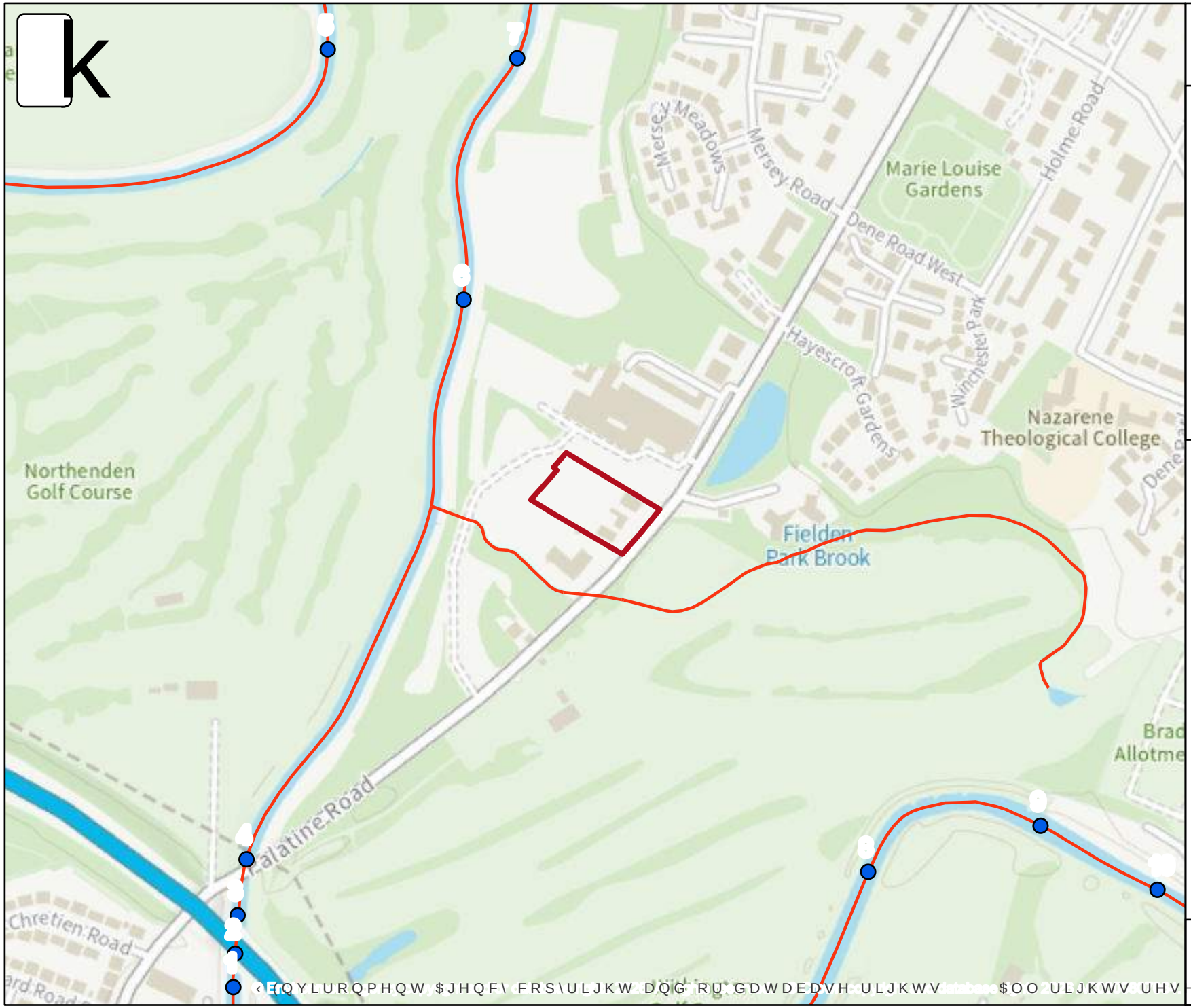
Label	Modelled location ID	Easting	Northing	50% AEP	20% AEP	10% AEP	5% AEP	4% AEP	3.33% AEP	2% AEP	1.33% AEP	1% AEP	0.5% AEP	0.1% AEP
				Level	Level	Level	Level	Level	Level	Level	Level	Level	Level	Level
1	1290653	383210	390504	27.90	28.41	28.53	28.83	28.89	28.93	29.0	29.04	29.20	29.30	30.0
2	1290577	383212	390537	27.88	28.39	28.52	28.82	28.88	28.92	28.99	29.03	29.19	29.30	29.95
3	1290513	383214	390574	27.88	28.39	28.52	28.81	28.88	28.91	28.98	29.03	29.19	29.29	29.91
4	1290756	383223	390629	27.82	28.33	28.46	28.76	28.82	28.86	28.93	28.98	29.14	29.24	29.84
5	1290663	383302	391417	26.36	26.85	26.98	27.28	27.35	27.38	27.46	27.51	27.64	27.71	29.53
6	1290523	383434	391174	27.42	27.94	28.07	28.38	28.44	28.48	28.55	28.61	28.74	28.81	29.58
7	1290806	383486	391409	27.30	27.82	27.95	28.25	28.31	28.35	28.42	28.47	28.61	28.69	29.52
8	1290537	383828	390617	29.46	29.96	30.08	30.37	30.43	30.47	30.54	30.56	30.58	30.62	30.77
9	1290536	383996	390662	29.65	30.15	30.27	30.57	30.63	30.67	30.74	30.78	30.79	30.85	30.97
10	1290553	384110	390599	29.78	30.28	30.40	30.69	30.75	30.78	30.85	30.87	30.89	30.94	31.03

Data in this table comes from the Upper Mersey 2017 model.
Level values are shown in mAOD, and flow values are shown in cubic metres per second.
Any blank cells show where a particular scenario has not been modelled for this location.

Defended

Label	Modelled location ID	Easting	Northing	50% AEP	20% AEP	10% AEP	5% AEP	4% AEP	3.33% AEP	2% AEP	1.33% AEP	1% AEP	0.5% AEP	0.1% AEP
				Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow
1	1290653	383210	390504	184.01	234.75	247.63	280.69	287.35	291.98	300.21	303.66	305.84	310.74	323.28
2	1290577	383212	390537	184.63	234.61	247.39	280.28	287.49	291.96	300.19	303.80	305.81	310.69	323.18
3	1290513	383214	390574	184.46	234.31	247.42	280.51	287.37	291.83	300.15	303.62	305.95	310.71	323.97
4	1290756	383223	390629	184.07	234.61	247.50	280.57	287.31	291.91	300.16	303.63	305.86	310.69	335.80
5	1290663	383302	391417	183.95	233.57	247.15	280.16	287.11	291.64	299.82	306.66	323.35	332.18	381.26
6	1290523	383434	391174	184.25	233.96	247.33	280.21	287.35	291.80	300.02	307.61	330.0	347.83	456.57
7	1290806	383486	391409	184.12	234.18	247.30	280.43	287.21	291.82	299.97	307.37	328.04	343.54	431.27
8	1290537	383828	390617	184.73	236.01	247.94	281.68	288.08	293.19	305.48	311.62	316.78	332.12	371.18
9	1290536	383996	390662	184.79	235.57	247.93	281.07	288.56	293.50	305.52	312.54	316.75	333.67	384.52
10	1290553	384110	390599	185.10	235.82	248.05	281.94	288.99	294.48	308.98	316.50	322.91	342.37	407.30

Data in this table comes from the Upper Mersey 2017 model.
Level values are shown in mAOD, and flow values are shown in cubic metres per second.
Any blank cells show where a particular scenario has not been modelled for this location.



Environment Agency

'HIHQFHV UHPRY
PRGHOOHG IOXY
QRGH ORFDWLRQ

/RFDWLRQ HDVWL

6FDOH &UHDWHG
-DQ

0RGHO QDPH
8SSHU 0HUVH\

6HOHFWHG DUH
0RGHOOHG ORF
0DLQ ULYHU

‹ EQYLURQPHQW $JHQF\ FRS\ULJKW DQG RU GDWDEDVH ULJKWV $OO ULJKWV UHVHUYHG ‹ &URZQ FRS\ULJKW

Modelled node locations data

Defences removed

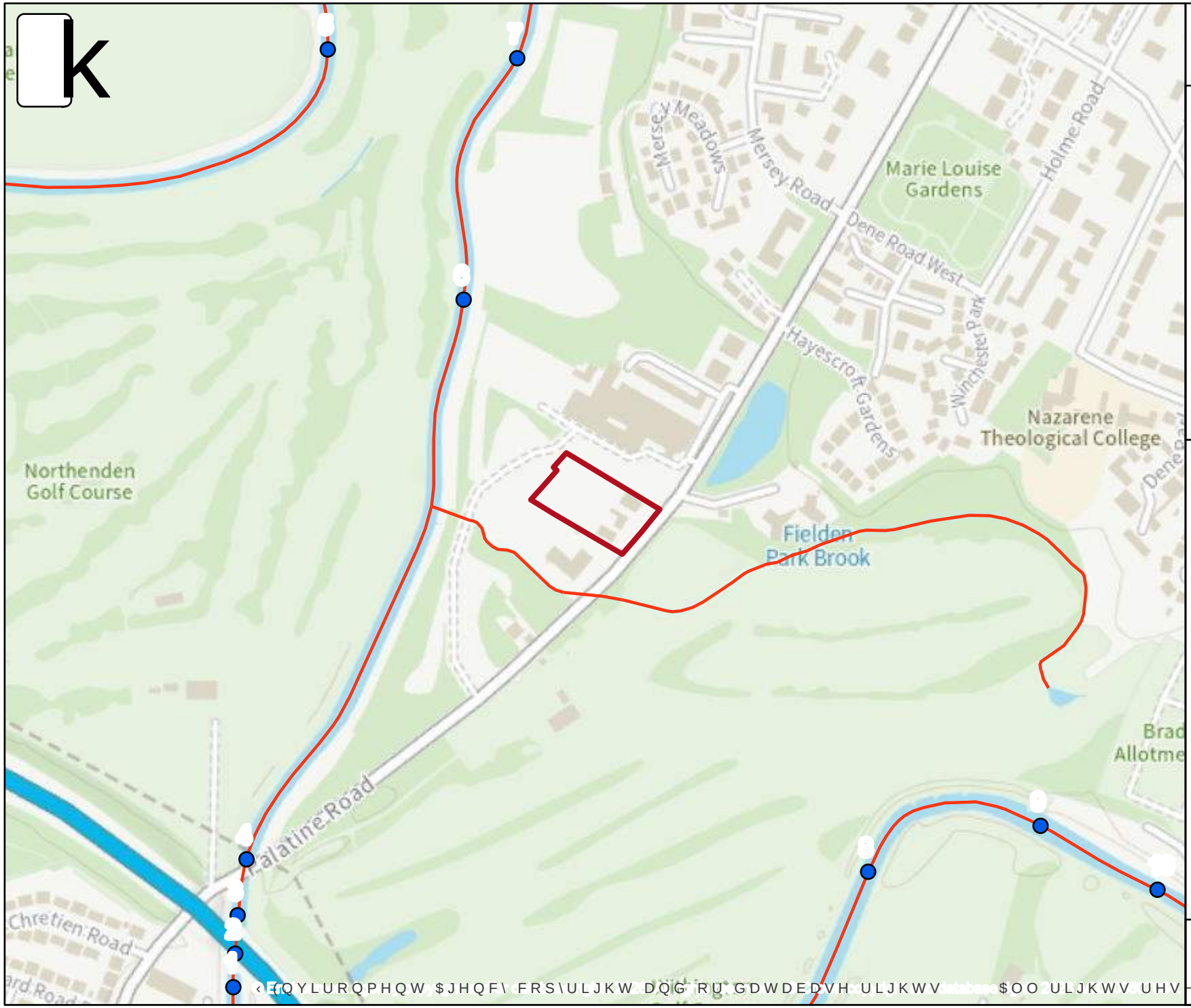
Label	Modelled location ID	Easting	Northing	50% AEP	20% AEP	10% AEP	5% AEP	4% AEP	3.33% AEP	2% AEP	1.33% AEP	1% AEP	0.5% AEP	0.1% AEP
				Level	Level	Level	Level	Level	Level	Level	Level	Level	Level	Level
1	1290653	383210	390504	27.25	27.46	27.55	27.65	27.71	27.77	27.92	28.05	28.15	28.41	29.59
2	1290577	383212	390537	27.21	27.40	27.49	27.58	27.65	27.70	27.87	28.0	28.10	28.37	29.55
3	1290513	383214	390574	27.21	27.38	27.46	27.54	27.61	27.66	27.83	27.97	28.08	28.35	29.51
4	1290756	383223	390629	27.09	27.20	27.23	27.27	27.34	27.41	27.61	27.78	27.90	28.22	29.44
5	1290663	383302	391417	26.15	26.66	26.98	27.26	27.35	27.42	27.62	27.79	27.91	28.22	29.41
6	1290523	383434	391174	26.61	26.75	26.99	27.27	27.36	27.43	27.64	27.82	27.94	28.26	29.45
7	1290806	383486	391409	26.61	26.76	27.0	27.25	27.35	27.42	27.61	27.76	27.87	28.15	29.40
8	1290537	383828	390617	28.75	29.0	29.22	29.39	29.44	29.48	29.57	29.62	29.66	29.76	30.15
9	1290536	383996	390662	28.76	29.03	29.26	29.42	29.47	29.51	29.59	29.65	29.69	29.79	30.15
10	1290553	384110	390599	28.82	29.05	29.27	29.43	29.48	29.51	29.60	29.66	29.70	29.80	30.16

Data in this table comes from the Upper Mersey 2017 model.
Level values are shown in mAOD, and flow values are shown in cubic metres per second.
Any blank cells show where a particular scenario has not been modelled for this location.

Defences removed

Label	Modelled location ID	Easting	Northing	50% AEP	20% AEP	10% AEP	5% AEP	4% AEP	3.33% AEP	2% AEP	1.33% AEP	1% AEP	0.5% AEP	0.1% AEP
				Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow
1	1290653	383210	390504	172.19	222.66	254.11	277.32	282.80	286.81	296.39	301.74	304.84	310.99	325.03
2	1290577	383212	390537	172.17	222.57	254.11	277.20	282.73	286.79	296.39	301.69	304.83	311.26	327.40
3	1290513	383214	390574	172.18	222.57	254.12	277.19	282.69	286.79	296.36	301.67	304.90	311.92	337.38
4	1290756	383223	390629	172.19	222.52	254.12	277.34	282.92	287.13	297.09	302.67	306.18	313.92	348.05
5	1290663	383302	391417	125.50	127.82	128.82	129.48	129.62	129.78	130.13	130.51	130.65	131.09	132.42
6	1290523	383434	391174	135.46	149.65	154.71	158.65	160.0	160.91	163.25	165.10	166.32	169.33	289.35
7	1290806	383486	391409	110.95	115.52	119.23	121.80	123.21	125.63	142.43	154.43	165.12	193.11	312.93
8	1290537	383828	390617	112.14	113.74	114.28	114.68	114.76	114.88	115.31	115.64	115.88	116.29	184.74
9	1290536	383996	390662	112.91	115.99	117.99	120.44	121.12	121.65	122.90	123.89	124.63	126.30	186.37
10	1290553	384110	390599	117.21	125.86	129.34	131.85	132.41	132.96	134.29	135.38	136.09	137.91	193.49

Data in this table comes from the Upper Mersey 2017 model.
Level values are shown in mAOD, and flow values are shown in cubic metres per second.
Any blank cells show where a particular scenario has not been modelled for this location.


k
Mersey Meadows
Mersey Road
Marie Louise Gardens
Holme Road
Dene Road West
Hayescroft Gardens
Winchester Park
Nazarene Theological College
Northenden Golf Course
Fielden Park Brook
Palatine Road
Chretien Road
Brad Allotme
'HIHQGHG
FOLPDWH FKDQJ
PRGHOOHG IOXY
QRGH ORFDWLRQ
/RFDWLRQ HDVWLQ
6FDOH &UHDWHG
-DQ
0RGHO QDPH
8SSHU 0HUVH\
6HOHFWHG DUH
0RGHOOHG ORF
0DLQ ULYHU
PHWUHV
&RQWDLQV 6XUYH

Modelled node locations data

Defended climate change

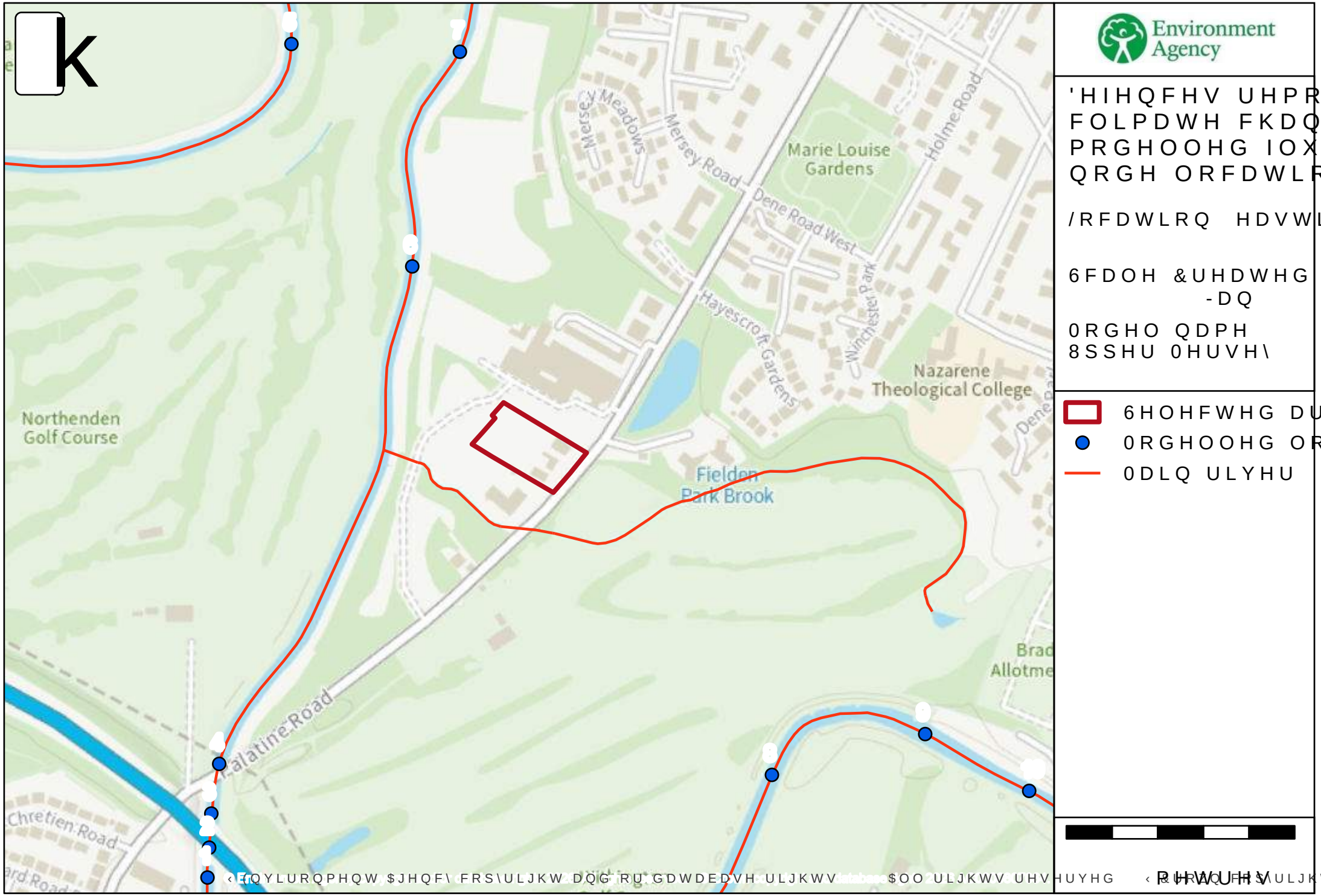
Label	Modelled location ID	Easting	Northing	1% AEP (+30%)	1% AEP (+35%)	1% AEP (+70%)	0.1% AEP (+30%)
				Level	Level	Level	Level
1	1290653	383210	390504	29.66	29.72	29.96	30.21
2	1290577	383212	390537	29.64	29.70	29.91	30.15
3	1290513	383214	390574	29.63	29.69	29.88	30.08
4	1290756	383223	390629	29.58	29.64	29.81	29.95
5	1290663	383302	391417	28.51	28.75	29.42	29.94
6	1290523	383434	391174	29.02	29.05	29.44	30.02
7	1290806	383486	391409	28.96	29.01	29.42	30.03
8	1290537	383828	390617	30.72	30.72	30.75	31.06
9	1290536	383996	390662	30.92	30.93	30.97	31.15
10	1290553	384110	390599	31.0	31.0	31.03	31.23

Data in this table comes from the Upper Mersey 2017 model.
Level values are shown in mAOD, and flow values are shown in cubic metres per second.
Any blank cells show where a particular scenario has not been modelled for this location.

Defended climate change

Label	Modelled location ID	Easting	Northing	1% AEP (+30%)	1% AEP (+35%)	1% AEP (+70%)	0.1% AEP (+30%)
				Flow	Flow	Flow	Flow
1	1290653	383210	390504	314.74	315.58	321.43	333.94
2	1290577	383212	390537	315.51	316.22	321.35	342.14
3	1290513	383214	390574	316.81	318.08	323.01	363.66
4	1290756	383223	390629	319.63	322.12	330.33	390.78
5	1290663	383302	391417	361.92	366.63	379.34	398.87
6	1290523	383434	391174	406.27	416.0	449.10	455.41
7	1290806	383486	391409	388.89	396.93	423.87	431.82
8	1290537	383828	390617	352.27	356.40	367.65	382.03
9	1290536	383996	390662	356.48	361.14	380.05	422.54
10	1290553	384110	390599	369.66	375.86	399.78	438.72

Data in this table comes from the Upper Mersey 2017 model.
Level values are shown in mAOD, and flow values are shown in cubic metres per second.
Any blank cells show where a particular scenario has not been modelled for this location.


Environment Agency
'HIHQFHV UHPRY
FOLPDWH FKDQJ
PRGHOOHG IOXY
QRGH ORFDWLRQ
/RFDWLRQ HDVWL
6FDOH &UHDWHG
-DQ
0RGHO QDPH
8SSHU 0HUVH\
6HOHFWHG DUH
0RGHOOHG ORF
0DLQ ULYHU
Marie Louise Gardens
Mersey Meadows
Mersey Road
Holme Road
Dene Road West
Hayescroft Gardens
Winchester Park
Nazarene Theological College
Northenden Golf Course
Fielden Park Brook
Palatine Road
Chretien Road
Allotme
‹ EQYLURQPHQW $JHQF\ FRS\ULJKW DQG GDWDEDVH ULJKWV $OO ULJKWV UHVHUYHG ‹ &URZQ FRS\ULJKW

Modelled node locations data

Defences removed climate change

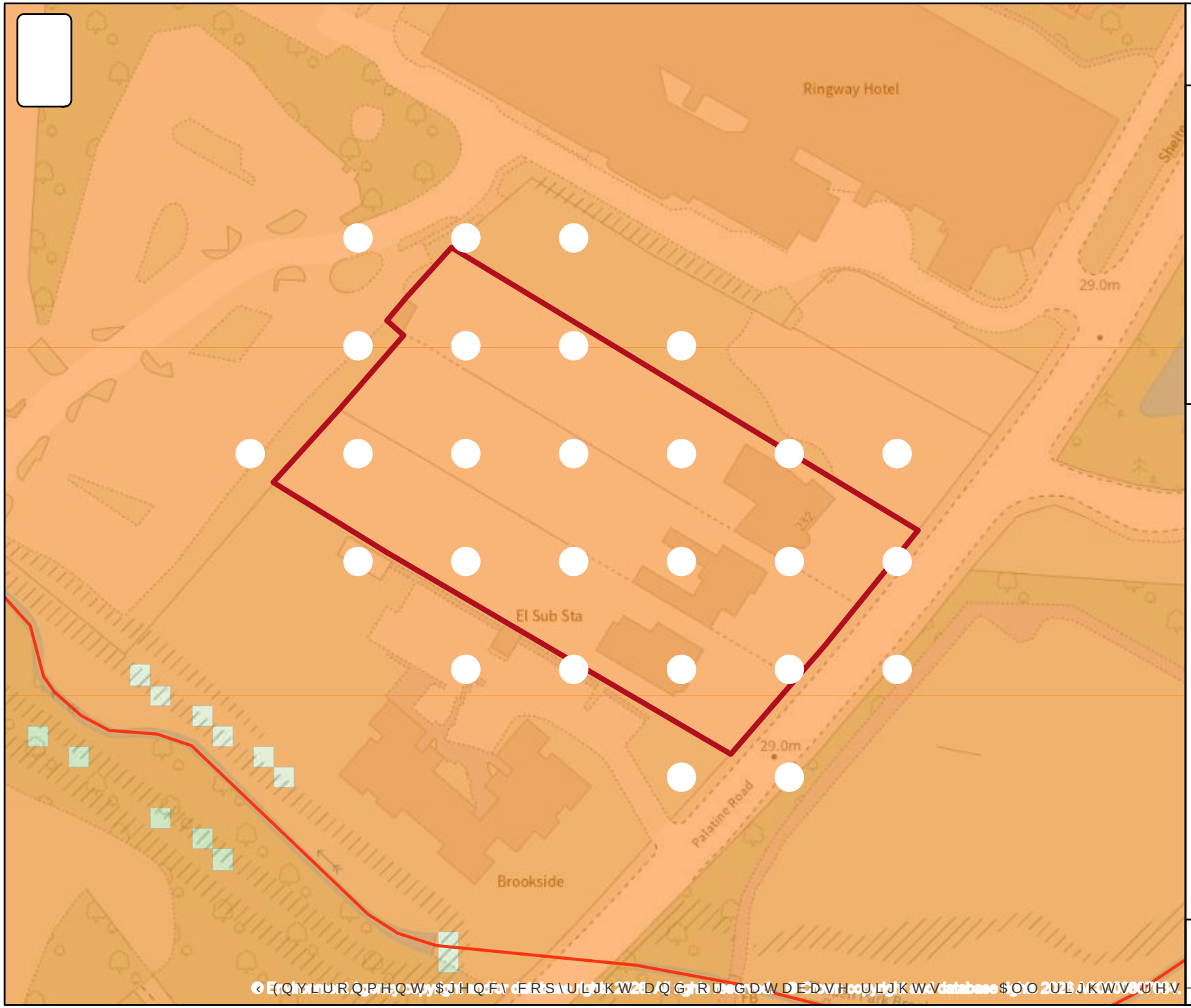
Label	Modelled location ID	Easting	Northing	1% AEP (+30%)	1% AEP (+35%)	1% AEP (+70%)	0.1% AEP (+30%)
				Level	Level	Level	Level
1	1290653	383210	390504	28.86	28.96	29.47	30.12
2	1290577	383212	390537	28.83	28.93	29.43	30.08
3	1290513	383214	390574	28.81	28.90	29.39	30.03
4	1290756	383223	390629	28.72	28.82	29.31	29.96
5	1290663	383302	391417	28.71	28.81	29.32	29.85
6	1290523	383434	391174	28.76	28.86	29.35	29.85
7	1290806	383486	391409	28.57	28.65	29.34	29.86
8	1290537	383828	390617	29.89	29.93	30.10	30.48
9	1290536	383996	390662	29.91	29.94	30.12	30.42
10	1290553	384110	390599	29.92	29.96	30.12	30.55

Data in this table comes from the Upper Mersey 2017 model.
Level values are shown in mAOD, and flow values are shown in cubic metres per second.
Any blank cells show where a particular scenario has not been modelled for this location.

Defences removed climate change

Label	Modelled location ID	Easting	Northing	1% AEP (+30%)	1% AEP (+35%)	1% AEP (+70%)	0.1% AEP (+30%)
				Flow	Flow	Flow	Flow
1	1290653	383210	390504	316.96	318.12	322.70	309.07
2	1290577	383212	390537	317.87	319.08	324.77	321.0
3	1290513	383214	390574	319.69	321.15	328.04	335.30
4	1290756	383223	390629	322.89	324.47	333.99	349.39
5	1290663	383302	391417	131.43	131.65	132.10	133.26
6	1290523	383434	391174	175.96	178.29	269.66	245.78
7	1290806	383486	391409	242.20	252.33	359.83	216.31
8	1290537	383828	390617	119.64	122.19	175.63	235.30
9	1290536	383996	390662	132.12	137.26	176.57	293.71
10	1290553	384110	390599	149.38	154.15	186.21	300.08

Data in this table comes from the Upper Mersey 2017 model.
Level values are shown in mAOD, and flow values are shown in cubic metres per second.
Any blank cells show where a particular scenario has not been modelled for this location.



Environment Agency

'HIHQGHG PRGH
IOXYLDO
H[WHQW DQG KH

/RFDWLRQ HDVWLQ

6FDOH &UHDWHG
-DQ

0RGHO QDPH
8SSHU 0HUVH\

6HOHFWHG DU

0DLQ ULYHU

0RGHOOHG ' JULG
:DWHU OHYHO LQ F

7KLV PDS VKRZV WKH
$(3 KHLJKW GDWD

PHWUHV

(QYLURQPHQW $JHQF\ FRS\ULJKW DQG RU GDWDEDVH ULJKWV

Sample point data

Defended

Label	Easting	Northing	50% AEP	20% AEP	10% AEP	5% AEP	4% AEP	3.33% AEP	2% AEP	1.33% AEP	1% AEP	0.5% AEP	0.1% AEP
			Height	Height	Height	Height	Height	Height	Height	Height	Height	Height	Height
1	383579	390922	NoData	NoData	NoData	NoData	NoData	NoData	29.35	29.48	29.54	29.60	30.08
2	383600	390922	NoData	NoData	NoData	NoData	NoData	NoData	29.36	29.48	29.54	29.60	30.09
3	383537	390943	NoData	NoData	NoData	NoData	NoData	NoData	NoData	29.35	29.43	29.51	29.94
4	383558	390943	NoData	NoData	NoData	NoData	NoData	NoData	NoData	29.36	29.44	29.51	29.98
5	383579	390943	NoData	NoData	NoData	NoData	NoData	NoData	NoData	29.40	29.48	29.55	30.05
6	383600	390943	NoData	NoData	NoData	NoData	NoData	NoData	29.33	29.45	29.52	29.58	30.07
7	383621	390943	NoData	NoData	NoData	NoData	NoData	NoData	29.35	29.45	29.51	29.57	30.05
8	383516	390964	NoData	NoData	NoData	NoData	NoData	NoData	28.87	29.34	29.43	29.50	29.93
9	383537	390964	NoData	NoData	NoData	NoData	NoData	NoData	29.02	29.35	29.43	29.50	29.94
10	383558	390964	NoData	NoData	NoData	NoData	NoData	NoData	NoData	29.35	29.43	29.50	29.94
11	383579	390964	NoData	NoData	NoData	NoData	NoData	NoData	29.07	29.35	29.44	29.51	29.96
12	383600	390964	NoData	NoData	NoData	NoData	NoData	NoData	29.22	29.36	29.45	29.52	30.01

Label	Easting	Northing	50% AEP	20% AEP	10% AEP	5% AEP	4% AEP	3.33% AEP	2% AEP	1.33% AEP	1% AEP	0.5% AEP	0.1% AEP
			Height	Height	Height	Height	Height	Height	Height	Height	Height	Height	Height
13	383621	390964	NoData	NoData	NoData	NoData	NoData	NoData	29.29	29.38	29.45	29.52	30.01
14	383495	390985	NoData	NoData	NoData	NoData	NoData	NoData	28.82	29.34	29.43	29.50	29.92
15	383516	390985	NoData	NoData	NoData	NoData	NoData	NoData	NoData	29.34	29.43	29.50	29.93
16	383537	390985	NoData	NoData	NoData	NoData	NoData	NoData	NoData	29.35	29.43	29.50	29.93
17	383558	390985	NoData	NoData	NoData	NoData	NoData	NoData	NoData	29.35	29.43	29.50	29.94
18	383579	390985	NoData	NoData	NoData	NoData	NoData	NoData	28.95	29.35	29.43	29.50	29.94
19	383600	390985	NoData	NoData	NoData	NoData	NoData	NoData	NoData	29.35	29.43	29.50	29.95
20	383621	390985	NoData	NoData	NoData	NoData	NoData	NoData	29.16	29.35	29.43	29.50	29.97
21	383516	391006	NoData	NoData	NoData	NoData	NoData	NoData	28.82	29.34	29.43	29.50	29.92
22	383537	391006	NoData	NoData	NoData	NoData	NoData	NoData	28.82	29.34	29.43	29.50	29.93
23	383558	391006	NoData	NoData	NoData	NoData	NoData	NoData	28.82	29.34	29.43	29.50	29.93
24	383579	391006	NoData	NoData	NoData	NoData	NoData	NoData	28.82	29.35	29.43	29.50	29.93

Label	Easting	Northing	50% AEP	20% AEP	10% AEP	5% AEP	4% AEP	3.33% AEP	2% AEP	1.33% AEP	1% AEP	0.5% AEP	0.1% AEP
			Height	Height	Height	Height	Height	Height	Height	Height	Height	Height	Height
25	383516	391027	NoData	NoData	NoData	NoData	NoData	NoData	28.82	29.34	29.43	29.50	29.92
26	383537	391027	NoData	NoData	NoData	NoData	NoData	NoData	28.82	29.34	29.43	29.50	29.92
27	383558	391027	NoData	NoData	NoData	NoData	NoData	NoData	28.82	29.34	29.43	29.50	29.93
Max value in selected area:			Not Calculated	Not Calculated	Not Calculated	Not Calculated	Not Calculated	Not Calculated	29.33	29.46	29.53	29.59	30.08

Data in this table comes from the Upper Mersey 2017 model. Height values are shown in mAOD, and depth values are shown in metres.
Any blank cells show where a particular scenario has not been modelled for this location.
Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.
'Max value in selected area' is the deepest depth or highest height at any location within your drawn boundary.

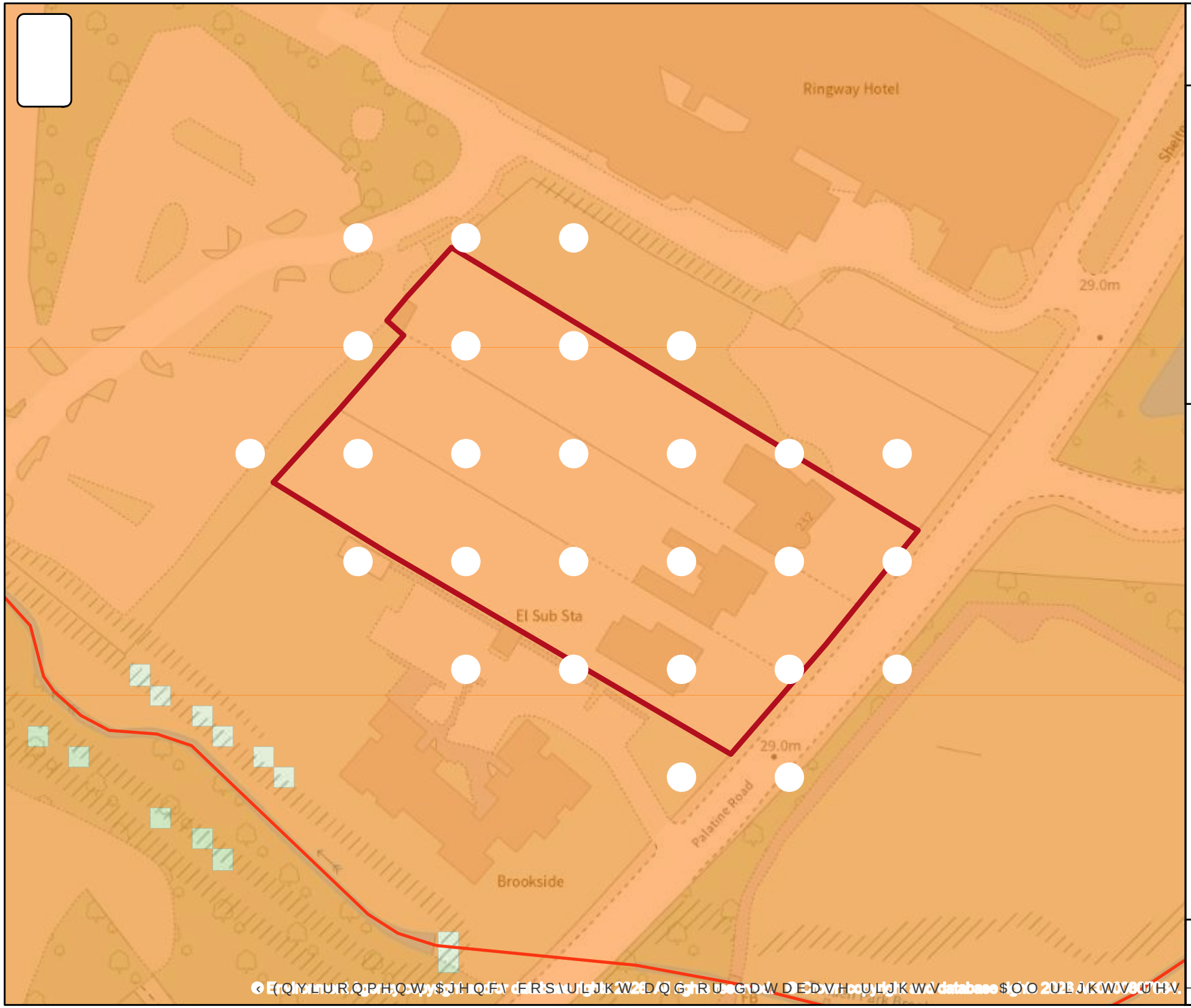
Defended

Label	Easting	Northing	50% AEP	20% AEP	10% AEP	5% AEP	4% AEP	3.33% AEP	2% AEP	1.33% AEP	1% AEP	0.5% AEP	0.1% AEP
			Depth	Depth	Depth	Depth	Depth	Depth	Depth	Depth	Depth	Depth	Depth
1	383579	390922	NoData	NoData	NoData	NoData	NoData	NoData	0.11	0.23	0.30	0.36	0.84
2	383600	390922	NoData	NoData	NoData	NoData	NoData	NoData	0.15	0.27	0.34	0.40	0.88
3	383537	390943	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.01	0.08	0.15	0.59
4	383558	390943	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.03	0.11	0.19	0.65
5	383579	390943	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.20	0.28	0.35	0.86
6	383600	390943	NoData	NoData	NoData	NoData	NoData	NoData	0.09	0.18	0.25	0.31	0.80
7	383621	390943	NoData	NoData	NoData	NoData	NoData	NoData	0.10	0.20	0.26	0.32	0.80
8	383516	390964	NoData	NoData	NoData	NoData	NoData	NoData	0.05	0.52	0.60	0.67	1.10
9	383537	390964	NoData	NoData	NoData	NoData	NoData	NoData	0.10	0.42	0.50	0.57	1.01
10	383558	390964	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.32	0.41	0.48	0.92
11	383579	390964	NoData	NoData	NoData	NoData	NoData	NoData	0.04	0.32	0.41	0.48	0.93
12	383600	390964	NoData	NoData	NoData	NoData	NoData	NoData	0.10	0.24	0.33	0.41	0.89

Label	Easting	Northing	50% AEP	20% AEP	10% AEP	5% AEP	4% AEP	3.33% AEP	2% AEP	1.33% AEP	1% AEP	0.5% AEP	0.1% AEP
			Depth	Depth	Depth	Depth	Depth	Depth	Depth	Depth	Depth	Depth	Depth
13	383621	390964	NoData	NoData	NoData	NoData	NoData	NoData	0.07	0.14	0.21	0.28	0.77
14	383495	390985	NoData	NoData	NoData	NoData	NoData	NoData	1.94	2.46	2.55	2.62	3.05
15	383516	390985	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.51	0.59	0.66	1.09
16	383537	390985	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.44	0.52	0.59	1.03
17	383558	390985	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.40	0.49	0.56	0.99
18	383579	390985	NoData	NoData	NoData	NoData	NoData	NoData	0.13	0.53	0.61	0.68	1.13
19	383600	390985	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.32	0.41	0.48	0.93
20	383621	390985	NoData	NoData	NoData	NoData	NoData	NoData	0.01	0.20	0.28	0.35	0.82
21	383516	391006	NoData	NoData	NoData	NoData	NoData	NoData	0.96	1.48	1.57	1.63	2.06
22	383537	391006	NoData	NoData	NoData	NoData	NoData	NoData	0.12	0.64	0.72	0.79	1.22
23	383558	391006	NoData	NoData	NoData	NoData	NoData	NoData	0.27	0.78	0.87	0.94	1.37
24	383579	391006	NoData	NoData	NoData	NoData	NoData	NoData	0.42	0.95	1.03	1.10	1.53

Label	Easting	Northing	50% AEP	20% AEP	10% AEP	5% AEP	4% AEP	3.33% AEP	2% AEP	1.33% AEP	1% AEP	0.5% AEP	0.1% AEP
			Depth	Depth	Depth	Depth	Depth	Depth	Depth	Depth	Depth	Depth	Depth
25	383516	391027	NoData	NoData	NoData	NoData	NoData	NoData	1.35	1.87	1.96	2.03	2.45
26	383537	391027	NoData	NoData	NoData	NoData	NoData	NoData	0.77	1.29	1.37	1.44	1.87
27	383558	391027	NoData	NoData	NoData	NoData	NoData	NoData	1.94	2.46	2.55	2.62	3.05
Max value in selected area:			Not Calculated	Not Calculated	Not Calculated	Not Calculated	Not Calculated	Not Calculated	1.38	1.90	1.99	2.06	2.48

Data in this table comes from the Upper Mersey 2017 model. Height values are shown in mAOD, and depth values are shown in metres.
Any blank cells show where a particular scenario has not been modelled for this location.
Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.
'Max value in selected area' is the deepest depth or highest height at any location within your drawn boundary.



Environment Agency

'HIHQFHV UHPRY
PRGHOOHG IOXY
H[WHQW DQG KH

/RFDWLRQ HDVWLQ

6FDOH &UHDWHG
-DQ

0RGHO QDPH
8SSHU 0HUVH\

6HOHFWHG DU

0DLQ ULYHU

0RGHOOHG ' JULG
:DWHU OHYHO LQ F

7KLV PDS VKRZV WKH
$(3 KHLJKW GDWD

(QYLURQPHQW $JHQF\ FRS\ULJKW DQG RU GDWDEDVH ULJKWV UHVHUYHG ‹ FURZQ FRS\ULJKW

PHWUHV

Sample point data

Defences removed

Label	Easting	Northing	50% AEP	20% AEP	10% AEP	5% AEP	4% AEP	3.33% AEP	2% AEP	1.33% AEP	1% AEP	0.5% AEP	0.1% AEP
			Height	Height	Height	Height	Height	Height	Height	Height	Height	Height	Height
1	383579	390922	NoData	NoData	NoData	29.39	29.43	29.47	29.55	29.60	29.63	29.71	30.02
2	383600	390922	NoData	NoData	NoData	29.40	29.44	29.47	29.55	29.60	29.64	29.72	30.03
3	383537	390943	NoData	NoData	NoData	NoData	29.31	29.34	29.38	29.41	29.43	29.48	29.67
4	383558	390943	NoData	NoData	NoData	NoData	29.32	29.34	29.40	29.44	29.47	29.54	29.80
5	383579	390943	NoData	NoData	NoData	NoData	29.35	29.39	29.47	29.52	29.56	29.64	29.97
6	383600	390943	NoData	NoData	NoData	29.37	29.41	29.44	29.52	29.57	29.60	29.68	30.00
7	383621	390943	NoData	NoData	NoData	29.39	29.42	29.45	29.52	29.57	29.59	29.67	29.98
8	383516	390964	NoData	NoData	NoData	28.88	28.91	28.92	28.97	28.98	29.01	29.05	29.44
9	383537	390964	NoData	NoData	NoData	29.05	29.07	29.08	29.14	29.19	29.22	29.28	29.56
10	383558	390964	NoData	NoData	NoData	29.09	29.11	29.14	29.21	29.25	29.29	29.35	29.62
11	383579	390964	NoData	NoData	NoData	29.12	29.18	29.21	29.27	29.31	29.34	29.40	29.70
12	383600	390964	NoData	NoData	NoData	29.25	29.28	29.31	29.40	29.45	29.48	29.55	29.88

Label	Easting	Northing	50% AEP	20% AEP	10% AEP	5% AEP	4% AEP	3.33% AEP	2% AEP	1.33% AEP	1% AEP	0.5% AEP	0.1% AEP
			Height	Height	Height	Height	Height	Height	Height	Height	Height	Height	Height
13	383621	390964	NoData	NoData	NoData	29.32	29.34	29.36	29.42	29.46	29.49	29.56	29.89
14	383495	390985	NoData	NoData	NoData	27.29	27.38	27.45	27.65	27.81	27.92	28.23	29.41
15	383516	390985	NoData	NoData	NoData	28.81	28.82	28.83	28.86	28.90	28.91	28.97	29.43
16	383537	390985	NoData	NoData	NoData	28.99	29.01	29.02	29.07	29.11	29.13	29.18	29.51
17	383558	390985	NoData	NoData	NoData	28.95	28.99	29.02	29.07	29.12	29.15	29.21	29.56
18	383579	390985	NoData	NoData	NoData	28.98	29.04	29.07	29.12	29.16	29.19	29.27	29.61
19	383600	390985	NoData	NoData	NoData	29.09	29.10	29.12	29.20	29.25	29.27	29.36	29.69
20	383621	390985	NoData	NoData	NoData	29.17	29.20	29.21	29.27	29.32	29.35	29.43	29.79
21	383516	391006	NoData	NoData	NoData	27.88	27.93	27.94	27.98	28.01	28.07	28.30	29.40
22	383537	391006	NoData	NoData	NoData	28.63	28.65	28.66	28.69	28.72	28.74	28.81	29.46
23	383558	391006	NoData	NoData	NoData	28.49	28.52	28.54	28.59	28.66	28.71	28.84	29.49
24	383579	391006	NoData	NoData	NoData	28.51	28.56	28.59	28.73	28.80	28.85	28.99	29.53

Label	Easting	Northing	50% AEP	20% AEP	10% AEP	5% AEP	4% AEP	3.33% AEP	2% AEP	1.33% AEP	1% AEP	0.5% AEP	0.1% AEP
			Height	Height	Height	Height	Height	Height	Height	Height	Height	Height	Height
25	383516	391027	NoData	NoData	NoData	27.59	27.63	27.67	27.78	27.84	27.92	28.20	29.40
26	383537	391027	NoData	NoData	NoData	28.17	28.21	28.25	28.41	28.49	28.54	28.67	29.45
27	383558	391027	NoData	NoData	NoData	28.19	28.24	28.28	28.51	28.60	28.67	28.83	29.50
Max value in selected area:			Not Calculated	Not Calculated	Not Calculated	29.38	29.42	29.46	29.54	29.59	29.62	29.70	30.02

Data in this table comes from the Upper Mersey 2017 model. Height values are shown in mAOD, and depth values are shown in metres.
Any blank cells show where a particular scenario has not been modelled for this location.
Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.
'Max value in selected area' is the deepest depth or highest height at any location within your drawn boundary.

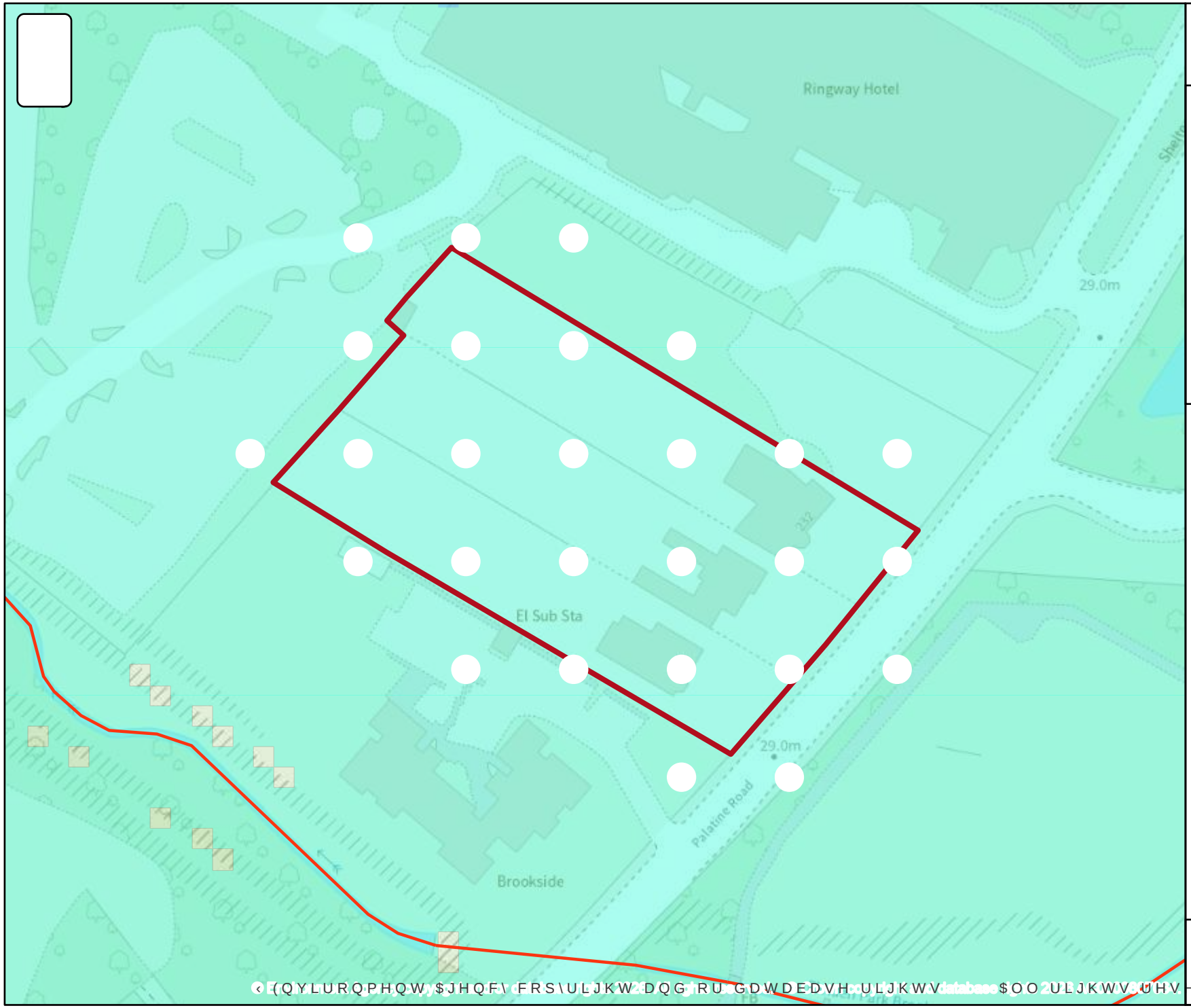
Defences removed

Label	Easting	Northing	50% AEP	20% AEP	10% AEP	5% AEP	4% AEP	3.33% AEP	2% AEP	1.33% AEP	1% AEP	0.5% AEP	0.1% AEP
			Depth	Depth	Depth	Depth	Depth	Depth	Depth	Depth	Depth	Depth	Depth
1	383579	390922	NoData	NoData	NoData	0.15	0.19	0.23	0.31	0.35	0.39	0.47	0.78
2	383600	390922	NoData	NoData	NoData	0.20	0.24	0.27	0.34	0.40	0.43	0.51	0.83
3	383537	390943	NoData	NoData	NoData	NoData	0.00	0.01	0.03	0.05	0.07	0.12	0.31
4	383558	390943	NoData	NoData	NoData	NoData	0.01	0.02	0.07	0.11	0.14	0.21	0.47
5	383579	390943	NoData	NoData	NoData	NoData	0.15	0.19	0.27	0.32	0.36	0.44	0.77
6	383600	390943	NoData	NoData	NoData	0.12	0.14	0.17	0.25	0.30	0.34	0.41	0.73
7	383621	390943	NoData	NoData	NoData	0.14	0.17	0.20	0.27	0.32	0.34	0.41	0.73
8	383516	390964	NoData	NoData	NoData	0.05	0.08	0.10	0.14	0.15	0.18	0.22	0.61
9	383537	390964	NoData	NoData	NoData	0.12	0.14	0.16	0.21	0.26	0.29	0.36	0.63
10	383558	390964	NoData	NoData	NoData	0.07	0.09	0.11	0.18	0.23	0.26	0.33	0.60
11	383579	390964	NoData	NoData	NoData	0.09	0.15	0.18	0.24	0.28	0.31	0.38	0.68
12	383600	390964	NoData	NoData	NoData	0.13	0.17	0.19	0.28	0.33	0.36	0.44	0.76

Label	Easting	Northing	50% AEP	20% AEP	10% AEP	5% AEP	4% AEP	3.33% AEP	2% AEP	1.33% AEP	1% AEP	0.5% AEP	0.1% AEP
			Depth	Depth	Depth	Depth	Depth	Depth	Depth	Depth	Depth	Depth	Depth
13	383621	390964	NoData	NoData	NoData	0.09	0.11	0.12	0.18	0.22	0.24	0.32	0.65
14	383495	390985	NoData	NoData	NoData	0.41	0.50	0.57	0.77	0.93	1.04	1.35	2.53
15	383516	390985	NoData	NoData	NoData	0.01	0.02	0.03	0.06	0.09	0.10	0.14	0.59
16	383537	390985	NoData	NoData	NoData	0.09	0.10	0.12	0.16	0.20	0.22	0.27	0.61
17	383558	390985	NoData	NoData	NoData	0.02	0.05	0.08	0.13	0.18	0.21	0.27	0.62
18	383579	390985	NoData	NoData	NoData	0.16	0.22	0.25	0.30	0.34	0.38	0.45	0.79
19	383600	390985	NoData	NoData	NoData	0.06	0.08	0.09	0.18	0.22	0.25	0.33	0.66
20	383621	390985	NoData	NoData	NoData	0.02	0.05	0.06	0.12	0.17	0.19	0.28	0.64
21	383516	391006	NoData	NoData	NoData	0.05	0.07	0.08	0.12	0.14	0.21	0.43	1.54
22	383537	391006	NoData	NoData	NoData	0.00	0.01	0.01	0.03	0.04	0.05	0.10	0.76
23	383558	391006	NoData	NoData	NoData	0.02	0.03	0.04	0.07	0.12	0.16	0.28	0.93
24	383579	391006	NoData	NoData	NoData	0.11	0.16	0.19	0.33	0.40	0.45	0.59	1.13

Label	Easting	Northing	50% AEP	20% AEP	10% AEP	5% AEP	4% AEP	3.33% AEP	2% AEP	1.33% AEP	1% AEP	0.5% AEP	0.1% AEP
			Depth	Depth	Depth	Depth	Depth	Depth	Depth	Depth	Depth	Depth	Depth
25	383516	391027	NoData	NoData	NoData	0.12	0.16	0.19	0.31	0.36	0.45	0.73	1.93
26	383537	391027	NoData	NoData	NoData	0.13	0.17	0.20	0.35	0.43	0.49	0.62	1.39
27	383558	391027	NoData	NoData	NoData	1.31	1.35	1.40	1.63	1.72	1.78	1.95	2.61
Max value in selected area:			Not Calculated	Not Calculated	Not Calculated	0.83	0.86	0.89	1.04	1.12	1.18	1.34	2.04

Data in this table comes from the Upper Mersey 2017 model. Height values are shown in mAOD, and depth values are shown in metres.
Any blank cells show where a particular scenario has not been modelled for this location.
Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.
'Max value in selected area' is the deepest depth or highest height at any location within your drawn boundary.



Environment Agency

'HIHQGHG FOLPDWH FKDQJ PRGHOOHG IOXY H[WHQW DQG KH /RFDWLRQ HDVWLC

6FDOH &UHDWHG -DQ

0RGHO QDPH 8SSHU 0HUVH\

6HOHFWHG DUH

0DLQ ULYHU

0RGHOOHG ' JULG :DWHU OHYHO LQ F

7KLV PDS VKRZV WKH $(3 KHLJKW GD

PHWUHV

(QYLURQPHQW$JHQF\ FRS\ULJKW DQG RU GDWDEDVH ULJKWV UHVHUYHG ‹ FURZQ FRS\ULJKW

Sample point data

Defended climate change

Label	Easting	Northing	1% AEP (+30%)	1% AEP (+35%)	1% AEP (+70%)	0.1% AEP (+30%)
			Height	Height	Height	Height
1	383579	390922	29.83	29.87	30.04	30.32
2	383600	390922	29.83	29.88	30.05	30.32
3	383537	390943	29.72	29.76	29.91	30.22
4	383558	390943	29.74	29.78	29.94	30.25
5	383579	390943	29.80	29.84	30.02	30.31
6	383600	390943	29.81	29.86	30.03	30.31
7	383621	390943	29.80	29.84	30.01	30.30
8	383516	390964	29.70	29.74	29.90	30.21
9	383537	390964	29.71	29.75	29.90	30.22
10	383558	390964	29.71	29.75	29.91	30.22
11	383579	390964	29.72	29.76	29.92	30.23
12	383600	390964	29.75	29.80	29.97	30.28

Label	Easting	Northing	1% AEP (+30%)	1% AEP (+35%)	1% AEP (+70%)	0.1% AEP (+30%)
			Height	Height	Height	Height
13	383621	390964	29.75	29.80	29.97	30.28
14	383495	390985	29.70	29.74	29.89	30.21
15	383516	390985	29.70	29.74	29.89	30.21
16	383537	390985	29.71	29.75	29.90	30.21
17	383558	390985	29.71	29.75	29.90	30.22
18	383579	390985	29.71	29.75	29.91	30.22
19	383600	390985	29.71	29.75	29.92	30.23
20	383621	390985	29.72	29.76	29.93	30.25
21	383516	391006	29.70	29.74	29.89	30.20
22	383537	391006	29.70	29.74	29.89	30.21
23	383558	391006	29.71	29.75	29.90	30.21
24	383579	391006	29.71	29.75	29.90	30.22

Label	Easting	Northing	1% AEP (+30%)	1% AEP (+35%)	1% AEP (+70%)	0.1% AEP (+30%)
			Height	Height	Height	Height
25	383516	391027	29.70	29.74	29.89	30.21
26	383537	391027	29.70	29.74	29.89	30.21
27	383558	391027	29.71	29.75	29.90	30.21
Max value in selected area:			29.83	29.87	30.04	30.32

Data in this table comes from the Upper Mersey 2017 model. Height values are shown in mAOD, and depth values are shown in metres.
Any blank cells show where a particular scenario has not been modelled for this location.
Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.
'Max value in selected area' is the deepest depth or highest height at any location within your drawn boundary.

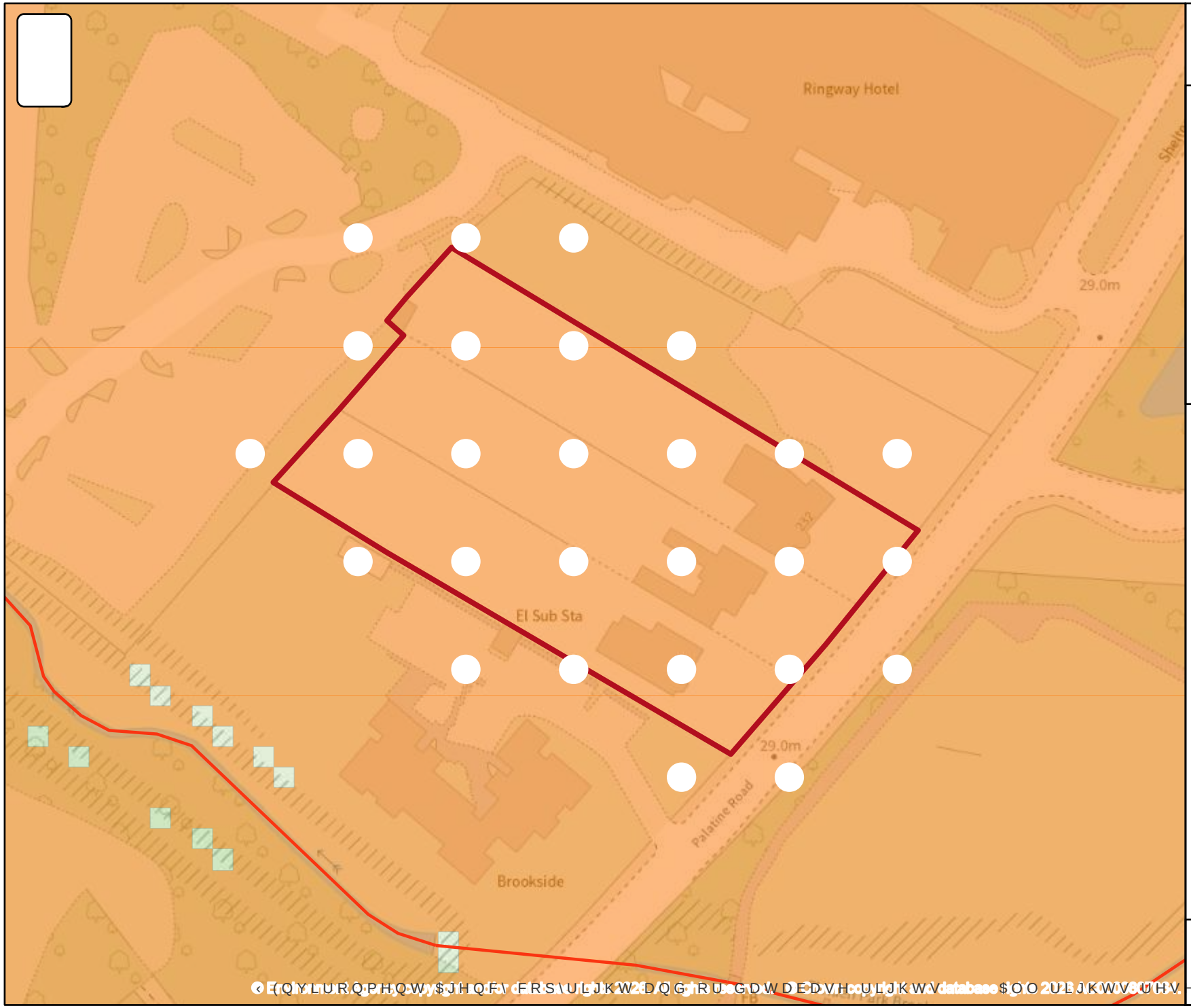
Defended climate change

Label	Easting	Northing	1% AEP (+30%)	1% AEP (+35%)	1% AEP (+70%)	0.1% AEP (+30%)
			Depth	Depth	Depth	Depth
1	383579	390922	0.59	0.63	0.80	1.08
2	383600	390922	0.63	0.67	0.84	1.12
3	383537	390943	0.36	0.40	0.55	0.86
4	383558	390943	0.41	0.46	0.62	0.92
5	383579	390943	0.60	0.64	0.82	1.11
6	383600	390943	0.54	0.59	0.76	1.04
7	383621	390943	0.55	0.59	0.76	1.05
8	383516	390964	0.88	0.92	1.07	1.39
9	383537	390964	0.78	0.82	0.98	1.29
10	383558	390964	0.69	0.73	0.89	1.20
11	383579	390964	0.69	0.74	0.90	1.21
12	383600	390964	0.64	0.68	0.86	1.16

Label	Easting	Northing	1% AEP (+30%)	1% AEP (+35%)	1% AEP (+70%)	0.1% AEP (+30%)
			Depth	Depth	Depth	Depth
13	383621	390964	0.51	0.56	0.73	1.03
14	383495	390985	2.82	2.86	3.01	3.33
15	383516	390985	0.87	0.90	1.05	1.37
16	383537	390985	0.80	0.84	0.99	1.31
17	383558	390985	0.77	0.81	0.96	1.28
18	383579	390985	0.89	0.94	1.09	1.41
19	383600	390985	0.69	0.73	0.89	1.21
20	383621	390985	0.57	0.61	0.78	1.10
21	383516	391006	1.84	1.88	2.03	2.34
22	383537	391006	1.00	1.03	1.19	1.50
23	383558	391006	1.14	1.18	1.33	1.65
24	383579	391006	1.31	1.35	1.50	1.82

Label	Easting	Northing	1% AEP (+30%)	1% AEP (+35%)	1% AEP (+70%)	0.1% AEP (+30%)
			Depth	Depth	Depth	Depth
25	383516	391027	2.23	2.27	2.42	2.73
26	383537	391027	1.65	1.68	1.83	2.15
27	383558	391027	2.82	2.86	3.02	3.33
Max value in selected area:			2.26	2.30	2.45	2.77

Data in this table comes from the Upper Mersey 2017 model. Height values are shown in mAOD, and depth values are shown in metres.
Any blank cells show where a particular scenario has not been modelled for this location.
Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.
'Max value in selected area' is the deepest depth or highest height at any location within your drawn boundary.



Environment Agency

'HIHQFHV UHPRY
FOLPDWH FKDQJ
PRGHOOHG IOXY
H[WHQW DQG KH
/RFDWLRQ HDVWLQ

6FDOH &UHDWHG
-DQ

0RGHO QDPH
8SSHU 0HUVH\

6HOHFWHG DU

0DLQ ULYHU

0RGHOOHG ' JULG
:DWHU OHYHO LQ F

7KLV PDS VKRZV WKH
$(3 KHLJKW GD

(QYLURQPHQW $JHQF\ FRS\ULJKW DQG RU GDWDEDVH ULJKWV
$OO ULJKWV UHVHUYHG ‹ FURZQ FRS\ULJKW

PHWUHV

Sample point data

Defences removed climate change

Label	Easting	Northing	1% AEP (+30%)	1% AEP (+35%)	1% AEP (+70%)	0.1% AEP (+30%)
			Height	Height	Height	Height
1	383579	390922	29.82	29.85	30.00	30.24
2	383600	390922	29.83	29.86	30.01	30.25
3	383537	390943	29.55	29.57	29.66	29.96
4	383558	390943	29.62	29.65	29.77	30.05
5	383579	390943	29.76	29.79	29.94	30.20
6	383600	390943	29.79	29.82	29.97	30.22
7	383621	390943	29.77	29.80	29.95	30.21
8	383516	390964	29.12	29.14	29.37	29.92
9	383537	390964	29.37	29.40	29.53	29.94
10	383558	390964	29.43	29.46	29.59	29.97
11	383579	390964	29.50	29.53	29.67	30.02
12	383600	390964	29.67	29.70	29.86	30.15

Label	Easting	Northing	1% AEP (+30%)	1% AEP (+35%)	1% AEP (+70%)	0.1% AEP (+30%)
			Height	Height	Height	Height
13	383621	390964	29.67	29.70	29.86	30.15
14	383495	390985	28.71	28.82	29.33	29.90
15	383516	390985	29.06	29.08	29.36	29.91
16	383537	390985	29.27	29.29	29.46	29.94
17	383558	390985	29.32	29.34	29.52	29.96
18	383579	390985	29.38	29.41	29.58	29.98
19	383600	390985	29.46	29.50	29.66	30.02
20	383621	390985	29.55	29.58	29.76	30.09
21	383516	391006	28.70	28.80	29.32	29.90
22	383537	391006	28.98	29.03	29.40	29.93
23	383558	391006	29.04	29.08	29.43	29.94
24	383579	391006	29.16	29.22	29.48	29.96

Label	Easting	Northing	1% AEP (+30%)	1% AEP (+35%)	1% AEP (+70%)	0.1% AEP (+30%)
			Height	Height	Height	Height
25	383516	391027	28.70	28.80	29.32	29.90
26	383537	391027	28.88	28.95	29.37	29.92
27	383558	391027	29.03	29.08	29.43	29.95
Max value in selected area:			29.82	29.84	30.00	30.24

Data in this table comes from the Upper Mersey 2017 model. Height values are shown in mAOD, and depth values are shown in metres.
Any blank cells show where a particular scenario has not been modelled for this location.
Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.
'Max value in selected area' is the deepest depth or highest height at any location within your drawn boundary.

Defences removed climate change

Label	Easting	Northing	1% AEP (+30%)	1% AEP (+35%)	1% AEP (+70%)	0.1% AEP (+30%)
			Depth	Depth	Depth	Depth
1	383579	390922	0.58	0.61	0.75	0.99
2	383600	390922	0.62	0.65	0.80	1.04
3	383537	390943	0.19	0.21	0.30	0.61
4	383558	390943	0.30	0.32	0.45	0.73
5	383579	390943	0.56	0.59	0.74	1.00
6	383600	390943	0.52	0.55	0.70	0.95
7	383621	390943	0.52	0.55	0.70	0.96
8	383516	390964	0.29	0.31	0.54	1.09
9	383537	390964	0.45	0.47	0.60	1.02
10	383558	390964	0.41	0.44	0.57	0.95
11	383579	390964	0.47	0.50	0.65	0.99
12	383600	390964	0.55	0.58	0.74	1.03

Label	Easting	Northing	1% AEP (+30%)	1% AEP (+35%)	1% AEP (+70%)	0.1% AEP (+30%)
			Depth	Depth	Depth	Depth
13	383621	390964	0.43	0.46	0.62	0.91
14	383495	390985	1.83	1.93	2.45	3.02
15	383516	390985	0.22	0.25	0.52	1.07
16	383537	390985	0.36	0.39	0.56	1.04
17	383558	390985	0.38	0.40	0.58	1.02
18	383579	390985	0.56	0.59	0.76	1.16
19	383600	390985	0.44	0.47	0.63	1.00
20	383621	390985	0.40	0.43	0.61	0.94
21	383516	391006	0.84	0.94	1.46	2.03
22	383537	391006	0.27	0.32	0.69	1.22
23	383558	391006	0.47	0.52	0.87	1.38
24	383579	391006	0.76	0.82	1.08	1.56

Label	Easting	Northing	1% AEP (+30%)	1% AEP (+35%)	1% AEP (+70%)	0.1% AEP (+30%)
			Depth	Depth	Depth	Depth
25	383516	391027	1.23	1.33	1.85	2.42
26	383537	391027	0.82	0.89	1.32	1.86
27	383558	391027	2.15	2.20	2.55	3.06
Max value in selected area:			1.55	1.60	1.97	2.49

Data in this table comes from the Upper Mersey 2017 model. Height values are shown in mAOD, and depth values are shown in metres.
Any blank cells show where a particular scenario has not been modelled for this location.
Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.
'Max value in selected area' is the deepest depth or highest height at any location within your drawn boundary.

Strategic flood risk assessments

We recommend that you check the relevant local authority's strategic flood risk assessment (SFRA) as part of your work to prepare a site specific flood risk assessment.

This should give you information about:

- the potential impacts of climate change in this catchment
- areas defined as functional floodplain
- flooding from other sources, such as surface water, ground water and reservoirs

Your Lead Local Flood Authority is Manchester District.

About this data

This data has been generated by strategic scale flood models and is not intended for use at the individual property scale. If you're intending to use this data as part of a flood risk assessment, please include an appropriate modelling tolerance as part of your assessment. The Environment Agency regularly updates its modelling. We recommend that you check the data provided is the most recent, before submitting your flood risk assessment.

Flood risk activity permits

Under the Environmental Permitting (England and Wales) Regulations 2016 some developments may require an environmental permit for flood risk activities from the Environment Agency. This includes any permanent or temporary works that are in, over, under, or nearby a designated main river or flood defence structure.

Find out more about flood risk activity permits

Help and advice

Contact the Greater Manchester Merseyside and Cheshire Environment Agency team at inforequests.gmmc@environment-agency.gov.uk for:

- more information about getting a product 5, 6, 7 or 8
- general help and advice about the site you're requesting data for

Flood map for planning

Your reference	Location (easting/northing)	Created
232-236 Palatine Road	**383562/390975**	**19 May 2026 13:42**

Your selected location is in flood zone 3, an area with a high probability of flooding.

This means:

- you must complete a flood risk assessment for development in this area
- you should follow the Environment Agency's standing advice for carrying out a flood risk assessment (see https://www.gov.uk/guidance/flood-risk-assessment-standing-advice)

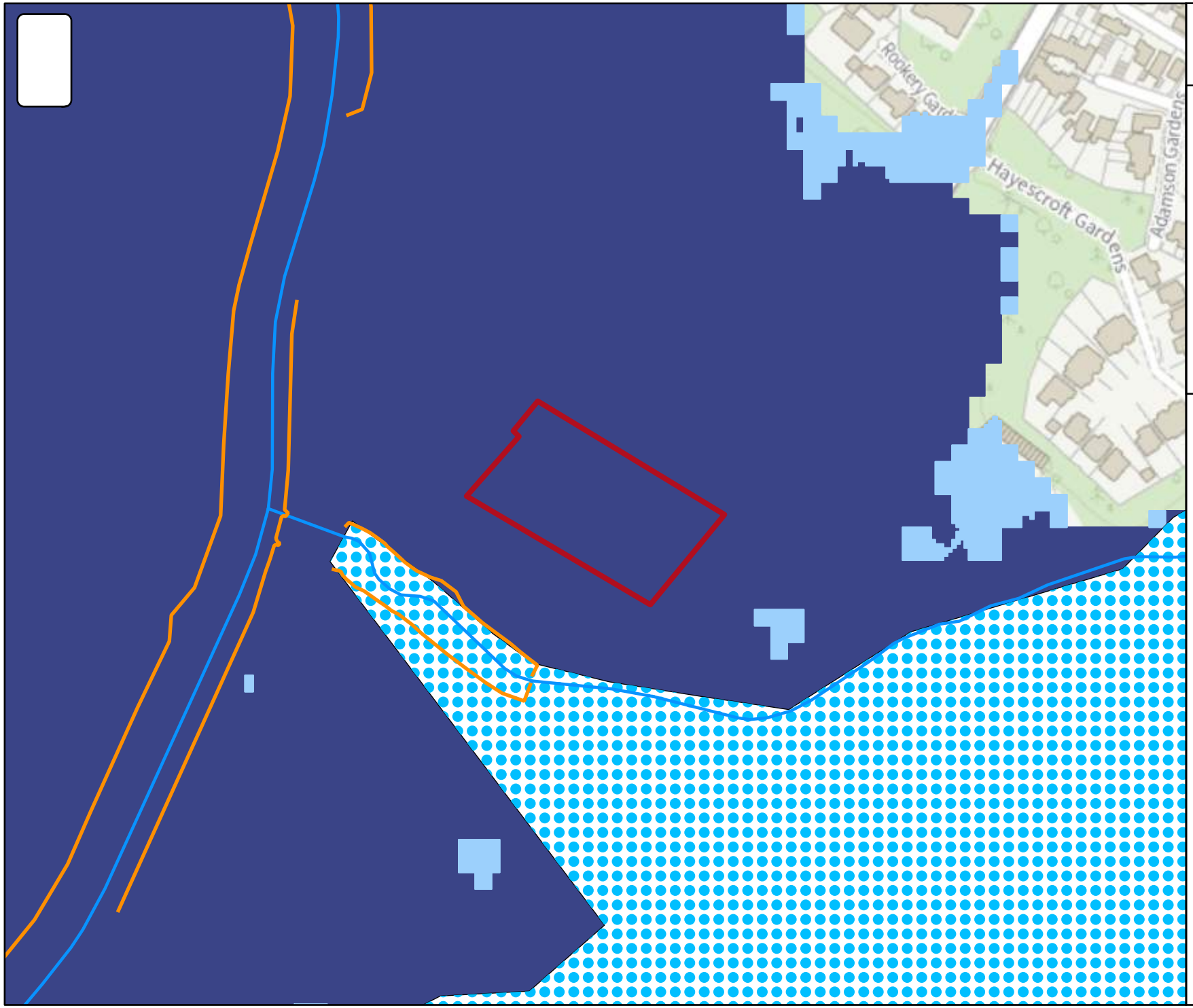
Notes

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

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

Flood risk data is covered by the Open Government Licence which sets out the terms and conditions for using government data. https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2026 AC0000807064. https://flood-map-for-planning.service.gov.uk/os-terms



Environment Agency

)ORRG PDS IRU S

<RXU UHIHUHQFH
3DODWLQH 5

/RFDWLRQ HDVWL

6FDOH

&UHDWHG
0D\

6HOHFWHG DUH
)ORRG]RQH
)ORRG]RQH
)ORRG]RQH
)ORRG GHIHQFH
0DLQ ULYHU
:DWHU VWRUDJ

P

3DJH RI

‹ (QYLURQPHQW $JHQF\ FRS\ULJKW DQG RU GDWDEDVH ULJKWV $OO ULJKWV UHVHUYHG ‹ &URZQ FRS\ULJKW DQG GDWDEDVH ULJKW

Upper Mersey Model Update

Final Report v1.0

October 2018

www.jbaconsulting.com

Environment Agency
Richard Fairclough House
Knutsford Road
WARRINGTON
Cheshire
WA4 1HT

Kevin Frodsham

JBA Consulting
Bank Quay House
Sankey Street
Warrington
Cheshire
WA1 1NN

Revision history

Revision Ref/Date	Amendments	Issued to
Draft v1.0 17/04/2018	Draft Report	Peter Hewitt, Environment Agency
Draft v2.0 21/09/2018	Addition of Section 8 (Flood Warning). Minor updates to text in response to comments received on Draft v1.0 and the hydraulic model review. Clarification of ABD's in Section 6.3.3 as areas >0.5km^2. Addition of labels showing location of blocked structure to Figures 7-1 to 7-12.	Peter Hewitt, Environment Agency
Final v1.0 26/10/2018	Update of thresholds on page 82 in response to Environment Agency comments on FW	Peter Hewitt, Environment Agency

Contract

This report describes work commissioned by the Environment Agency as part of the Modelling 4 Package 2016/2017 awarded on the 10th of November 2016. The Package Manager for the Environment Agency was Cath Sanders and the JBA consulting Package Manager is Gary Deakin. The Environment Agency's representation for the project was Peter Hewitt. Jack Pordham, Jonathan Porteous and Kevin Frodsham of JBA Consulting carried out this work.

Prepared by ..... Kevin Frodsham BSc BA MSc PhD

Senior Analyst

Reviewed by ..... Gary Deakin BSc CEng MICE

Technical Director

Purpose

This document has been prepared as a Final Report for the Environment Agency. JBA Consulting accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

JBA Consulting has no liability regarding the use of this report except to the Environment Agency.

Acknowledgements

JBA Consulting would like to thank the staff at the Environment Agency for their input and provision of data for the project including Peter Hewitt and Louise Cramp.

Copyright

© Jeremy Benn Associates Limited 2018.

Carbon footprint

A printed copy of the main text in this document will result in a carbon footprint of 58g if 100% post-consumer recycled paper is used and 73g if primary-source paper is used. These figures assume the report is printed in black and white on A4 paper and in duplex.

JBA is aiming to reduce its per capita carbon emissions.

Executive summary

JBA Consulting was commissioned by the Environment Agency in 2016 to deliver an updated hydraulic model and associated flood mapping deliverables for the Upper Mersey, under Lot 1 of the Water and Environmental Management (WEM) Framework. The Upper Mersey model contains the full length of the Upper Mersey from Stockport to the Manchester Ship Canal plus the downstream reaches of several tributaries. This reach of the Upper Mersey also contains the Didsbury and Sale Ees automated Flood Storage Areas (FSAs).

Prior to this study, the existing Flood Zones (FZs) were based on the projection of flood outlines from the Environment Agency's (2012) 1D only Upper Mersey model and the main purpose of the current commission was to convert the existing 1D model into a 1D-2D hydraulic model to allow for a better understanding of floodplain mechanisms and address some perceived deficiencies in the existing Flood Zones.

This study considers only the fluvial risk from the Upper Mersey and tributaries. The source of the risk is, therefore, heavy rainfall across the Upper Mersey catchment. The main pathways examined are overtopping of the existing defences or potential defence failure, perhaps exacerbated by blockage. The main receptors are several communities in Stockport and South Manchester that typically lie around the periphery of the Upper Mersey floodplain and some isolated properties combined with agricultural ground and recreational facilities that occupy the main floodplain.

The hydraulic model was updated as follows;

- No new hydrology calculations were undertaken, other than obtaining inflows for previously unmodeled events, so the design levels and outlines are based on an underlying hydrology from 2012.
- The Environment Agency considered the 1D component of the Upper Mersey (2012) model to be fit for purpose so updates to the 1D component of the model were limited to;
    - Removing 1D floodplain representation.
    - Undertaking a node relabelling exercise to ensure that the Upper Mersey 1D nodes were consistent with current flood mapping specification.
    - A small number of additional tasks to facilitate the linkage of the 1D model to 2D.
- Creating a new 2D (TUFLOW) model of the entire Upper Mersey floodplain (including modelled tributaries) with a cell size of 8 metres. The topography of the 2D model grid was based on 1m LIDAR DTM tiles that had been flown in March 2016.
- A defended model scenario was created, which modelled the extensive Upper Mersey flood defences (embankments and walls) at crest level based on a combination of the 2016 LIDAR DTM and bank crest survey from 2008 and 2017.
- An undefended scenario was created by removing the Upper Mersey defences to appropriate bank levels and, in keeping with the previous (2012) undefended mapping approach, the inlets and outfalls to the Didsbury and Sale Ees FSAs were kept closed for the duration of each event.
- A blockage analysis was undertaken of six structures with 25%, 50% and 75% blockage proportions for 1% AEP (present-day) and 1% AEP + 30% (climate change) events.

The design inflows were run through the updated model scenarios with the following main outcomes;

- The model predictions were found to evaluate reasonably against recent events depicted in the historic flood map, in that most localities that have experienced

recent flooding are modelled to flood at moderate return periods (i.e. up to 2% AEP).

- The 1% AEP flood outline and river levels were modelled to be insensitive to the choice of downstream boundary applied at the Manchester Ship Canal.
- The defended (existing risk) outlines and levels are broadly similar to the previous (2012) model results. However, the benefits of the 2D floodplain representation are demonstrated by the modelling of a small number of new urban flow routes that represent an increased risk relative to previous modelling. These include;
  - A 1% AEP flow route that originates upstream of the existing defences and flows along Ford lane and Mill Lane in Northenden
  - A 0.1% AEP flow route that by-passes the Warren Street culvert in Stockport and places the Town Centre at risk.
  - A 0.1% AEP flow that originates upstream of Kingsway and flows beneath the railway line to potentially place a large area of East Didsbury at flood risk.
- The undefended outlines and levels are also improved by the 2D modelling of the floodplains but are broadly similar to the previous (2012) model results.
- The undefended flood outlines are generally larger than the defended flood outlines but there are some areas where they are locally smaller because of the removal of all the Upper Mersey defences in one undefended scenario. The updated Flood Zones will, therefore, need to be a combination of defended and undefended flood outlines.
- The extensive raised defences alongside the Upper Mersey lead to a large number of potential Areas Benefitting from Defences, many of which are small and/or very irregular in shape. It is, therefore, recommended that a size limit is used to define a formal set of ABDs. This report recommends that only ABDs larger than 0.5km^2 are retained in the Flood Maps.
- Climate change, evaluated using the UKCP09 guidance, is modelled to increase the 1% AEP risk and 0.1% AEP risk. Climate change factors of +30% and +35% are modelled to place additional properties in Stockport, East Didsbury, Northenden and Barlow Moor at 1% AEP risk. A +70% climate change factor would cause the future 1% AEP risk to be similar to the present-day 0.1% AEP risk.
- The blockage scenarios are modelled to increase river levels on the upstream side of structures and, in some cases, increase the number of properties at risk. In general, the high (75%) blockage proportion increases the risk much more significantly than the low (25%) and medium (50%) blockage proportions but it should be noted that the probability of large blockage proportions along the Upper Mersey will be low.

In relation to Flood Warning, it is recommended that the two existing Flood Alert Areas are updated to reflect the extreme flood outlines generated during this study. It is also recommended to update the ten existing Flood Warning Areas and associated RES FW thresholds. An eleventh Flood Waring Area is proposed for Northenden due to the modelled flow route behind the existing defences along Ford Lane.

Contents

1	Introduction	1
1.1	Background	1
1.2	The Upper Mersey study area	1
1.3	Assets	5
1.3.1	Hydraulic Structures	5
1.3.2	Hydrometric Gauges	6
1.3.3	Flood Defence Assets	6
1.4	Flood History	11
1.5	Previous Studies	11
1.5.1	Upper Mersey and Micker Brook Flood Risk Mapping Study (Halcrow, 2008)	11
1.5.2	Upper Mersey Model Review and Update – (Hyder Consulting, 2012)	11
1.6	Project Brief	12
1.7	Deliverables	12
1.8	About this report	12
2	Flood Response	13
2.1	Sources	13
2.2	Pathways	13
2.3	Receptors	13
3	Model Approach and Justification	14
3.1	Approach Requirements	14
3.2	Hydrological Modelling	14
3.3	Hydraulic Modelling	14
4	Input Data	16
4.1	Existing Hydraulic Model(s)	16
4.2	Cartographic Data	16
4.3	GIS Data	16
4.4	Topographic Data	16
4.4.1	LIDAR	16
4.4.2	Survey	16
4.5	Hydrometric Data	17
4.6	Calibration/Verification Data	18
4.7	Site Visit	18
5	Technical Method and Implementation	20
5.1	Hydrological Modelling	20
5.1.1	Model Inflows	20
5.1.2	Downstream Boundary	21
5.2	Hydraulic Modelling	24
5.2.1	1D Domain	24
5.2.2	2D Domain	25
5.2.3	Hydraulic Boundaries	26
5.3	Climate Change	26
5.4	Blockage Runs	27
5.5	Model Proving	27
5.5.1	Calibration and Verification	27
5.5.2	Sensitivity Testing	31
5.6	Flood Mapping	32
5.7	Model Performance	33
5.7.1	1D (Flood Modeller) Stability	33
5.7.2	TUFLOW	34

6	Flood Mapping Results	36
6.1	Introduction	36
6.2	Existing Risk (Defended), Present Day, Flood Mapping Results	36
6.2.1	Peak River Levels	36
6.2.2	Modelled Flood Outlines	38
6.2.3	Flood Hazard	41
6.3	Undefended, Present Day, Flood Mapping Results	41
6.3.1	Flood Outlines	41
6.3.2	Comparison with existing Flood Zones	46
6.3.3	Areas Benefiting from Defences	51
6.4	Climate Change	51
7	Blockage	56
7.1	Approach	56
7.2	A560, Stockport Bridge	56
7.3	Warren Street Culvert	59
7.4	Brinksway Bridge	59
7.5	Princess Parkway Bridge	64
7.6	Crossford Bridge	64
7.7	Flixton Bridge	64
8	Flood Warning	71
8.1	Overview	71
8.2	Flood Alert Areas	71
8.3	Flood Warning Areas (FWAs)	74
8.3.1	Existing Flood Warning Areas	74
8.3.2	Proposed FWA Updates	74
8.3.3	Proposed new Northenden FWA	77
8.4	Developing Flood Warning Thresholds	81
9	Assumptions and Limitations	83
10	Conclusions and Recommendations	85
10.1	Conclusions	85
10.2	Recommendations	86

List of Figures

Figure 1-1; The Upper Mersey study area. 2
Figure 1-2: Photographs of the Upper Mersey study reach 4
Figure 1-3; Location of formal flood defences 7
Figure 1-4; Example raised defences along the Upper Mersey. 9
Figure 1-5; Didsbury and Sale Ees FSA Inlet and Outlet Structures. 10
Figure 4-1; Available Upper Mersey bank crest survey. 19
Figure 5-1: Upper Mersey Model Schematic 22
Figure 5-2; Comparative flow (m^3/s) through FSA inlet Sluices 28
Figure 5-3; Historic flood outlines in the Didsbury and Northenden areas 30
Figure 5-5: TUFLOW cumulative 2D Mass Balance Error plots 35
Figure 5-6: TUFLOW 2D dVol plots 35
Figure 6-1; Modelled, peak 1% and 0.1% AEP, defended, river levels 37
Figure 6-2; Selected present-day, defended, flood outlines 39
Figure 6-3; Present-day, defended, 1% AEP, peak flood depth map 42
Figure 6-4; Selected present-day, undefended, flood outlines 44
Figure 6-5; Comparison of modelled 1% AEP flood outlines with existing Flood Zone 3 47
Figure 6-6; Comparison of modelled 0.1% AEP flood outlines with existing Flood Zone 2 49
Figure 6-7; Areas Benefiting from Defences 52
Figure 6-8; Future (with climate change), defended, flood outlines 54
Figure 7-1: 1% AEP event blockage scenarios at the A560 (Stockport Bridge) 57
Figure 7-2; 1% AEP +30% CC event blockage scenarios at A560 (Stockport Bridge) 58
Figure 7-3; 1% AEP event blockage at the Warren Street Culvert 60
Figure 7-4; 1% AEP plus 30% CC event blockage at the Warren Street Culvert 61
Figure 7-5; 1% AEP event blockage at Brinksway Bridge 62
Figure 7-6; 1% AEP plus 30% CC event blockage at Brinksway Bridge 63
Figure 7-7; 1% AEP event blockage at Princess Parkway Bridge 65
Figure 7-8; 1% AEP plus 30% CC event blockage at Princess Parkway Bridge 66
Figure 7-9; 1% AEP event blockage at Crossford Bridge 67
Figure 7-10; 1% AEP plus 30% CC event blockage at Crossford Bridge 68
Figure 7-11; 1% AEP event blockage at Flixton Bridge 69
Figure 7-12; 1% AEP plus 30% CC event blockage at Flixton Bridge 70
Figure 8-1; Comparison of existing and proposed Flood Alert areas (Stockport to West Didsbury) 72
Figure 8-2; Comparison of existing and proposed Flood Alert areas (West Didsbury to Carrington) 73
Figure 8-3; Existing FWAs alongside the Upper Mersey between Stockport and West Didsbury 75
Figure 8-4; Existing FWAs alongside the Upper Mersey between West Didsbury and Flixton.76
Figure 8-5; Proposed revised FWAs alongside the Upper Mersey between Stockport and West Didsbury 78
Figure 8-6; Proposed revised FWAs alongside the Upper Mersey between West Didsbury and Carrington 79
Figure 8-7; FWFRAs identified in Northenden 80
Figure 8-8; Proposed new FWA in Northenden 81

List of Tables

Table 5-1; Peak flows from the Upper Mersey (2012) flood mapping study 20
Table 5-2; Modelled inflows for missing return periods 21
Table 5-3: Climate Change Scenarios 27
Table 5-4: Blockage scenarios 27
Table 5-5; Gauged ranking and flow magnitude for historic flood events 31
Table 6-1: Modelled design river levels (m AOD) at specified locations 36
Table 8-1; List of existing thresholds and Flood Warning Areas 77
Table 8-2; Summary of the FWFRAs at Northenden 80
Table 8-3; Summary of the proposed new FWA in Northenden 81
Table 8-4; Summary of the new thresholds for the Upper Mersey FWAs 82
Table 8-5; The First Property to Flood for each FWA 82

Abbreviations

1D	One Dimensional (modelling)
2D	Two Dimensional (modelling)
AEP	Annual Exceedance Probability
ASCII	American standard character set for information interchange
dVol	Change in volume in the TUFLOW model since the previous time (m3)
FEH	Flood Estimation Handbook
Flood Modeller (FM)	Hydrology and hydraulic modelling software
FSA	Flood Storage Area
FWA	Flood Warning Area
FWFRA	Flood Warning Flood Risk Area
FZ	Flood Zones
GIS	Geographical Information System
ISIS	Hydrology and hydraulic modelling software
MSC	Manchester Ship Canal
NFCDD	National Flood and Coastal Defence Database
NGR	National Grid Reference
OS	Ordnance Survey
QMED	Median Annual Flood (with return period 2 years)
TUFLOW	Two-dimensional Unsteady FLOW (a hydraulic model)
WEM	Water and Environmental Management
WwTW	Wastewater Treatment Works

1 Introduction

1.1 Background

JBA Consulting was commissioned by the Environment Agency in 2016 to deliver an updated hydraulic model and associated flood mapping deliverables for the Upper Mersey, under Lot 1 of the Water and Environmental Management (WEM) Framework. The Upper Mersey model extends the full length of the Upper Mersey from Stockport to the Manchester Ship Canal (MSC). It also includes the downstream reaches of a number of tributaries that drain into the Upper Mersey; the River Goyt, River Tame, Chorlton Platt Gore and Old Eea Brook, in addition to an overflow channel of the Mersey in the Stretford area.

Prior to this study, the existing Flood Zones (FZs) were based on the projection of flood outlines from the Environment Agency's most recent (2012) 1D only Upper Mersey model and the main purpose of the current commission was to convert the existing 1D model into a 1D-2D hydraulic model to provide a better understanding of floodplain mechanisms across the study area and enable the generation of higher definition flood mapping products. The update was also anticipated to address some perceived deficiencies in the existing Flood Zones.

The hydrology and 1D components of the previous Upper Mersey (2012) model were considered fit for purpose by the Environment Agency so the Upper Mersey (2018) Update study did not require any detailed review or update of the existing components of the 1D model, with the exception of a node re-labelling exercise that was requested during the course of the study. The focus of the study was to update the floodplain representation from 1D to 2D at a suitable definition to correct any perceived inaccuracies in the current Flood Zones. The study is restricted to the fluvial flood risk from the Upper Mersey and previously modelled tributaries and the direct fluvial risk from other watercourses has not been studied, nor has the risk from other sources. The key flood pathways being considered are, therefore, restricted to direct overtopping from the modelled watercourses and the spread of floodwater across the floodplain.

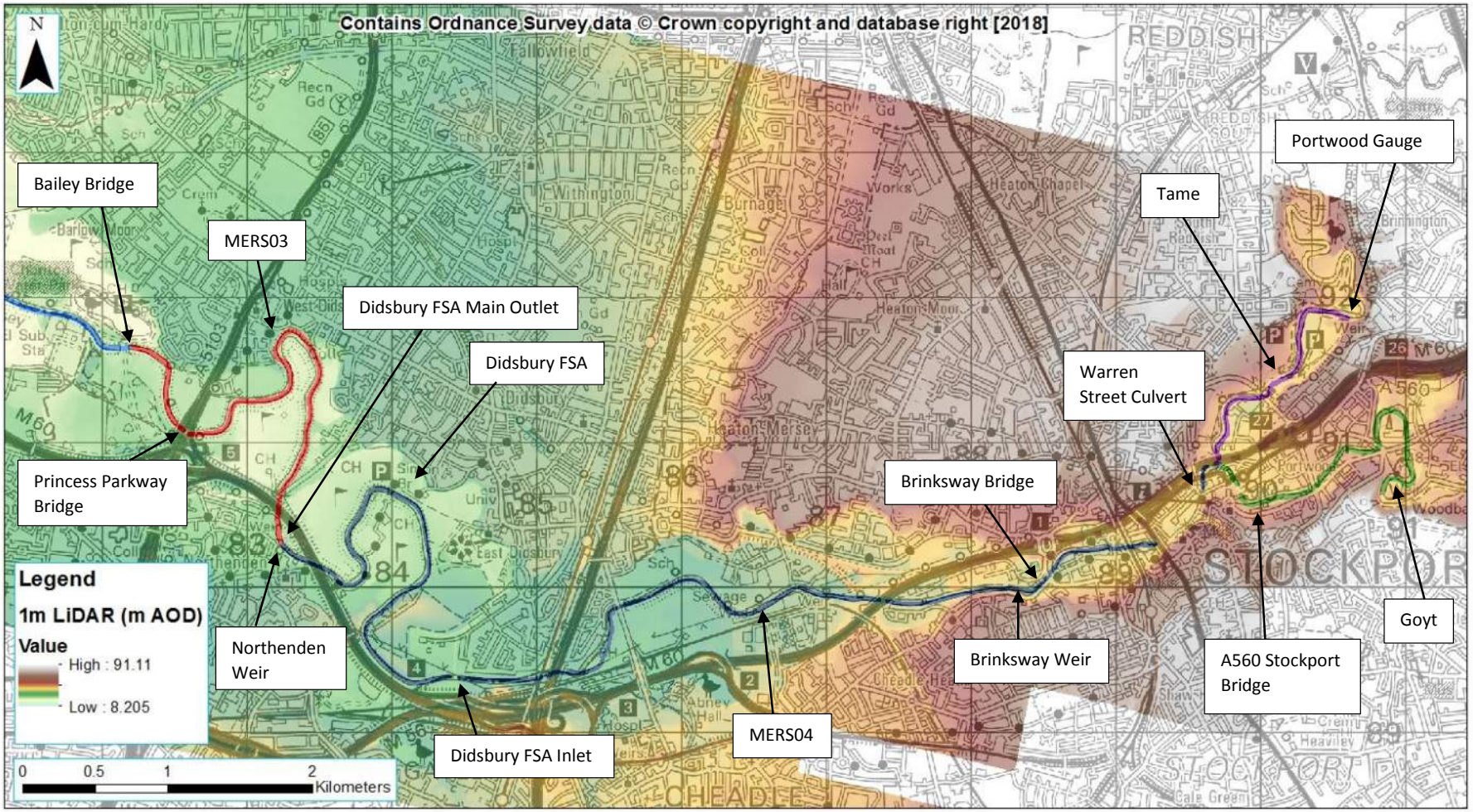
1.2 The Upper Mersey study area

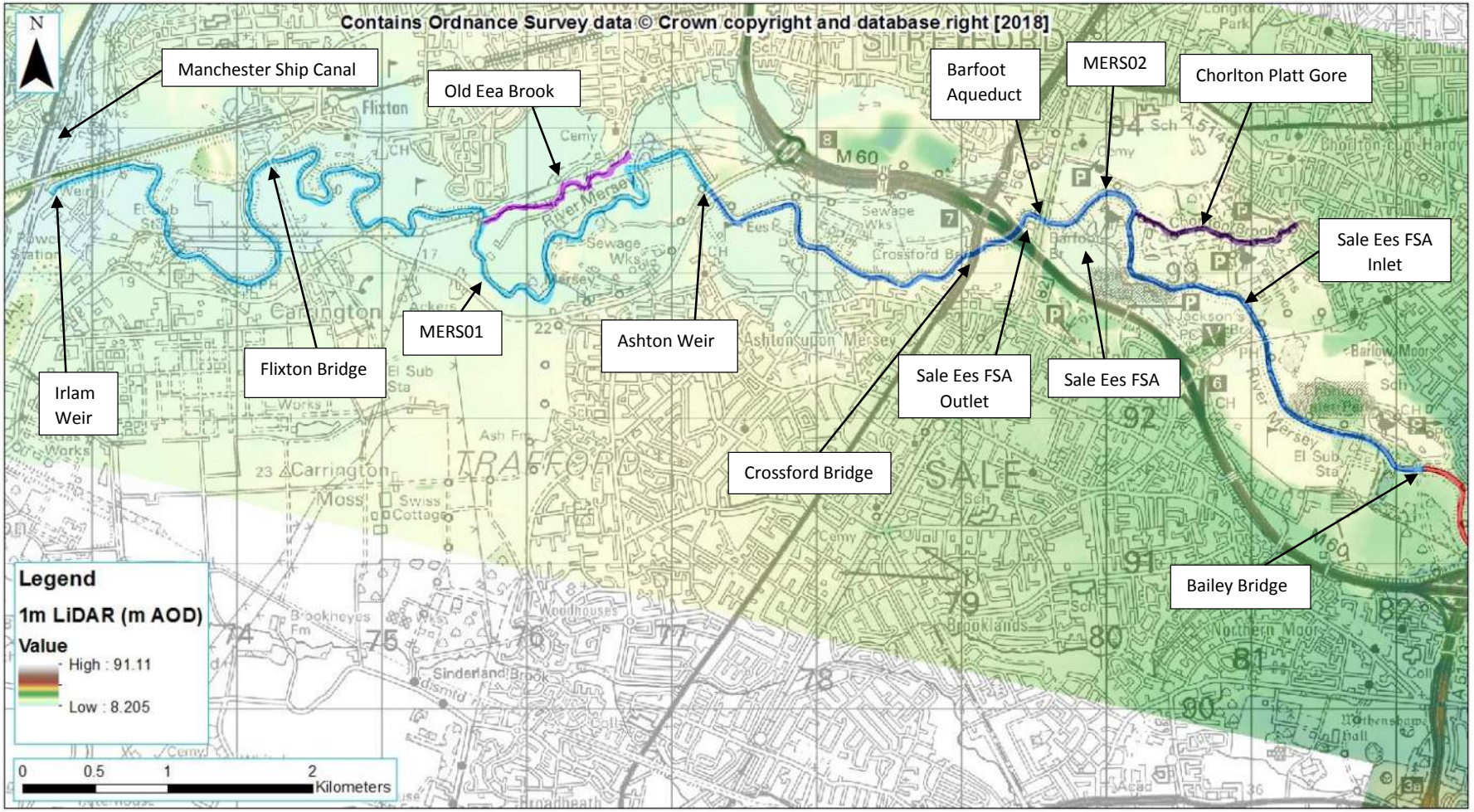
The 1D Upper Mersey model (Figure 1-1) extends from Portwood Weir (NGR 390590, 391860) on the River Tame and Stringers weir (NGR 390830, 390460) on the River Goyt downstream to the confluence of the River Mersey with the Manchester Ship Canal (NGR 372660, 393520), close to Irlam locks.

The Upper Mersey generally flows from east to west and drops from a bed level of around 34.5m AOD at the confluence of the Rivers Tame and Goyt to around 6.3m AOD at the confluence with the Manchester Ship Canal, an average fall of less than 1 in 1,000 over its 30-kilometre length. Near its upstream extent in Stockport, the Upper Mersey floodplain is narrow. However, for much of its length downstream of Didsbury the river is accompanied by a wide expanse of floodplain. Much of this floodplain is rural (either undeveloped, agricultural or recreational) but, due to the large size of the study area and proximity to the large urban hub of Manchester, there are a large number of properties potentially at flood risk; the main at-risk communities being Stockport, Didsbury, Northenden, Stretford, Ashton and Flixton.

An extensive system of raised flood defences (primarily earth embankments but also some walls), most of which are owned and maintained by the Environment Agency, have been built alongside the Upper Mersey and some of its tributaries. In addition, there are automated flood storage areas (FSAs) at Didsbury and Sale Ees, where automated sluices allow floodwater to be stored more efficiently than under natural conditions.

Figure 1-1; The Upper Mersey study area.




Contains Ordnance Survey data © Crown copyright and database right [2018]
N
Manchester Ship Canal
Old Eea Brook
Barfoot Aqueduct
MERS02
Chorlton Platt Gore
Sale Ees FSA Inlet
MERS01
Ashton Weir
Flixton Bridge
Irlam Weir
Sale Ees FSA Outlet
Sale Ees FSA
Crossford Bridge
Bailey Bridge
Legend
1m LiDAR (m AOD)
Value
High : 91.11
Low : 8.205
0 0.5 1 2
Kilometers

The Environment Agency operates these two FSAs to maximise reductions in peak flood level downstream.

The Upper Mersey model includes approximately:

- 30.0km of the Upper Mersey from the Tame and Goyt confluence at NGR 389677 390843 to Irlam Weir (NGR 372717, 393545) adjacent to the Manchester Ship Canal;
- 1.6km of the River Tame from Tiviot Dale (NGR 390591, 391855) to the start of the Upper Mersey (NGR 389677 390843);
- 2.7km of the River Goyt from NGR 390845, 390671, upstream of New Bridge Lane to the start of the Upper Mersey (NGR 389677 390843);
- 1.2km of Chorlton Platt Gore from Brookburn Road (NGR 381310, 393340) to the Upper Mersey confluence at NGR 380183 393427;
- 2.2km of an overflow channel that runs from Hawthorn Road (at NGR 380000 393550) to NGR 377840, 393,469 near New Croft Farm.
- 1.3km of Old Eea Brook from NGR 376693 393828 to the Upper Mersey confluence at NGR 375698 393359.

Some photographs illustrating the nature of the channel along the Upper Mersey study reach are shown in Figure 1-2.

Figure 1-2: Photographs of the Upper Mersey study reach



The existing Flood Zones (prior to this study) were based on the Environment Agency's 1D only, Upper Mersey (2012) model. These showed that while only limited urban areas would likely be at risk from a 1% AEP event, significant urban extents could be at risk from a 0.1% AEP event. The updated model results are compared with the existing Flood Zones in Section 6.

1.3 Assets

1.3.1 Hydraulic Structures

There are a large number of hydraulic structures within the Upper Mersey study area. However, since the scope of this study was limited to updating the floodplain representation along the study reach, no work was undertaken in relation to modifying the representation of structures along these reaches other than changes that were necessary to facilitate linkage to 2D.

A list of the hydraulic structures included in the model is provided in Appendix B (Model User Guide) but no detailed explanation is provided of the modelling approach adopted for each structure. Previous hydraulic modelling reports should be consulted for this information. This Section notes some of the key structures that were involved in some of the decision making during the current commission.

The current commission involved an update of the 1D model node labels so that they better matched current flood mapping specification. Part of this relabelling required the division of the Upper Mersey into separate reaches, which cannot exceed 10 kilometres in length and which conventionally begin and end at prominent structures. The four reaches of the Upper Mersey (Figure 1-1) were delineated as follows;

- MERS01 – Irlam Weir to Ashton Weir
- MERS02 – Ashton Weir to Bailey Bridge
- MERS03 – Bailey Bridge to Northenden Weir
- MERS04 - Northenden Weir to Tame/Goyt confluence.

Bridges and Culverts

Bridges and culverts have the potential to significantly affect the flood hydraulics and limit downstream flows due to their limited size and/or the potential constriction of flow. Since the Upper Mersey is relatively wide (i.e. typically at least 20 metres), most structures will likely function more like bridges than culverts; although two long culverts do occur within the upper reaches of the Upper Mersey in Stockport. In addition, the Sale Ees FSA outlet pipe is modelled as a culvert. In total there are 29 bridges and 3 culverts are included within the Upper Mersey model. These are listed in Appendix B.

The Upper Mersey Model Update commission required a blockage analysis of six structures. These were chosen based on a subjective assessment of the potential risk of blockage by considering; i) how likely each structure was to block, and ii) the potential magnitude of the consequence of any blockage. Other than the Warren Street Culvert, the chosen structures correspond to old arched bridges, which were considered to have a greater likelihood of blockage than many of the more modern, single span and/or flat-soffited bridges. The following structures (Figure 1-1) were chosen for the blockage analysis;

- Stockport Bridge (River Goyt)
- Warren Street Culvert, Stockport (Upper Mersey)
- Brinksway Bridge, Edgeley (Upper Mersey)
- Princess Parkway Bridge, Barlow Moor (Upper Mersey)

- Crossford Bridge, Sale (Upper Mersey)
- Flixton Bridge, Flixton (Upper Mersey)

Weirs

Weirs also play an important role in controlling local river levels. There are several large weirs along the study reach of the Upper Mersey and tributaries. The following weirs are used (or have been used in the past) to gauge levels and flows along the Upper Mersey.

- Brinksway (Upper Mersey, Edgeley)
- Northenden Weir (Northenden)
- Ashton Weir (Ashton upon Mersey)
- Irlam Weir (Irlam)

The Portwood Weir on the River Tame is also gauged and marks one of the upstream extents of the model. In addition to the gauged weirs, there are sizeable weirs on the River Goyt at Millgate and Howard Street in Stockport and the Upper Mersey at Heaton Mersey Bleachworks.

Several rubble weirs are also included in the hydraulic model in the reach between Barlow Moor and Ashton upon Mersey. These are located at Borrowdale Cresent (Barlow Moor), Princess Parkway Bridge (Barlow Moor), Chorlton Waterpark (Barlow Moor), Sale Ees inlet (Sale), Barfoot Aqueduct (Sale), Mosley Acre Farm (Sale), New Manor Farm (Sale), Stretford WwTW (Sale), Ashton Cricket Club (Ashton upon Mersey).

1.3.2 Hydrometric Gauges

There are several Environment Agency hydrometric gauges (flow, level and rainfall) within the Upper Mersey study area. Since neither flow estimation nor model calibration were requirements of this commission, hydrometric data was not critical to this study.

Flow gauges within the study area;

- Brinksway (Upper Mersey) velocity area station operating since 1955.
- Ashton Weir (Upper Mersey) ultrasonic flow gauge operating since 1958.
- Portwood (River Tame) rated flow gauge operating since 1943.

Flow was also recorded between 1934 and 1983 via a rating at Irlam Weir.

In addition to these flow gauges, there are river level gauges at Northenden and Flixton Bridge on the Upper Mersey and several water level sensors are also involved in the operation of the Didsbury and Sale FSAs.

Rain gauges are present but were not used in this study.

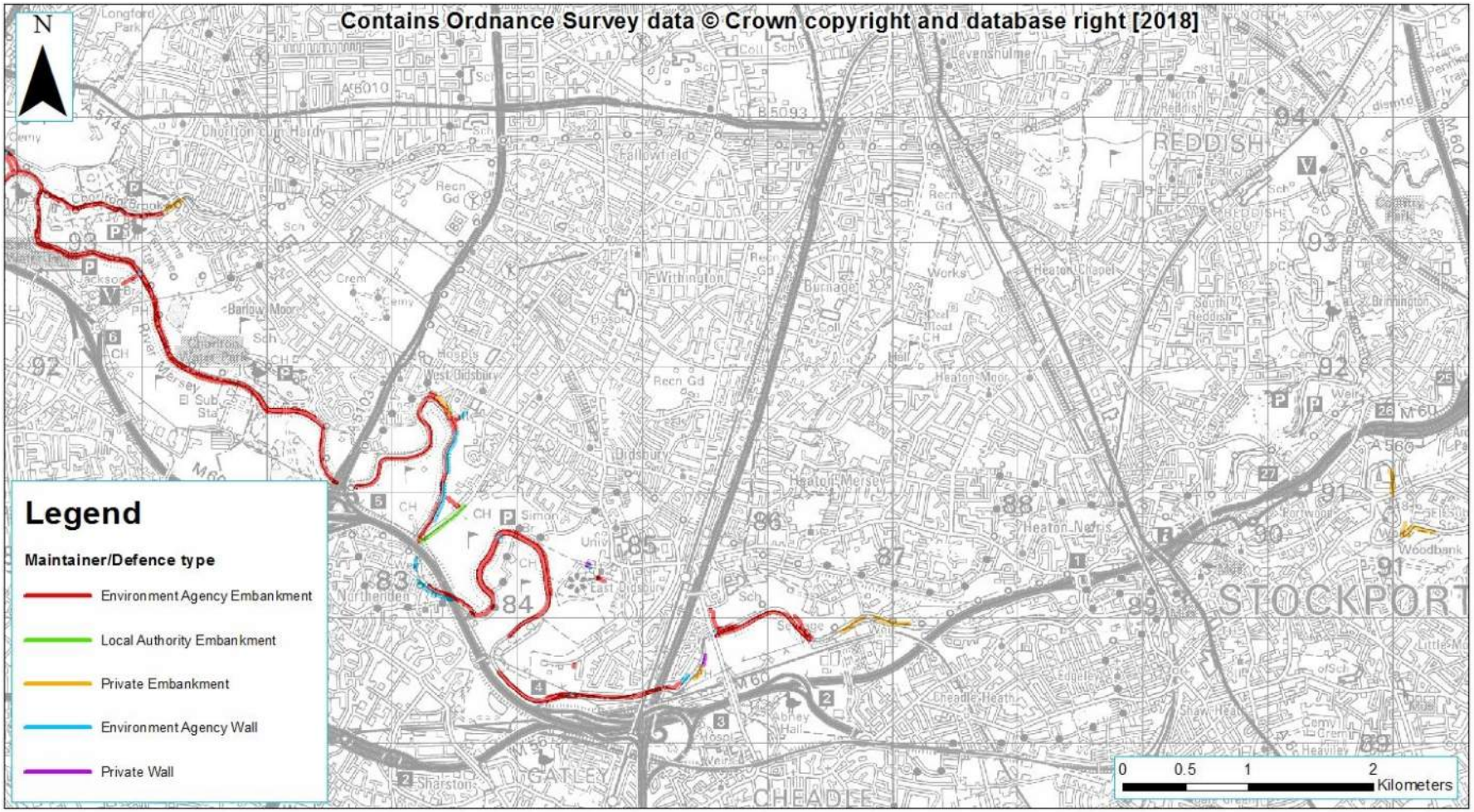
1.3.3 Flood Defence Assets

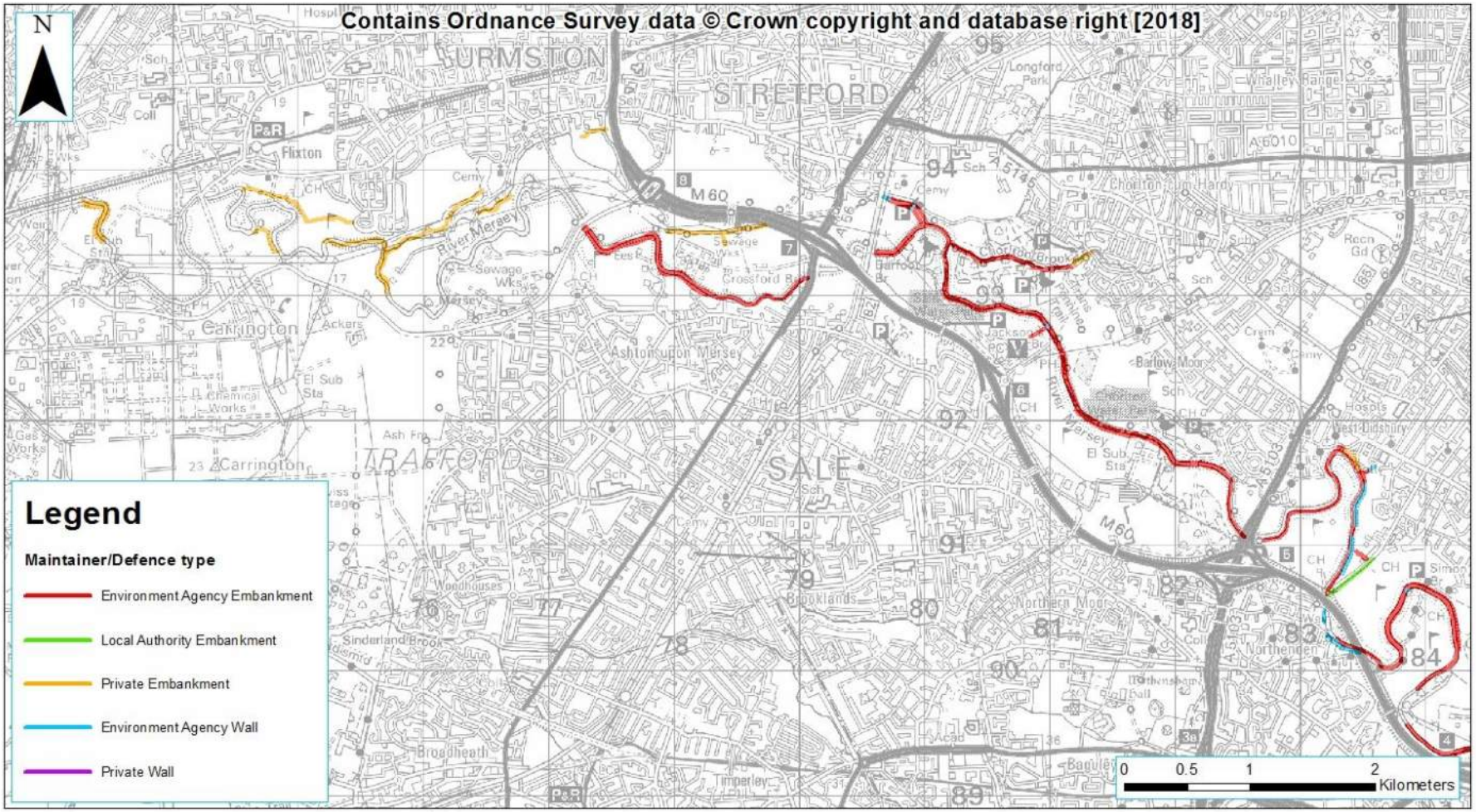
There is an extensive system of flood defence assets within the Upper Mersey study area. These are listed within the Environment Agency's assets database as follows;

- Raised flood defences (embankments and walls)
  - Formal Environment Agency owned raised defences
  - Informal, private, raised defences.
- Automated flood storage reservoirs (Didsbury and Sale Ees FSAs)

The locations of these flood defence assets are shown in Figure 1-3.

Figure 1-3; Location of formal flood defences




Contains Ordnance Survey data © Crown copyright and database right [2018]
N
Legend
Maintainer/Defence type
Environment Agency Embankment
Local Authority Embankment
Private Embankment
Environment Agency Wall
Private Wall
0 0.5 1 2
Kilometers

Raised defences.

The Upper Mersey floodplain is protected by an extensive but intermittent system of embankments and walls, which are largely Environment Agency owned, between Heaton Mersey to the confluence with the Manchester Ship Canal. Privately-owned defences occur primarily near the upstream extent of the River Goyt and in the downstream reaches of the Upper Mersey floodplain. Photographs of example defence assets are included in Figure 1-4, which shows a wall and embankment along the left bank near Northenden Weir, a typical embanked reach close to the Sale Ees inlet structure and the flood gate near Stenner Lane.

It was not possible to examine walk the full length of the Upper Mersey defences on the site visit but the defences that were viewed were generally observed to be in good condition so that raised sections were modelled to contain floodwater up to crest level in the defended model scenario. A desktop check of the listed defence assets was also undertaken when building the model to determine how best to include each asset in the defended and undefended scenarios. This revealed that not all assets shown in Figure 1-3 were significantly raised above the floodplain (e.g. there are no raised defences at the Waterside Hotel and Leisure Centre in East Didsbury) and a GIS summary table was produced that outlined the recommended approach for building the defended and undefended model scenarios. The site visit also confirmed that recent development in the Northenden area had resulted in some modification of the local defences and, in view of this, a local bank crest survey was undertaken in late 2017 to provide the most up-to-date crest levels for inclusion in the model.

Figure 1-4; Example raised defences along the Upper Mersey.



Flood Storage Areas (FSAs)

Two Flood Storage Areas (FSAs) have been commissioned along the Upper Mersey to reduce the risk to floodplain communities. The operation of both the Didsbury and Sale Ees FSAs is automated via a set of detailed control rules that open and close the inlet and outlet control structures (Figure 1-3 and Figure 1-5) according to a set of river and floodplain levels, which are monitored by sensors located both in and outside the storage areas. The operational rules of the two FSAs were already programmed into the Upper Mersey 1D (2012) model and the only modification required in the current commission was to ensure that one of the Didsbury FSA sensors, which is located within the FSA, was correctly located within the 2D model domain and appropriately linked to the 1D model. The Upper Mersey operational instructions should be consulted to obtain the details of the FSA operation.

The Didsbury and Sale Ees FSAs were both considered to be flood defences in the previous flood mapping study (Hyder 2012), in that both the inlet and outlet sluices were kept closed for duration of the undefended model runs. This approach has been retained in the current study.

Figure 1-5; Didsbury and Sale Ees FSA Inlet and Outlet Structures.



1.4 Flood History

The Upper Mersey 2009 CFMP (Catchment Flood Management Plan) noted that the Upper Mersey catchment has historically been subject to sudden periods of flooding but did not differentiate between flooding within the current study area and flooding of the upper catchment and tributaries outside the area of interest in this study. The most significant flood event, that had a widespread effect on the Upper Mersey catchment, appears to have occurred in 1965 when the River Mersey breached its banks and widespread damage was caused as well as loss of livestock, although the details of this event are lacking.

A historic flood map was made available to this study. This provides a rough outline from past events and also highlights several localities primarily in the Didsbury and Northenden areas, at which fluvial flooding has been recorded between 1964 and 2008. This historic flood map is presented in in Section 5.5.1 (Figure 5-3), where it is discussed in relation to model verification.

The Upper Mersey flood defences have been improved on many occasions since the 1965 event, including the creation of the Sale Ees and Didsbury FSAs so the flood risk will likely have changed over the period of the historic flood record in response to these and other catchment changes.

No significant flooding observed in December 2015 when many of the watercourses draining the Pennines were observed to flood.

1.5 Previous Studies

The flood risk from the Upper Mersey has been studied and documented for many years. This section lists the two most relevant, recent flood mapping studies, from which information was supplied to the current commission. These studies can be used to reference older studies.

1.5.1 Upper Mersey and Micker Brook Flood Risk Mapping Study (Halcrow, 2008)

A 1D (ISIS) model was constructed of the whole of the Upper Mersey for the Environment Agency by Halcrow in 2008. This was based on an original model of part of the Upper Mersey that dated back to the 1990s and, in the intervening period, had been the subject of various updates and configurational changes. Much of the original 1990's modelling was based on a river cross-sectional survey from February 1998 and an aerial floodplain survey from August 1991. However, the Halcrow (2008) update did manage to include a large number of new river sections from a survey that was undertaken in November 2007.

1.5.2 Upper Mersey Model Review and Update – (Hyder Consulting, 2012)

Hyder were commissioned by the Environment Agency in 2011 to review and update the Halcrow (2008) model, making use of up-to-date topographic survey to review and amend the configuration of the previous model and incorporate a revised hydrology. The hydrology and model updates are summarised in an Upper Mersey Model Review and Update (2011/2012) Final Report, March 2012, which was available to the current study.

Since the Upper Mersey Review and Update involved a significant review of the previous Upper Mersey model and its hydrology, followed by subsequent updates, the Environment Agency have considered that the 2012 hydrology and 1D channel representation were fit for purpose at the start of the present commission and no further review of these aspects was required.

1.6 Project Brief

The main aim of the Upper Mersey project was to deliver a new 1D-2D hydraulic model, which could be used to;

- Produce appropriate flood risk mapping deliverables;
- Produce appropriate Flood Alert and Flood Warning Area shapefiles;
- Provide an understanding of the risk of structure blockage along the main watercourse.

1.7 Deliverables

The project findings are presented as follows:

- This Main Report with Technical Appendices, which detail the methods, assumptions, findings and recommendations;
- The new 1D-2D hydraulic model;
- GIS grids and flood outlines;
- MapEdit compatible GIS layers.

1.8 About this report

This document forms the main report for the Upper Mersey 1D-2D modelling study, which is part of the larger Environment Agency Modelling 4 package of works.

Chapter 2 describes the flood response in the Upper Mersey study area. The hydrology and modelling approach and justification are outlined in Chapter 0 and the data that was available to the study in Chapter 4. The technical model (both hydrological and hydraulic) implementation is described in Chapter 5, which also includes a summary of model proving. The flood mapping results are detailed in Chapter 6. The results of additional model scenarios (blockage) are discussed in Section 7. The development of Flood Warning Areas is described in Chapter 8. The main assumptions made in developing the models and limitations of the final models and results are listing in Chapter 0. Conclusions and recommendations for further work are detailed in Chapter 9.1.

2 Flood Response

This chapter briefly summarises the conceptual flood risk along the modelled watercourses, using the source-pathway-receptor model. A more detailed assessment of the flood response is provided in succeeding chapters.

2.1 Sources

Flooding could potentially occur in the Upper Mersey catchment from a variety of sources; fluvial, surface water, ground water and/or surcharging of the sewer system. However, this study only assesses the fluvial risk from the modelled watercourses. The source is, therefore, limited to high rainfall in the main and tributary catchments, although there may be some minor additional contributing factors e.g. local rainfall leading to increased discharge through surface water drainage systems. The potential impact of high levels on the Manchester Ship Canal is also briefly considered in the study (Section 5.5.2).

2.2 Pathways

Due to the moderate size of the catchment and generally steep gradient of the main (Tame and Goyt) tributary catchments, there is normally a short lead time before a flood wave will peak on the Upper Mersey and fluvial flooding will result when the channel capacity is exceeded. The most obvious risk is overtopping of the bank crests, potentially accentuated by structures such as bridges, leading to the inundation of receptors. There is also a risk to receptors from the blockage of structures leading to overtopping, particularly at the older, more constricted, structures. Defence failure (including breach) is an additional risk that is quantified in this study via an undefended flood model, in which all flood defence assets are assumed to fail.

2.3 Receptors

The Upper Mersey study area is moderately urbanised. Although, a large percentage of the floodplain is not developed or only developed for recreational purposes, the existing flood maps show that parts of several communities could be at risk of fluvial flooding. These include Stockport, Didsbury, Northenden, Stretford, Sale Ashton upon Mersey and Flixton.

3 Model Approach and Justification

3.1 Approach Requirements

The main aim of the study was to upgrade the existing Environment Agency 1D only Upper Mersey model to a linked 1D-2D hydraulic model in order to facilitate improvements to the Environment Agency's Flood Map for Planning and deliver a more accurate baseline fluvial flood risk maps to better inform future development proposals decisions. Model outputs will also be used to update the local Flood Warning Areas within the Upper Mersey study area.

This chapter outlines the modelling rationale.

3.2 Hydrological Modelling

A revised set of peak flow estimates for the Upper Mersey and its tributaries were produced as part of the Upper Mersey Model Review and Update study (Hyder) in 2012 so a further update was not required for the current commission. Many of the previously estimated peak flows had also previously been incorporated into suitable model inflow (IED) files that were supplied with the Upper Mersey (2012) 1D only model for use in this study.

In view of the above, the hydrology required from the present commission involved two relatively low-key stages;

- The peak flow estimation for return periods that were not presented in the 2012 documentation,
- The creation of suitable model inflow (IED) files for those return periods that had not previously been supplied with an inflow file.

Further detail on the methodology and findings of the hydrological analysis can be found in Chapter 5.

3.3 Hydraulic Modelling

A linked 1D-2D (Flood Modeller - TUFLOW) modelling approach was taken for this study, in which the 1D floodplain representation of the existing Upper Mersey 1D (ISIS/FM) model was replaced by a 2D (TUFLOW) representation of the floodplain. The addition of the 2D domain allowed a better quantification of floodplain flow routes, particularly within urban areas where flow routes will typically be significantly more complex than can be represented in a typical 1D only model.

Since the scope of the study was to assume that the existing Upper Mersey (2012) channel configuration was fit for purpose and no further calibration of 1D parameters (e.g. roughness) was required, the geometry of the watercourses in the 1D (FM) component of the linked 1D-2D model is relatively unchanged from the 2012 model, the main changes in response to the final scope being;

- The removal of the 1D floodplain representation (i.e. the deletion of 1D RESERVOIRs and associated SPILL units and the trimming of extended cross-sections).
- The relabelling of the Upper Mersey node labels to better meet FRM specifications, which included the re-measuring of chainages along the Upper Mersey.

A 2D domain with a cell size of 8 metres was created across an area of 27.5km^2. This extends for the entire length of the (2012) 1D model, from Portwood and Stringers Weirs to the Manchester Ship Canal, and was configured to contain the worst-case flood outline from the range of modelled design events without ponding against the domain boundary. The general floodplain topography was based on 1m LIDAR DTM elevations from data that had been flown in March 2016. Modifications to this LIDAR based floodplain representation were made to ensure that the crest

elevations of flood defences were modelled at appropriate elevations. These topographic modifications are documented in Section 5.2.2.

The design event inflows were then run through an existing risk (defended) version of the linked 1D-2D model to obtain a set of defended, design flood levels and outlines. A set of undefended design flood mapping results was similarly obtained by running an undefended version of the model, in which the flood defence crests were reduced to normal ground levels and the FSA sluices were not operational. Finally, a set of blockage scenarios was also run for six structures, as specified in the scope.

Further detail of the model can be found in Section 5.2 and Appendix B.

4 Input Data

This chapter lists the data made available by the Environment Agency for use in the Upper Mersey study.

4.1 Existing Hydraulic Model(s)

The Upper Mersey 2012 Hyder model (Upper Mersey 2012 (ea013_0162)) was made available to this study to form the 1D template for the required 1D-2D model.

4.2 Cartographic Data

Ordnance Survey Mapping

OS MasterMap was supplied and used to inform the spatially variant floodplain (2D) roughness map used by the model.

OS 1:25,000, 1:25,000 and 1:250,000 Map Backgrounds were downloaded for use in reports.

4.3 GIS Data

The following GIS layers were supplied to help inform the study and present the results;

- Existing Flood Maps
- River Centrelines
- Environment Agency GIS Asset Database (supplemented by a spreadsheet with more detailed information of raised defences downloaded from the AIMS database)
- National Receptor Database

4.4 Topographic Data

4.4.1 LIDAR

The whole Upper Mersey study area is covered by 1m resolution LIDAR (DTM and DSM) data that was flown on 25th March 2016. The raw LIDAR tiles were supplied to JBA at start-up and the model build commenced with this dataset, which still had null areas present. However, during the course of the study, the processed 2016 DTM tiles became available at www.data.gov.uk so these were downloaded and used to define the floodplain topography of the final model.

Checks were carried out of the LIDAR against the available bank crest survey (see Section 4.4.2) and this revealed a good match between embankment crests, which enabled LIDAR to be used to increase the definition of the modelled bank crests (i.e. the spill elevations between 1D and 2D domains) relative to the existing bank crest survey.

4.4.2 Survey

River Survey

The scope refers to an original river topographic survey from 1998, supplemented by additional information collected in 2007, 2008 & 2011. Surveys from 1996 and 2007 were made available to the study but a readme file in the supplied EA data states the Environment Agency were unable to locate the 2008 and 2011 surveys noting that 'The purpose (of the study) is the improvement of floodplain representation, so what has been supplied may prove to be sufficient'.

The supplied surveys were;

- December 1996 – River Mersey Flood Alleviation Scheme (Scott Wilson Kirkpatrick) - Contains river and extensive floodplain survey between the A560 (Stockport) and Recorder House (Ashton).
- November 2007 - Mersey Remodel (Survey System Ltd). Contains river survey of the Tame, Goyt and Upper Mersey (upstream of King Street West Bridge), which together form the upstream reaches of the full Upper Mersey (2012) model.

From comments in the existing 1D model, it would appear that river-sections in the Upper Mersey downstream of Recorder House (i.e. the downstream extent of the 1996 survey) were based on a survey from February 1998 (not supplied).

Since the Upper Mersey Model Update did not require any significant adjustment of the 1D domain, the absence of past river surveys did not unduly influence the current commission. However, it should be noted that a significant length of the modelled reaches is based on survey that is at least 20 years old.

Bank Crest Survey

A number of ground level surveys were made available to the study. Of these, the following embankment survey was used to help define the defence crest levels;

- EA080001 – June 2008 survey (supplied in x, y, z format) along much of the raised flood defences within the Upper Mersey study area labelled as follows;
    - 01317MERS – Bank crest data alongside the Upper Mersey
    - 01317DIDS – Bank crest data in the vicinity of Millgate Farm (close to the Didsbury FSA inlet)
    - 01317FIEL – Bank crest data alongside the Didsbury FSA outflow channel (west of Palatine Road)
    - 01317MERO – Bank crest data alongside part of the Upper Mersey overflow channel
    - 01317OLDE - Bank crest data along Old Eea Brook

The extent of these surveys is shown in Figure 4-1.

Some additional bank crest survey was also undertaken during the course of the current commission, after it was discovered during the site visit that the flood defences had recently been reconfigured on the left bank of the Upper Mersey adjacent to Northenden Weir (Figure 4-1). This survey was undertaken by JBA Consulting in November 2017 and this new survey is supplied with the project deliverables as Appendix C.

4.5 Hydrometric Data

The Upper Mersey Model Update (2018) study was not expected to undertake any significant update of the hydrology nor any detailed model calibration. Therefore, the study had limited requirements for hydrometric data and, although, the following hydrometric datasets were made available to the study, this was largely for reference;

- Ashton Weir Day Max Flow & Level
- Brinksway Weir Day Max Flow & Level
- Didsbury Basin Golf Course Day Max Level
- Didsbury Basin Stenner Lane Day Max Level
- Didsbury Gate Position
- Didsbury Gates Day Max Level
- Flixton Bridge Day Max Level

- Lower Bredbury Day Max Level
- Northenden Day Max Level
- Portwood Day Max Flow & Level
- Sale Ees Basin Day Max Level
- Sale Ees Basin Gate Position
- Sale Ees Gates Day Max Level
- Sale Waterpark Day Max Level

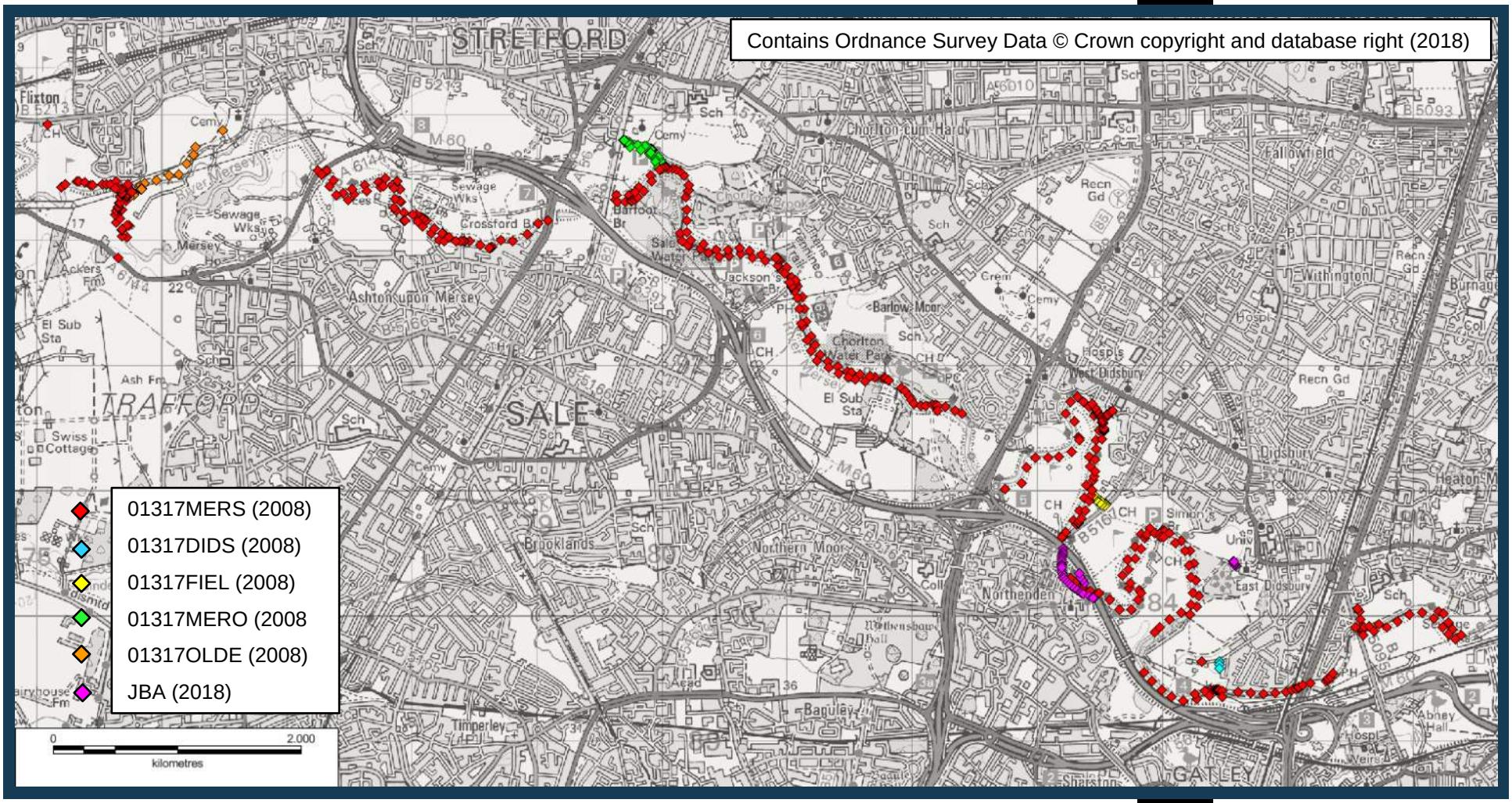
4.6 Calibration/Verification Data

No detailed calibration was required from the study and the scope requested that model verification should be limited to a comparison of design event levels and outlines with the anecdotal flood evidence. Since there have been only localised flooding events along the Upper Mersey since the Didsbury and Sale Ees FSAs came on-line, the model verification has been limited to checking that the modelled frequency of flood basin operation reflects reality and checking the model predictions against the available including the historic flood map (5.5.1).

4.7 Site Visit

A site walkover was undertaken on 3rd November 2017 and was attended by representatives from JBA Consulting and the Environment Agency. A number of photographs were taken during the site visit and several of these are included in this report.

Figure 4-1; Available Upper Mersey bank crest survey.



5 Technical Method and Implementation

This chapter outlines the technical development of the hydrological and hydraulic models. Since the Upper Mersey study largely relied upon an existing hydrology, a separate hydrology report (FEH Calculation Record) was not produced for this study. However, a Model User Guide (Appendix B) has been produced to accompany the finished hydraulic model.

5.1 Hydrological Modelling

5.1.1 Model Inflows

As noted in Section 3.2, no new hydrological calculations were required from this study. However, some hydrological investigation was required to derive flows for design events, for which model inflow files (IED) had not been previously created (i.e. as part of the 2012 flood mapping study).

The basis of the current Upper Mersey design hydrology is documented in the Upper Mersey Model Review and Update 2011/2012 Final Report. Table 5-1 is taken from this report and shows the peak model inflows for a range of design events.

Table 5-1; Peak flows from the Upper Mersey (2012) flood mapping study

Inflow	Flood peak (m^3/s) for the following flood events (annual chance 1 in x)						
	2	10	20	75	100	200	1,000
Portwood	63	98	114	148	156	177	308
Goyt	102	151	169	201	208	224	372
Micker	19.5	28.6	32.5	41	43	49	64
ChorltBrook	3.9	5.4	6.1	7 .8	8.2	9.4	13.2
Gatley	2.8	4.3	5.0	6.7	7.1	8.3	12.0
Ashton1	7.4	10.9	12.4	15.3	16.0	17.7	30.8
Ashton2	2.1	3.1	3.5	4.4	4.6	5.1	8.8
ChPlattGore	7.9	14.5	19.0	27.1	28.1	30.1	31.1
M51	5.4	7.6	8.4	10.1	10.5	11.4	19.9
M52	4.0	5.6	6.3	7.5	7.8	8.5	14.8
M53	0.5	0.7	0.8	0.9	0.9	1.0	1.8

Model inflow (IED) files were also available from the 2012 study for all the events shown in Table 5-1. However, since the current commission also required design results from 20% AEP (1 in 5yr), 4% AEP (1 in 25yr), 3.3% AEP (1 in 30yr) and 2% AEP (1 in 50yr) events, it was necessary to develop a set of model inflows for each of these events for the current study. This was achieved as follows;

- For Portwood, Goyt, Micker and Gatley the growth parameters documented in the 2012 FEH Calculation Record were input into a JBA FEH (Statistical) Spreadsheet, that was able to replicate the range of peaks flows shown in Table 5-1. The peak flows for the previously missing return periods could then simply be extracted from the spreadsheet and are shown in Table 5-2.

- For Chorlton Brook, the above method was unable to successfully generate the peak flows shown in Table 5-1. Therefore, rather than spending a large amount of time to precisely obtain inflows from this watercourse, a pragmatic approach was taken to subjectively assess suitable peak flows for the intermediate periods. This decision was justified by the fact that the inflows from Chorlton Brook are an order of magnitude smaller than the main upstream (Tame and Goyt) inflows so any raised uncertainties in the tributary inflows should not impact significantly on the flows along the Upper Mersey. The subsequent peak model inflows are shown in Table 5-2.
- The approach taken in 2012 for deriving model inflows into Chorlton Platt Gore, had been to extract the flows from the Environment Agency's Chorlton Platt Gore model. Since, it would have been impractical to estimate a revised set of inflows for the Chorlton Platt Gore model and then re-run this model to obtain inflows to the Upper Mersey model, a pragmatic approach was again taken to subjectively assess suitable peak flows for the intermediate periods (Table 5-2).
- A similarly pragmatic approach was taken towards deriving the lateral inflows (Ashton 1, Ashton 2, M51, M52 and M53) for missing return periods (Table 5-2).

Table 5-2; Modelled inflows for missing return periods

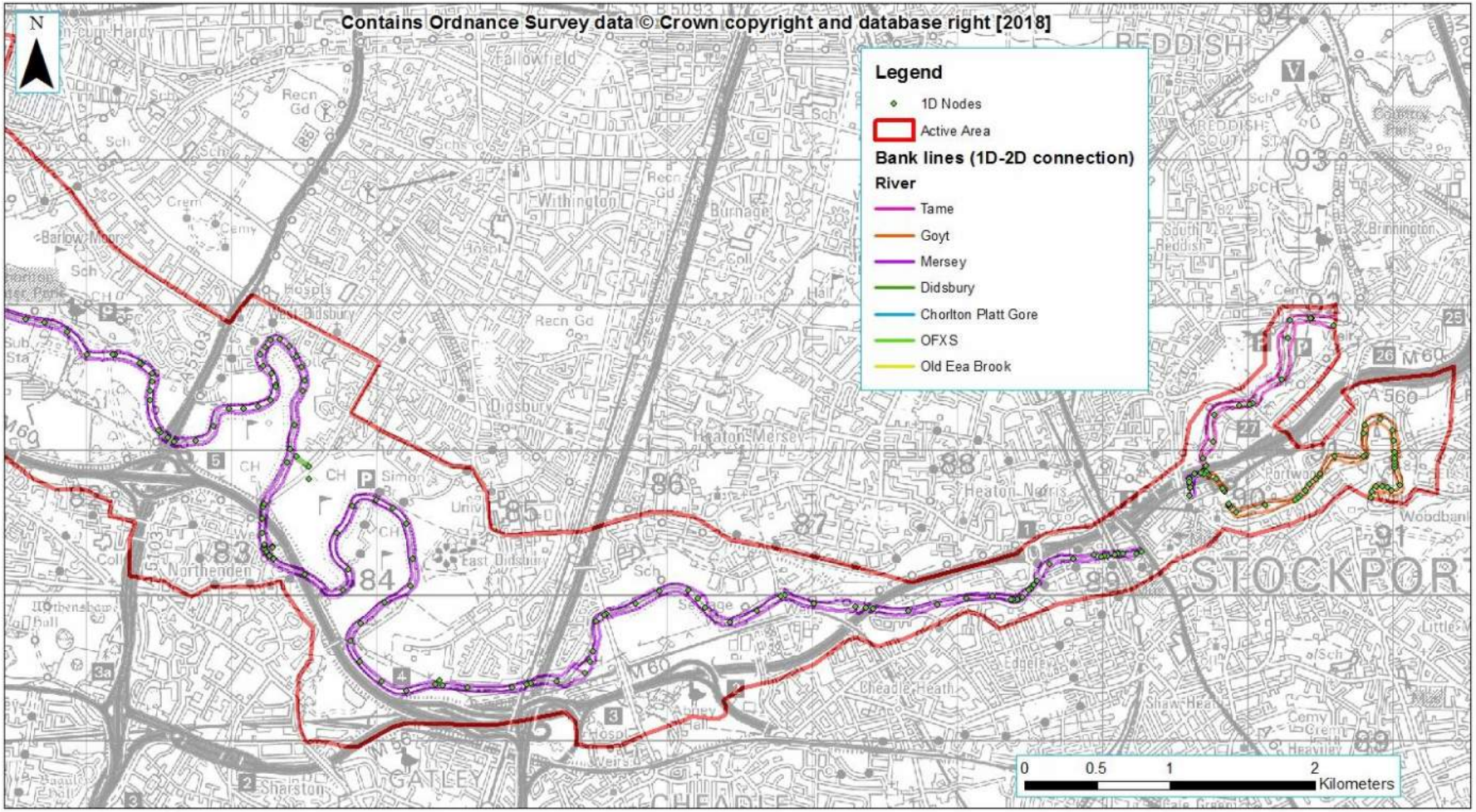
	Flood peak (m^3/s) for the following flood events (annual chance 1 in x)			
	5	**25**	**30**	**50**
Portwood	83	120	124	137
Goyt	132	174	179	192
Micker	25.3	33.8	34.8	37.9
ChorltBrook	4.3	6.2	6.3	6.5
Gatley	3.7	5.2	5.4	6.1
Ashton1	9.5	12.9	13.3	14.4
Ashton2	2.7	3.6	3.8	4.1
ChPlattGore	11.6	21.9	23.5	25.4
M51	6.9	8.7	9.0	9.8
M52	5.1	6.5	6.8	7.3
M53	0.6	0.8	0.9	0.9

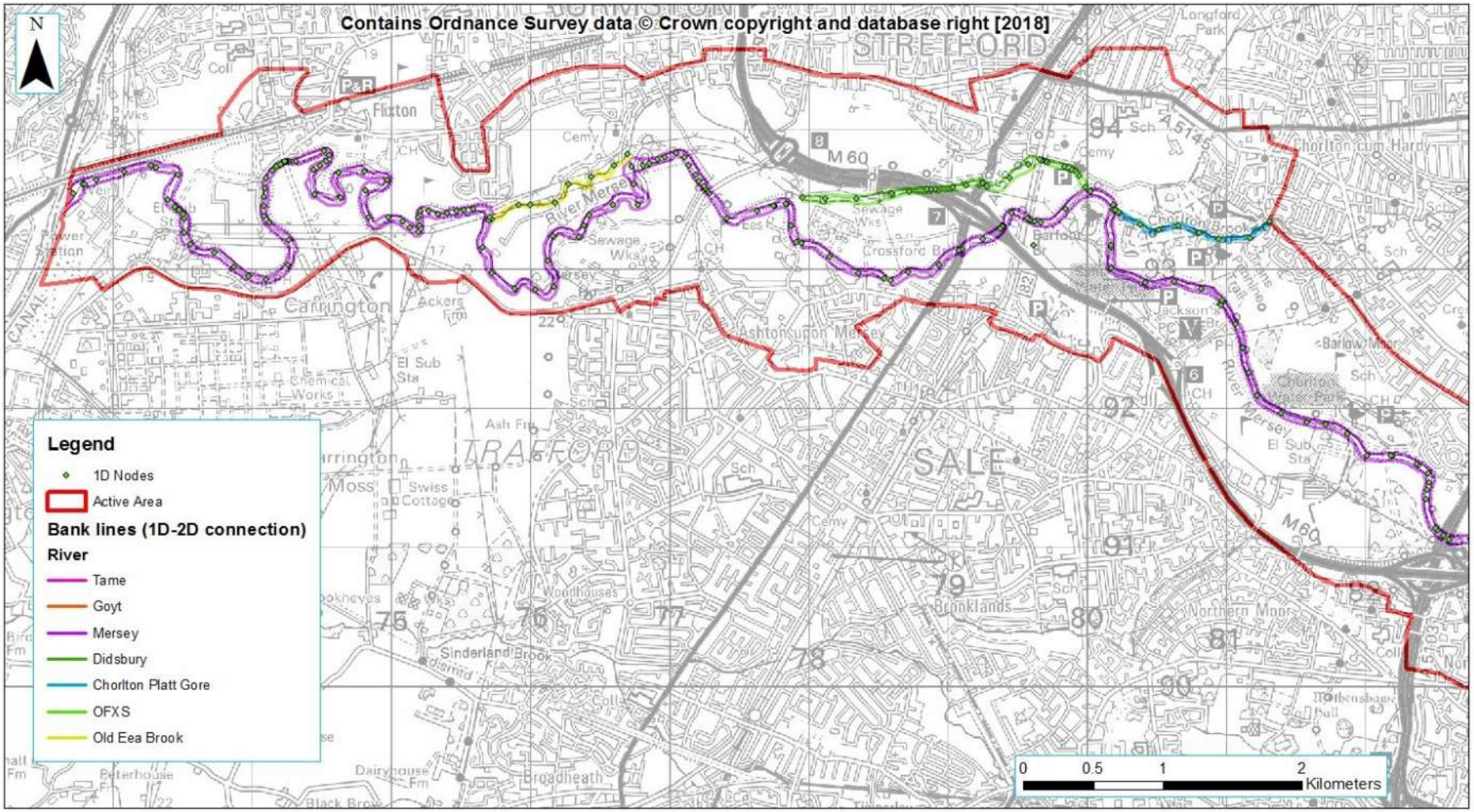
One correction was also applied to the supplied (2012) model inflow (IED) files. This was to generate the ReFH rainfall series from a WINTER only storm instead of the original DEFAULT approach, which had caused some of the inflow hydrographs to be generated from a WINTER storm and others from a SUMMER storm.

5.1.2 Downstream Boundary

The downstream boundary was maintained from the 2012 Upper Mersey model as the normal operating level of 8.42m AOD along the Manchester Ship Canal in the pound downstream of Irlam Locks. Sensitivity testing of the downstream boundary to conditions on the Manchester Ship Canal was undertaken by timing a 1% AEP event on Upper Mersey to coincide with 10% and 1% AEP events, respectively, on the Manchester Ship Canal. This outcome of these tests is documented in Section 5.5.2.

Figure 5-1: Upper Mersey Model Schematic




Contains Ordnance Survey data © Crown copyright and database right [2018]
N
Legend
1D Nodes
Active Area
Bank lines (1D-2D connection)
River
Tame
Goyt
Mersey
Didsbury
Chorlton Platt Gore
OFXS
Old Eea Brook
0
0.5
1
2
Kilometers
STRETFORD
TRAFFORD
SALE
Flixton
Carrington
Ashton upon Mersey
Sinderland Brook
Broadheath
Brooklands
Northern Moor
Barlow Moor
M60

5.2 Hydraulic Modelling

As discussed in Section 3.3, a linked 1D-2D (FM-TUFLOW) hydraulic model was created from the Environment Agency's existing 1D only Upper Mersey (2012) model. This section summarises some of the key features of the updated hydraulic model. More detailed information on the model can be found in the Model User Guide, Appendix B. A model schematic of the updated model is provided as Figure 5 2, which shows the 1D and 2D model extents

5.2.1 1D Domain

This section highlights some of the main decisions that were involved in developing the 1D component of the hydraulic model;

- The floodplain representation was removed from the existing Upper Mersey (2012) 1D model as follows;
    - Extended river, structure and spill sections were cropped to the approximate channel bank crests to allow the floodplain to be represented in the 2D model domain.
    - The extremities of a small number of cross-sections were updated, as necessary, with LIDAR elevations to better match the width of the inactive 2D channel where the available (trimmed) survey data was narrower than the proposed 2D inactive channel width GIS layer.
    - All 1D RESERVOIR units and associated overtopping SPILLs were removed from the model.
- Model nodes on the Upper Mersey were relabelled to reflect current flood mapping specification. This necessitated an update of the model chainage throughout the model[1]. The details of the node relabelling process are provided in the Model User Report and a look-up table has been produced, which enables the nodes in the 2012 model to be compared to the updated model nodes.
- The GIS network layer of 1D nodes for connection to the 2D (TUFLOW) domain was created by exporting the bed invert coordinates from the geo-referenced 1D cross-sections into GIS. Some minor transformations were then made to better locate a small number of sections (i.e. to ensure that a structure was geo-located accurately). Once the 1D nodes layer had been created, the node labelling exercise re-calculated the chainages between successive nodes by measuring these distances directly in GIS.
- DUMMY HTBDY units were attached to the floodplain side of the inlet and outlet units to both the Didsbury and Sale Ees FSAs to allow the modelled 1D (FM) sluices and outfalls to link directly to 2D (TUFLOW) instead of 1D RESERVOIR units. The internal sensor within the Didsbury FSA, which is located near Palatine Road Bridge and is used as a control on the state of the inlet gate, was included in the model by creating a nominal (sluice) structure in the 1D model, which was then linked to a 2D SX boundary (via a DUMMY HTBDY unit) that was mapped at the correct location of the sensor, as provided by the Environment Agency. No changes were made to the existing model control rules, which operate the Didsbury and Sale Ees FSA inlet and outlet structures, and none were needed following the model node relabelling exercise because the existing control rules all refer to structures (and the sensor), which did not require relabelling.

---

[1] The Upper Mersey (2012) model was found to have a discrepancy of 700m between the 1D model chainage and the measured GIS chainage along the 30-kilometre reach of the Upper Mersey; 100 metres of this was found in the Warren Street Culvert.

- The representations of most hydraulic structures were only altered insofar as was necessary to link to 2D (TUFLOW) e.g. adjusting widths to match the active local 1D channel width rather than the full width of the floodplain.
- A small number of floodplain structures (e.g. culverts beneath the M60, the Palatine Road culvert within the Didsbury FSA and two access tracks beneath the railway line in Flixton) were modelled as 1D (ESTRY) culverts embedded within the 2D (TUFLOW) domain.
- A small number of 1D SPILL units were added to the 1D model to allow for potential overtopping of structures since 0.1% AEP with climate change (+30%) results were required from the model. One further SPILL unit was added (on the basis of survey points) to allow water to spill directly from the Upper Mersey into the overflow channel (modelled with reach identifier OFXS) opposite Sale Water Park, where none existed in the original model.
- On model review, it was noted that an existing comment in the 1D model suggested that the configuration of the 1D model might need to be reviewed in the relation to the ASDA car park above the River Goyt in Stockport since the 0.1% AEP with climate change (+30%) model run was found to exceed the soffit level of the car park. Therefore, although the scope of the current study did not involve any updates to the 1D component of the model, a sensitivity test was undertaken in which the Asda car park was modelled as a culvert on the basis of the original survey. This was run for the 0.1% AEP + 30% CC event, which was the only event that would reach the soffit. The impact of the culvert was found to be negligible on the local flood levels and outlines because at this magnitude of event the car park is, anyway, by-passed on both sides. No alterations were subsequently made to the 1D model to generate the final results since, for all events up 0.1% AEP plus climate change (30%), an open channel representation of the reach beneath the car park is considered more appropriate since this can better represent the variable channel geometry.

5.2.2 2D Domain

This section highlights some of the main decisions that were involved in developing the 2D component of the hydraulic model.

Domain configuration

A single domain, 8m cell size, 2D (TUFLOW) model grid was defined across an active area of 27.5km^2. This extends along the full 1D extent of the existing Upper Mersey (2012) model, including tributaries, and is sufficient to enclose the most extreme flood outline that was modelled (0.1% AEP with + 30% climate change). An 8m cell size was ultimately chosen, following sensitivity testing, because a higher definition (6m) model grid took twice as long to run yet produced no significant improvement in the 1% AEP flood outlines. In addition, a 6m cell size and was unable to produce suitably stable 0.1% AEP results at this stage.

A multiple domain model was considered but discounted on the basis that there were no, obvious, high risk (1% AEP) areas that looked likely to benefit significantly from higher definition modelling, especially given the potential drawbacks of multiple domain modelling (i.e. licensing issues, increased model complexity and stability issues).

Floodplain topography

The basic floodplain topography was primarily defined on the basis of the downloaded 1m composite LIDAR DTM that was flown in March 2016.

The accurate modelling of bank crests is important when modelling systems with raised flood defences and the Upper Mersey used a combination of bank crest survey

and the most recent LIDAR to define the bank crests. A comparison of the recent LIDAR DTM with the Upper Mersey 2008 bank crest survey revealed a very good fit of embankment crest levels alongside the Upper Mersey, which would be expected given that the embankments are generally had a broad, flat crest and were considered to be in good condition.

Therefore, since the embankment crests are accurately represented in the LIDAR data, all flood embankments along the Upper Mersey were modelled by point inspecting the LIDAR DTM at 25 metre spacings and supplementing this with the 2008 survey points. Since LIDAR is not appropriate for defining wall crest elevations, wall crests were defined solely on the basis of available survey elevations.

A small number of additional topographic adjustments were made to the LIDAR based grid to include for bridge decks and smooth across a small number of local instabilities but, in general, the LIDAR quality was considered sufficient to model the Upper Mersey floodplain.

Roughness and building representation

Floodplain roughness was defined on the basis of OS MasterMap Land Use categories and roughness values were allocated to different land use categories using a similar roughness template to that which had been used for the other MP4 modelling studies (as documented in Appendix B).

Buildings were represented in the model via raised roughness values of 0.2 but with no topographic alterations (i.e. no additional threshold levels on top of the LIDAR DTM elevations). This is also consistent with other MP4 modelling studies.

5.2.3 Hydraulic Boundaries

Other than those required to link the 1D (FM or ESTRY) domain to 2D (TUFLOW), the hydraulic boundaries were largely defined within the 1D (FM) component of the model.

The 1D (FM) model boundaries consist of;

- Eleven ReFH boundary units corresponding to the inflows shown in Table 5-1;
- A Head-Time (HTBDY) boundary unit at the downstream limit of the model, which is configured to the normal operating level (i.e. 8.42m AOD) on the Manchester Ship Canal. This is unchanged from the supplied model.

The 2D (TUFLOW) boundaries consist of;

- HX boundaries located along the banks of the modelled 1D watercourses to permit overtopping of the river banks from 1D to 2D (and vice versa).
- SX boundaries to link 1D (FM) structures (FSA inlet and outlet sluices and sensor) and 1D (ESTRY) structures (floodplain culverts) to the 2D (TUFLOW) domain.
- Two short HQ (level-flow) boundaries placed along the Bridgwater Canal to allow floodwater, which enters the canal to exit the 2D domain without adversely ponding against the domain boundary. This boundary is only activated in the extreme 0.1% AEP + 30% climate change event.

5.3 Climate Change

In April 2016, the Environment Agency released updated guidelines on how the predicted (UKCP09) effects of climate change should be applied to flood risk modelling. The Upper Mersey study area is situated in NW England, the climate change scenarios that were required to implement the new guidance in this study are shown in Table 5-3.

Table 5-3: Climate Change Scenarios

Study	AEP	Scenario	Flow increase
Upper Mersey	1%	2080s epoch – Central (50th)	30%
	1%	2080s epoch – Higher Central (70th)	35%
	1%	2080s epoch – Upper (90th)	70%
	0.1%	2080s epoch – Central (50th)	30%

5.4 Blockage Runs

As part of this study, an assessment of the risk from the blockage of key structures was required. The blockage runs that were carried out are shown in Table 5-4. Each of the six structures were modelled with blockage percentages of 25%, 50% and 75%[2]. The results of the blockage runs are presented in Section 7.

Table 5-4: Blockage scenarios

Structure	Blockage percentage	AEP events
Stockport Bridge (River Goyt)	25%	10%, 2%, 1%
	50%	10%, 2%, 1%
	75%	10%, 2%, 1%
Warren Street Culvert (Upper Mersey)	25%	10%, 2%, 1%
	50%	10%, 2%, 1%
	70%	10%, 2%, 1%
Brinksway Bridge (Upper Mersey)	25%	10%, 2%, 1%
	50%	10%, 2%, 1%
	75%	10%, 2%, 1%
Princess Parkway Bridge (Upper Mersey)	25%	10%, 2%, 1%
	50%	10%, 2%, 1%
	75%	10%, 2%, 1%
Disused Railway Culvert (Upper Mersey)	25%	10%, 2%, 1%
	50%	10%, 2%, 1%
	75%	10%, 2%, 1%
Flixton Bridge (Upper Mersey)	25%	10%, 2%, 1%
	50%	10%, 2%, 1%
	75%	10%, 2%, 1%

5.5 Model Proving

5.5.1 Calibration and Verification

There was no requirement to undertake any calibration of the newly updated, linked 1D-2D model, and a simple verification of the design event predictions against the recent anecdotal flood history was required. Given that there are no detailed records of damaging flood events along the Upper Mersey since the current flood defence scheme was implemented, verification was largely limited to validating the frequency

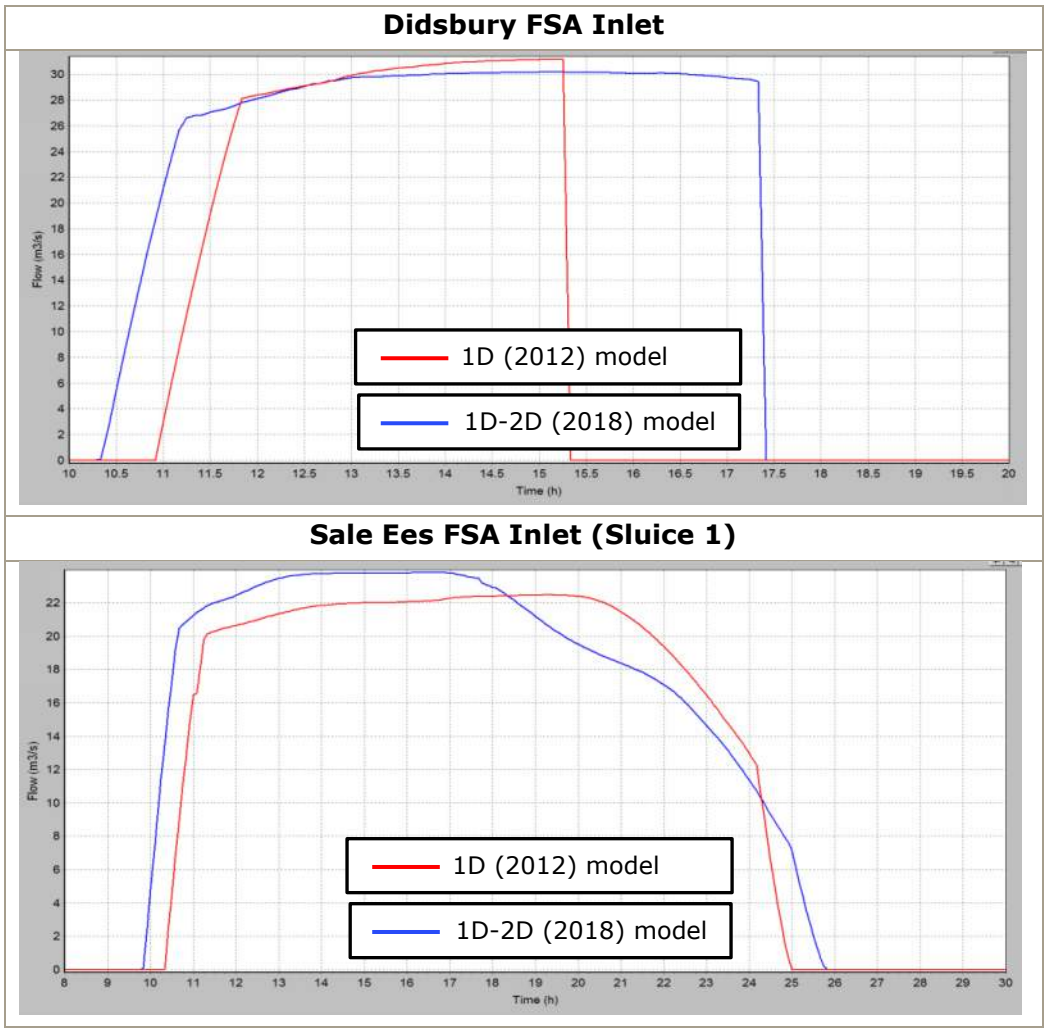
[2] Note that it was not possible to obtain stable results for a high blockage proportion of 75% for Warren Street Culvert.

of the operation of the Didsbury and Sale Ees FSAs, evaluating the potential magnitudes of some historic flood outlines in the Didsbury and Northenden areas and checking that the model predicts a generally low flood risk to urban areas that is in keeping with the recent flood history.

FSA Operation

The model predicts that the inlets to both the Sale Ees and Didsbury FSAs would be triggered at a return period of between 1 in 2 and 1 in 5 years when the flow at Ashton Weir exceeds approximately 200m^3/s. This prediction is identical to that of the previous Upper Mersey (2012) model, which provides reassurance that the model upgrade has not significantly influenced the modelled operation of the FSAs. The evidence from the gauge record and site observations provided by the Environment Agency suggests that this prediction is close to the design threshold.

Figure 5-2; Comparative flow (m^3/s) through FSA inlet Sluices



Some checks were carried out to ensure that the conversion from a 1D to a 1D-2D model did not adversely affect the operation of the Didsbury and Sale Ees FSAs. Figure 5-2 shows the difference in flow through the inlet sluices[3] between the previous (1D only) model and the updated 1D-2D model. This shows that, although, there are some differences in timing between the opening and closing times of the

[3] Note that the inlet structure into the Sale Ees FSA is modelled as two identical sluices. Therefore, the total flow into the basin will be twice that shown in the Figure.

sluices, the inlet operation shows no sign of the control rules having been broken as a result of the model updates. The difference in closure time for the Didsbury FSA is more noticeable and is considered to represent an improvement over the previous model since the sensor that controls the closure of the gate is now accurately geo-located within the 2D domain rather than being linked to a large 1D reservoir unit.

Evaluation against the Historic Flood Map

The historic flood map records several historic flooding episodes in the Didsbury and Northenden areas (see Figure 5-3). The larger polygons are all attributed to an event dated 1st-2nd January 1964 but no further evidence on this event is provided with the historic outline and since these dates do not register as a significant event in the Upper Mersey gauge record, it is assumed that this information likely relates to flood extent data of an indeterminate age.

In addition to the flood polygons of indeterminate age, there are several smaller polygons that reflect more localised flooding. These historic flood locations are all attributed to the channel capacity being exceeded so are likely to be the result of fluvial flooding, as follows;

- Commercial property on Tiviot Dale just upstream of the Warren Street culvert in Stockport in January 2008.
- The Parrs Wood School playing fields in East Didsbury in December 1978.
- The Waterside Hotel and Leisure Centre in East Didsbury in December 1978, February 2002 and January 2008.
- Ford Lane, Boat Lane and Mill Lane in Northenden, variously in July 1973, December 1978, March 1998, October 1998 and November 2000.
- Didsbury Golf Course in December 1978.
- The area around the Britannia Country House in Didsbury in both March and October 1998.
- An area between Chorlton Platt Gore and the Upper Mersey in December 1978.
- The area around Flixton Road Bridge in both March and October 1998.

A breach of the right bank defence of the Mersey near Millgate Farm in East Didsbury is also documented from October 1973. No detailed information is provided on the subsequent flood extent but it this event does demonstrate the potential for local failure of the Upper Mersey defences.

A check on the gauged flow record at both Brinksway and Ashton Weirs for the events listed on the historic flood map reveals information on the rank and magnitude of the flows for each of these events as shown in Table 5-5. Flows at Ashton Weir were gauged to be in the range of 200 to 225m^3/s for all of these historic events. This presumably reflects the fact that Ashton Weir is located downstream of the main storage areas on the Upper Mersey floodplain so is the not the best indicator of flood magnitude or frequency. The gauged flows during these historic events at Brinksway Weir, upstream of the main storage areas, are more variable so a rough estimate of return periods for these historic events can be obtained by comparing the recorded flows with the expected design flows at Brinksway[4]. Using this approach, flows of between 200 and 300m^3/s would broadly correlate to events between 1 in 5 and 1 in 20 years.

[4] These are assessed relative to the sum of the calculated design inflows for the Tame and Goyt, which were provided in Table 4-3 of the 'Upper Mersey Model Review and Update 2011/2012' Final Report, rather than at Brinksway, itself, for which no design estimate was provided.

Figure 5-3; Historic flood outlines in the Didsbury and Northenden areas

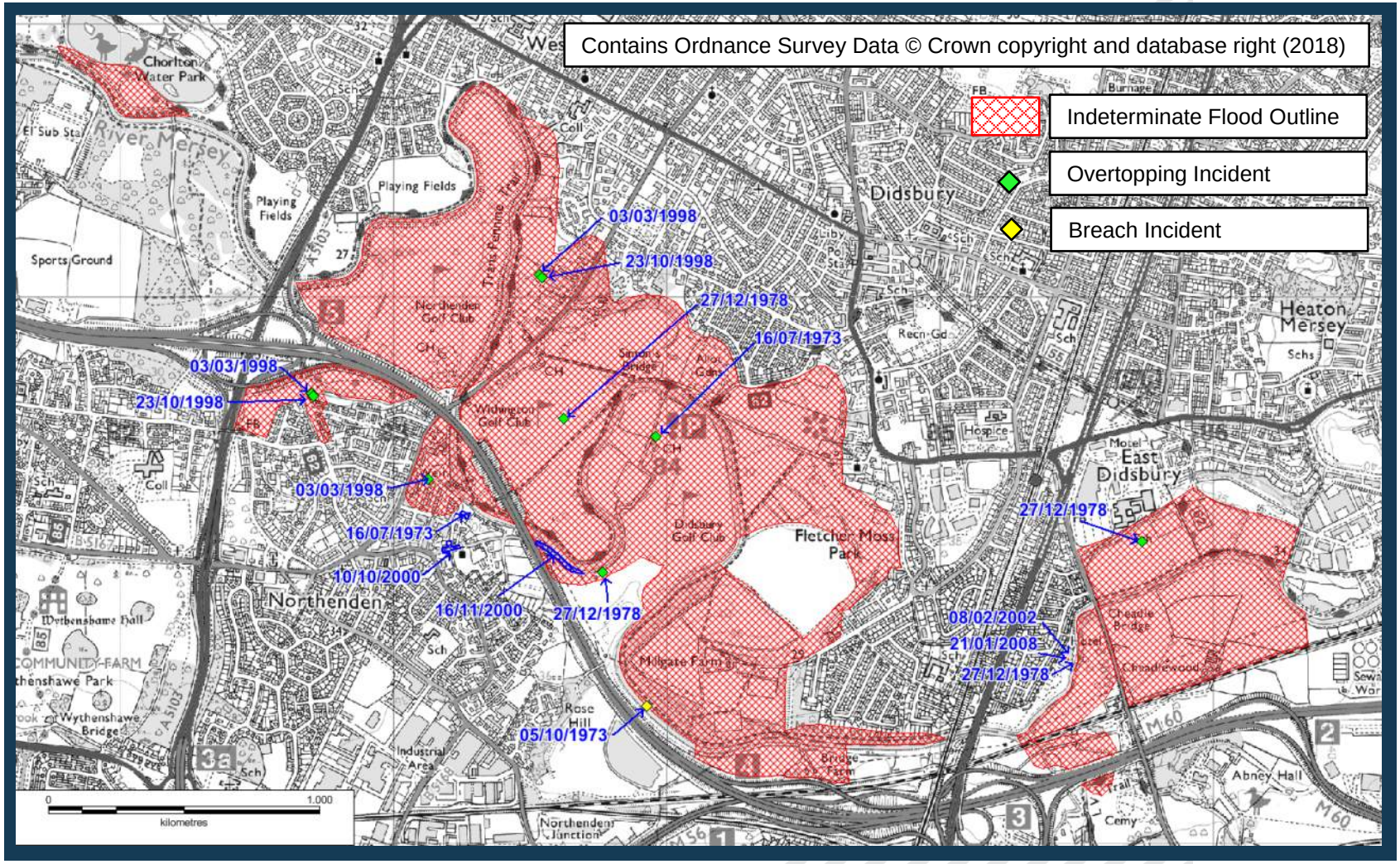


Table 5-5; Gauged ranking and flow magnitude for historic flood events

	Brinksway		Ashton	
	Rank	Flow (m3/s)	Rank	Flow (m3/s)
July 1973	1	299	6	224
December 1978,	13	203	15	201
March 1998,	11	212	8	221
October 1998	6	227	7	222
November 2000	3	238	5	225
February 2002	8	222	14	202
January 2008	13	203	N/A	N/A

The historic flood map would, therefore, appear to suggest that a small number of localities, particularly within the Didsbury and Northenden areas, are at a relatively high risk of flooding. A comparison of the historically flooded areas with the design outlines obtained from the design model results (presented in Section 6.2) predicts that;

- The Parrs Wood School playing fields, The Waterside Hotel and Leisure Centre, Ford Lane, Didsbury Golf Course and the area between Chorlton Platt Gore and the Upper Mersey are potentially at risk from events in the order of 10% AEP;
- Boat Lane and Mill Lane and the area around Flixton Bridge are potentially at risk from events with a threshold of between 5% and 3.3% AEP;
- The area around the Didsbury Golf Course clubhouse and the Britannia Country House in Didsbury are potentially at risk from a 2% AEP event.

Since all of the sites that have been recorded to flood in the historic flood map are simulated by the model to flood at low or moderate return periods and since, most of the areas occupied by the historic flood polygons of indeterminate age are modelled to flood at return periods up to 1% AEP, there is no obvious evidence that the model is significantly misrepresenting the observed flood thresholds. In addition, it should be noted that defence improvements including the coming on-line of the Sale Ees and Didsbury FSAs will have post-dated several of the documented historic flood events so the current level of protection is likely to be higher than when some of these past events occurred. Undocumented defence failure and blockage could also have contributed to past flood extents so a perfect match between historic and design flood outlines is not to be expected. Finally, the defended flood risk presented in Section 6 is generally consistent with the recent flood history in that few urban areas are modelled to be at risk until design flood events in excess of 1% AEP are simulated.

5.5.2 Sensitivity Testing

Sensitivity testing demonstrates the variation in model results that can arise from varying certain, key, model parameters and/or inputs within potentially realistic ranges. The sensitivity testing is described in detail in Appendix B. In summary,

formal sensitivity tests were carried out on the defended 1% AEP event with respect to the following parameters[5];

- Manning's *n* roughness - ±20% change in roughness in 1D open channel and 2D domains.
- Model inflow - ±20% change in all 1% AEP model inflows.
- Downstream boundary – 10% AEP event and 1% AEP river level series were extracted from the Environment Agency's Manchester Ship Canal (2018) model to compare with using the normal operating level of 8.42m AOD.

The following model sensitivities were recorded for the Upper Mersey model:

- The 1% AEP flood outline is moderately sensitive to roughness; a 20% increase in roughness causes a 12% increase in the 1% AEP flood extent, whereas a 20% reduction in roughness causes a 28% decrease in the 1% AEP flood extent. River levels along the Upper Mersey are typically altered within the range ±0.4 metres in response to these roughness tests.
- The 1% AEP flood outline is sensitive to flow; a 20% increase in flow causes a 31% increase in the 1% AEP flood extent, whereas a 20% reduction in flow causes a 38% decrease in the 1% AEP flood extent. River levels along the Upper Mersey are altered by up to 2 metres in response to these flow tests. These changes are concentrated in the reach between Didsbury and Ashton and largely appear to reflect variations in the amount of floodplain storage utilised between the different flow scenarios.
- The 1% AEP flood outline and river levels were modelled to be insensitive to the choice of downstream boundary applied at the Manchester Ship Canal. This is largely attributable to the presence of Irlam Weir at the downstream extent of the Upper Mersey model and the elevated nature of the lower Upper Mersey floodplain relative to the modelled, peak, design flood levels on the Manchester Ship Canal (peak 10% AEP MSC level = 10.56m AOD and peak 1% AEP MSC level = 11.84m AOD). Whilst, a 0.1% AEP event on the Manchester Ship Canal would likely have an impact on the Upper Mersey, the joint probability of this type of event would likely be significantly higher than the currently modelled design events.

5.6 Flood Mapping

The Upper Mersey study area contains an extensive series of formal flood defences (see Section 1.3.3). There was, therefore, a requirement to model both defended ('existing risk') and undefended ('without defences') model scenarios as part of this commission in addition to set of blockage runs.

The defended model scenario was created with raised flood defences configured at crest level and with both FSAs working according to the programmed control rules. Walls were only included in the defended model scenario where the banks were documented to be formal raised flood defences on the supplied AIMS database. This excludes some local walled sections, as for example in Stockport, where informal walls could provide some localised protection but were not constructed as flood walls.

The undefended model scenario involved the reduction of embankments and walls to natural floodplain levels and the Sale Ees and Didsbury FSA inlet and outlet sluices were both disabled, in keeping with the previous Upper Mersey (2012) flood mapping approach. The results of the defended and undefended models are summarised in

[5] Note that 2D cell size was tested at 6 and 8 metres and revealed that the difference in 1% AEP outlines was insufficient to warrant the extra effort of producing a full set of flood mapping deliverables based on a 6 metre grid. The results of this test are not included report because they were undertaken on a pre-draft version of the model.

Section 6 and the results of the blockage runs are summarised in Section 7. Further detail on the configuration and performance of the various model scenarios is provided in Appendix B.

The models were configured to produce water level, depth, velocity and hazard grids at 8m definition. These peak water level, depth, velocity and hazard grids have been supplied as project deliverables for each probability event that was run through the model. These are present within the TUFLOW model results folder in the model and also within Appendix A.

5.7 Model Performance

This section provides a summary of the general performance of the Upper Mersey (2018) hydraulic model:

- The models were run double precision with a one or two second 1D (FM) timestep and a two second TUFLOW timestep.
- All models were run for a hydrograph duration of 40 hours. Model run times varied between 9 and 16 hours depending on the event, model scenario and number of modelling cores that were in use at the same time.
- The 1D (FM) run time parameters were largely retained from the Upper Mersey (2012) model. Both an Automated Preissmann slot and a raised maxitr had previously been used. Maxitr was relaxed to default value for most of the defended model scenarios but increased to 17 for the undefended scenarios to avoid poor convergence associated with the remaining flapped outfall from the Didsbury FSA.

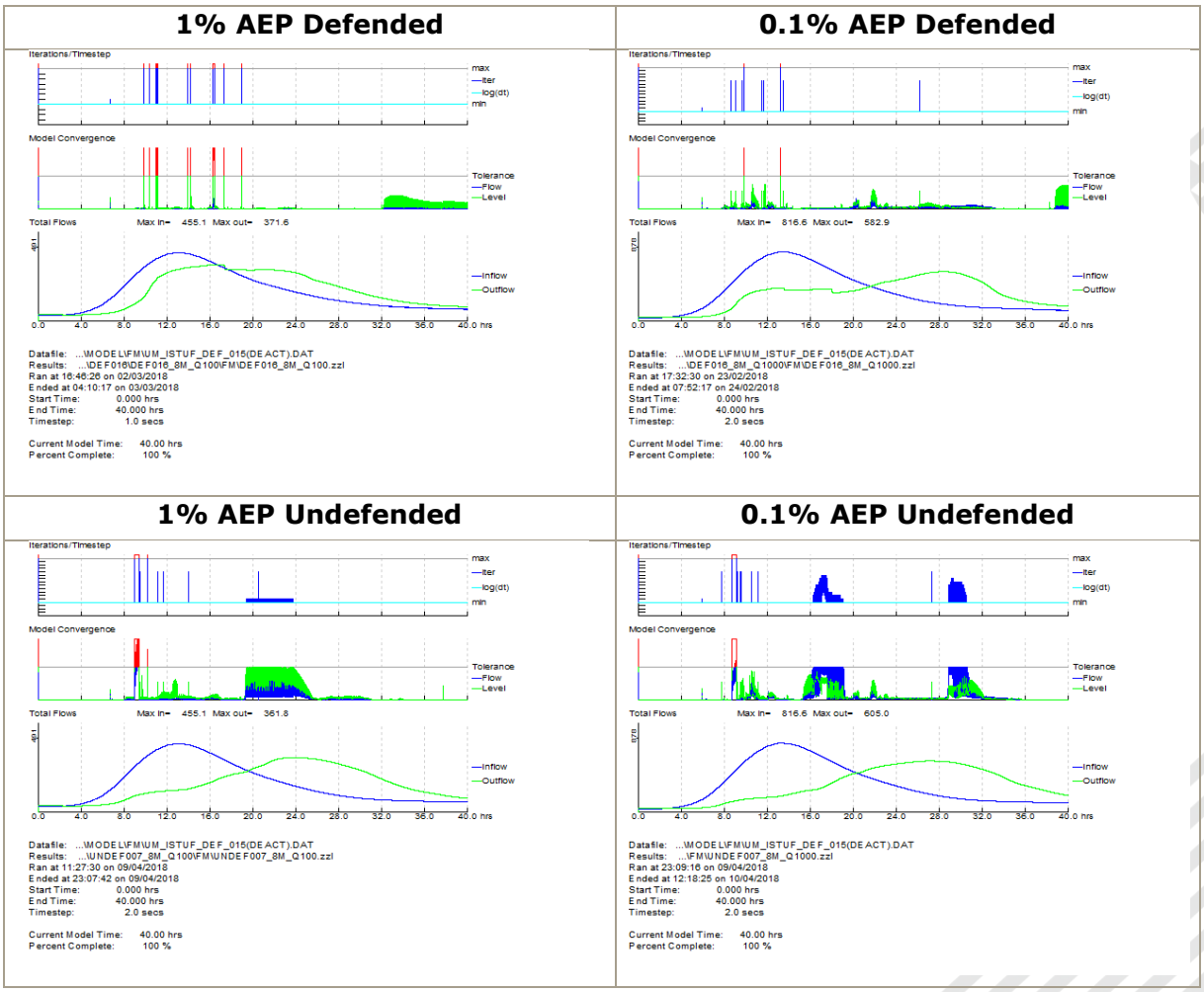
5.7.1 1D (Flood Modeller) Stability

Figure 5-4 shows the 1D model run time plots from the 1% and 0.1% AEP defended and undefended scenarios.

In general, there are only a few, short-lived instances of poor 1D (FM) convergence during the simulations, which generally occur when a structure changes mode of operation (e.g. free flow to orifice flow). However, a longer period of non-convergence was sometimes found to occur in some of the less extreme flood events that was associated with the opening and closure of the flapped outfall to the west of Palatine Road. This was largely remedied by increasing maxitr in the undefended models to 17. However, the sudden changes in flow of less than $1m^3/s$ through this outfall that accompanied this poor convergence would, anyway, have been unlikely to have impacted on the River Mersey flood levels.

The 1D (FM) time series results along the study reach have been checked and are typically smooth for all return periods up to and including 1% AEP. At higher flows, stability patches have been used along the banks to stabilise the 1D-2D flux at locations where noticeable oscillations originally occurred across the 1D-2D boundary. Some oscillations in the 1D-2D flux remain at a small number of localities in the more extreme design events, typically associated with the short tributary reaches that cut across the Upper Mersey floodplain, but these are not considered to be of sufficient magnitude or extent to cast doubt on the main model results.

Figure 5-4: 1D convergence plots



5.7.2 TUFLOW

There are several TUFLOW stability checks that should be undertaken on models. These include:

- Checking the number and location of any negative depth warnings;
- Checking the 2D mass balance error (both cumulative as recorded in tabular form and spatially as viewable via MB1 and/or MB2 map outputs);
- Checking that there are no sharp or persistent oscillatory changes in the total volume of floodwater in the 2D domain between timesteps (dVol).

In summary, across the model design runs:

- There are no 2D negative depths within either the 1D (ESTRY) or 2D (TUFLOW) model domains for events and scenarios up to 0.1% AEP and there are a minimal number of 2D negative depth warnings for the 0.1% AEP model runs;
- The cumulative 2D mass balance error (MBE) for the models are within the guideline tolerance of ±1.5% for the duration of the model runs except for a very short period of initial wetting when the number of wet cells is small. Figure 5-5 shows the time varying MBE plots for the 1% and 0.1% AEP defended model simulations and shows that the MBE is smooth and within tolerance after initial wetting.

- The MB1 and MB2 maps reveal some localised areas of high 2D mass balance error, typically along bank crests or roads, which increase with return period. Further roughness patches could have reduced the magnitude and extent of these remaining areas of high local MBEs but any remaining high MBE areas are not considered to have a significant adverse impact on the model results.
- There is no evidence of instability (i.e. sharp or oscillations changes) in the cumulative 2D dVol plots from either the defended or undefended model scenario (Figure 5-6). Their overall shape is due to flood water entering the 2D domain (from the 1D channels) during the rising limb of the flood event and exiting the 2D domain (to the 1D channels) as the inflow hydrographs recede.

Figure 5-5: TUFLOW cumulative 2D Mass Balance Error plots

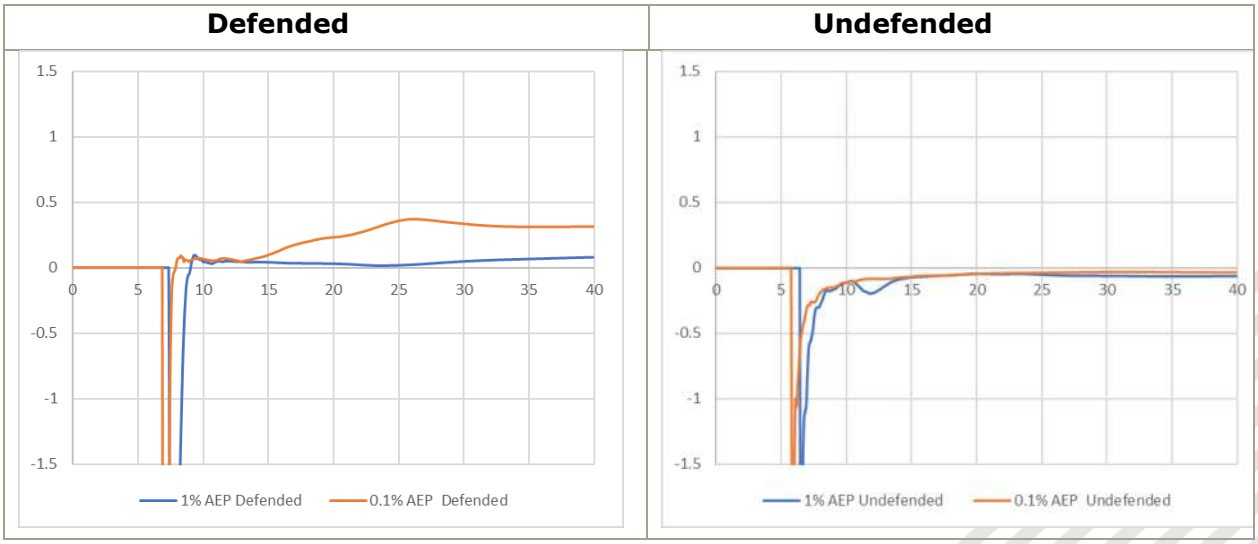
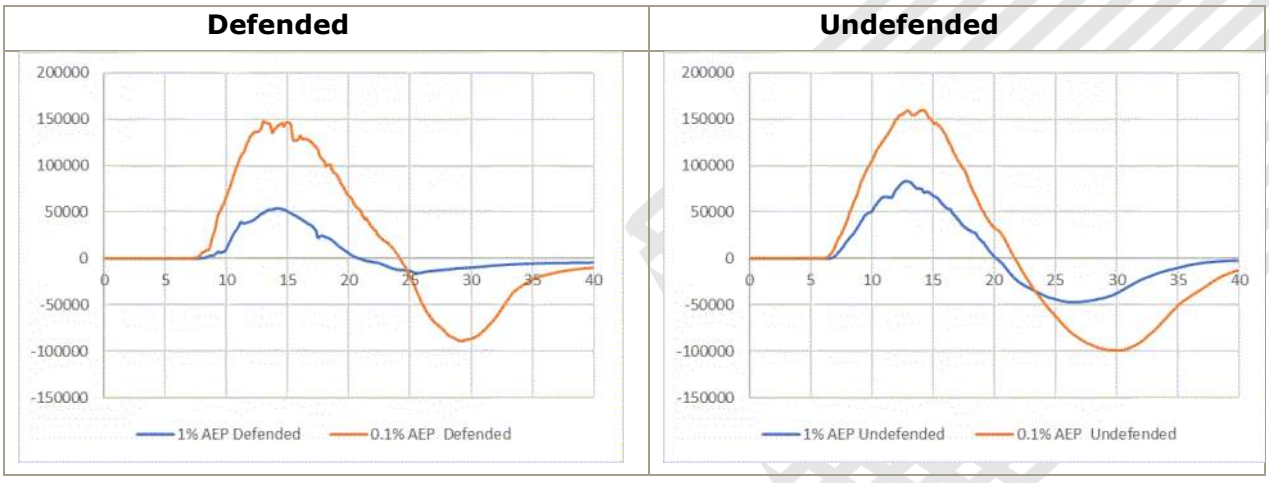


Figure 5-6: TUFLOW 2D dVol plots



6 Flood Mapping Results

6.1 Introduction

This chapter provides an overview of the main model results, presenting and commenting on;

- Design flood levels and outlines;
- The threshold (onset) of any flooding to the main communities and infrastructure.
- The impact of the defences
- A comparison with the existing flood zones that were developed during the previous (2012) flood mapping study.
- The potential impact of climate change

The 15 design events (including 4 with climate change) were run for the defended and undefended scenarios. This chapter documents the main findings in relation to design flood levels and outlines and model deliverables. Further details on the design model runs is provided in Appendix B.

The following raw results are supplied within the hydraulic model for each design event combination:

- River levels, flows and velocities (in the FM results)
- Water Level, Depth, Velocity and Hazard grids (in the TUFLOW results)

The following processed results are supplied within Appendix A:

- Tables of peak river level, flow and velocity.
- Flood outlines
- Water Level, Depth, Velocity and Hazard grids
- MapEdit compatible GIS layers

6.2 Existing Risk (Defended), Present Day, Flood Mapping Results

6.2.1 Peak River Levels

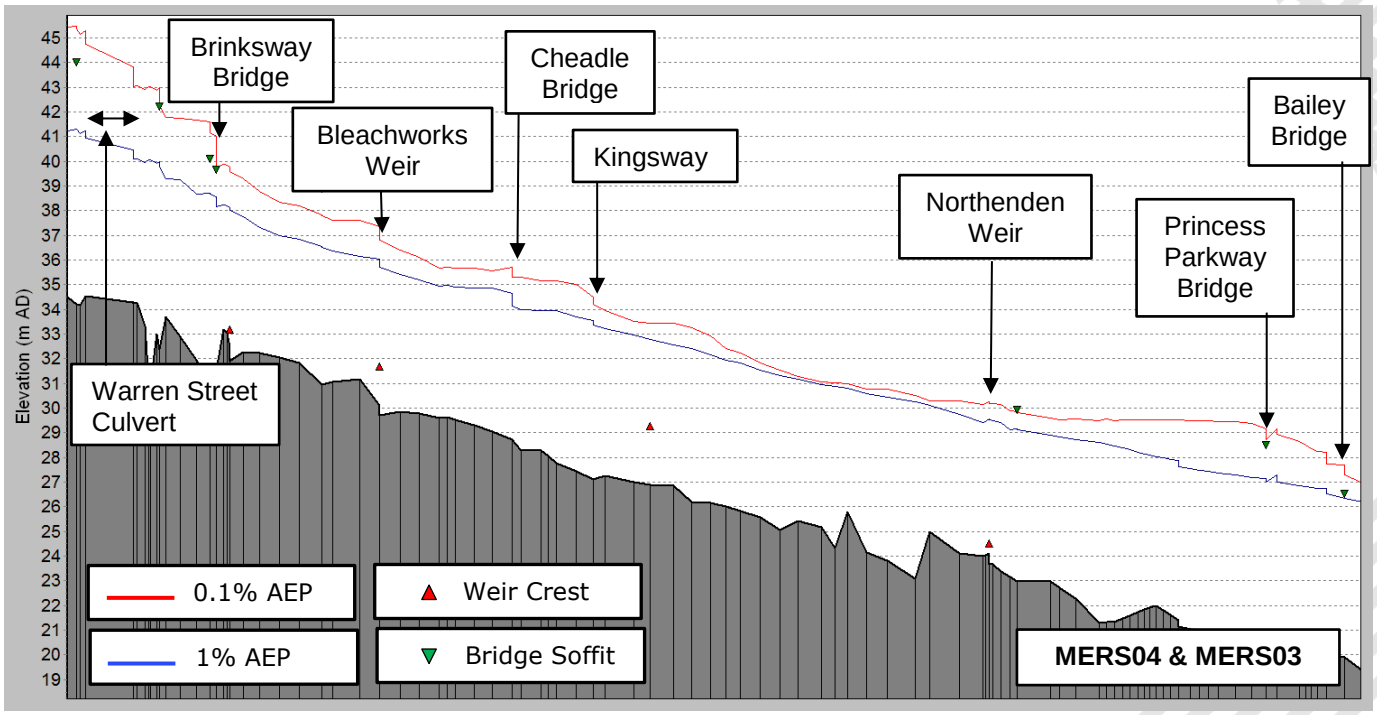
Table 6-1 shows the modelled peak defended design river levels at a select number of locations along the Upper Mersey study reach. A full set of river level and flows for each model node is provided in Appendix A. The peak 1% AEP flood levels from the previous Upper Mersey (2012) flood mapping study have also been included in Table 6-1, for comparison with the results of the current study. This demonstrates that, although, the 1% AEP levels from both studies are generally similar, there are exceptions notably in the more upstream reaches of the Upper Mersey, which is considered to have occurred largely in response to the chainage adjustments that were made as part of the 1D node relabelling exercise.

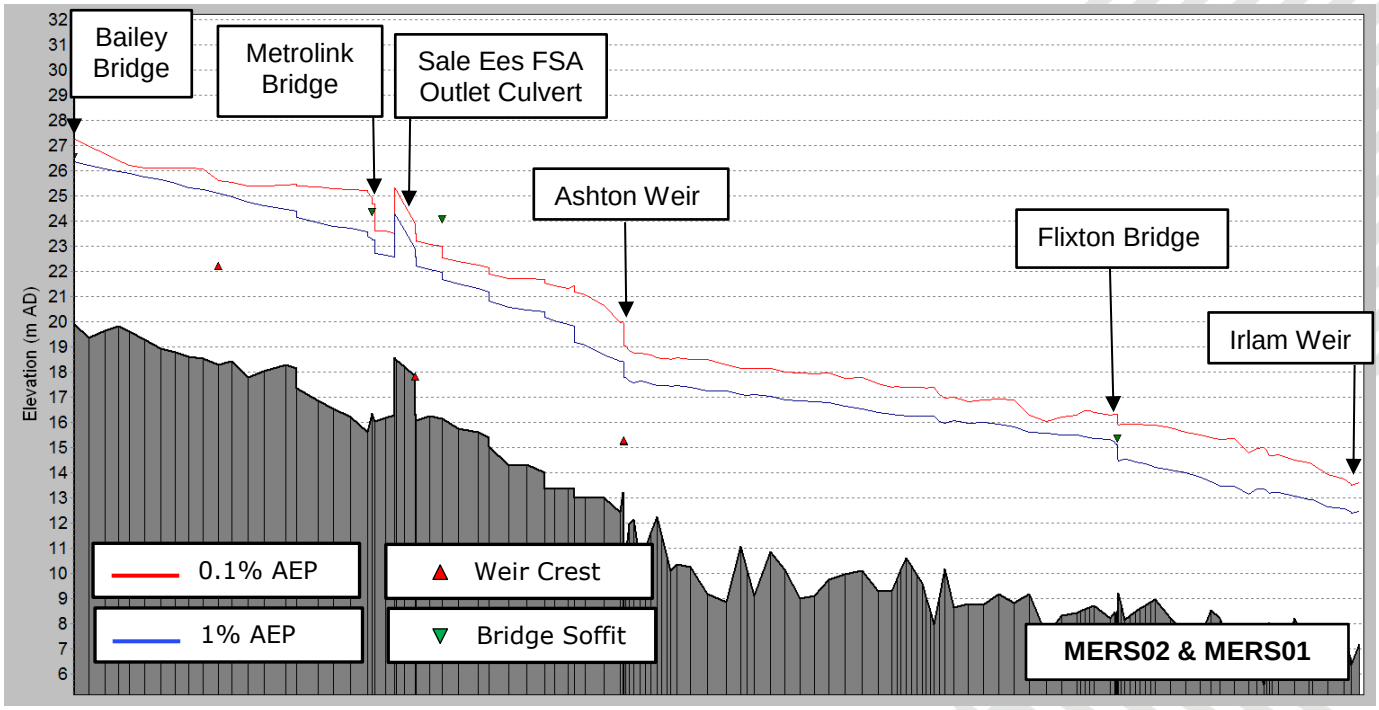
Table 6-1: Modelled design river levels (m AOD) at specified locations

	50%	5%	1%	1% (2012)	1% +30%	0.1%
Tame/Goyt confluence	38.44	40.13	41.24	40.73	42.64	45.45
Brinksway Weir	36.24	37.46	38.14	38.13	38.90	39.78
Didsbury FSA Inlet	31.40	32.33	32.78	32.84	33.19	33.43
Northenden Weir	28.25	29.23	29.55	29.52	29.95	30.24
Sale Ees FSA Inlet	24.14	24.81	25.08	24.78	25.37	25.61
Ashton Weir	17.72	18.15	18.39	18.15	18.67	19.89
Irlam Weir	11.99	12.31	12.46	12.46	12.63	13.59

Figure 6-1 shows long section profiles of the peak, present-day, 1% and 0.1% AEP, river levels from the defended model scenario, which helps to illustrate some of the main structural controls along the Upper Mersey. The Didsbury FSA is located between Kingsway Bridge and Northenden Weir and the Sale Ees FSA is located between Bailey Bridge and the Metrolink Bridge.

Figure 6-1; Modelled, peak 1% and 0.1% AEP, defended, river levels





6.2.2 Modelled Flood Outlines

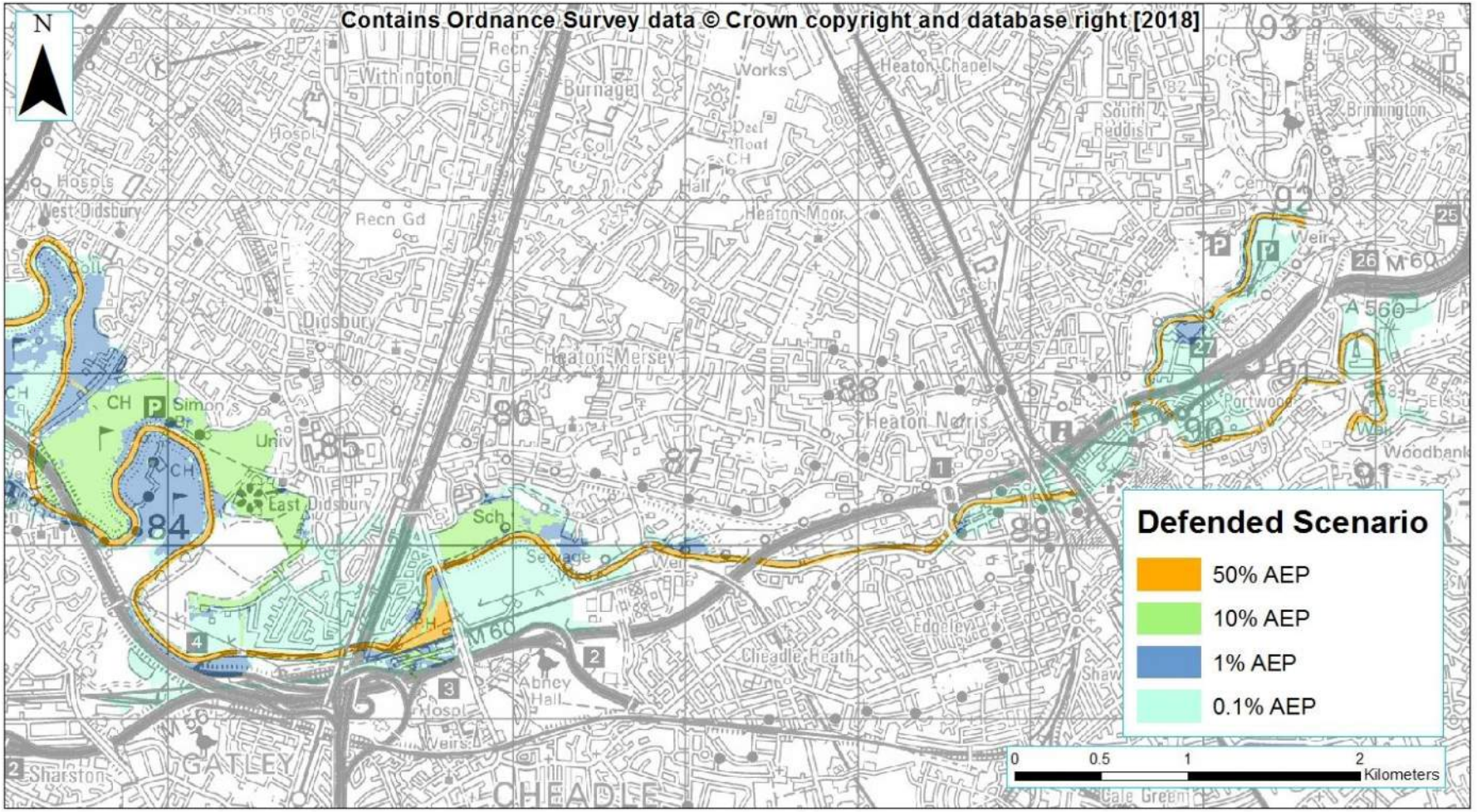
The modelled, present day (i.e. without climate change), flood outlines for the defended scenario for each design return period are provided as GIS deliverables in Appendix A. This scenario represents the flood risk under existing conditions (i.e. unblocked and with defences retaining water up to crest level). A select number of these are mapped onto Figure 6-2.

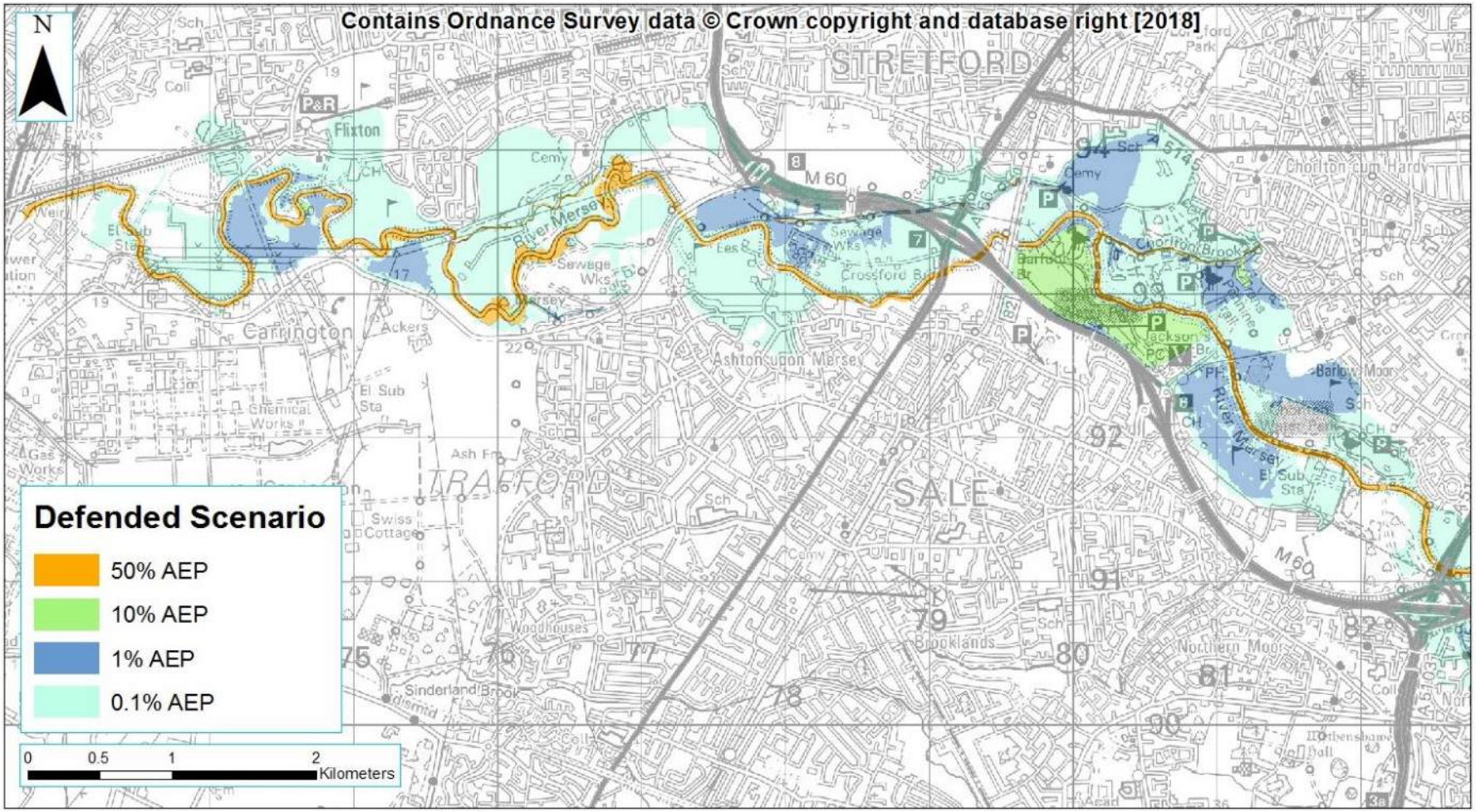
The following observations are noted in relation to the modelled, present-day, defended, flood outlines;

- The modelled threshold for both the Sale Ees and Didsbury FSAs is modelled to be between 1 in 2 and 1 in 5 years. This is consistent with the previous modelling and observed operation of the FSAs.
- With the flood defences functioning at crest level, the model predicts that property would only be at risk in a small number of locations during a 1% AEP event. The 1% AEP risk is modelled to be largely limited to;
    - The Meadow Industrial Estate in Stockport from direct overtopping of the left bank of the River Tame, with an approximate 2% AEP threshold.
    - The back of Ford Street in Stockport from direct overtopping of the left bank of the Upper Mersey, with an approximate 1.3% AEP threshold.
    - Commercial premises on Barton Road in Heaton Mersey from overtopping of the right bank of the Upper Mersey, with an approximate 2% AEP threshold. This represents an increased risk relative to previous mapping studies
    - The Waterside Hotel and Leisure Club (East Didsbury) and Golden Days Garden Centre (Cheadle) from the direct overtopping of the right and left banks of the Upper Mersey, respectively. The former has an approximate 20% AEP threshold.
    - Several properties, including residential, within and around the periphery of the Didsbury FSA from floodwater filling the flood storage area. Millgate Farm is modelled to have an approximate 10% AEP threshold whereas Palatine Road is modelled to be overtopped from within the basin leading to potential inundation of property to the west of the road in a 3.3% AEP event.
    - Residential property is modelled to be at risk along Mill Lane, St Hilda's Road and Kennworthy Lane in Northenden from a flow route that originates from overtopping of the left bank of the Upper Mersey alongside Ford Lane upstream of the M60. Overtopping is modelled to occur upstream of the existing local defences in Northenden, which start downstream of the M60. Floodwater is modelled to affect Ford Lane at a threshold of 50% AEP but the flow route behind the defences towards Mill Lane is not modelled to commence until a 4% AEP event. This location represents an increased risk relative to previous mapping studies.
    - Commercial property within Sale Ees Water Park from floodwater filling the flood storage area is flooded, with an approximate 3.3% AEP threshold.
    - Sporting facilities associated with West Didsbury and Chorlton AFC are modelled to be at risk from overtopping of the left bank of Chorlton Platt Gore, with an approximate 3.3% AEP threshold.

  Most of these flood risk localities are evident on the existing flood maps but the 1% AEP risk to properties on Barton Road and in Northenden represents an increased risk that has been picked up by the higher definition modelling of floodplain flow routes due to the modelling of the floodplain in 2D.

Figure 6-2; Selected present-day, defended, flood outlines




Contains Ordnance Survey data © Crown copyright and database right [2018]
N
Defended Scenario
50% AEP
10% AEP
1% AEP
0.1% AEP
0
0.5
1
2
Kilometers
STRETFORD
TRAFFORD
SALE
M 60
Flixton
Carrington
Ashton upon Mersey
Brooklands
Northern Moor
River Mersey
Sinderland Brook
Chorlton Brook
Barlow Moor

- The 0.1% AEP defended flood outline is generally similar to the previous 0.1% AEP defended outline. However, the upgrade from 1D to 2D floodplain representation has resulted in two new urban areas being modelled to be at risk during a present day, extreme, 0.1% AEP event;
    - The Warren Street culvert is modelled to be by-passed in a 0.1% AEP event leading to a flow route through Stockport Town Centre.
    - A large number of properties on either side of Kingsway in East Didsbury are modelled to be at 0.1% AEP risk from floodwater that flows from east to west including through bridge openings beneath the railway line.

Risk to infrastructure

In addition to the risk to communities stated above the following transport infrastructure is modelled to flood;

- M60 in a 0.1% AEP event at several locations in Stockport and around the Junction 5 slip roads and Junction 8.
- Some B roads (e.g. Palatine Road – B5167 and Flixton Road – B5158) are modelled to flood in a 1% AEP event but, in general, 'A' roads (e.g. the A560 in Stockport, Kingsway – A34, Princess Road – A5103 and Chester Road – A56) are not modelled to flood until an extreme 0.1% AEP event.
- Railway lines are not modelled to flood across the range of modelled flood events

6.2.3 Flood Hazard

The upgrade of the Upper Mersey model from 1D to 1D-2D means that flood depth, velocity and hazard information has automatically been recorded for each design simulation. The peak depth, velocity and hazard grids are provided as ASCII grids within the project deliverables (Appendix A). Figure 6-3 provides an example of the present-day, defended, 1% AEP peak flood depth map. The raw TUFLOW hazard results are provided within the model and can be used to generate animations and/or view the hazard maps at set time intervals for each return periods, as required.

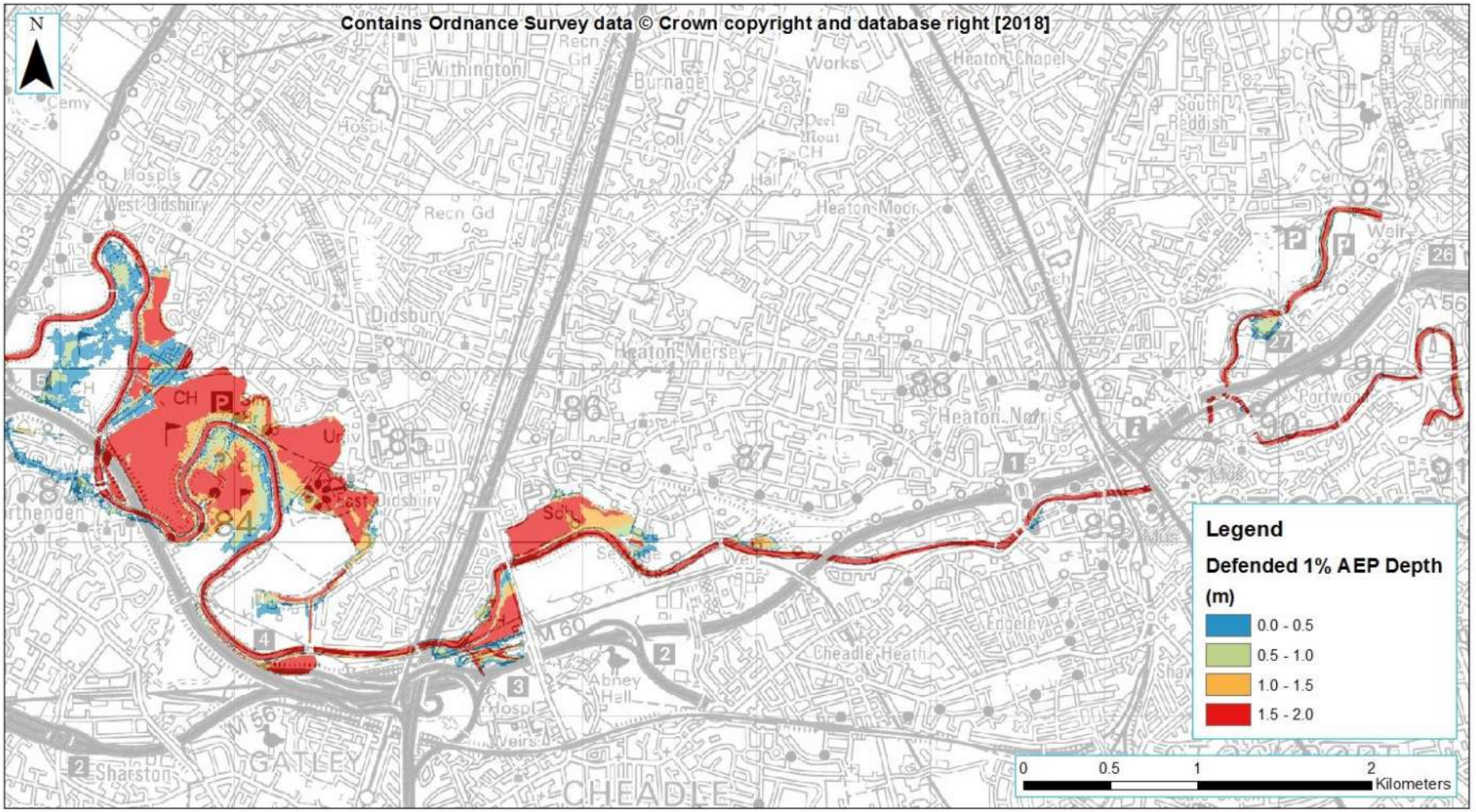
6.3 Undefended, Present Day, Flood Mapping Results

6.3.1 Flood Outlines

The modelled, present day (i.e. without climate change), flood outlines for the undefended scenarios for each design return period are provided as GIS deliverables in Appendix A. Figure 6-4 shows a select number of the modelled, present-day, undefended flood outlines. This shows that the removal of the flood embankments alongside the Upper Mersey would lead to the flooding of some rural areas including those occupied by the Didsbury and Sale Ees FSAs in an event as low as 50% AEP. Flooded areas would remain primarily rural at moderate (10% AEP) return periods.

A comparison of the undefended 1% AEP outline with the defended 1% AEP flood outline (as shown in Figure 6-2) reveals that the undefended 1% AEP outline is generally larger than the defended 1% AEP flood outline. However, the significant reduction in river levels that can occur locally in response to the removal of all the flood defences in a single undefended scenario has led to the situation where the undefended 1% AEP flood outline is smaller than the defended 1% AEP flood outline at some locations. This is most obvious for the flow route that is modelled to flow along Mill Lane into Northenden, which is modelled in the defended but not undefended 1% AEP scenario. The undefended 0.1% AEP flood outline is similarly not always larger than the defended 0.1% AEP flood outline. This means that the revised Flood Zones will need to be created as a (worse-case) combination of the modelled defended and undefended flood outlines.

Figure 6-3; Present-day, defended, 1% AEP, peak flood depth map



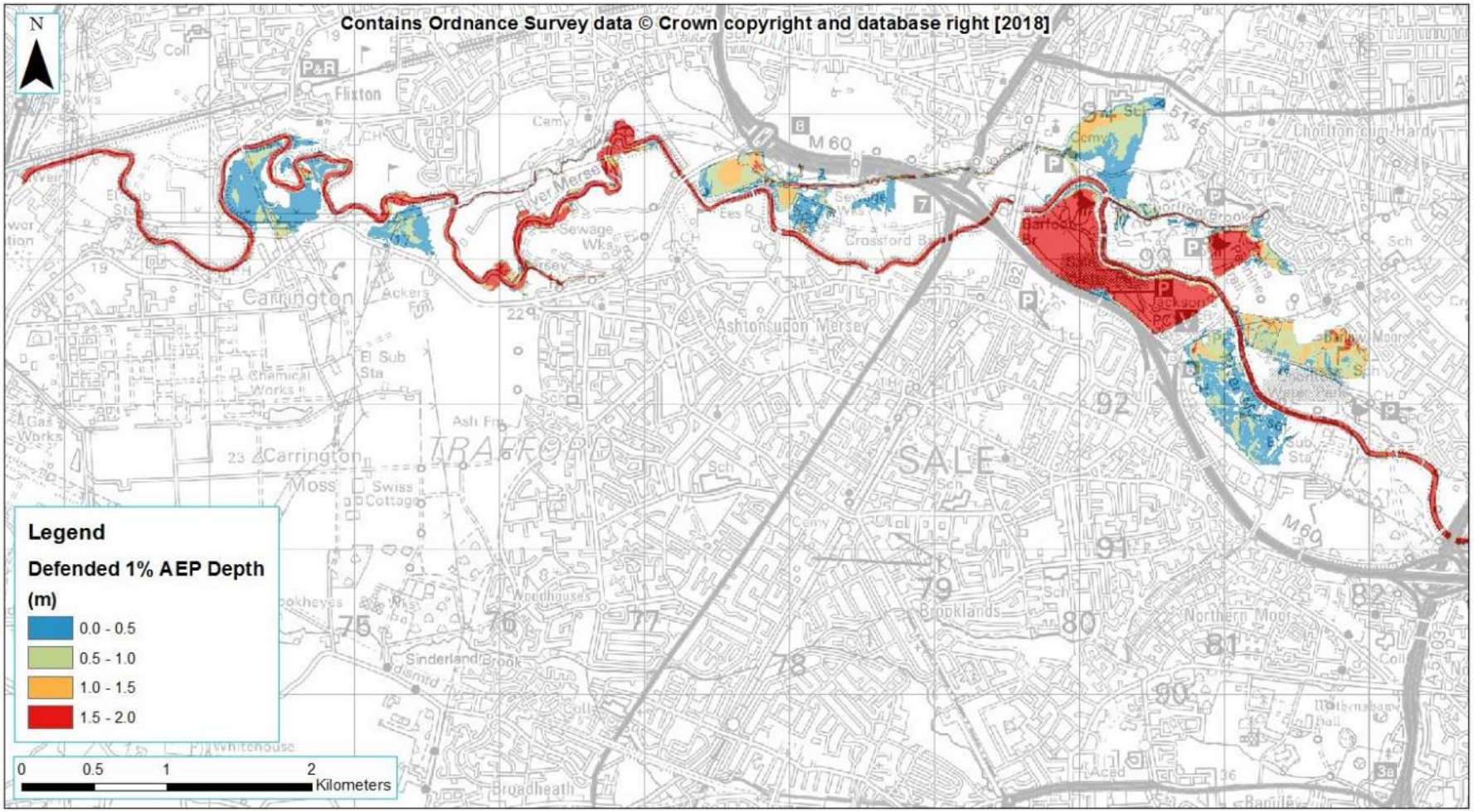
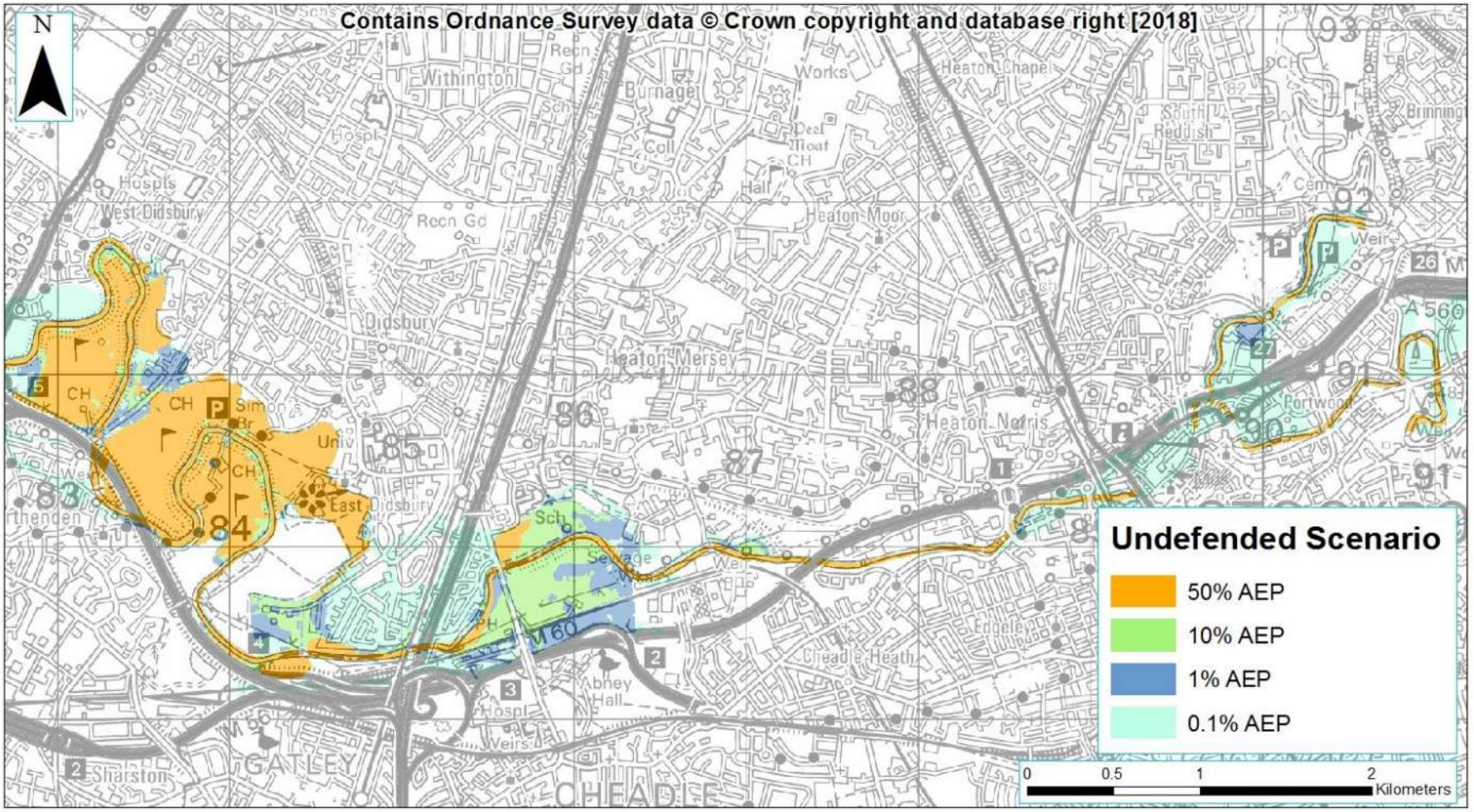
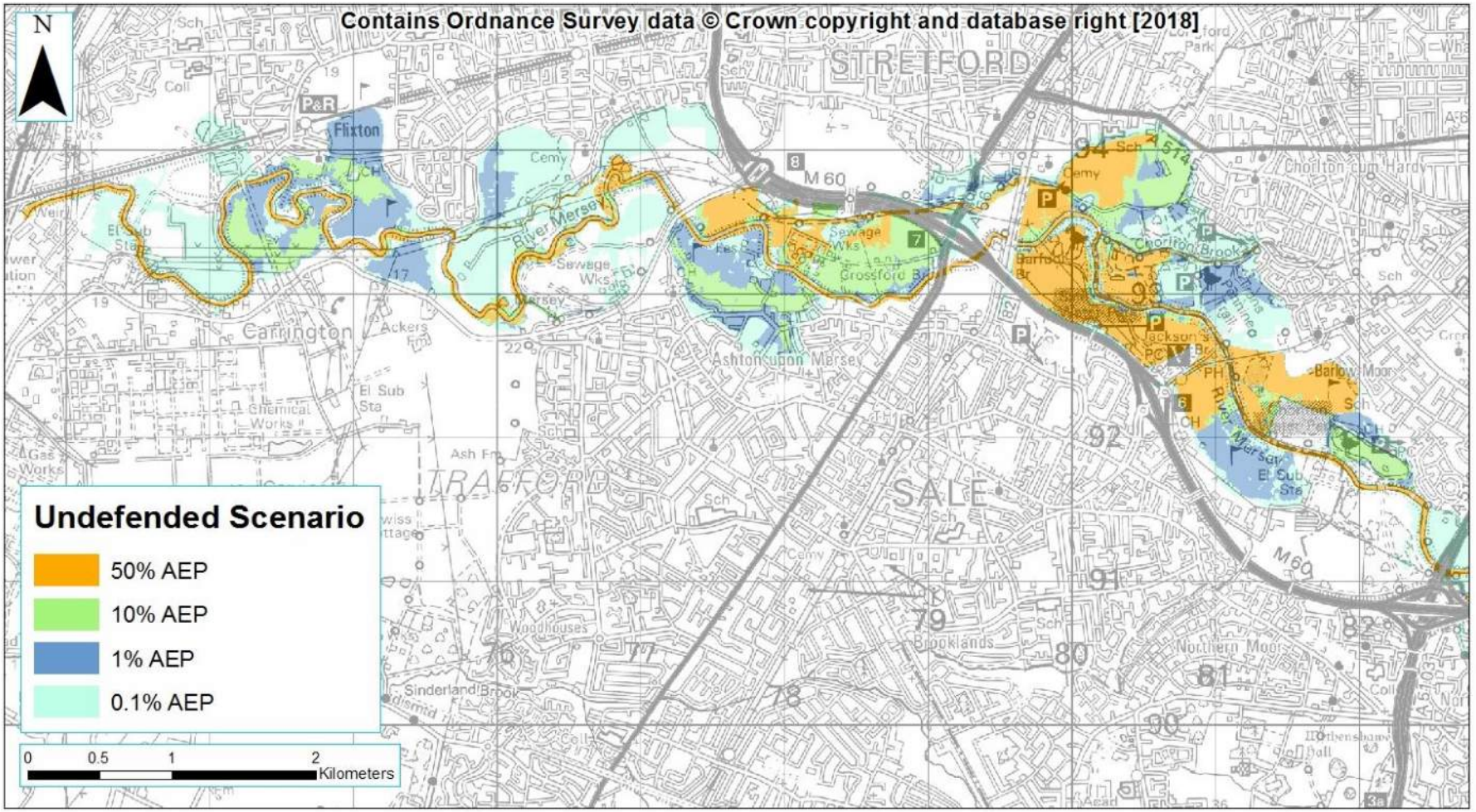

Contains Ordnance Survey data © Crown copyright and database right [2018]
N
Legend
Defended 1% AEP Depth (m)
0.0 - 0.5
0.5 - 1.0
1.0 - 1.5
1.5 - 2.0
0 0.5 1 2
Kilometers
Flixton
Carrington
Ashton upon Mersey
SALE
TRAFFORD
M60
Broadheath

Figure 6-4; Selected present-day, undefended, flood outlines



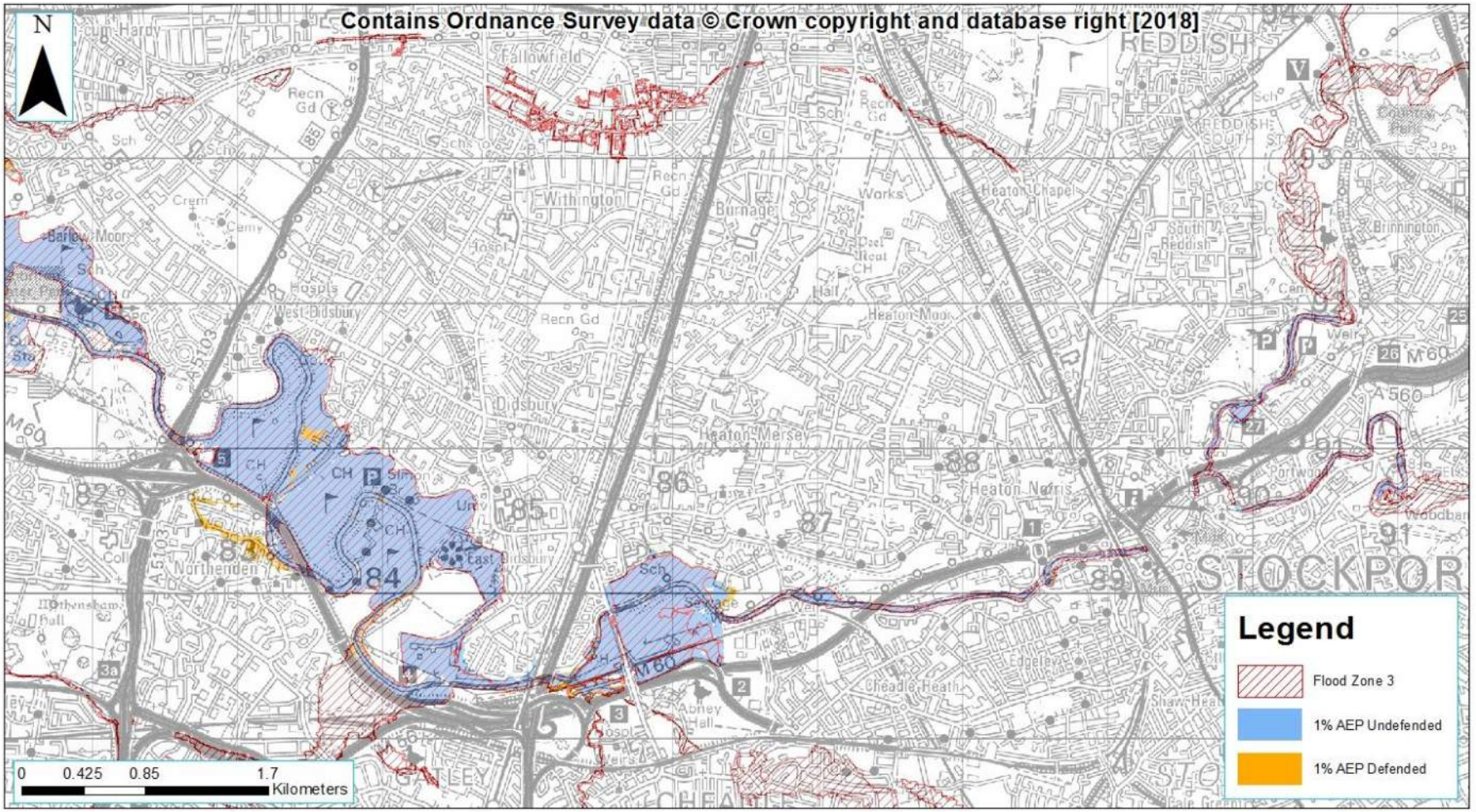

Contains Ordnance Survey data © Crown copyright and database right [2018]
N
Undefended Scenario
50% AEP
10% AEP
1% AEP
0.1% AEP
0
0.5
1
2
Kilometers
STRETFORD
SALE
TRAFFORD
Flixton
Carrington
Ashton upon Mersey
Brooklands
Northern Moor
Barlow Moor
River Mersey
Sinderland Brook
M60

6.3.2 Comparison with existing Flood Zones

Figure 6-5 and Figure 6-6 show the modelled, present day, 1% and 0.1% AEP (combined defended and undefended) flood outlines, respectively, alongside the current EA Flood Zones 3 and 2, from which the following observations are made;

- The modelled 1% AEP (combined undefended and defended) flood outline obtained in this study are broadly similar to the existing Flood Zone 3 with the following obvious differences;
  - A 1% AEP (defended) flow route from Ford Lane in Northenden was not captured in the previous flood map.
  - A 1% AEP flow route beneath the Bridgwater Canal in Stretford was not captured in the previous flood map.
  - Floodwater is not modelled to pass across the M60 embankment opposite the Didsbury FSA inlet to affect property around Longley Lane in the Northenden Junction area in a 1% AEP event so the risk may be reduced in this area relative to the existing Flood Zone 3. However, it is possible that the existing Flood Zone 3 in this area may reflect the risk from another watercourse.
  - An area around Church Road in Flixton is now modelled to be at risk in the undefended 1% AEP scenario.
- The modelled 0.1% AEP (combined undefended and defended) flood outline obtained in this study are broadly similar to the existing Flood Zones 2 with the following obvious differences;
  - A 0.1% AEP flow route, which originates from upstream of the Warren Street culvert in Stockport, floods a large area of Stockport Town Centre that is not captured in the existing flood map.
  - A large area of East Didsbury on either side of Kingsway is modelled to be at risk during a 0.1% AEP event from floodwater that overtops the right bank of the Upper Mersey alongside Wilmslow Road and Morningside Drive and flows in a general westward direction onto Kingsway and beyond via bridges beneath the railway line.
  - The number of properties at 0.1% AEP risk within Northenden is reduced in response to the more precise modelling of flow routes following overtopping of the left bank of the Upper Mersey.
  - Princess Road is modelled to be overtopped in a 0.1% AEP event increasing the number of properties at risk in Barlow Moor relative to the existing flood map.
  - Fairy Lane substation on the left bank of the Upper Mersey is modelled to be at a 0.1% AEP risk, which was not captured in the previous flood map.
  - Properties on Poplar Road in Stretford are modelled to be at a 0.1% AEP risk, which was not captured in the previous flood map.
  - The 0.1% AEP outline close to the Manchester Ship Canal is noticeably smaller than the existing Flood Zone 2. This is assumed to be because Flood Zone 2 in this area largely represents the risk from the Manchester Ship Canal.

Figure 6-5; Comparison of modelled 1% AEP flood outlines with existing Flood Zone 3



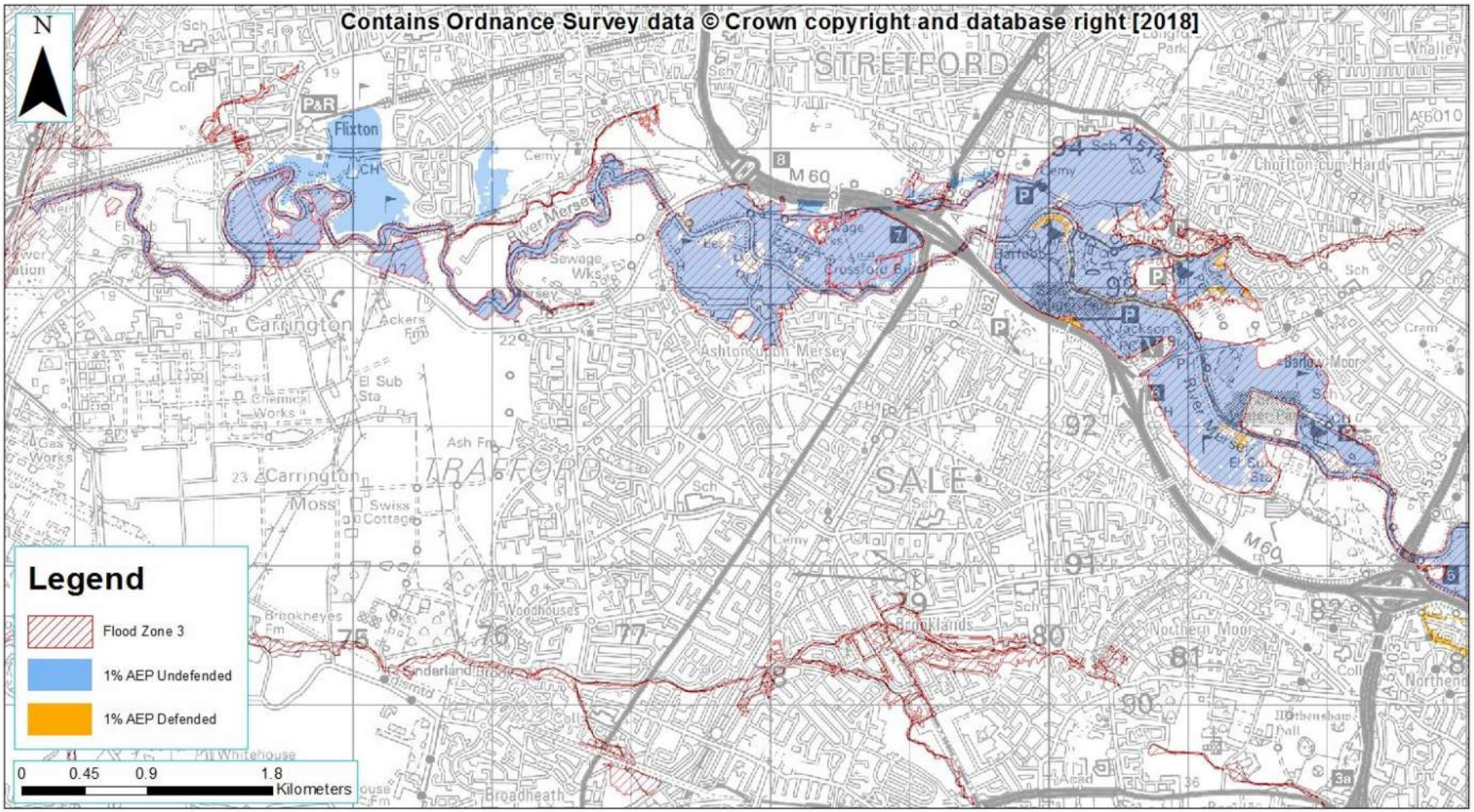
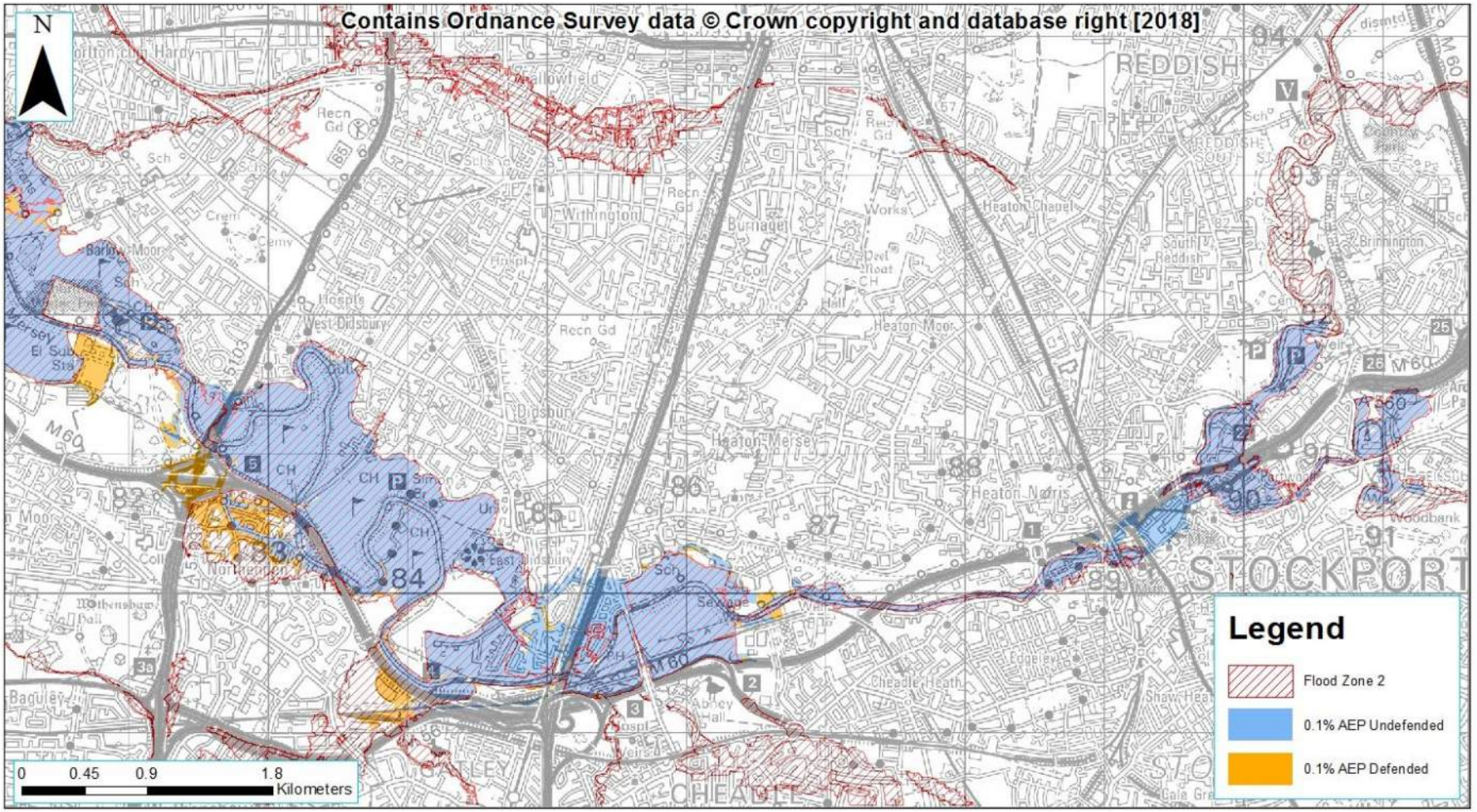
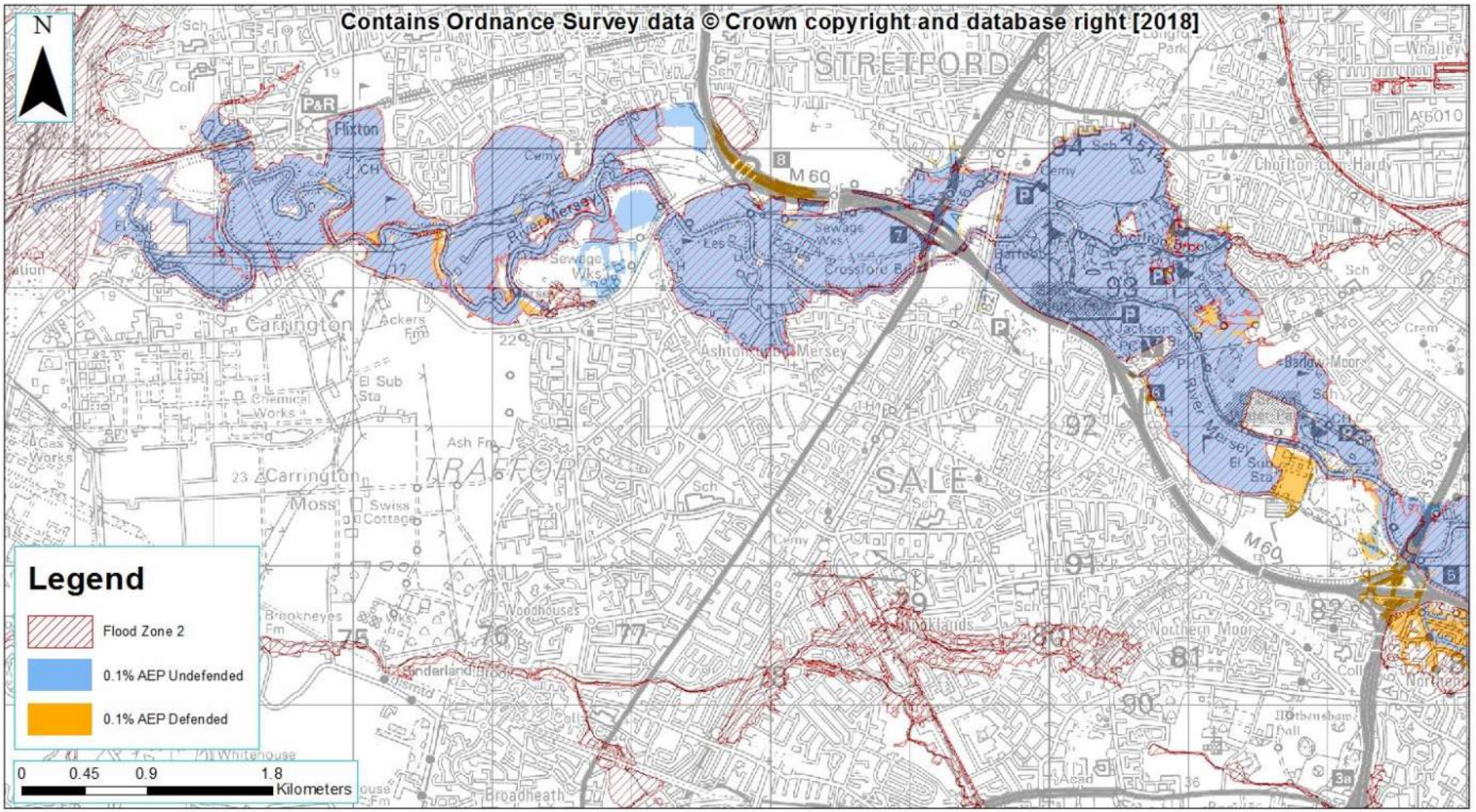

Contains Ordnance Survey data © Crown copyright and database right [2018]
N
Legend
Flood Zone 3
1% AEP Undefended
1% AEP Defended
0 0.45 0.9 1.8
Kilometers
STRETFORD
SALE
TRAFFORD
Carrington
Flixton
M60
River Mersey

Figure 6-6; Comparison of modelled 0.1% AEP flood outlines with existing Flood Zone 2




Contains Ordnance Survey data © Crown copyright and database right [2018]
N
Legend
Flood Zone 2
0.1% AEP Undefended
0.1% AEP Defended
0 0.45 0.9 1.8
Kilometers
STRETFORD
SALE
TRAFFORD
Carrington
Flixton
M60
River Mersey

6.3.3 Areas Benefiting from Defences

Areas Benefiting from Defences (ABDs) are defined as areas that are modelled to be flooded in an undefended 1% AEP model scenario but are modelled to remain dry in a defended 1% AEP model scenario. Figure 6-7 shows the modelled, present day, defended and undefended 1% AEP flood outlines together with Areas Benefiting from Defences (ABDs), which are defined as differences between the defended and undefended 1% AEP flood outlines that are greater than 0.5km^2 in area. As with the existing flood maps, a large number of potential ABD's arose from the modelling results that were small and/or irregularly shaped and many of these defended only rural areas of the floodplain. In view of this, it was agreed with the Environment Agency that only ABDs, which exceed 0.5km^2 should be provided with the MapEdit deliverables in order to provide a meaningful set of ABDs. These ABDs include areas around Cheadle Wood Farm, Tuscan Road (close to the Didsbury FSA inlet), parts of Didsbury Golf Course, Chorlton Water Park, Chorlton Ees Nature Reserve, Turn Moss Playing Fields, Bradley Lane, the Ashton-upon-Mersey Golf and Cricket fields, Urmston Meadows and Flixton Golf Course.

The model assumes a good condition for all existing defences. This is likely to be true for the Environment Agency maintained embankment and walls but it should be noted that there also are some private defences along the Upper Mersey that may not be maintained to the same high standard but have also been assumed as being in good a condition.

6.4 Climate Change

The modelled, future (i.e. with climate change), 1% and 0.1% AEP, defended, flood outlines are provided as GIS deliverables in Appendix A. and are illustrated in Figure 6-8.

The following increases in the 1% AEP flood outline relative to the baseline (present-day) outline were modelled in response to increasing climate change factors;

- 1% AEP + 30% = 46% larger
- 1% AEP + 35% = 55% larger
- 1% AEP + 70% = 132% larger

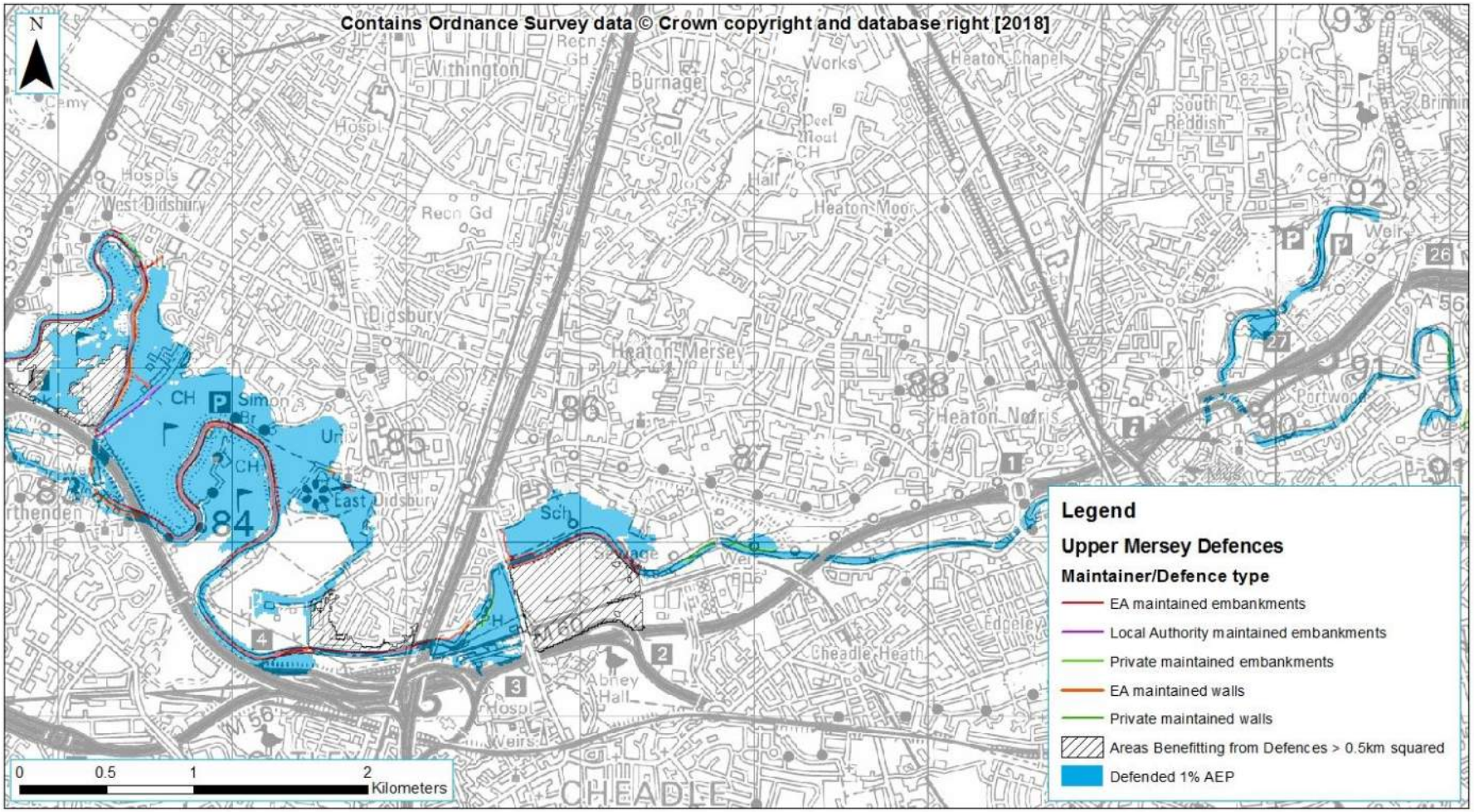
The increase in 1% AEP risk due to the +30% and +35% climate change factors is most prevalent along the central reach of the Upper Mersey floodplain between Heaton Mersey and Ashton Weir but the increase in 1% AEP flood extent due to the +70% climate change factor is distributed along the whole of the Upper Mersey model reach. Urban areas that are placed at a noticeably increased risk in response to either 30 or 35% climate change factors include parts of Stockport, East Didsbury, Northenden and Barlow Moor. A 70% climate change factor is modelled to lead to a future 1% AEP risk that would be broadly similar to the present day 0.1% AEP risk.

A 17% increase in the 0.1% AEP flood outline is modelled relative to the baseline (present-day) outline in response to a climate change factor of +30%.

Table 6-1 shows that a 30% increase in 1% AEP flows would lead to an increase in flood levels of between 0.17m and 0.76m at a select number of locations along the Upper Mersey. In general, the difference in flood level due to climate change was modelled to decrease in a downstream direction due to the attenuating influence of the Upper Mersey floodplain, including FSAs, which is most prevalent along the central reaches of the Upper Mersey study reach.

The undefended, future (i.e. with climate change), 1% and 0.1% AEP events were also run as part of this commission. These results are supplied within the model deliverables (in Appendix A) but are not commented on here as these represent future, hypothetical scenarios.

Figure 6-7; Areas Benefiting from Defences



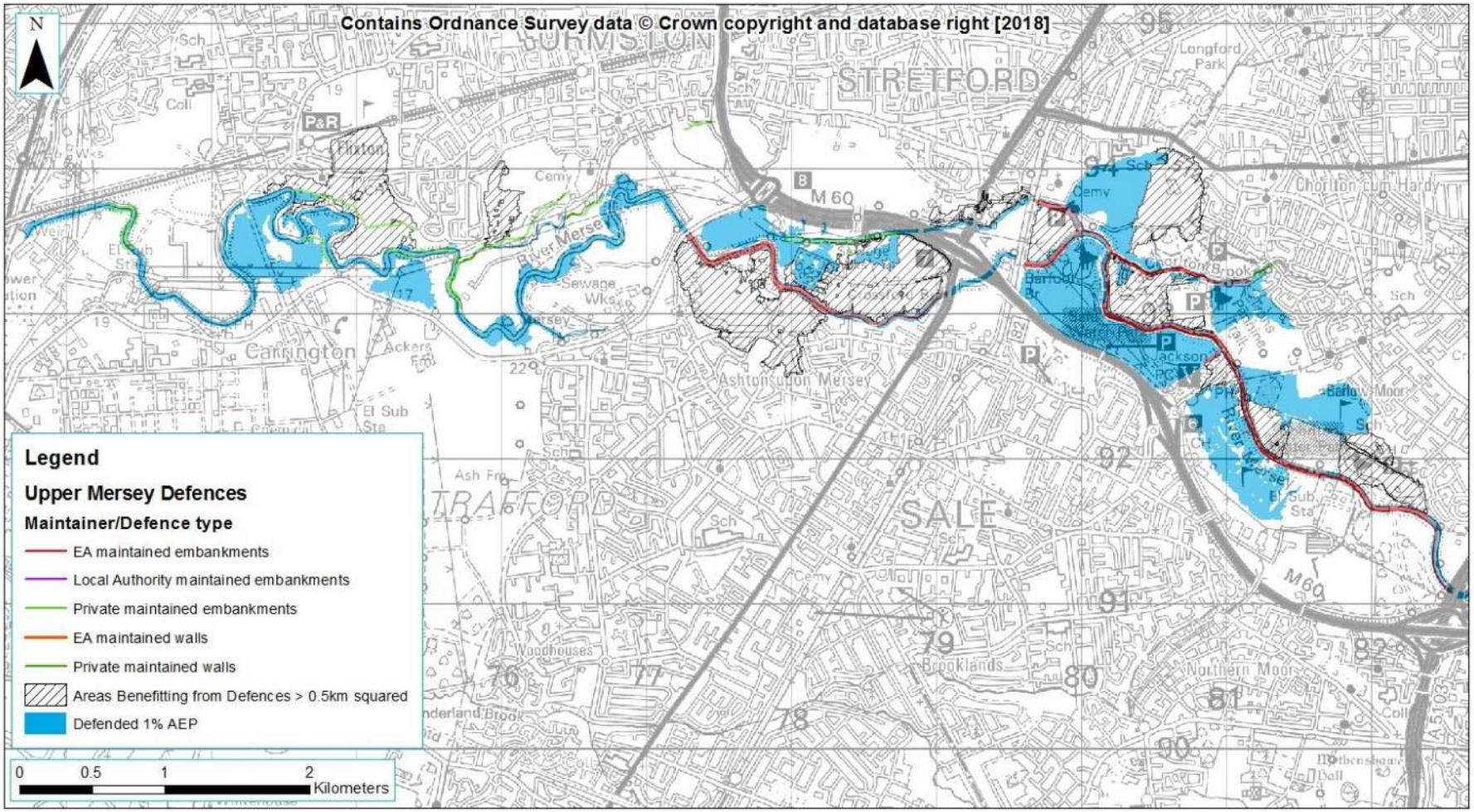
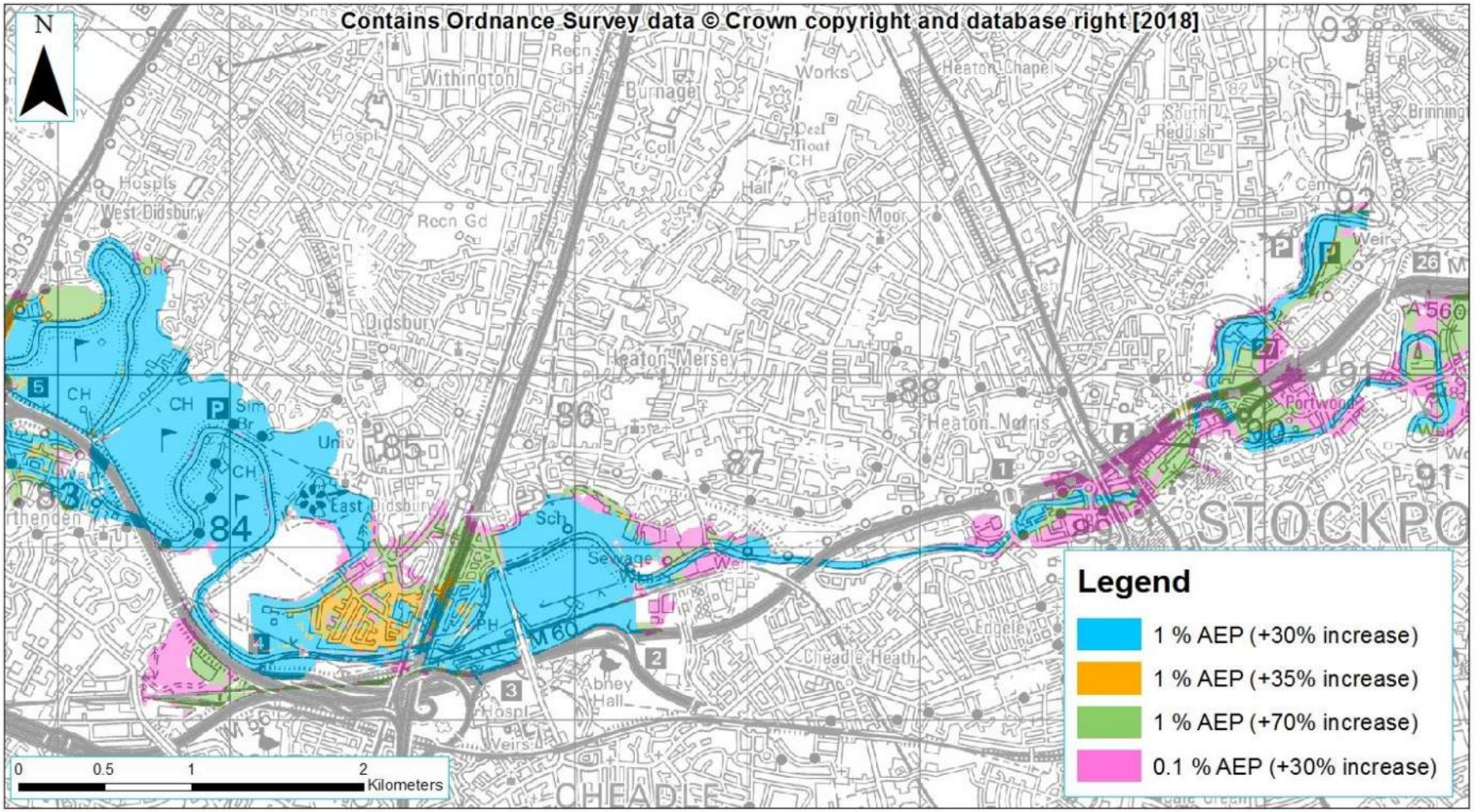
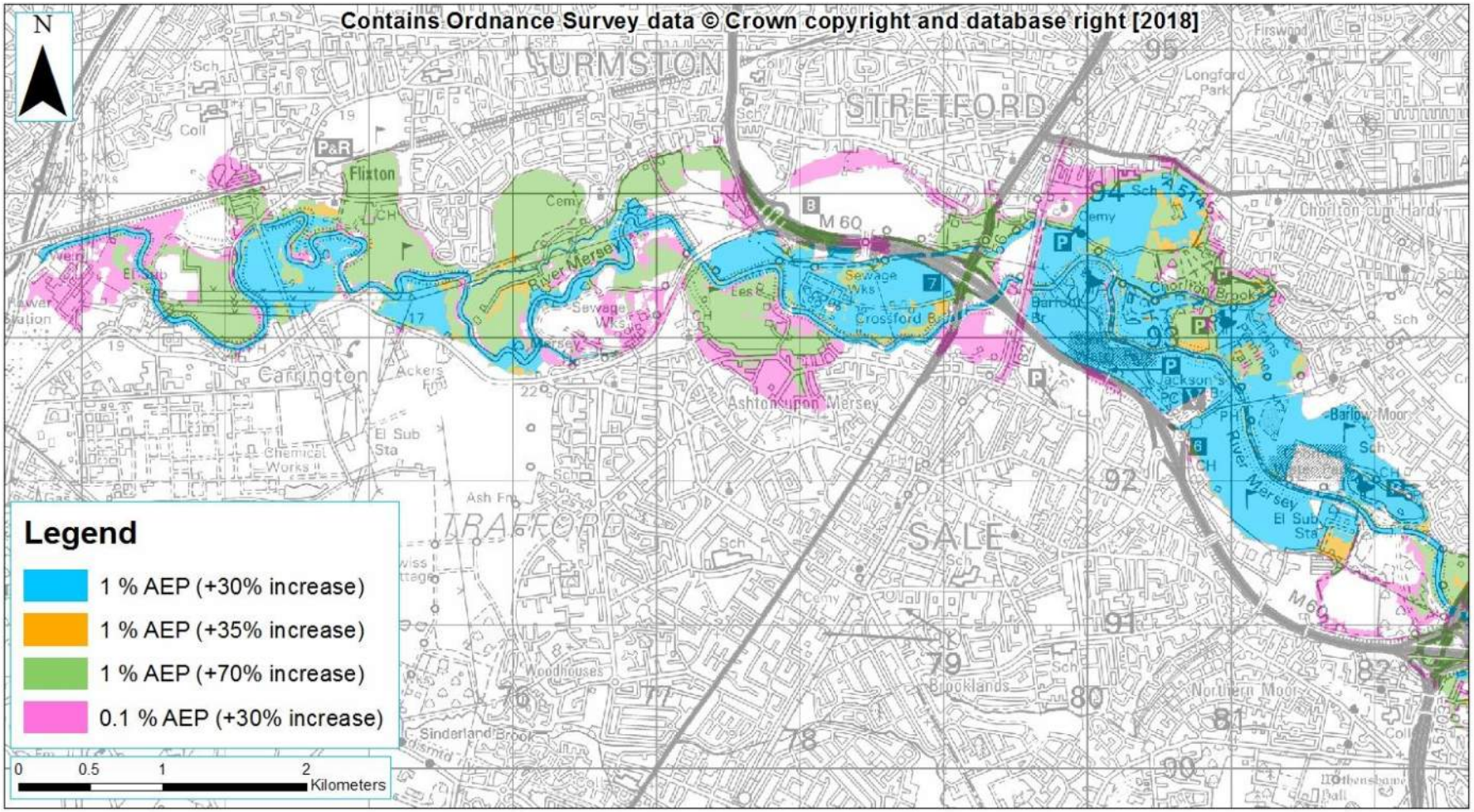

Contains Ordnance Survey data © Crown copyright and database right [2018]
N
Legend
Upper Mersey Defences
Maintainer/Defence type
EA maintained embankments
Local Authority maintained embankments
Private maintained embankments
EA maintained walls
Private maintained walls
Areas Benefitting from Defences > 0.5km squared
Defended 1% AEP
0
0.5
1
2
Kilometers
STRETFORD
SALE
TRAFFORD
M60
M63
M602
M69
River Mersey
Carrington
Flixton
Ashton upon Mersey
Brooklands
Northern Moor
Barlow Moor
Chorlton cum Hardy
Longford Park

Figure 6-8; Future (with climate change), defended, flood outlines




Contains Ordnance Survey data © Crown copyright and database right [2018]
N
Legend
1 % AEP (+30% increase)
1 % AEP (+35% increase)
1 % AEP (+70% increase)
0.1 % AEP (+30% increase)
0 0.5 1 2
Kilometers
SURMSTON
STRETFORD
TRAFFORD
SALE
Flixton
Carrington
Ashton upon Mersey
Chorlton cum Hardy
Barlow Moor
Brooklands
Woodhouses
Sinderland Brook
River Mersey
M 60

7 Blockage

7.1 Approach

In addition to the flood risk results documented in Section 6, this study has assessed the impact of blockages at six locations along the Upper Mersey model reach. The following locations were agreed with the Environment Agency;

- The A560 (Stockport Bridge) on the River Goyt
- The Warren Street culvert (Upper Mersey)
- The Brinksway Bridge (Upper Mersey)
- The Princess Parkway Bridge (Upper Mersey)
- Crossford Bridge (Upper Mersey)
- Flixton Bridge (Upper Mersey)

These locations were identified as likely to have the greatest impact on flood risk if blocked. Three blockage proportions were modelled: low (25%), medium (50%), and high (75%). The impact of these varying degrees of blockage was assessed for both the present-day 1% AEP event and future 1% AEP plus 30% climate change event. This approach is consistent with the blockage approach used across the MP4 modelling package, unless more prescriptive guidance was provided at the scoping stage. However, it should be noted that high blockage proportions are considered unlikely to occur on a river as wide as the Upper Mersey.

The Warren Street culvert was modelled as a culvert, whereas the other five structures were modelled as bridges. Blockages were simulated by inserting a blockage unit upstream of the bridge or culvert inlet unit and simulating the required blockage proportion using different event (IED) files[6]. This approach means that only the entrance of the Warren Street culvert was blockade rather than applying a full-length blockage to this 500-metre long structure.

Blockage at each location was assessed independently. The following sub-sections describe the impact of the assessment completed at each structure. Many of the modelled blockages are of multiple arched bridges, in which case the surcharging is reported relative to the lowest soffit level of the structure.

7.2 A560, Stockport Bridge

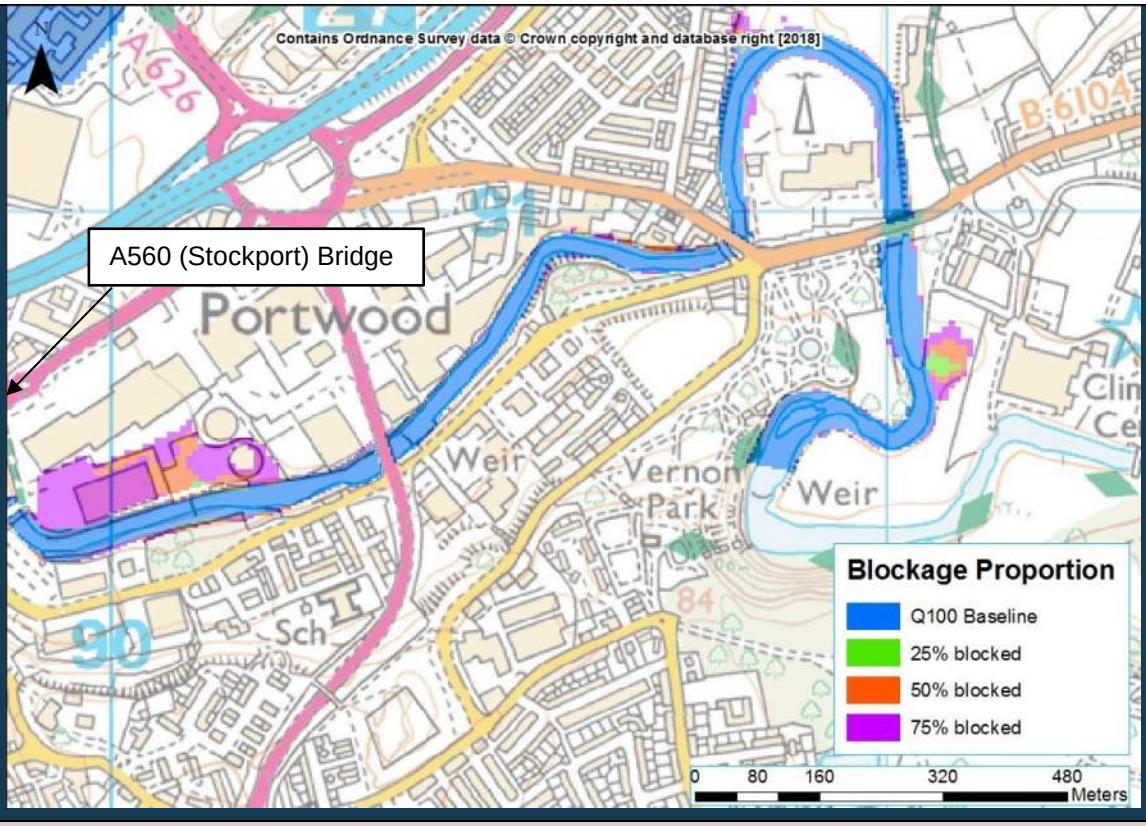
Figure 7-1 illustrates the change in 1% AEP upstream water levels and flood outlines associated with the blockage of the A560 (Stockport) Bridge. Blocking the bridge along the A560 by 25%, 50% and 75% causes upstream water levels to increase by 0.14m, 0.49m and 1.67m, respectively but surcharging does not occur until a 75% blockage. The Matalan at Millgate is modelled to be at risk from a 50% blockage.

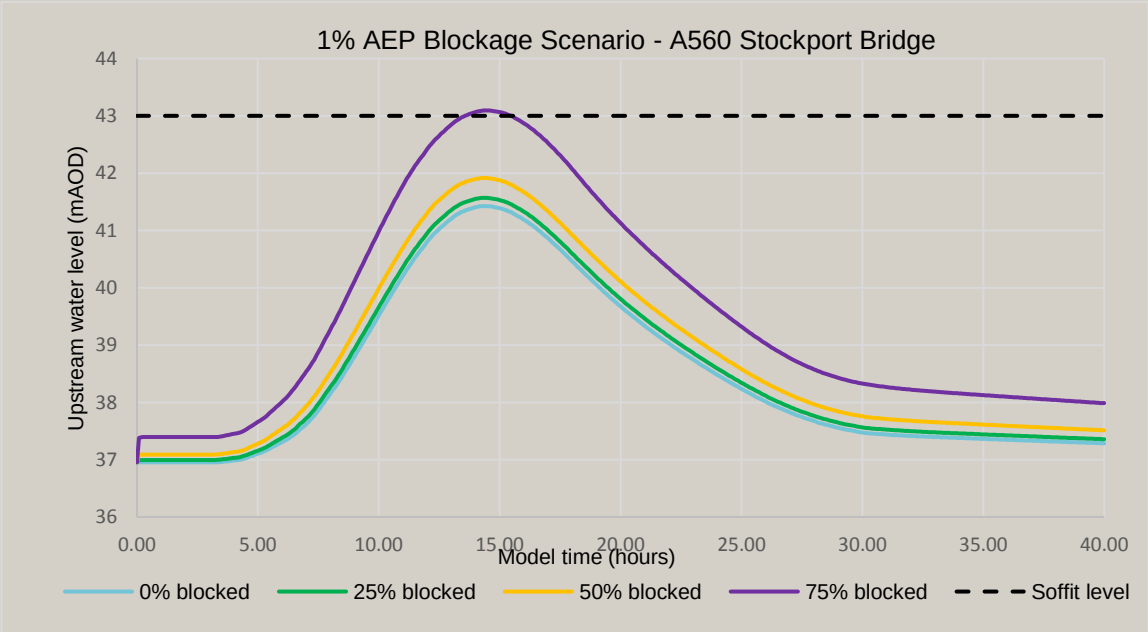
Figure 7-2 illustrates the change in upstream 1% AEP + 30% (climate change) water levels and flood outlines associated with the blockage of the A560. In this case the bridge is surcharged for short period during all blockage runs. The 1% AEP + 30% (climate change) flood extent is not greatly increased by either 25% or 50% blockages but further properties (e.g. the Peel Centre shopping park and along Great Portwood, Avenue and Brewery Streets) and additional upstream areas are modelled to be at risk in response to a 75% blockage event.

---

[6] A separate DAT file was initially created for the blockage runs by adding blockage units, with 0% blockage and no loss coefficients, at the required blockage locations to the DAT file that had been used for the design runs. Separate IED files configured to the required blockage porprtions were then simulated in association with this modified DAT file.

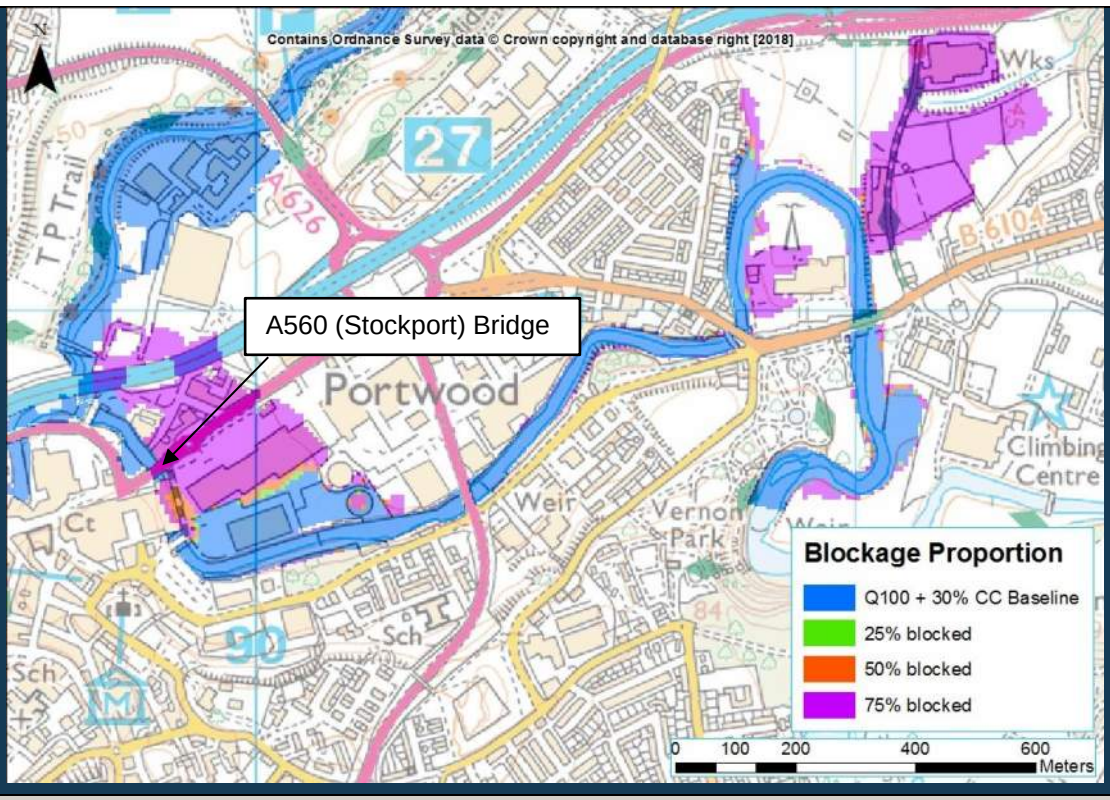
Figure 7-1: 1% AEP event blockage scenarios at the A560 (Stockport Bridge)

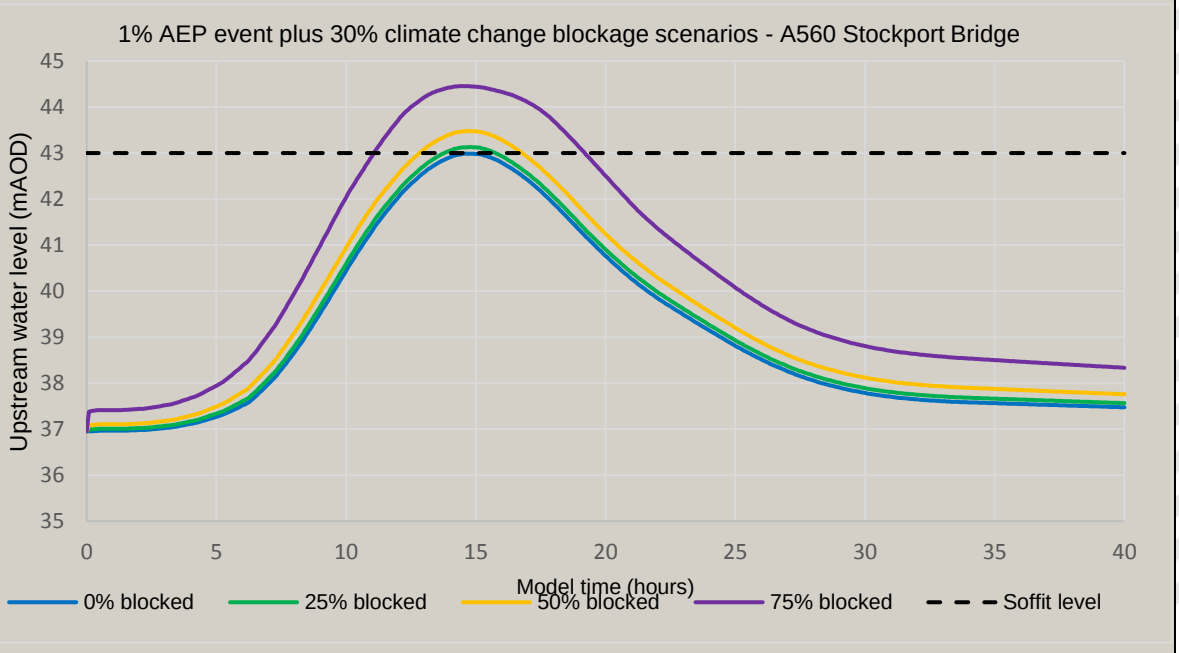




	0% Blocked	25% Blocked	50% Blocked	75% Blocked
Peak Upstream water level (m AOD)	41.43	41.57	41.92	43.09
Surcharging Duration (hrs)	0	0	0	1.92

Figure 7-2; 1% AEP +30% CC event blockage scenarios at A560 (Stockport Bridge)





	0% Blocked	25% Blocked	50% Blocked	75% Blocked
Peak Upstream water level (m AOD)	42.99	43.13	43.48	44.45
Surcharging Duration (hrs)	0	2.03	4.11	8.25

7.3 Warren Street Culvert

Figure 7-3 illustrates the change in 1% AEP upstream water levels and flood outlines associated with the blockage of the Warren Street culvert. Blocking the culvert along the A560 by 25%, 50% and 70%[7] causes upstream water levels to increase by 0.34m, 1.14m and 2.82m, respectively but surcharging does not occur until a 70% blockage. As with the A560 Bridge, the Matalan at Millgate is modelled to be at risk from a 50% blockage. However, it is not until the 70% blockage that a flow route originates from the right bank of the culvert and flows into Stockport Town Centre. A 70% blockage is also modelled to notably increase the at-risk areas alongside the Tame (at the Meadow Hill commercial estate) and Goyt (Matalan area).

Figure 7-4 illustrates the change in upstream 1% AEP + 30% (climate change) water levels and flood outlines associated with the blockage of the Warren Street culvert. In this case it was not possible to stabilise the culvert for in excess of 60% blockage so a high blockage proportion has not been modelled. However, the large size of this culvert will significantly reduce the probability of a high blockage proportion. The culvert becomes surcharged under the 50% blockage scenario during a 1% AEP + 30% (climate change) event leading to the same flow route into Stockport Town Centre as was modelled under the 1% AEP/70% blockage scenario. In addition, this scenario increases the risk upstream along both the Rivers Tame and Goyt.

7.4 Brinksway Bridge

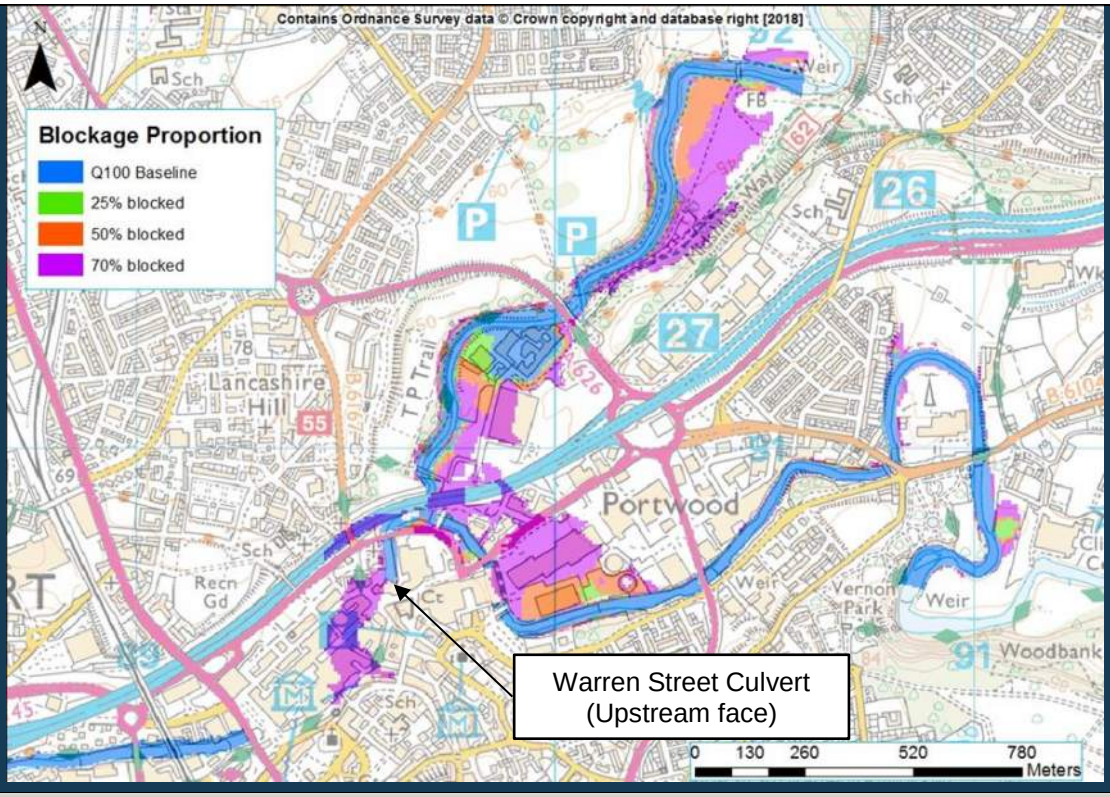
Figure 7-5 illustrates the change in 1% AEP upstream water levels and flood outlines associated with the blockage of Brinksway Bridge. Blocking the bridge by 25%, 50% and 70% causes upstream water levels to increase by 0.2m, 0.68m and 2.2m, respectively but surcharging does not occur until a 75% blockage. The 25% and 50% blockages are modelled to lead to only minor increases to the baseline 1% AEP flood extent but the 75% blockage scenario is modelled to flood a number of additional properties along Brinksway Street, Ford Street and Heaton Lane.

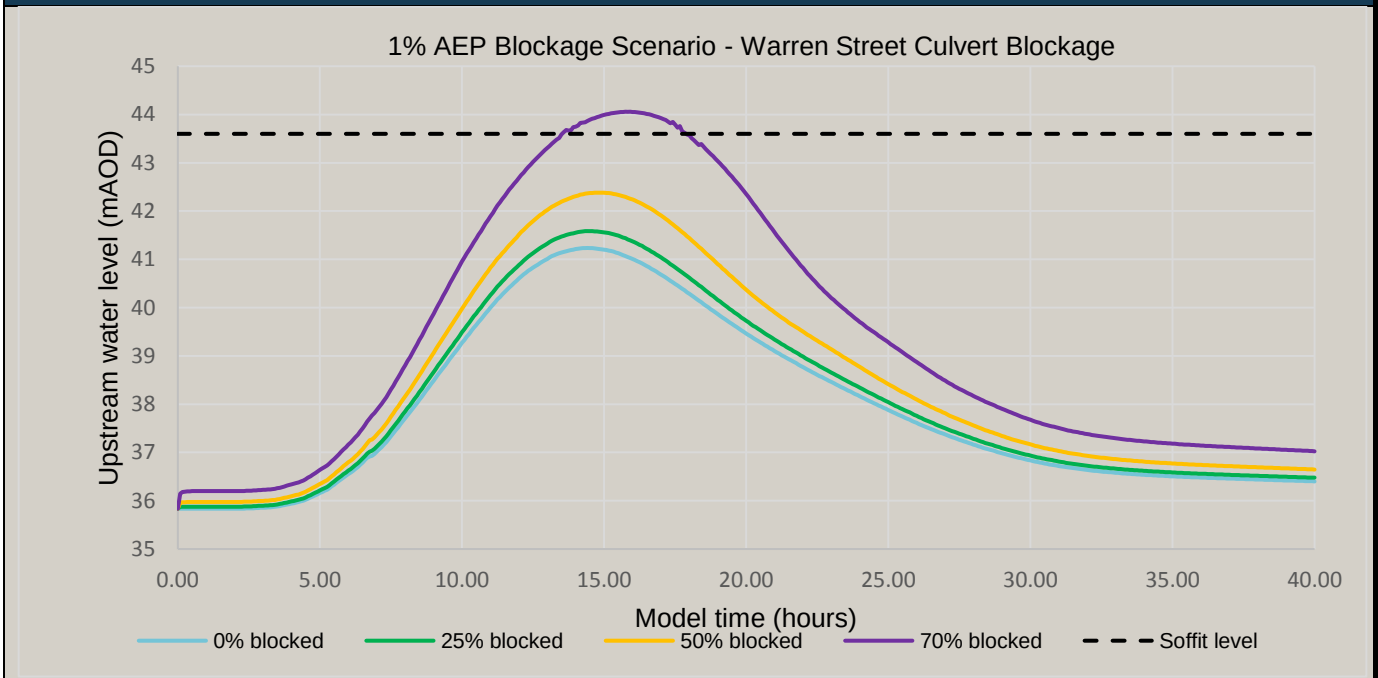
Figure 7-6 illustrates the change in upstream 1% AEP + 30% (climate change) water levels and flood outlines associated with the blockage of Brinksway Bridge. Blocking the bridge by 25%, 50% and 75% causes upstream water levels to increase by 0.24m, 0.79m and 2.09m, respectively and surcharging occurs across the range of events, although for a much longer duration in the 75% blockage scenario. The 1% AEP + 30% (climate change) flood extent is not greatly increased by either 25% or 50% blockages but further properties (along Brinksway and several side streets as far upstream as Stockport Bus Station) are modelled to be at risk in response to a 75% blockage event.

High blockage proportions at Brinksway Bridge are also still modelled to have an impact on the flood risk upstream of the Warren Street culvert.

[7] Note that it was possible to stabilise 1% AEP event with a 70% but not a 75% blockage so the 70% blockage scenario is considered suitable close to be documented as a high blockage scenario.

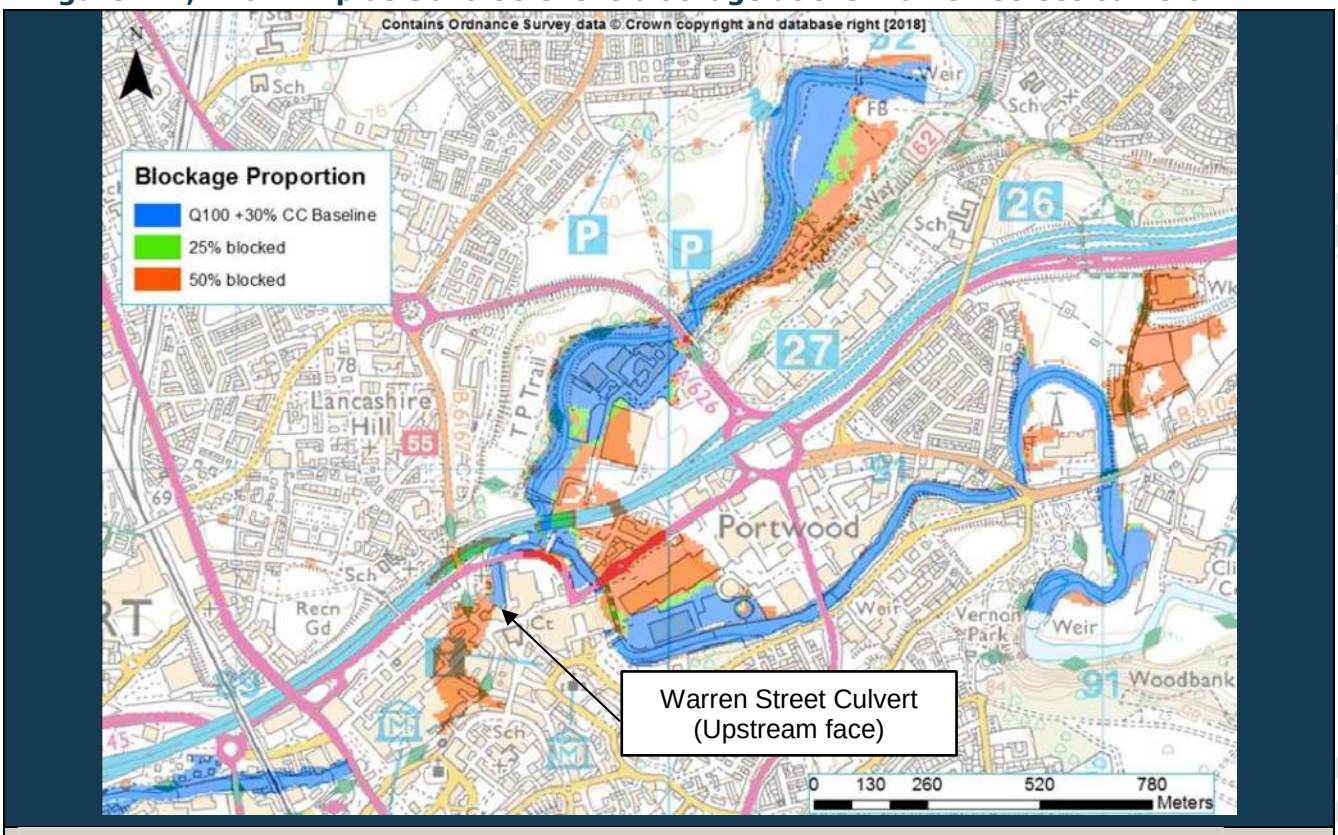
Figure 7-3; 1% AEP event blockage at the Warren Street Culvert

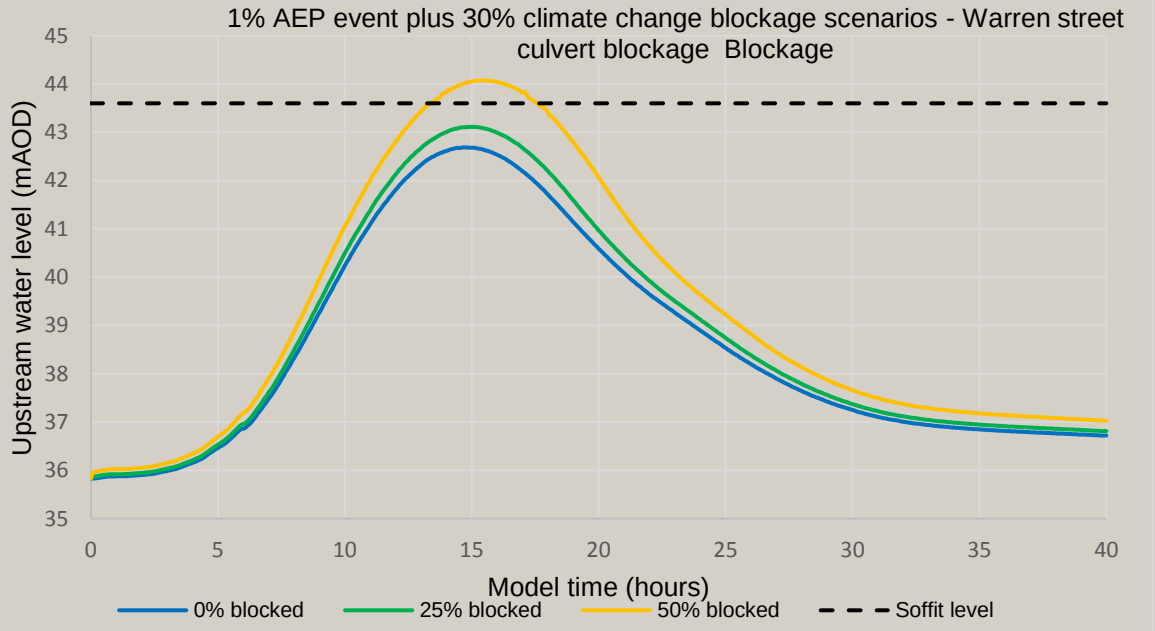




	0% Blocked	25% Blocked	50% Blocked	70% Blocked
Peak Upstream water level (m AOD)	41.24	41.58	42.38	44.06
Surcharging Duration (hrs)	0	0	0	4.34

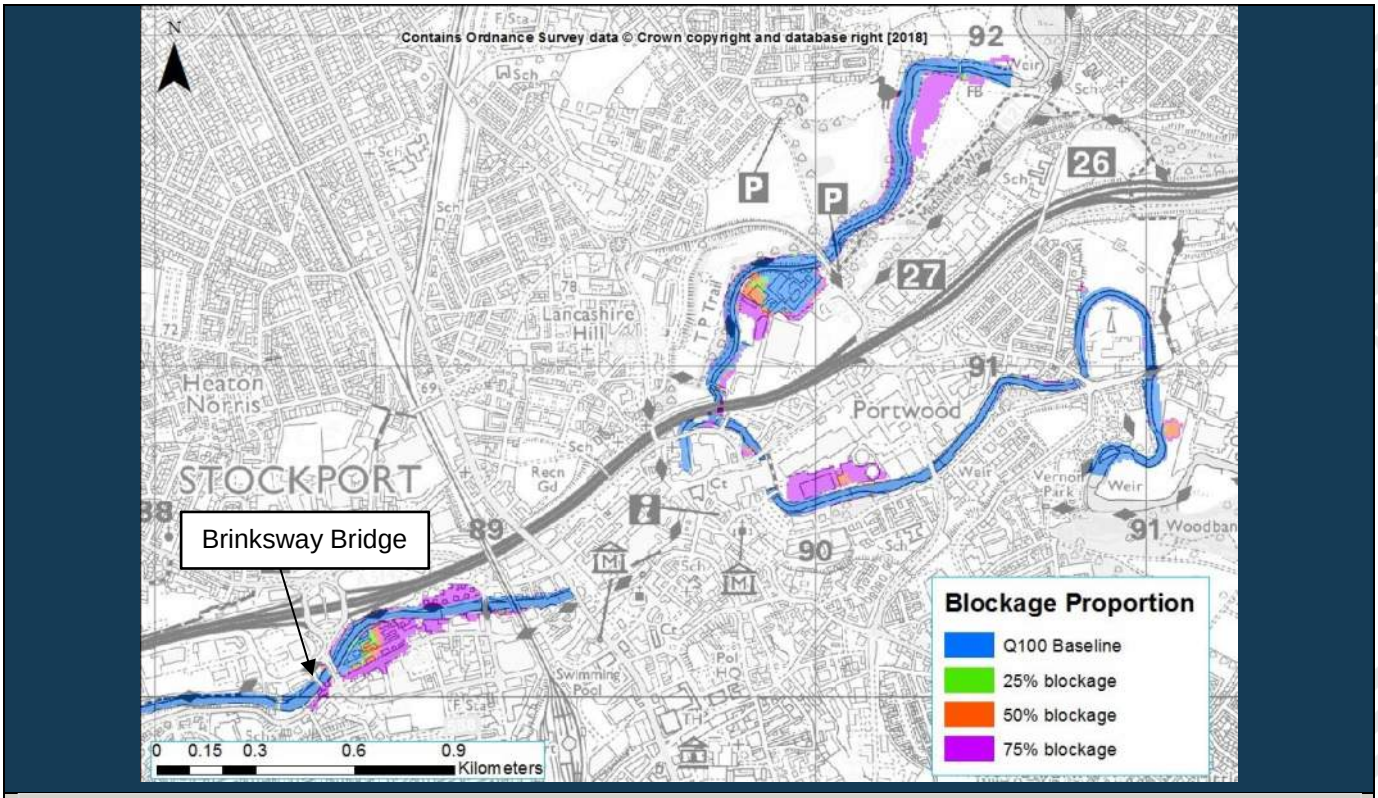
Figure 7-4; 1% AEP plus 30% CC event blockage at the Warren Street Culvert

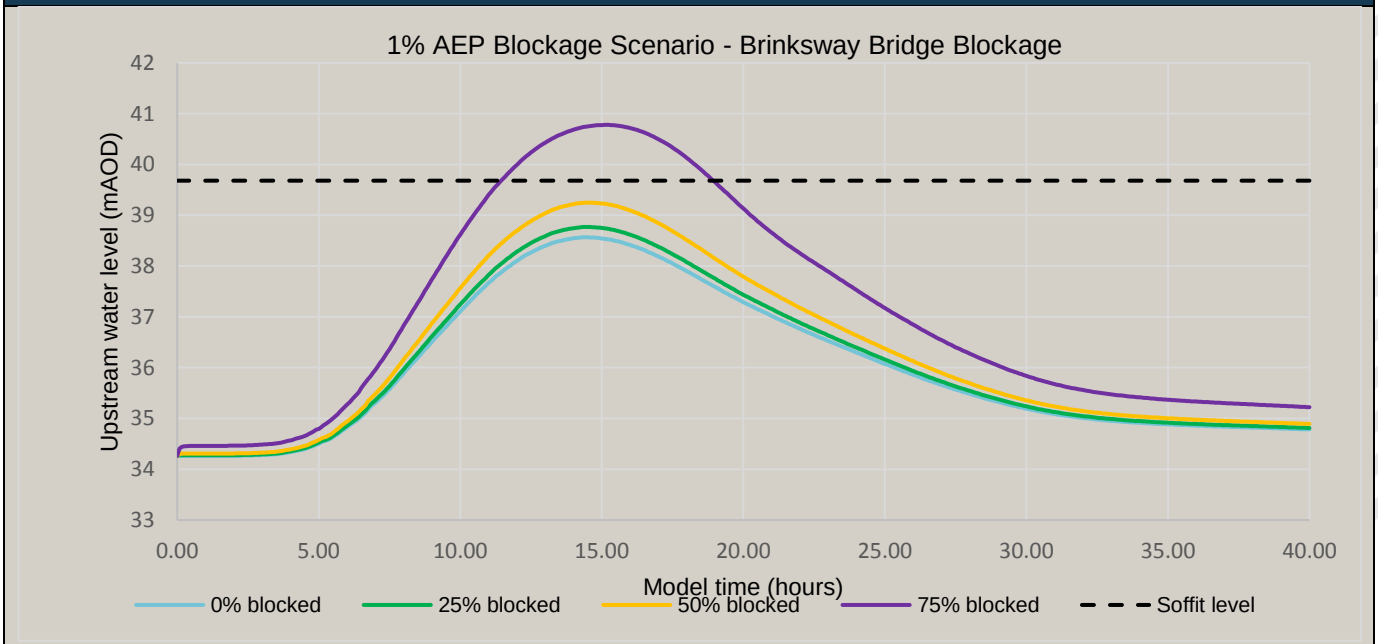




	0% Blocked	25% Blocked	50% Blocked	75% Blocked
Peak Upstream water level (m AOD)	42.68	43.11	44.07	N/K
Surcharging Duration (hrs)	0	0	0	N/K

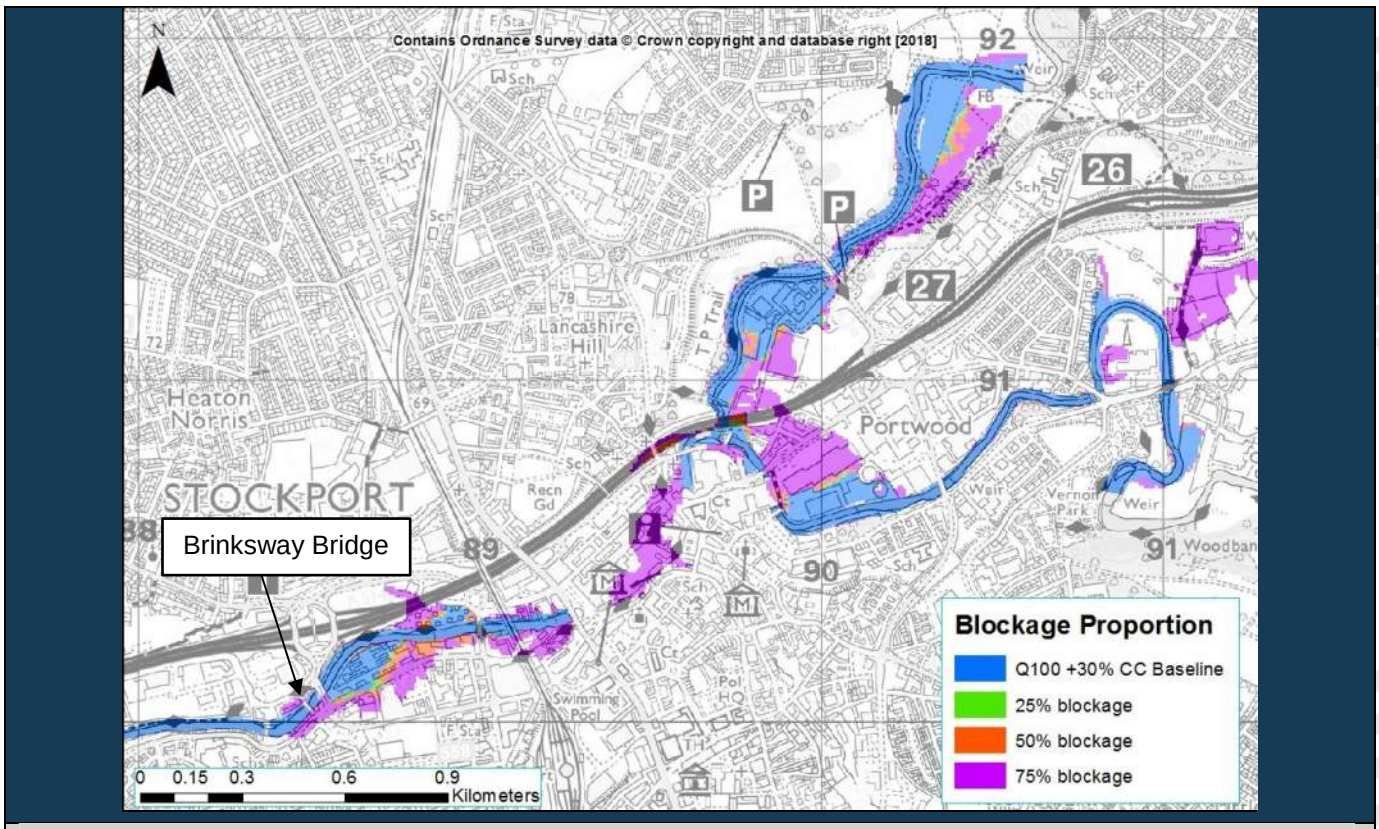
Figure 7-5; 1% AEP event blockage at Brinksway Bridge

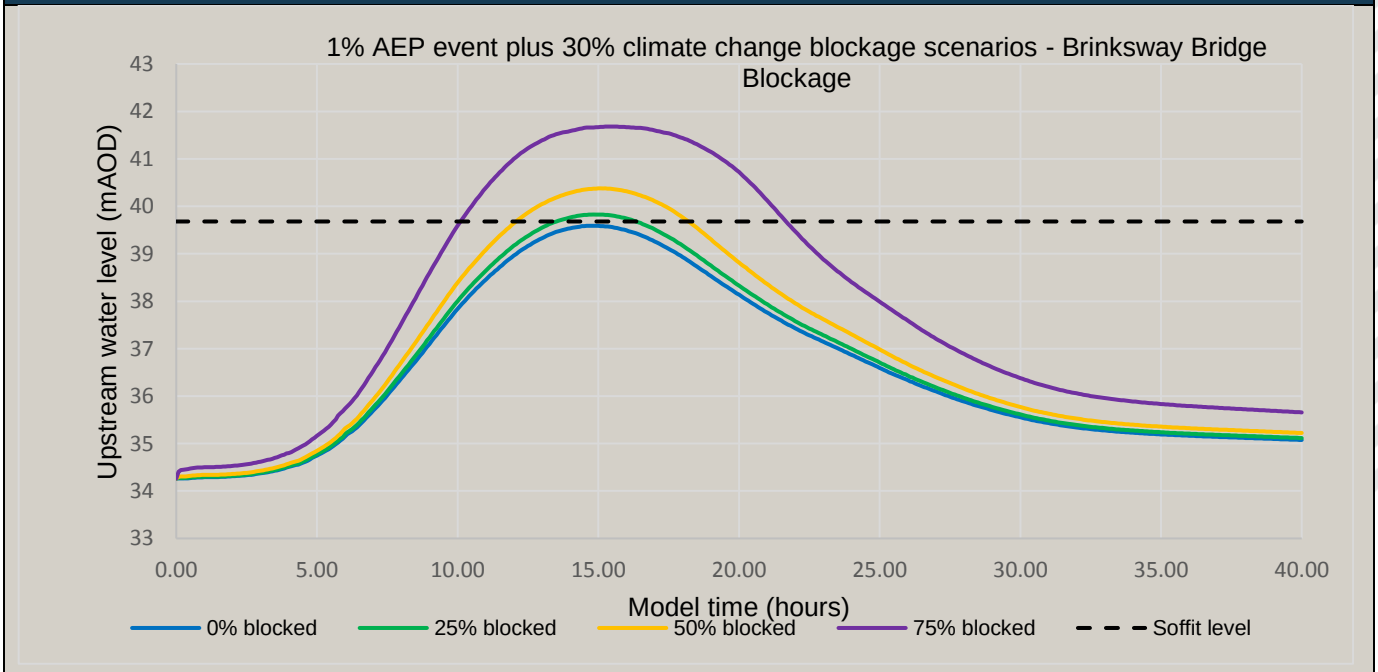




	0% Blocked	25% Blocked	50% Blocked	75% Blocked
Peak Upstream water level (m AOD)	38.57	38.77	39.25	40.78
Surcharging Duration (hrs)	0	0	0	7.5

Figure 7-6; 1% AEP plus 30% CC event blockage at Brinksway Bridge





	0% Blocked	25% Blocked	50% Blocked	75% Blocked
Peak Upstream water level (m AOD)	39.59	39.83	40.38	41.68
Surcharging Duration (hrs)	0	2.75	6.09	11.58

7.5 Princess Parkway Bridge

Figure 7-7 illustrates the change in 1% AEP upstream water levels and flood outlines associated with the blockage of Princess Parkway Bridge. Blocking the bridge by 25%, 50% and 75% causes upstream water levels to increase by 0.09m, 0.29m and 0.97m, respectively. The bridge is not modelled to surcharge during any of the 1% AEP runs. The 25% and 50% blockages lead to only moderate increases to the 1% AEP flood extent but the 75% blockage is modelled to place additional properties at risk along Penroy Avenue, Waterford Avenue and Mersey Crescent as well as noticeably increasing the flood extent across Northenden Golf Course.

Figure 7-8 illustrates the change in upstream 1% AEP + 30% (climate change) water levels and flood outlines associated with the blockage of Princess Parkway Bridge. Blocking the bridge by 25%, 50% and 75% causes upstream water levels to increase by 0.13m, 0.44m and 1.12m, respectively but surcharging is restricted to the 75% blockage scenario. The 1% AEP + 30% (climate change) flood extent is not greatly increased by the 25% blockage scenario but, as the road embankment is modelled to be overtopped, in the 50% and 75% blockage scenarios, additional properties are placed at risk on a combination of Rylstone Avenue, Mersey Crescent, The Beeches, and Newbrook Avenue. These higher blockage proportions also need to a noticeable increase in flood extent across the Parkway and Merseybank playing fields.

7.6 Crossford Bridge

Figure 7-9 illustrates the change in 1% AEP upstream water levels and flood outlines associated with the blockage of Crossford Bridge. Blocking the bridge by 25%, 50% and 75% causes upstream water levels to increase by 0.12m, 0.36m and 1.00m, respectively. The bridge is not modelled to surcharge in response to any of the modelled blockage scenarios. However, the blockages are modelled to lead to increased flood extents across the rural floodplain both upstream and downstream of Crossford Bridge.

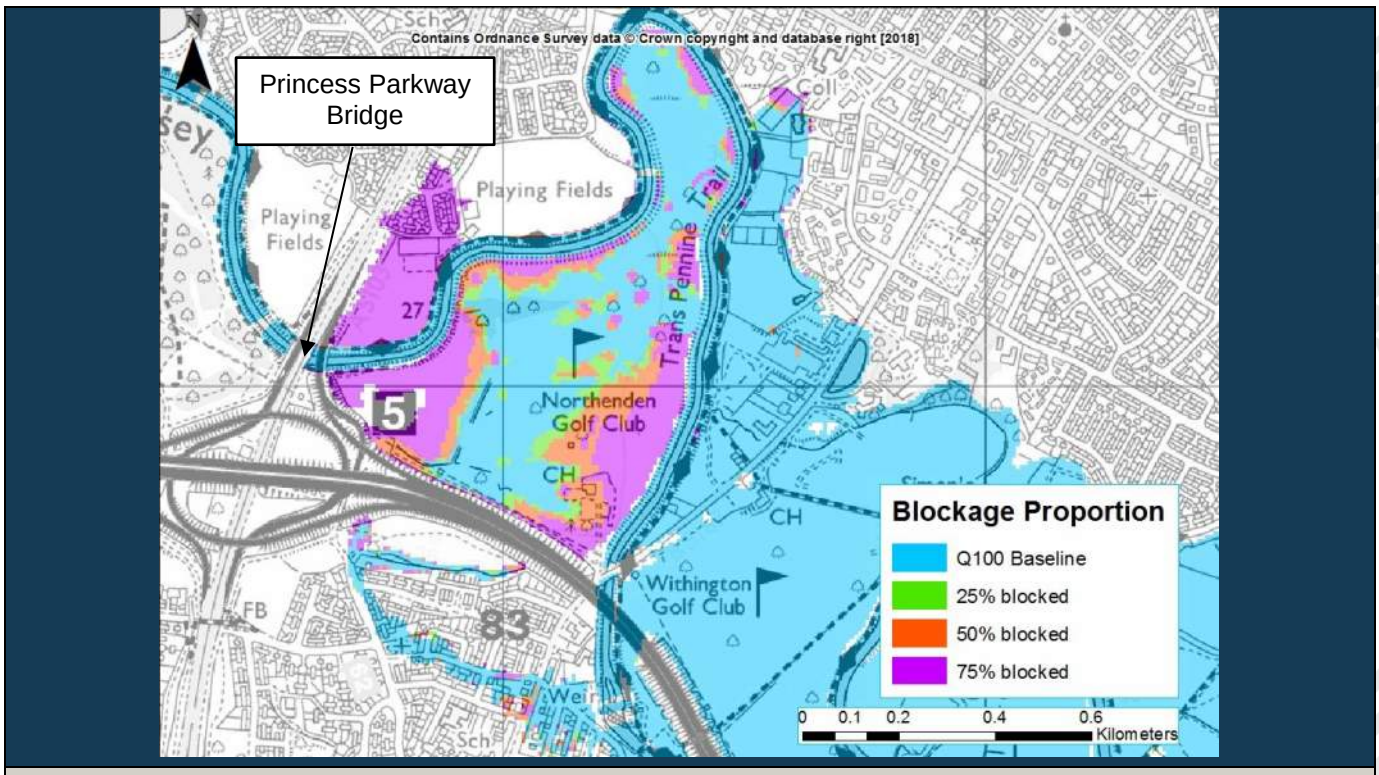
Figure 7-10 illustrates the change in upstream 1% AEP + 30% (climate change) water levels and flood outlines associated with the blockage of Crossford Bridge. Blocking the bridge by 25%, 50% and 75% causes upstream water levels to increase by 0.11m, 0.34m and 0.95m, respectively but, as with the 1% AEP event, the bridge is not modelled to surcharge during any of the blockage scenarios. The 1% AEP + 30% (climate change) flood extent is not greatly increased during any of the blockage scenarios.

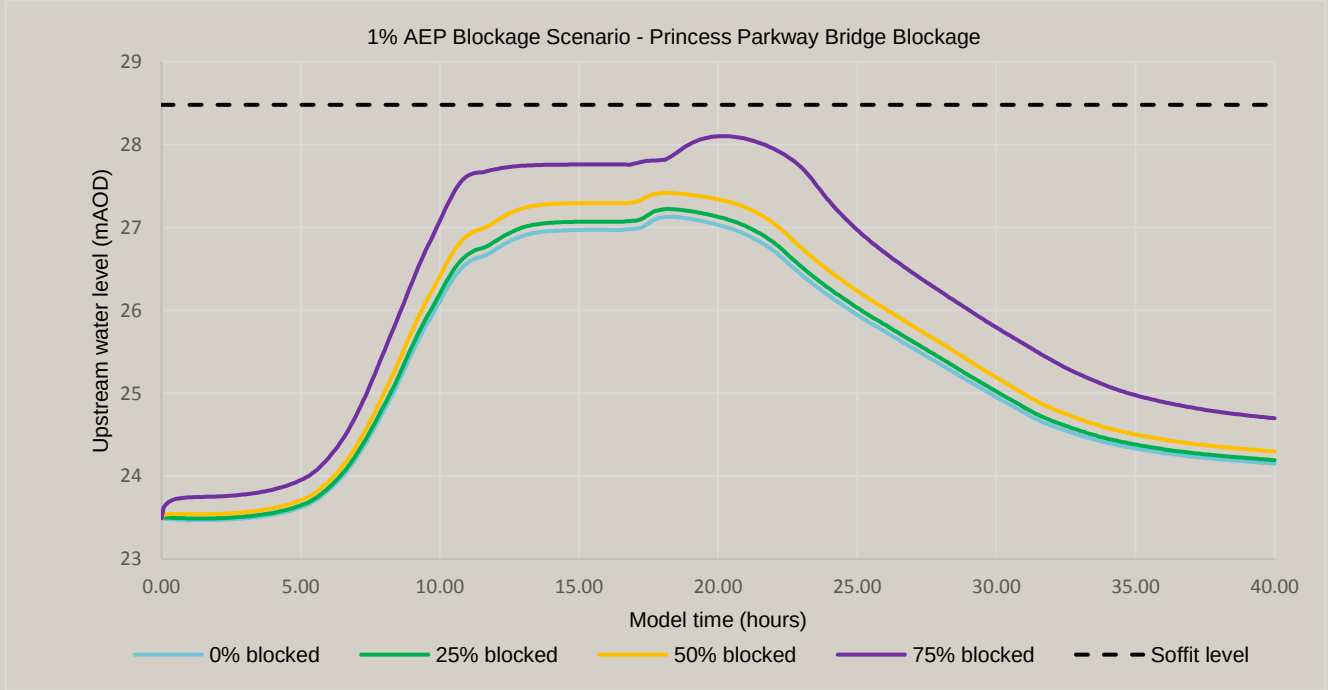
7.7 Flixton Bridge

Figure 7-11 illustrates the change in 1% AEP upstream water levels and flood outlines associated with the blockage of Flixton Bridge. Blocking the bridge by 25%, 50% and 75% causes upstream water levels to increase by 0.14m, 0.37m and 0.72m, respectively and the bridge is modelled to surcharge in response to the 50% and 75% blockage scenarios. The 25% and 50% blockages are only modelled to lead to small increases in the 1% AEP flood extent but the 75% blockage is modelled to place some additional properties at risk around the periphery of the golf course.

Figure 7-12 illustrates the change in upstream 1% AEP + 30% (climate change) water levels and flood outlines associated with the blockage of Flixton Bridge. Blocking the bridge by 25%, 50% and 75% causes upstream water levels to increase by 0.10m, 0.28m and 0.55m, respectively and surcharging occurs during this event during all blockage scenarios, including the baseline (unblocked). The 1% AEP + 30% (climate change) flood extent is not greatly increased by the 25% blockage scenario that from the 50% blockage scenario is larger but does not increase the number of properties at risk. However, the 75% blockage scenario affects a larger area of the golf course and increases the number of properties at risk along both Church Road and in the Lansdowne Road area.

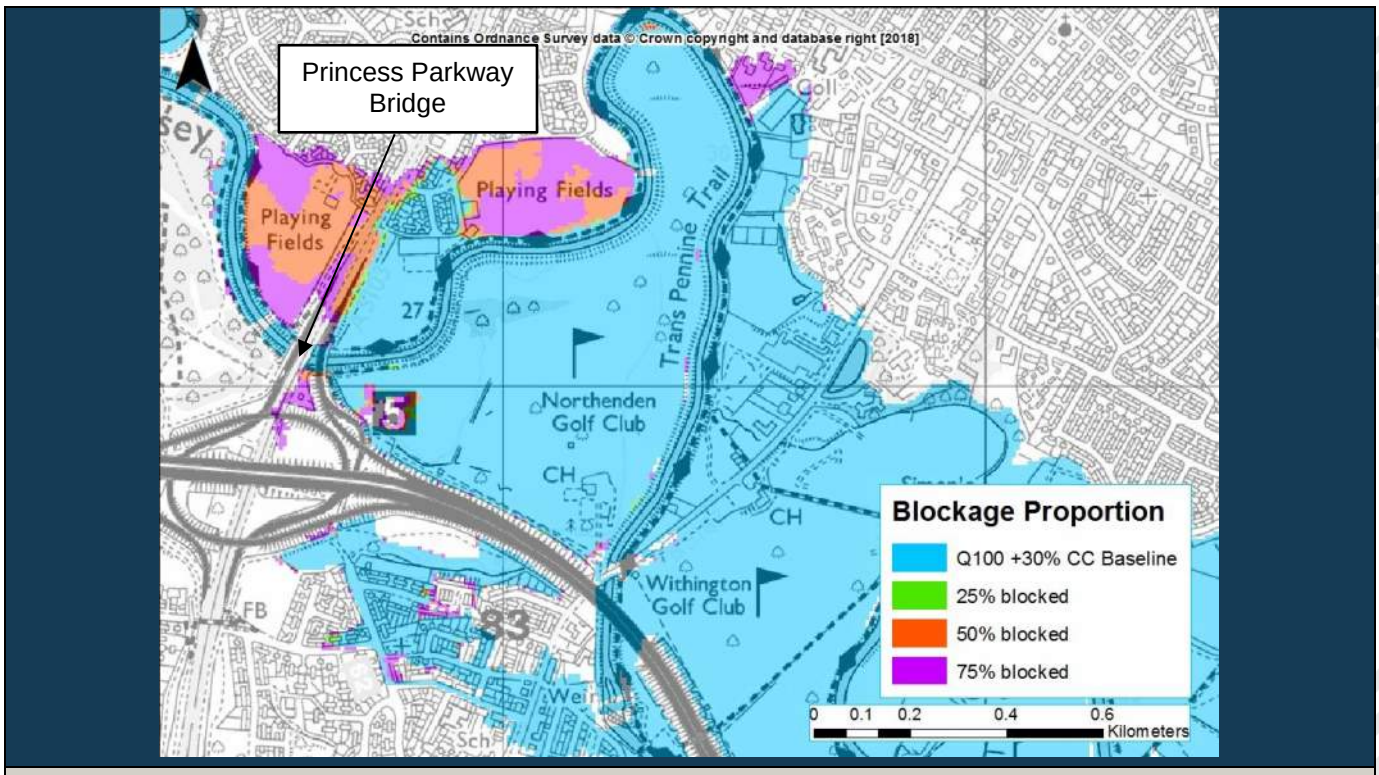
Figure 7-7; 1% AEP event blockage at Princess Parkway Bridge

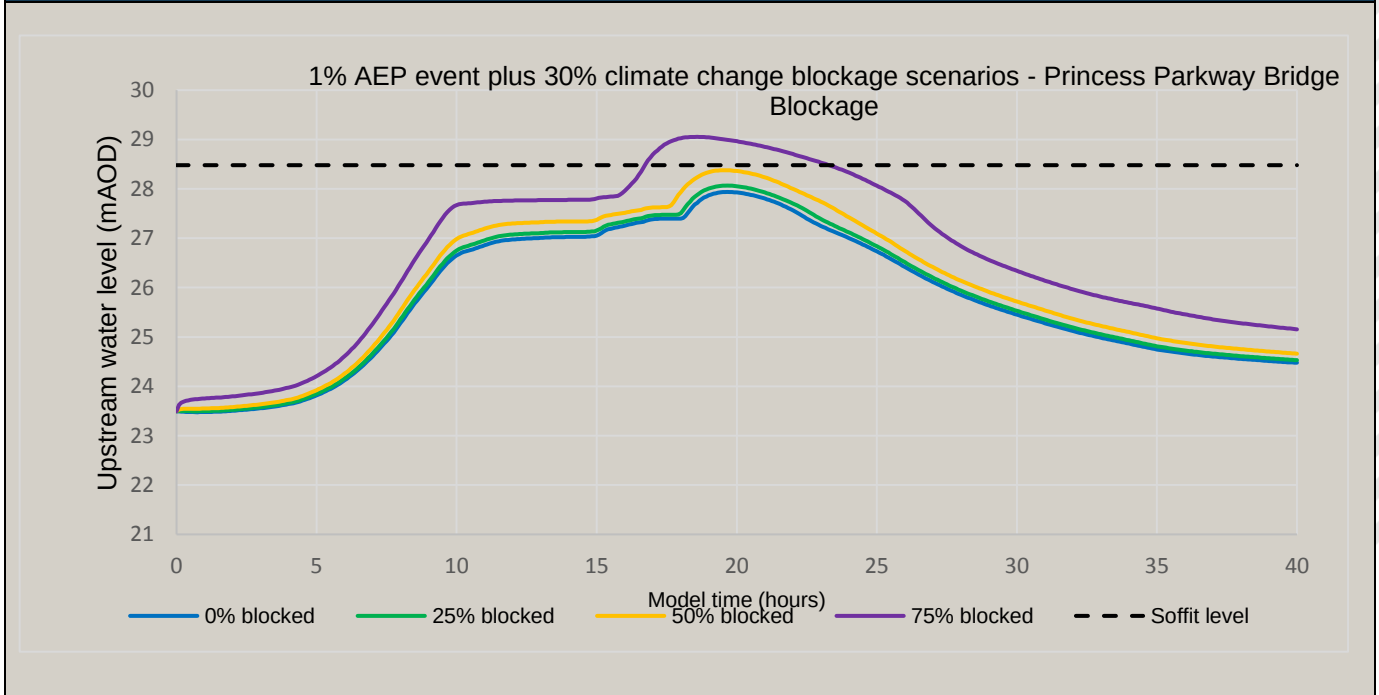




	0% Blocked	25% Blocked	50% Blocked	75% Blocked
Peak Upstream water level (m AOD)	27.13	27.22	27.41	28.10
Surcharging Duration (hrs)	0	0	0	0

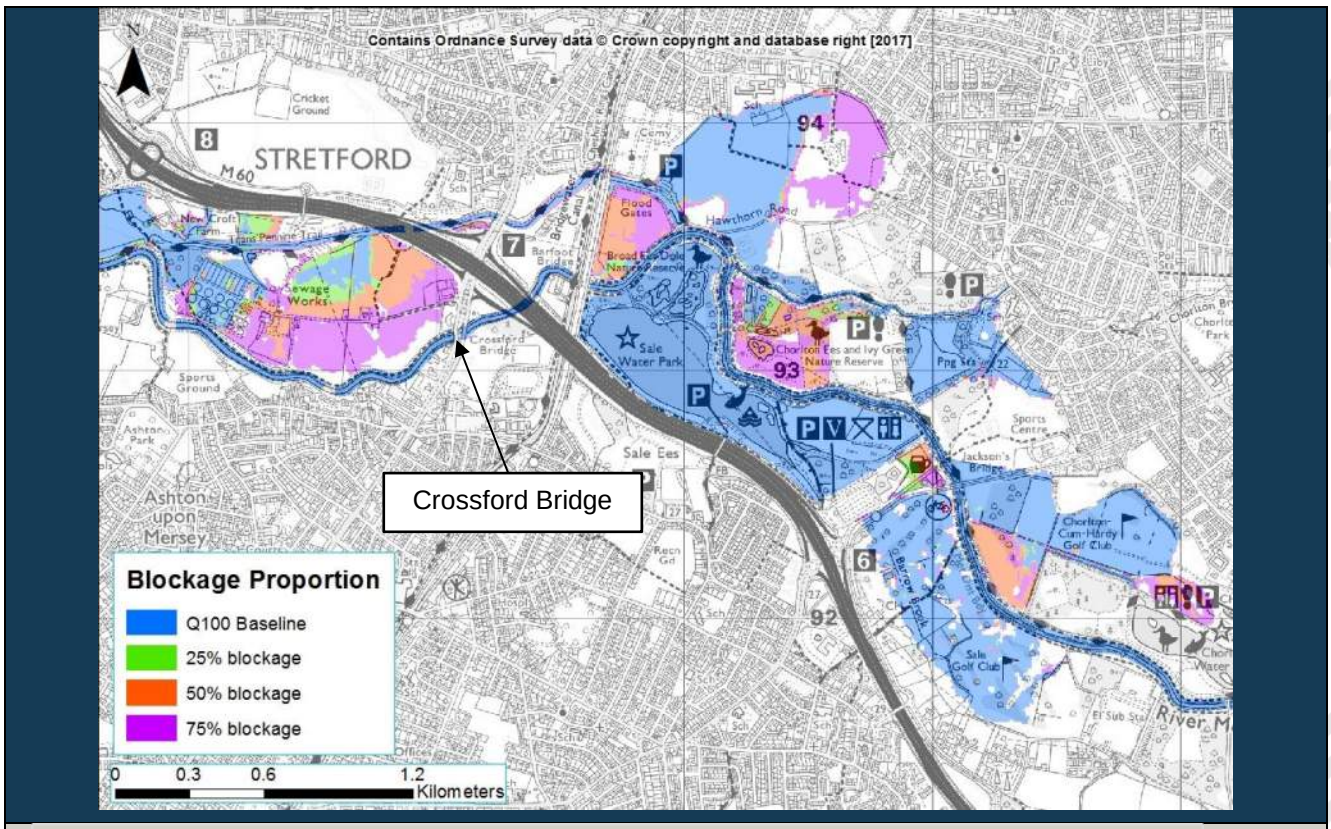
Figure 7-8; 1% AEP plus 30% CC event blockage at Princess Parkway Bridge

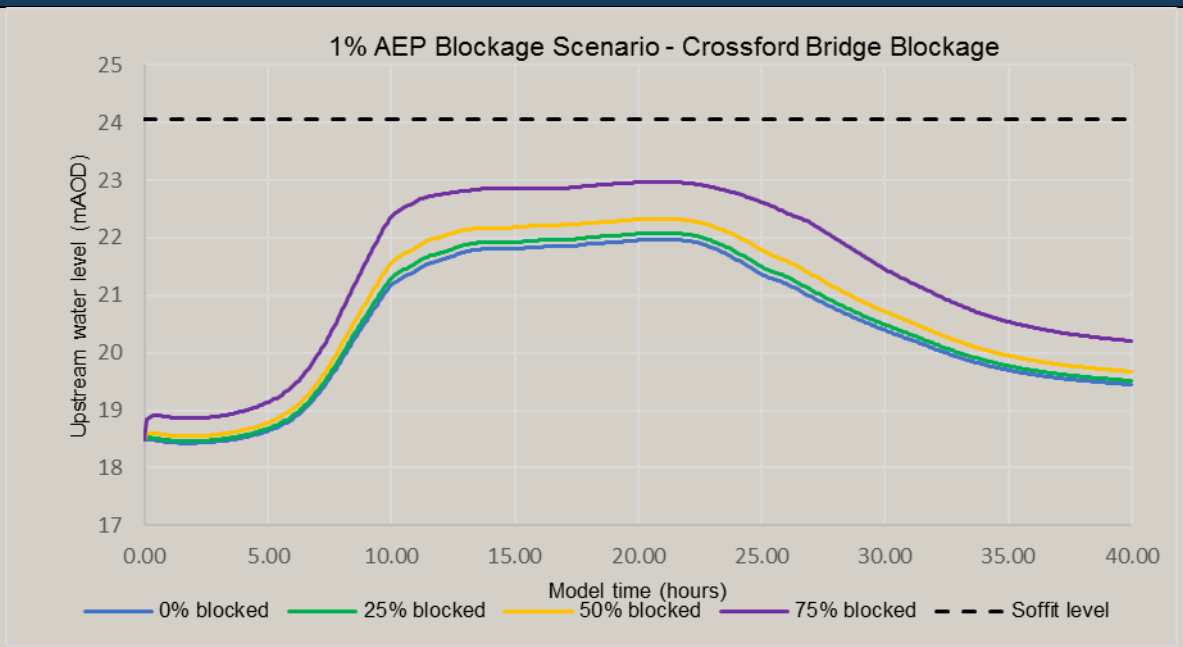




	0% Blocked	25% Blocked	50% Blocked	75% Blocked
Peak Upstream water level (m AOD)	27.94	28.07	28.38	29.05
Surcharging Duration (hrs)	0	0	0	6.66

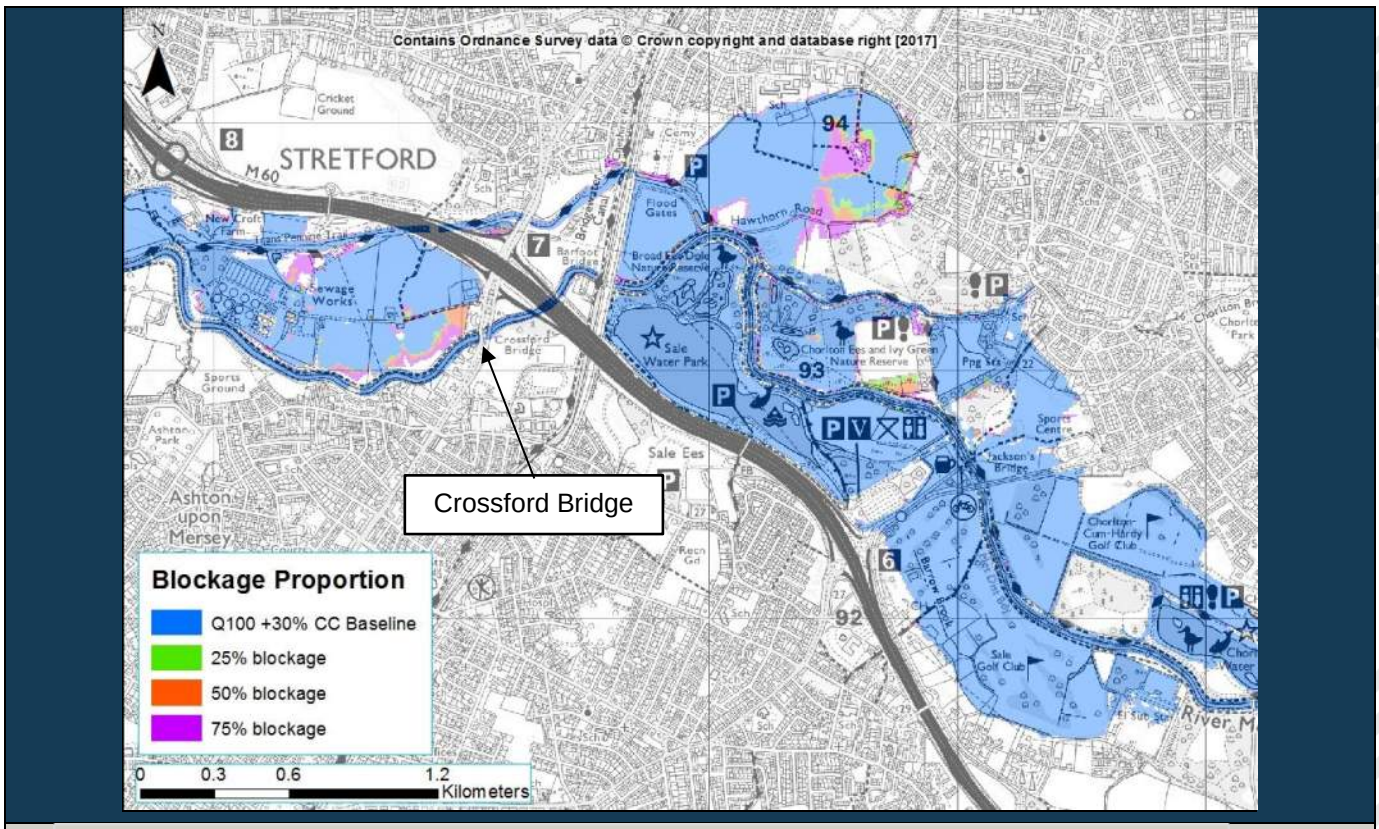
Figure 7-9; 1% AEP event blockage at Crossford Bridge

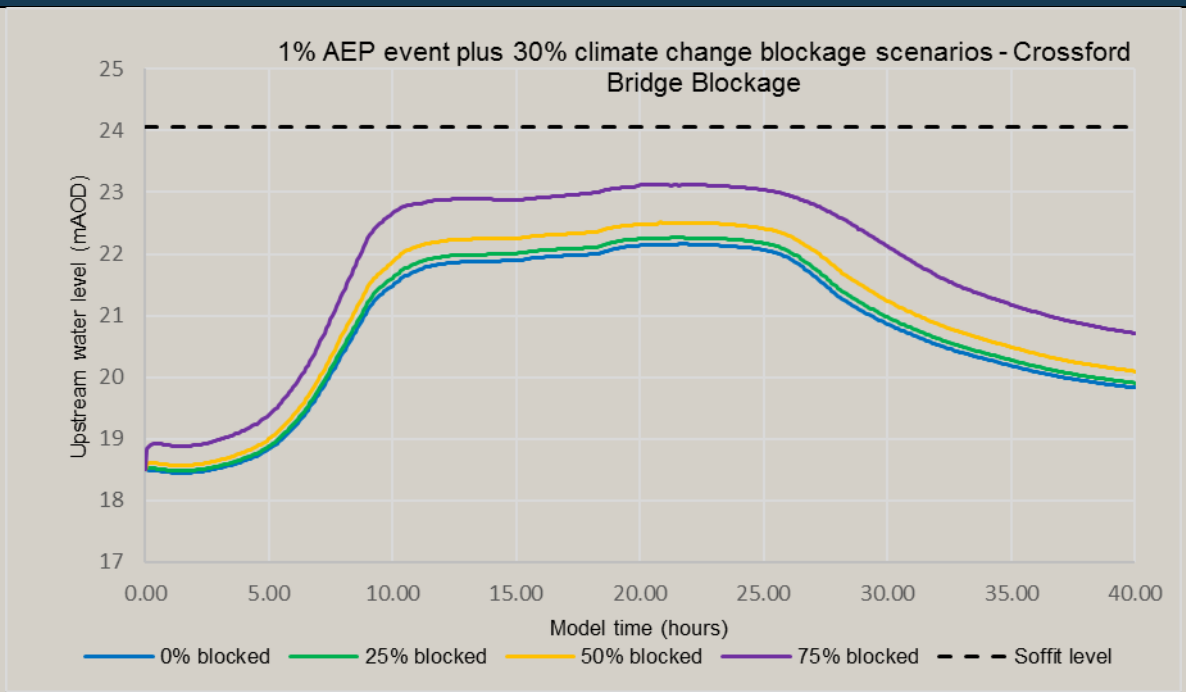




	0% Blocked	25% Blocked	50% Blocked	75% Blocked
Peak Upstream water level (m AOD)	21.97	22.09	22.33	22.97
Surcharging Duration (hrs)	0	0	0	0

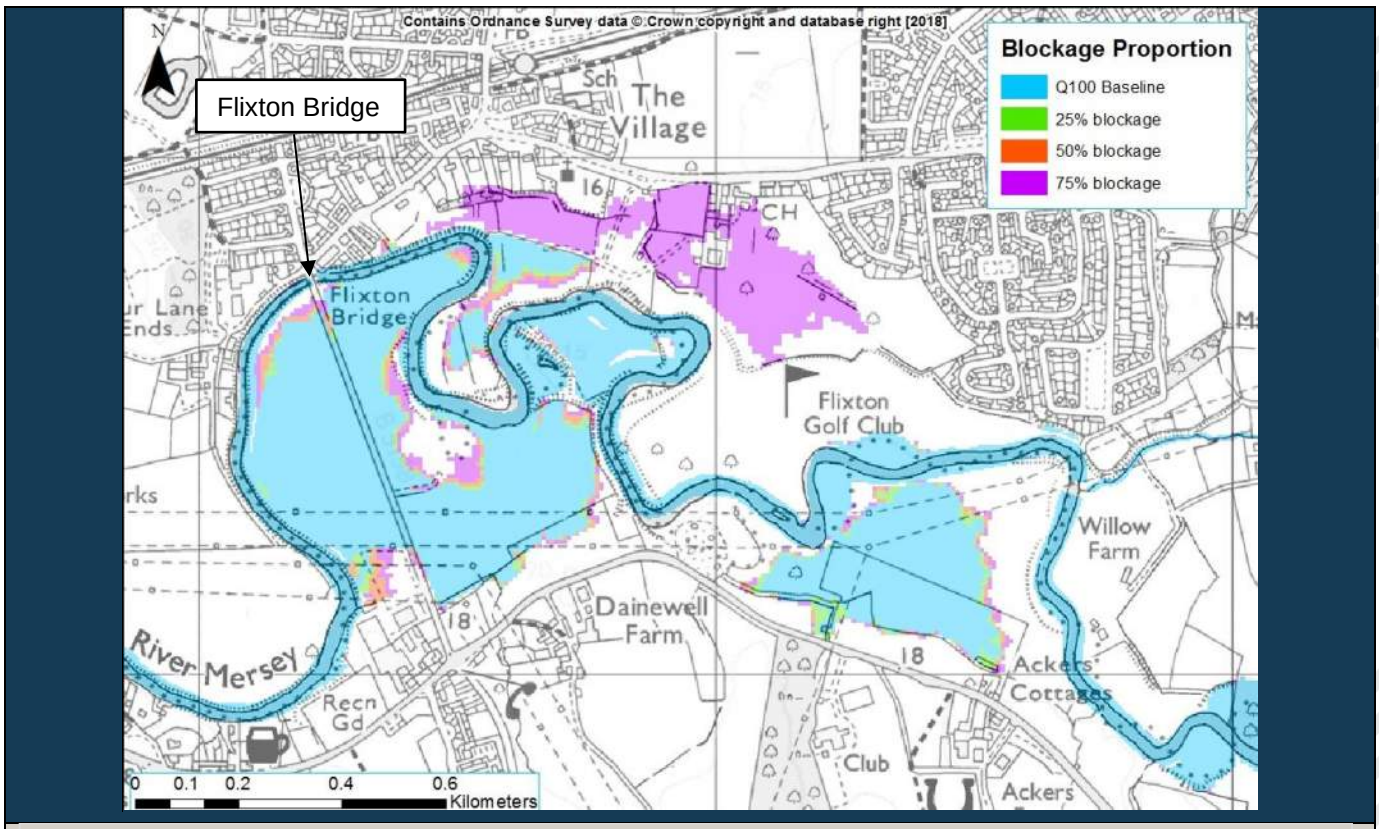
Figure 7-10; 1% AEP plus 30% CC event blockage at Crossford Bridge

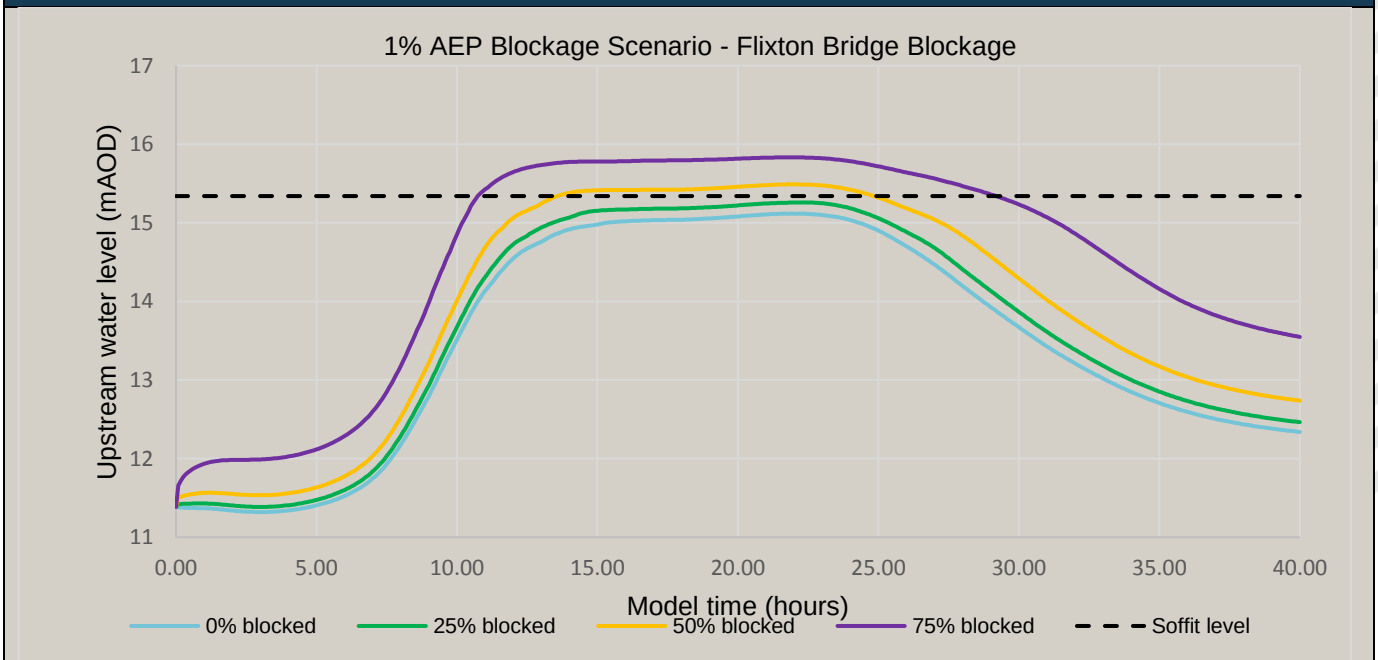




	0% Blocked	25% Blocked	50% Blocked	75% Blocked
Peak Upstream water level (m AOD)	22.17	22.28	22.51	23.12
Surcharging Duration (hrs)	0	0	0	0

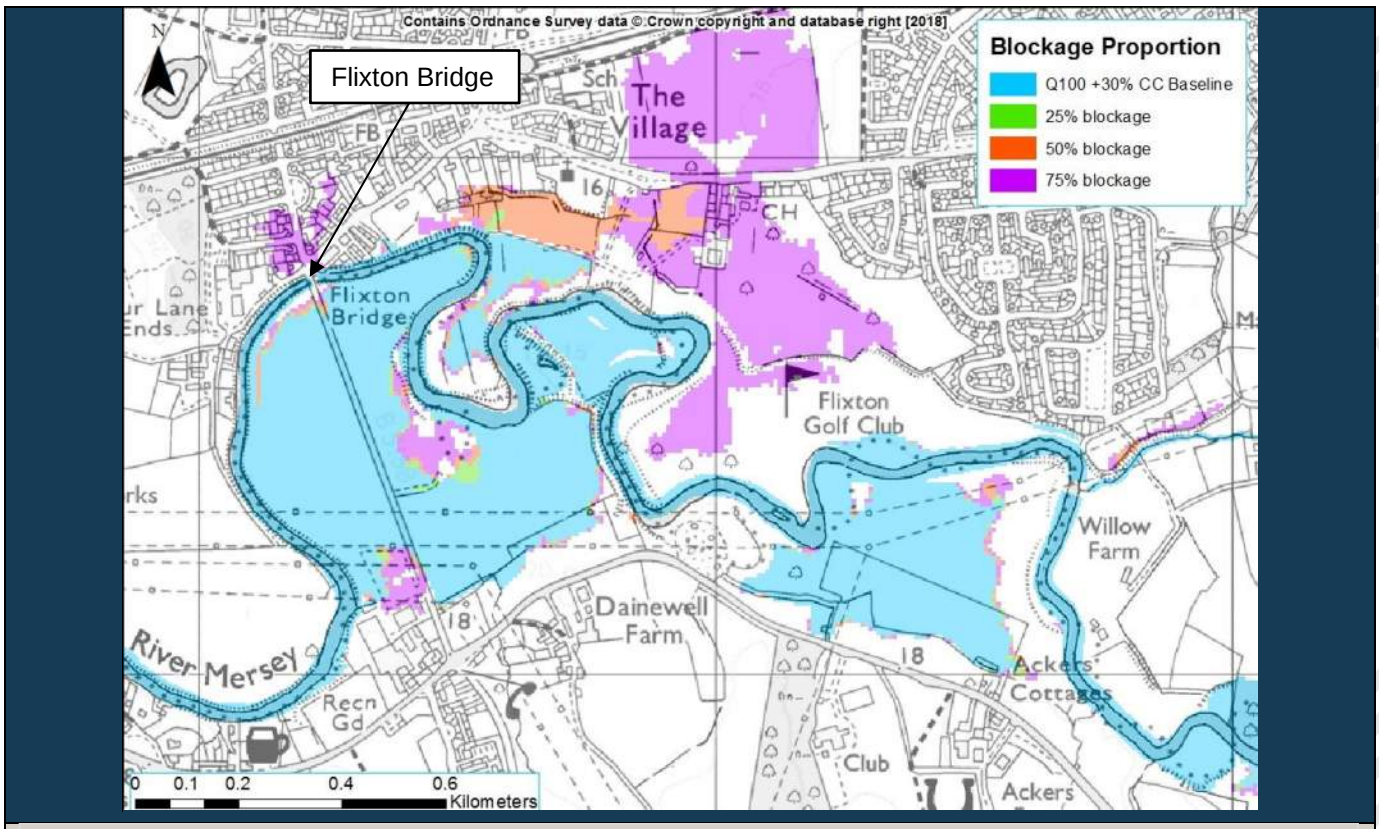
Figure 7-11; 1% AEP event blockage at Flixton Bridge

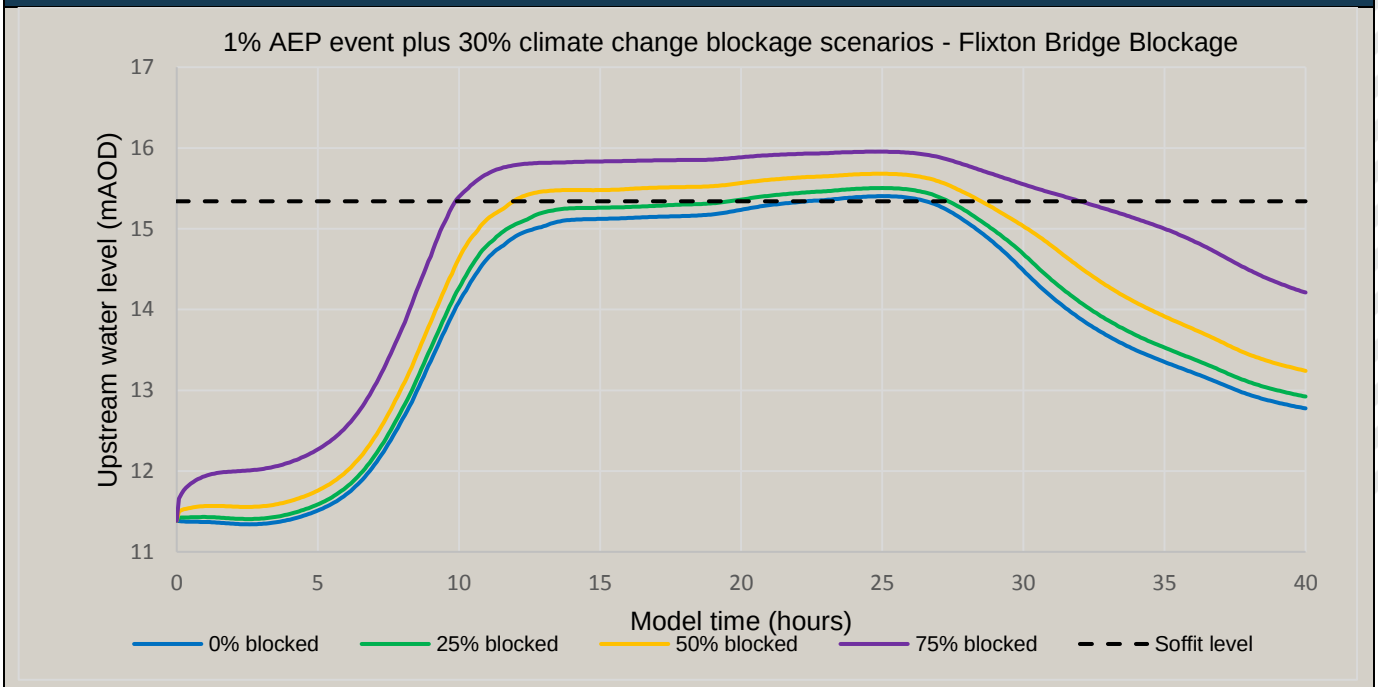




	0% Blocked	25% Blocked	50% Blocked	75% Blocked
Peak Upstream water level (m AOD)	15.12	15.26	15.49	15.83
Surcharging Duration (hrs)	0	0	11.25	18.5

Figure 7-12; 1% AEP plus 30% CC event blockage at Flixton Bridge





	0% Blocked	25% Blocked	50% Blocked	75% Blocked
Peak Upstream water level (m AOD)	15.40	15.50	15.68	15.95
Surcharging Duration (hrs)	4.17	7.59	16.58	22.09

8 Flood Warning

8.1 Overview

Environment Agency guidelines prefer that, where possible, Result Thresholds (RES FW) in combination with a forecasting model are used to issue flood warnings. An existing flood warning system based on previous modelling results is currently in place for properties on the Upper Mersey floodplain. This pairs RES FW thresholds at one of the several levels gauges along the Upper Mersey with the properties predicted to be at risk when any given threshold is reached at the gauge. This Section outlines the existing flood warning system and shows how this can be improved using the modelling results obtained as part of the Upper Mersey Model Update (2016) study. An updated set of Flood Alert areas, Flood Warning Flood Risk Areas (FWFRAs) and Flood Warning areas (FWAs) is then presented for properties that are modelled to be at risk of flooding from the Upper Mersey.

8.2 Flood Alert Areas

There are currently two Flood Alert areas that cover the Upper Mersey study reach documented in this study, named as follows;

- The River Mersey Uplands catchments for the Rivers Goyt and Tame at Stockport (Figure 8-1),
- The Middle River Mersey from Stockport downstream to Irlam Weir (Figure 8-1 and Figure 8-2).

Flood Alert Areas are normally defined solely on the basis of the undefended 0.1% AEP event since this is generally expected to indicate the widest extent of flooding for flood warning purposes. However, as noted in Section 6.3.1, the impact of removing the extensive network of raised defences alongside the Upper Mersey in a single undefended modelling scenario locally drops river levels to the extent that the defended 0.1% AEP outline can be locally larger than the undefended event. Under these circumstances, it is recommended that both the updated Flood Zone 2 and Flood Alert Areas are based on the merged defended and undefended 0.1% AEP flood outlines.

Figure 8-1 and Figure 8-2 show the updated 0.1% AEP flood outlines (both defended and undefended) alongside the existing Flood Alert Areas. These show that, in general, the existing Flood Alert Areas would be sufficient to identify most of the properties at risk from the Upper Mersey, with the exception of Stockport Town Centre, East Didsbury and Stretford where the updated modelling has identified that a larger number of properties would be at risk from an extreme event. In view of this, it is recommended that the 'The Middle River Mersey from Stockport downstream to Irlam Weir' Flood Alert Area is updated to reflect the remodelled 0.1% AEP flood outlines. Although the updated flood risk is more similar to existing within the 'River Mersey Uplands catchments for the Rivers Goyt and Tame at Stockport' Flood Alert Area, there are some small changes to the number of properties at risk so it is also recommended to update this area.

Figure 8-1; Comparison of existing and proposed Flood Alert areas (Stockport to West Didsbury)

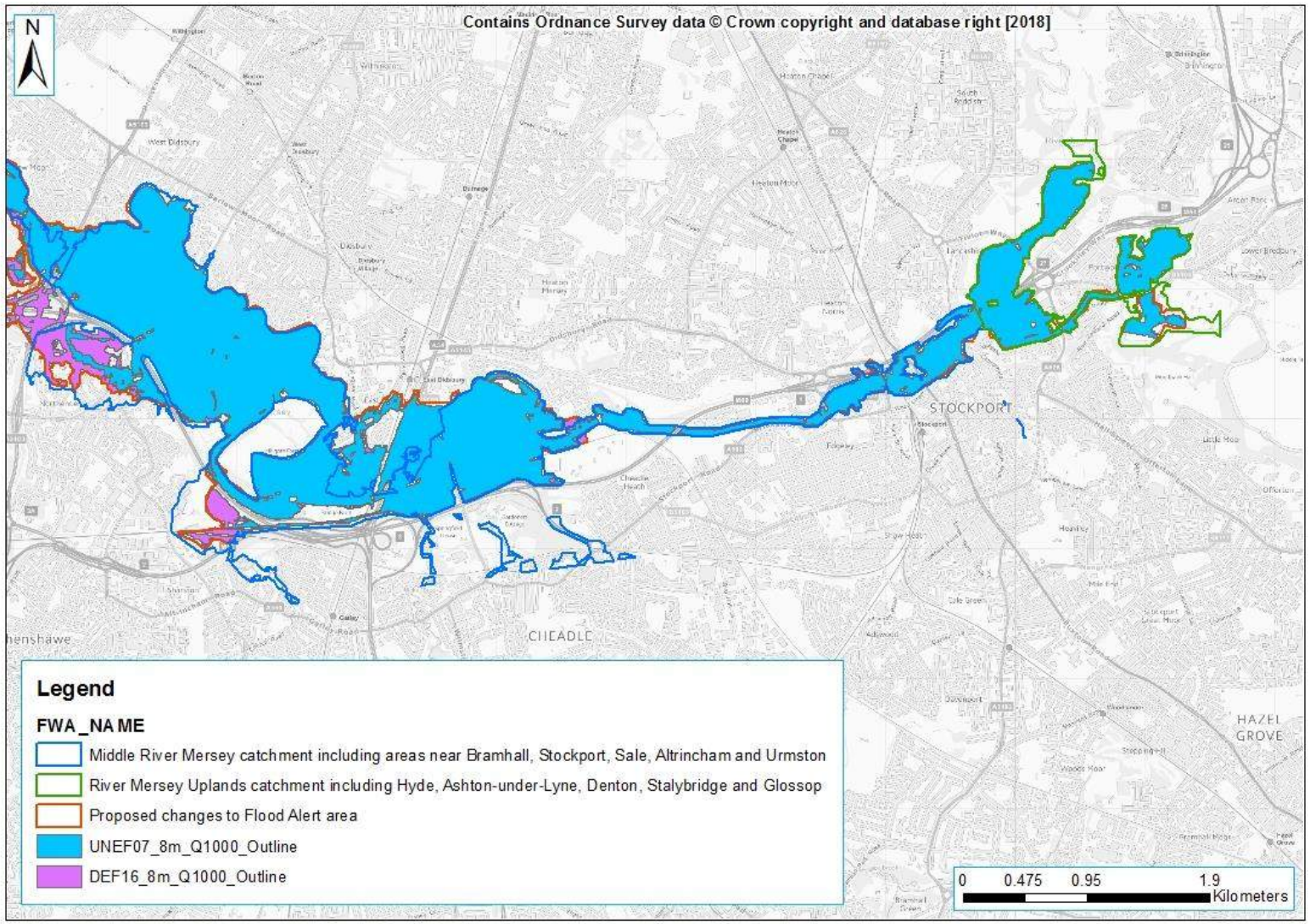
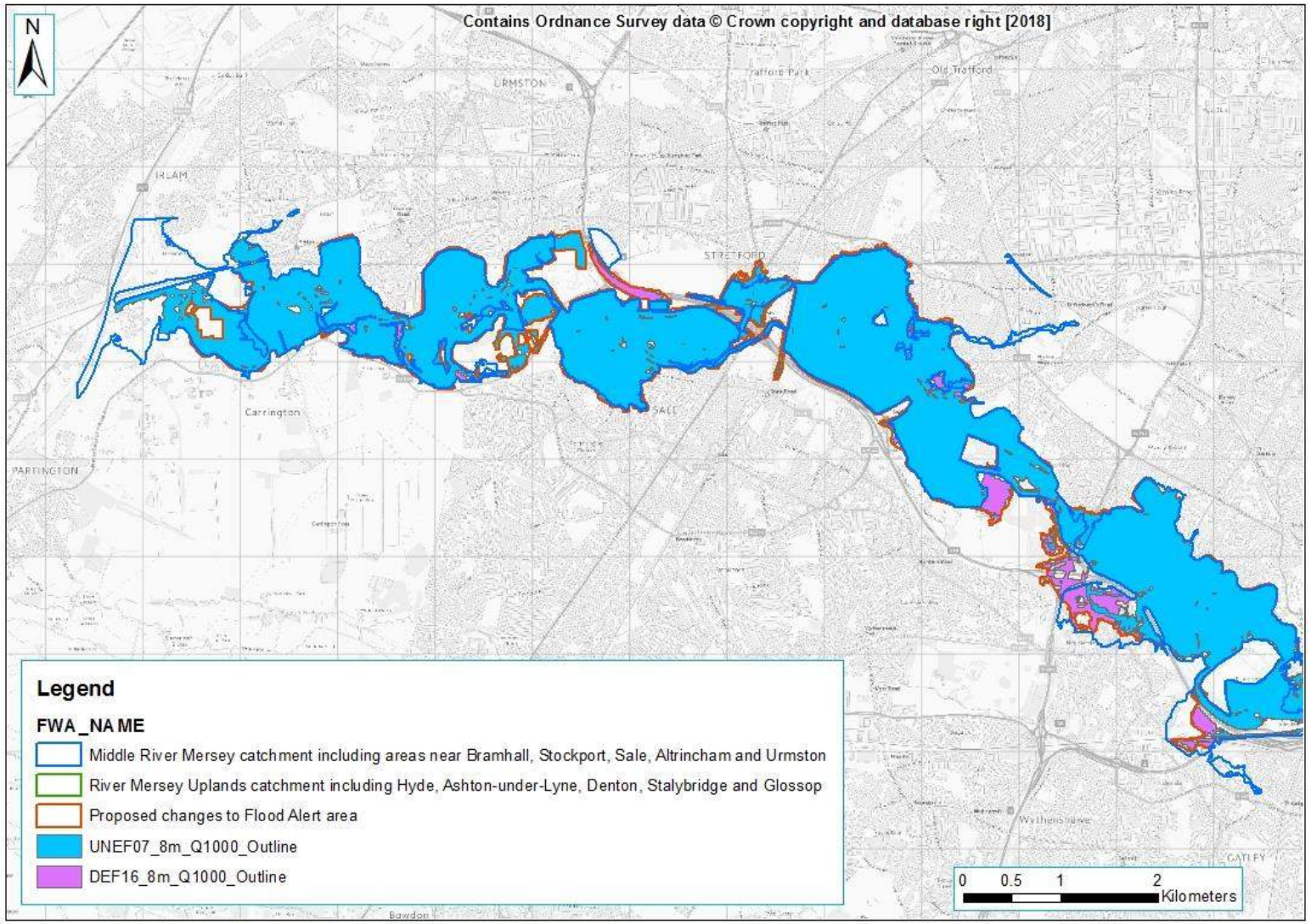


Figure 8-2; Comparison of existing and proposed Flood Alert areas (West Didsbury to Carrington)



8.3 Flood Warning Areas (FWAs)

8.3.1 Existing Flood Warning Areas

There are currently ten existing FWAs that cover the Upper Mersey study area. The existing FWAs are illustrated in Figure 8-3 and Figure 8-4 and the current RES FW thresholds for each of these FWAs are provided in Table 8-1 based on datum levels supplied for this study by the Environment Agency[8].

8.3.2 Proposed FWA Updates

Since, the results of the Upper Mersey (2018) Model Update are broadly similar to the results obtained from previous studies, there would appear to be no need to make radical changes to the existing system of FWAs. Therefore, we would recommend the following approach to update the FWAs;

- In most cases, only small adjustments should be made to the existing FWA polygons and the RES FW thresholds should be updated to ensure they are consistent with the latest model results.
- More significant adjustments should be made to the following existing FWAs to capture the increased risk within these communities modelled during this study;
    - 013FWFGM31 'River Goyt and Mersey at Stockport' to reflect the increased number of properties at risk from the modelled flow route through Stockport Town Centre.
    - 013FWFGM33 'River Mersey at East Didsbury' to reflect the increased number of properties at risk from the modelled flow routes through East Didsbury.
    - 013FWFGM37 'River Mersey at Chorlton and Sale Golf Clubs and Chorlton Water Park' to reflect the increased number of properties at risk in Stretford from the modelled flow route beneath the railway line and Bridgwater Canal along Hawthorn Road. Note that it is proposed to place these properties in 013FWFGM37 rather than 013FWFGM38 because the flow route originates upstream of the railway and canal. In view of this, it may be considered sensible to rename the two FWAs so that 013FWFGM37 includes reference to 'Stretford' and 'Stretford' is removed from 013FWFGM38.
    - 013FWFGM40 'River Mersey at Flixton Village' to reflect the modelled risk to the perimeter of the Carrington power station.
- The 'West Didsbury and Northenden' FWA (013FWFGM35) should be split to reflect the new flooding mechanism within Northenden identified during this study as the flow route along Ford Lane from upstream of the M60. The outcome of this split should be a reduced West Didsbury FWA (013FWFGM35) and a new FWA covering Northenden, the detail of which is presented in Section 8.3.3.

The proposed updated FWAs are shown in Figure 8-5 and Figure 8-6.

[8] Note that it is recommended that a datum check should be carried out on the Upper Mersey gauges since the datums provided for the FW analysis in this study (as shown in Table 8-1) do not all agree with those that currently appear on the Environment Agency's on-line Flood Information Service (https://flood-warning-information.service.gov.uk/river-and-sea-levels).

Figure 8-3; Existing FWAs alongside the Upper Mersey between Stockport and West Didsbury

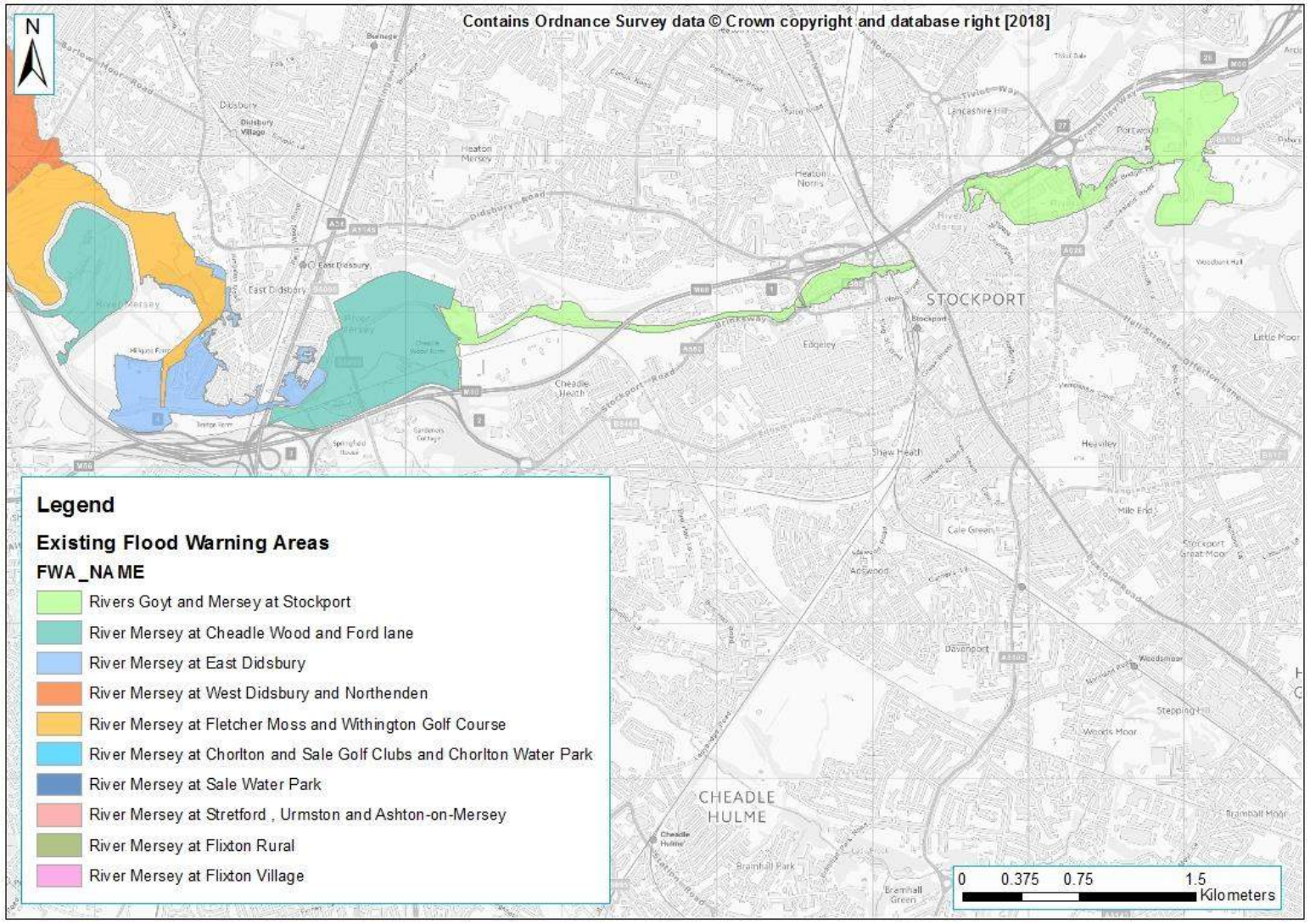


Figure 8-4; Existing FWAs alongside the Upper Mersey between West Didsbury and Flixton.

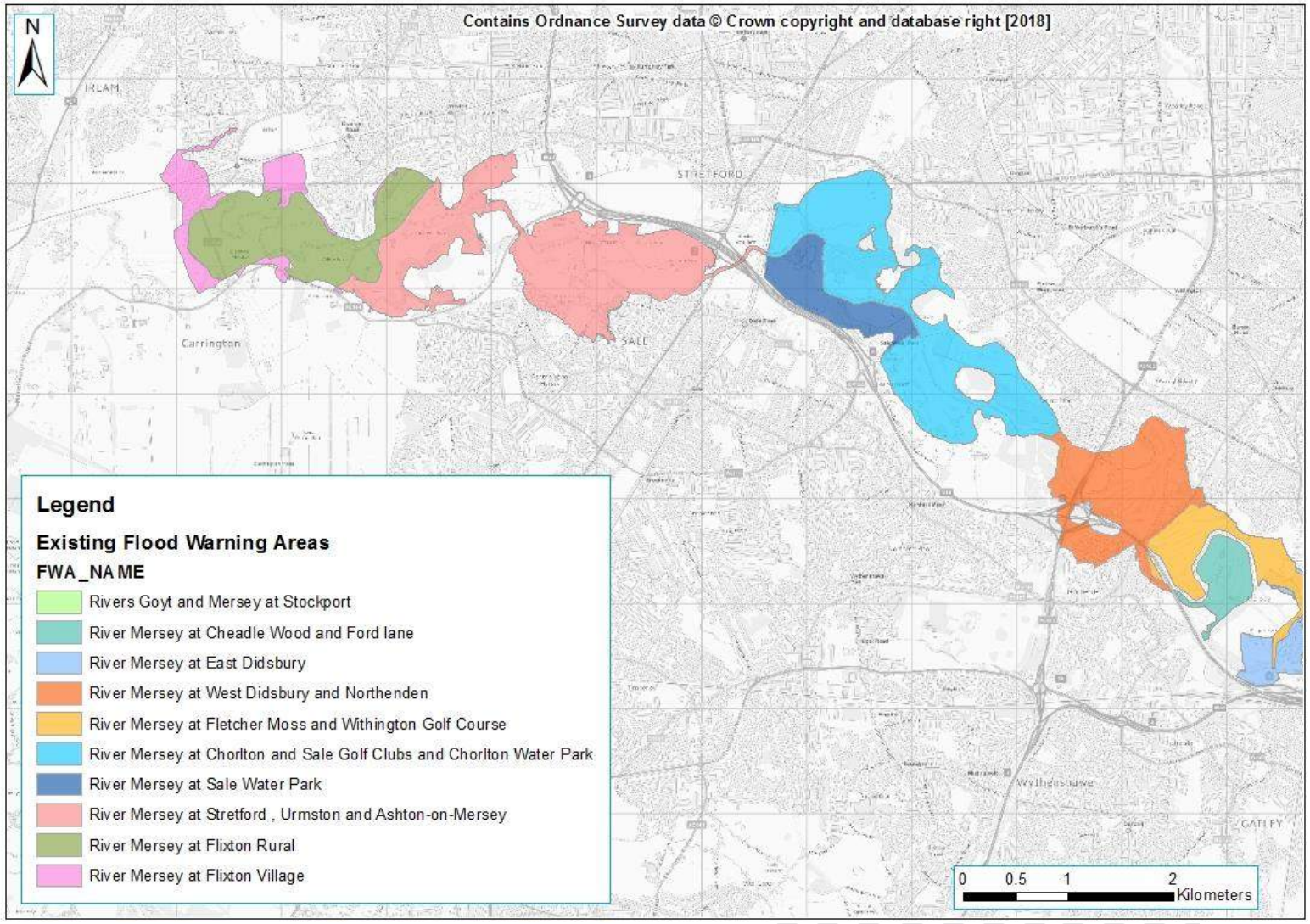


Table 8-1; List of existing thresholds and Flood Warning Areas

Flood Warning Area Code	Flood Warning Area Name	Trigger Telemetry Site	Datum (m AOD)	RES FW Threshold (m ALD)
013FWFGM31	Rivers Goyt and Mersey at Stockport	Brinksway	33.598	5.2
013FWFGM32	River Mersey at Cheadle Wood and Ford Lane	Didsbury	25.003	6.5
013FWFGM33	River Mersey at East Didsbury	Didsbury	25.003	7.4
013FWFGM34	River Mersey at Fletcher Moss and Withington Golf Course	Didsbury	25.003	6.9
013FWFGM35	River Mersey at West Didsbury and Northenden	Northenden Weir	25.99	3.1
013FWFGM36	River Mersey at Sale Water Park	Sale Ees	20	4.4
013FWFGM37	River Mersey at Chorlton and Sale Golf Clubs and Chorlton Water Park	Sale Ees	20	4.66
013FWFGM38	River Mersey at Stretford, Urmston and Ashton on Mersey	Ashton weir	14.852	4.45
013FWFGM39	River Mersey at Flixton Rural	Flixton	10.378	5
013FWFGM40	River Mersey at Flixton Village	Flixton	10.378	5.7

8.3.3 Proposed new Northenden FWA

As outlined in Section 8.3.2, it is recommended that properties that have been identified as being at risk from the flow route along Ford Lane in Northenden should be grouped into a new FWA.

In order to define a new flood warning area, FWFRAs (Flood Warning Flood Risk Areas) are first derived. These are based on properties which are grouped into flood risk communities based on a combination of the return period at which they first flood, specific mechanisms of flooding and/or community factors. Based on a combination of the modelled, defended, flood outlines, OS Mastermap and NRD (National Receptor Database) data, seven FWFRAs are proposed for Northenden. These FWFRAs are illustrated in Figure 8-7 and each FWFRA is summarised in Table 8-2.

It is then proposed to group these seven FWFRAs into one new FWA in Northenden, which is illustrated in Figure 8-8. A summary of the proposed new FWA is provided in Table 8-3. The Northenden area should then be removed from FWA 013FWFGM35 'West Didsbury and Northenden'.

Figure 8-5; Proposed revised FWAs alongside the Upper Mersey between Stockport and West Didsbury

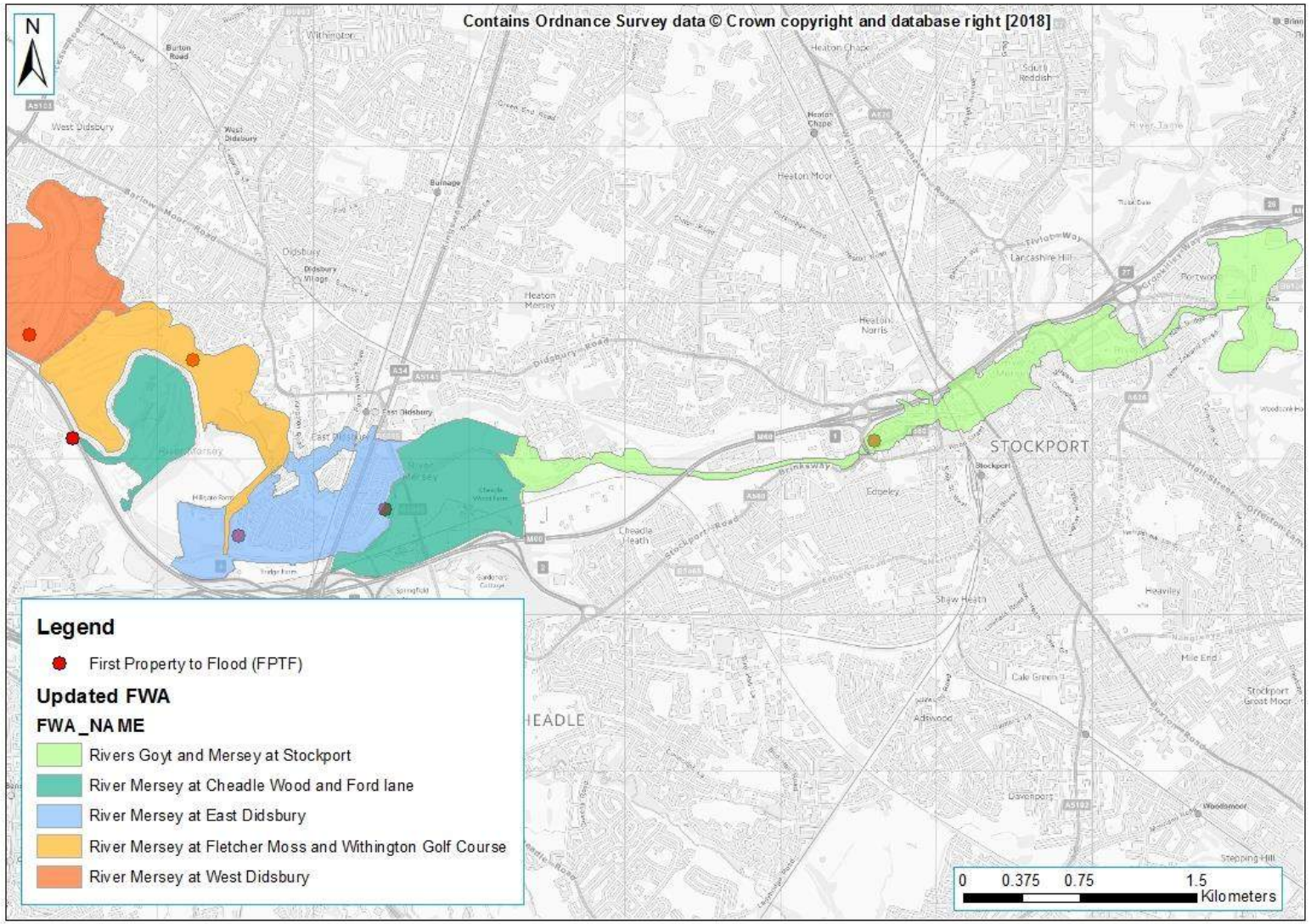


Figure 8-6; Proposed revised FWAs alongside the Upper Mersey between West Didsbury and Carrington

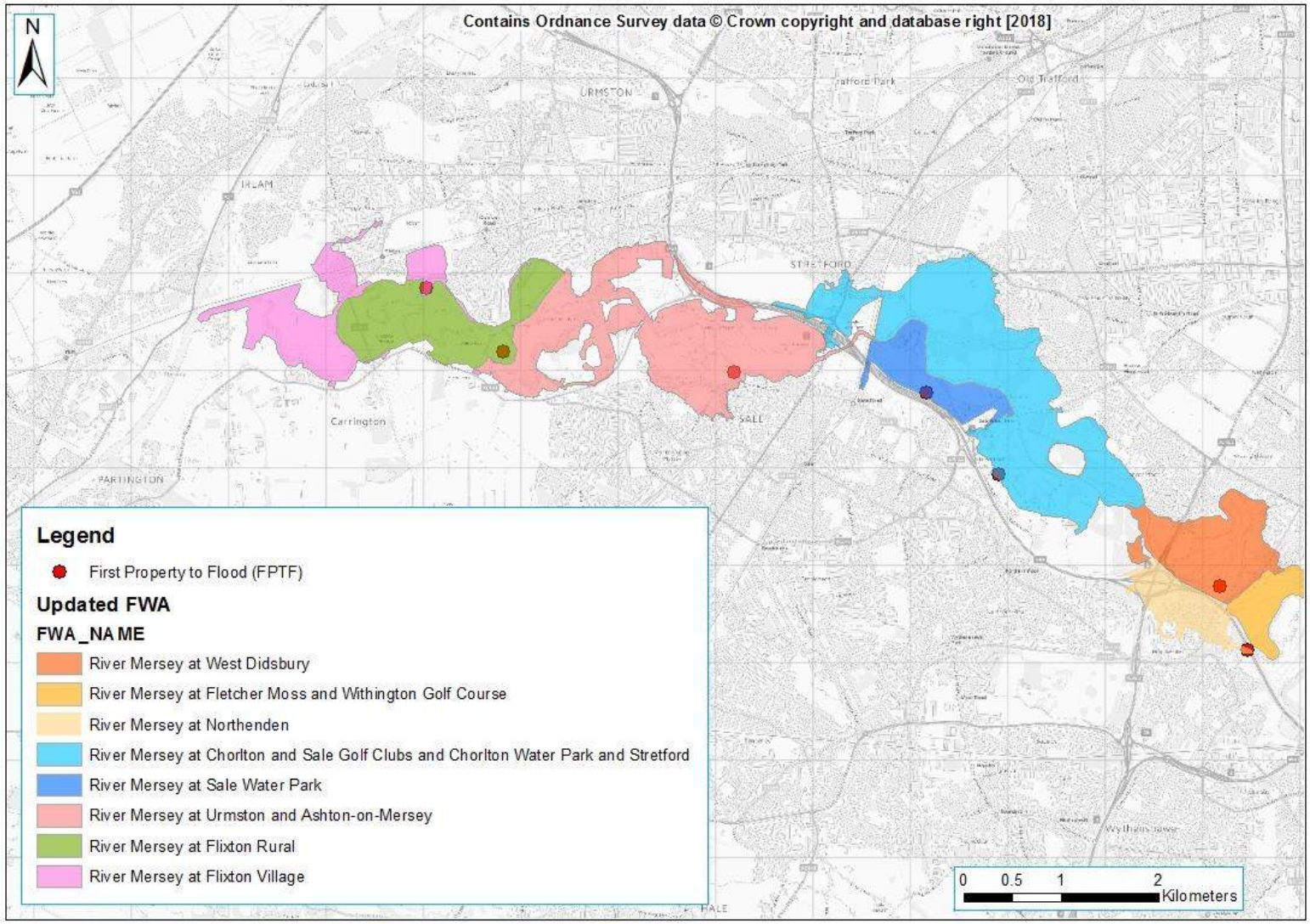


Figure 8-7; FWFRAs identified in Northenden

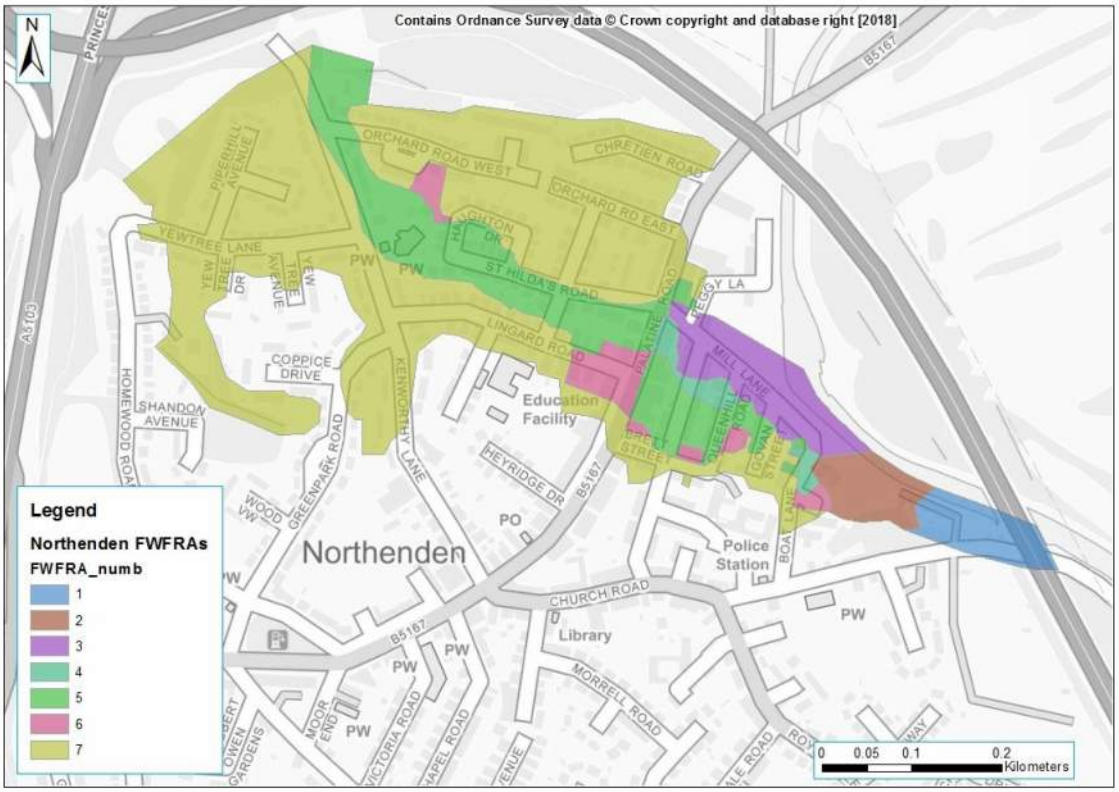


Table 8-2; Summary of the FWFRAs at Northenden

FWFRA Number	Area	Onset of flooding to properties (return period)
FWFRA1	Northenden at Ford Ln & Riverside Caravan Park	20
FWFRA2	Northenden at Ford Ln Riverside Caravan Park and Boat Ln	25
FWFRA3	Northenden at Mill Lane	50
FWFRA4	Northenden at Govan St, Queenhill Rd, Allanson Rd and Palatine Rd	75
FWFRA5	Northenden at Govan St, Queenhill Rd, Allanson Rd, Palatine Rd, St Hilda's Rd, Kenworthy Ln, Haughton Dr, Orchard Rd West	100
FWFRA6	Northenden at Queenhill Rd, Boat Ln, Brett St, Palatine Rd, Lingard Rd, Kenworthy Ln	200
FWFRA7	Northenden	1000

Figure 8-8; Proposed new FWA in Northenden

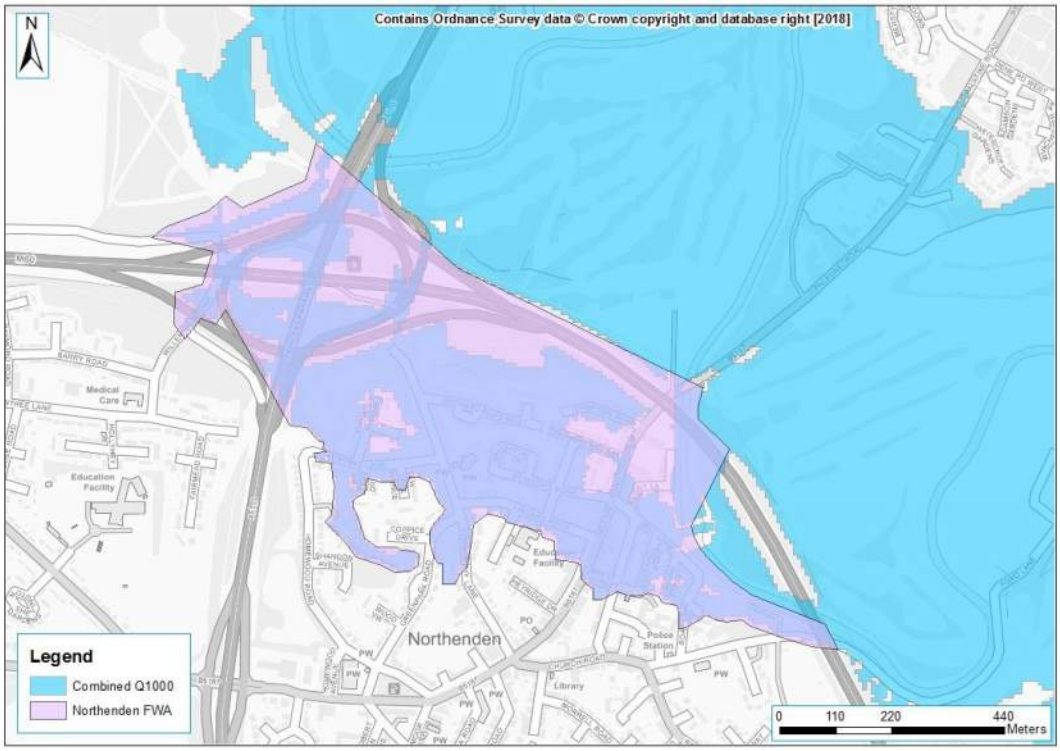


Table 8-3; Summary of the proposed new FWA in Northenden

Flood Warning Area	Flood Warning Name	Trigger Telemetry Site	Number of Properties Flooded
TBC	River Mersey at Northenden	Northenden Weir	654

8.4 Developing Flood Warning Thresholds

The RES FW thresholds for the updated FWAs have been extracted from the model by identifying the first property to flood in each of the updated FWAs and linking this to the level at the relevant gauge (as listed in Table 8-1 and Table 8-3) at the time when this property floods. In detail the thresholds were derived by identifying the level in Flood Modeller at the gauge location at the time when the 2D model results showed the first property to flood in the SMS viewer software.

The updated RES FW thresholds for each FWA are shown in Table 8-4 and the first property that was identified to flood within each FWA is listed in Table 8-5 and included in

Figure 8-5 and Figure 8-6. Table 8-4 also permits a comparison of the updated thresholds with the previous thresholds. In general, the updated thresholds are lower than the existing thresholds. This is attributed to the increased accuracy of the 2D modelling software, which explicitly models floodplain flow routes and allows a more accurate linkage between gauge levels and property flooding than the previous 1D only approach. Note that the thresholds can be revised if the first properties to flood listed in Table 8-5 were required to be updated (e.g. to exclude sports grounds and clubhouses etc).

Table 8-4; Summary of the new thresholds for the Upper Mersey FWAs

Flood Warning Area Code	Flood Warning Area Name	Existing RES FW Threshold (m AOD)	New RES FW Threshold (m AOD)	New RES FW Threshold (m ALD)
013FWFGM31	Rivers Goyt and Mersey at Stockport	38.798	37.529	3.931
013FWFGM32	River Mersey at Cheadle Wood and Ford Lane	31.503	31.472	6.469
013FWFGM33	River Mersey at East Didsbury	32.403	31.681	6.678
013FWFGM34	River Mersey at Fletcher Moss and Withington Golf Course	31.903	30.118	5.115
013FWFGM35	River Mersey at West Didsbury	29.09	27.321	1.306
TBC	River Mersey at Northenden (Proposed)	-	29.276	2.916
013FWFGM36	River Mersey at Sale Water Park	24.4	24.228	4.228
013FWFGM37	River Mersey at Chorlton and Sale Golf Clubs Chorlton Water Park and Stretford	24.66	23.928	3.928
013FWFGM38	River Mersey at Urmston and Ashton on Mersey	19.302	17.803	2.951
013FWFGM39	River Mersey at Flixton Rural	15.378	15.6	5.27
013FWFGM40	River Mersey at Flixton Village	16.078	14.574	4.244

Table 8-5; The First Property to Flood for each FWA

Flood Warning Area Code	Flood Warning Area Name	First Property to flood
013FWFGM31	Rivers Goyt and Mersey at Stockport	Pioneer Works, Ford Street, SK3 0BT, Stockport
013FWFGM32	River Mersey at Cheadle Wood and Ford Lane	Waterside Hotel & Leisure Club, Wilmslow Road, East Didsbury, M20 5WZ, Greater Manchester
013FWFGM33	River Mersey at East Didsbury	40 Tuscan Road, East Didsbury, M20 5GS, Greater Manchester
013FWFGM34	River Mersey at Fletcher Moss and Withington Golf Course	Didsbury Sports Ground, Ford Lane, M20 2RU, Greater Manchester
013FWFGM35	River Mersey at West Didsbury	Northenden Golf Club, Palatine Road, M22 4FR, Greater Manchester
TBC	River Mersey at Northenden (Proposed)	13A, Riverside Park Caravan Site, Ford Lane, M22 4UQ, Northenden, Greater Manchester
013FWFGM36	River Mersey at Sale Water Park	Trafford Water Sport Centre, Rifle Road, Sale, M33 2LX, Greater Manchester
013FWFGM37	River Mersey at Chorlton and Sale Golf Clubs and Chorlton Water Park and Stretford	Fairways Farm, Golf Road, Sale, M33 2XU, Greater Manchester
013FWFGM38	River Mersey at Urmston and Ashton on Mersey	Trafford MV RFCC, Finny Bank Road, Sale, M33 6LR, Greater Manchester
013FWFGM39	River Mersey at Flixton Rural	Willow Farm, Urmston Meadows 52-70 Riverside Drive Off Southgate Urmston, Urmston, Manchester M41 9QP
013FWFGM40	River Mersey at Flixton Village	Shaw Hey Farm, Edgeley Road, Flixton, M41 6EQ, Greater Manchester

9 Assumptions and Limitations

All hydraulic models represent approximations of reality. They are also normally designed for a specific purpose and are, therefore, not necessarily able to cope with hydraulic situations that lie outside their initial scope. This section lists some of the known limitations of the Upper Mersey (2018) model.

- The hydrology has not been recalculated for this study but is recent (2012) and is supported by a reasonable record of gauge data. Therefore, although the hydrology is normally one of the biggest uncertainties in hydraulic modelling, greater confidence can be placed on the current Upper Mersey hydrology than that from many, especially ungauged, catchment models.
- Detailed calibration of the revised 1D-2D model has not bene undertaken. However, a verification exercise against the recent flood history provides some confidence that the model provides a reasonable match to the expected locations and thresholds of flooding.
- Extrapolating the model predictions to more extreme events will be prone to uncertainty and it is assumed that the model continues to perform well against extreme events.
- The topographic data that underpins the hydraulic model is of various ages and sources. The 2D domain that was created as part of this study is primarily based on LIDAR DTM flown in March 2016, with some bank crest survey from 2008 and 2017. The good general correlation between the LIDAR and survey and recent nature of the LIDAR provides confidence in the floodplain and embankment geometries. By contrast the 1D (channel) domain is based on river sections that date to as far back as 1998. This is cause for some concern but the previous calibration of the model and fact that the revised (1D-2D) model evaluates well with the historic record suggests that the channel geometry still produces acceptable results.
- The nature of the 2D domain (cell size, building approach, roughness etc) can have a significant influence on flood risk in some models. The size of the Upper Mersey 2D floodplains precluded a high definition TUFLOW model. Instead the model is based on an 8-metre cell size. Some urban flow routes would likely be improved with a smaller cell size but this would come at the price of a more complex model. Since there are few urban flow routes at the 1% AEP level, then a higher definition model would only likely provide higher definition urban flow routes in extreme events, which are, by definition, prone to higher levels of uncertainty than 1% AEP results. Therefore, at this stage, there would not appear to be a strong case for modelling the Upper Mersey floodplain at a higher definition.
- The modelling undertaken represents only the fluvial flood risk from the Upper Mersey and tributaries and does not include for any direct surface water risk from the collection of rainfall, surcharging of the sewer system or urban runoff routes.
- It has been assumed that ground levels represent an appropriate initial water level within the automated Flood Storage Areas (FSAs). This effectively assumes that the drain efficiently following any event and that the outlets are maintained in good condition. The probability of multi-peaked events or the impact of higher initial water levels has not been studies as part of this commission but higher water levels in the FSAs would likely lead to an increased flood risk.
- Blockage runs have been modelled in isolation to provide an indicative idea of the impact of blockage at structure. However, a real event could suffer from multiple blockages.

- Local defence failures have happened in the past so local defence failure is a real risk in future. Local defence failure would likely be in the form of breaches, which might give rise to higher local hazards than those depicted in the undefended results that have been produced for this study, which assumed widespread removal of the defences.

10 Conclusions and Recommendations

10.1 Conclusions

The Environment Agency's Upper Mersey (2012) hydraulic model has been updated for flood mapping purposes. The principal update was the upgrade of the floodplain representation from 1D (ISIS/FM) to 2D (TUFLOW) representation. The existing 1D floodplain representation has been replaced by an 8-metre cell size 2D (TUFLOW) domain, the topography of which is based on LIDAR DTM (flown in 2016) and bank crest survey (from 2008 and 2017). The remaining 1D channel component was left largely unchanged from the existing (2012) model with the exception of a node re-labelling exercise, which also involved an update of the 1D chainages. The existing (2012) hydrology was not updated but some minor hydrology was undertaken to generate the inflows for return periods that had not been previously modelled.

Defended, undefended and blockage scenarios were modelled at a range or return periods to produce an updated flood risk.

The following conclusions can be drawn from this project:

- The modelled risk from the updated model evaluates reasonably against the recent, historic, flood record.
- The updated design flood outlines are broadly similar with the previous (2012) flood outlines but a small number of important flow routes, which were not picked up by the previous 1D only modelling, are simulated by the modelling the floodplain in 2D based on recent high definition LIDAR. These place several additional properties in Northenden at 1% AEP risk and a large number of properties in Stockport Town Centre and East Didsbury at 0.1% AEP risk.
- Since the defended 1% and 0.1% AEP flood outlines are locally larger than their undefended counterparts (due to the widespread removal of all defences in the latter scenario), the updated Flood Zones will need to be defined as a composite of the defended and undefended flood outlines.
- A comparison of the defended and undefended 1% AEP outlines together define a large number of potential ABDs, many of which are small and/or irregular in shape. A pragmatic approach will likely have to be taken towards defining ABDs. In this report, an approach is taken towards defining only those potential ABDs that are greater than 0.5km^2 in area as formal ABDs.
- The modelled range of climate change enhanced 1% AEP events (+30%, +35% and +70%) are all smaller than the present day 0.1% AEP event in terms of flood extent and risk to properties, with flood depths, velocities and hazard remaining lower. The +30 and +35% factors are modelled to place a small number of urban areas at increased 1% AEP risk.
- Blockage is modelled to increase upstream river levels at all six structures that were subject to blockage analysis. However, the impact of blockage on the number of properties at risk varies significantly for different structures. In reality, high blockage factors are unlikely to occur on a river as wide as the Upper Mersey.
- Downstream boundary sensitivity tests were undertaken using the 10% and 1% AEP design results from the Environment Agency's Manchester Ship Canal (2018) model instead of the normal operating level (of 8.42m AOD). This showed that the 1% AEP design results on the Upper Mersey are insensitive to the level on the Manchester Ship Canal.

10.2 Recommendations

The Upper Mersey model update has successfully produced a fit-for-purpose linked 1D-2D model from the previous 1D only Upper Mersey model. The model verification suggests that the model is producing reasonable predictions. Therefore, there are no recommendations for immediate action. The following actions should ensure that the Upper Mersey model continues to produce realistic results:

- Model calibration using observed hydrographs from recent high flow events could further improve confidence in the model predictions.
- Although, the model evaluates well against recent historic events, parts of the 1D model are still based on data and approaches that are older than best practice would normally allow. Therefore, if the model is to be used to investigate local schemes, then it would be sensible to review the 1D channel definition and structure representation in the relevant reaches via check survey and review of structures.
- The undefended flood outlines are based on a single scenario that removes all raised flood defences along the Mersey. In reality, defence failure is likely to be localised and this could lead to a local risk that is higher than depicted on the flood map. In such cases, breach modelling could be undertaken to gain a clearer picture of the areas at risk behind the defences and the potential hazard from local defence failure.
- The model should be maintained in line with future development in the study area (e.g. built development, flood defence schemes and/or other catchment changes) and verified against any further flood information (including future events) that becomes available.
- As noted in a footnote within Section 8, it is recommended that a datum check should be carried out on the Upper Mersey gauges since the datums provided for the FW analysis in this study (as shown in Table 8 1) do not all agree with those that currently appear on the Environment Agency's on-line Flood Information Service (https://flood-warning-information.service.gov.uk/river-and-sea-levels). These differences are most noticeable for the Northenden and Brinksway gauges.

Appendices

A Model Deliverables

In addition to this report, the project has the following key deliverables that are being supplied in full in electronic format with final delivery.

A.1 Hydraulic Models

All design event model files associated with the new 1D-2D hydraulic models for the Upper Mersey including results.

A.2 ASCII Grids

ASCII grids for peak flood level, depth, velocity and hazard for all modelled design events.

A.3 GIS Polygons

- Flood outline polygons.
- MapEdit deliverables
    - Modelled information locations (node points);
    - Modelled Flood Group;
    - Modelled Flood Outline;
    - Modelled measurement;
- Flood Warning polygons.
    - Proposed Flood Alert Areas
    - Proposed Flood Warning Areas
    - FWFRAs behind the new Northenden FWA

A.4 1D Node Point Tables

Microsoft Excel spreadsheet containing peak level, flow and velocity at each 1D node for all design events.

Offices at

Coleshill
Doncaster
Dublin
Edinburgh
Exeter
Glasgow
Haywards Heath
Isle of Man
Limerick
Newcastle upon Tyne
Newport
Peterborough
Saltaire
Skipton
Tadcaster
Thirsk
Wallingford
Warrington

Registered Office
South Barn
Broughton Hall
SKIPTON
North Yorkshire
BD23 3AE
United Kingdom

+44(0)1756 799919
info@jbaconsulting.com
www.jbaconsulting.com
Follow us:

Jeremy Benn Associates Limited

Registered in England 3246693

JBA Group Ltd is certified to:
ISO 9001:2015
ISO 14001:2015
OHSAS 18001:2007

Introduction

This report provides a detailed record of information on the hydraulic model of the River Mersey through Manchester, Greater Manchester, updated for the Modelling 4 Package (2016/17). It complements the information in the main report which gives more general information on the model.

The format of this report is the Intellectual Property of JBA Consulting. Copying or reproduction of its contents is prohibited without the express permission of JBA Consulting.

JBA Project Manager

Kevin Frodsham BSc BA MSc PhD

Revision History

Revision Ref / Date Issued	Amendments	Issued to
v1.0 April 2018		Peter Hewitt

Modellers

Prepared by ..... Jack Pordham BSc MA

Reviewed by ..... Kevin Frodsham BSc BA MSc PhD

Contents

1. Source of Key Model Data 2

2. Overview 4

2.1 1D model overview 4
2.2 2D model overview 9
2.3 1D-2D linking Overview 14

3. Model runs 15

3.1 Design event runs – Defended 15
3.2 Design event runs – Undefended 19
3.3 Design event runs – Blockage 22
3.4 Model Structure 24

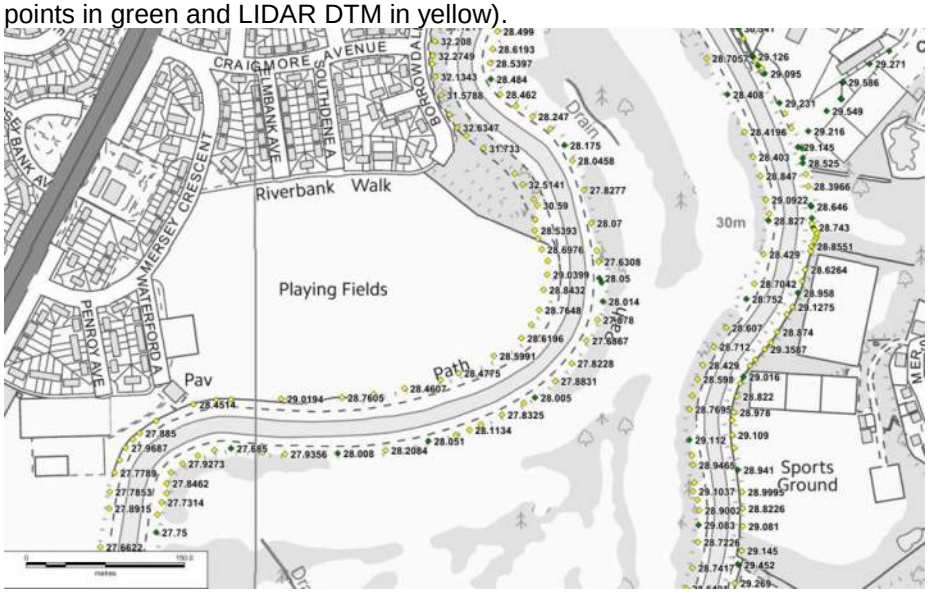
4. Model Proving 26

4.1 Model Calibration 26
4.2 Sensitivity testing 26

1. Source of Key Model Data

Item	Comments

Existing 1D (ISIS) model	The Environment Agency supplied JBA with the hydraulic model and final report from the Upper Mersey Model Review and Update (2012) study undertaken by Hyder.
	
	The supplied model was a 1D only (ISIS) model.
	
	The ISIS models supplied by the EA were:
	• DAT files (dated February 2012)
	  ○ *UM_04_Def_F*
	  ○ *U M_03_Undef_F.dat*
	• *Def_IED files*
	  ○ *Q2.IED* - 50% AEP
	  ○ *Q10.IED* - 10% AEP
	  ○ *Q20.IED* - 5% *AEP*
	  ○ *Q075.IED* - 1.33% AEP
	  ○ *Q100.IED* - 1% AEP
	  ○ *Q100CC20*.IED - 1%+CC20
	  ○ *Q100CC30.IED* - 1%+CC30
	  ○ *Q1000.IED* - 0.1%
	• *Undefended IED (closing FSA inlets and outfalls)*
	  ○ *Mersey_undef.IED*
	• *Example IEFs*
	  ○ *UM_11_Def_F_Q0100.IEF*
	  ○ *UM_10_Undef_F_Q0100.IEF*
	
	Final Report - 5002-UA003646-GDR-02-Final_Report_F.pdf

LIDAR & other Topographic data	1m resolution LIDAR DTM tiles, which were flown in March 2016 and cover the entire study area, were downloaded from **https://environment.data.gov.uk/** in July 2017 as the following tiles; *dtm_F0189962.asc_20160325_20160325_mm_units* *dtm_F0189963.asc_20160325_20160325_mm_units* *dtm_F0189964.asc_20160325_20160325_mm_units* *dtm_F0189966.asc_20160325_20160325_mm_units* *dtm_F0189967.asc_20160325_20160325_mm_units* *dtm_F0189968.asc_20160325_20160325_mm_units* *dtm_F0189970.asc_20160325_20160325_mm_units* *dtm_F0189971.asc_20160325_20160325_mm_units* *dtm_F0189972.asc_20160325_20160325_mm_units* The extent of the 2016 LIDAR is illustrated in Figure 1-1 of the main Upper Mersey Model Update Report. The initial model version was built using the raw 2016 LIDAR tiles supplied by the Environment Agency at project start-up. These raw tiles had not yet been fully processed and contained NULL areas across some areas of open water. Therefore, the early models required some NULL LIDAR override patches, which have continued into the final model. LIDAR was compared with available bank crest survey (2008) and revealed a very good match along embankment crests (as shown below with survey points in green and LIDAR DTM in yellow).  Contains Ordnance Survey Data © Crown copyright and database right (2018)
Topographic survey of defences/ bank crests	Information on bank crest and defence heights was available from the following sources; • Original river section surveys (1996-8 & 2007) • Bank crest survey (EA080001 - 2008) • Bank crest survey (JBA - 2017) Section 4.4.2 of the main report summarises the various survey information and Figure 4.1 of the main report shows the extent of the available bank crest survey.
OS Mastermap	The 2D roughness map is based on OS Mastermap. The following topographic area tiles were downloaded on 22nd August 2017; *SJ7090 / SJ7590 / SJ8085 / SJ8090 / SJ8585 / SJ8590 / SJ9085 & SJ9090* This was sufficient to cover the whole study area apart from one small area (0.04km^2) close to Northenden Junction, which remained outside the final 0.1% flood extent.

2. Overview

This section provides greater detail on the schematisation of the hydraulic model. Since this commission represents an update to an existing model, most elements of the 1D model build and schematisation are unchanged from the existing model and users should refer to previous documentation for the detail and justification of the 1D model schematisation and parameters.

Detail is only provided to enable the user to understand where changes have been made as part of this model update.

General modelling assumptions, limitations and uncertainty are included in the main Upper Mersey Model Update (2018) report (Section 9).

Item	Comments
What software & reason for choice	This commission was to update an existing hydraulic model and to run simulations using undefended scenarios. The existing model was a 1D only ISIS model and the requirement was to upgrade this to a linked 1D-2D model. The updated model is accordingly a 1D-2D (FM-TUFLOW) model run with the latest version of both software versions at the time of the simulation. **Flood Modeller (FM) - 4.3** **TUFLOW - 2017-09-AC-iDP-w64**
General schematisation	A model schematic is included as Figure 5-1 of the main Report and the main changes undertaken in the 2018 Upper Mersey Update are included in Section 5.2 of the main Report.

2.1 1D model overview

1D Channel	Model Chainage (m)
Upper Mersey	4 reaches MERS01 (9.5kms) – Irlam Weir to Ashton Weir MERS01_0000 to MERS01_9505 MERS02 (6.8kms) – Ashton Weir to Bailey Bridge MERS02_0020 to MERS02_6891 MERS03 (3.8kms) – Bailey Bridge to Northenden Weir MERS03_0000 to MERS03_3768 MERS04 (9.8kms) – Northenden Weir to Tame/Goyt confluence. MERS04_0000 to MERS04_9787
River Tame	TAME00000 -TAME001718 (1.6kms)
River Goyt	GOYT000000-GOYT002774 (2.7kms)
Chorlton Platt Gore	Chorconu – CHORLTON (1.2kms)

Overflow Channel	OFXS5U-OFSWEET (2.2kms)
Old Eas Brook	OLDE01_0000 - OLDE01_1300 (1.3kms)
Didsbury FSA Outflow	DIDS01_2428-DIDS01_2382 (0.1kms)
1D Configuration	
Inflow boundaries	All inflow boundaries names and locations are unchanged from the supplied model. Missing return periods have been calculated using an approach documented in the main report. Storm season updated from DEFAULT to WINTER. There are eleven FM FEHBDY units; • Goyt • Portwood • Micker • ChortlBrook • Gatley • Ashton1 • Ashton2 • M51 • M52 • M53 • M54
Downstream boundary	The downstream boundary is an HTBDY configured to the normal operating level (8.42 m AOD) on the Manchester Ship Canal. The model has been tested against both 10% AEP and 1% AEP HTBDYs from the Environment Agency's (2108) Manchester Ship Canal and found to be insensitive to these downstream boundaries.
Labelling system used	Model nodes and labelling were updated were carried out as a CE in the scope. Although, the 1D model extents are unchanged from the previous Upper Mersey (2012) model, a node relabelling exercise was undertaken on the Upper Mersey (due to the difficulty in navigating the previous model nodes). This node relabelling replaced the previous node labels (that had their origins in a number of separate models) with a more conventional node labelling approach of watercourse identifier followed by reach identifier, a chainage and a potential structure type. Hence; • MERS01_4065 is located on Reach 01 of the Upper Mersey at a chainage of 4065m from the downstream boundary. • MERS2_2701bu is a bridge located on Reach 02 of the Upper Mersey at a chainage of 2701m from the downstream of this reach. A look-up table that enables the new node labels to be compared against the old labels is supplied with the model deliverables. The node relabelling exercise required the separation of the Upper Mersey into a set of reaches as follows; • MERS01 – Irlam Weir to Ashton Weir • MERS02 – Ashton Weir to Bailey Bridge • MERS03 – Bailey Bridge to Northenden Weir • MERS04 - Northenden Weir to Tame/Goyt confluence.

Also, to allocate appropriate chainage identifiers to each node label within a reach, the model chainages were updated with values that were measured in GIS between the individual 1D nodes evident in the TUFLOW 1D_isis_nodes GIS layer. The table below shows a comparison of the chainages that are present in the 2012 and 2018 models.

Reach	2012 Model	2018 Model	QA Check (GIS)
MERS01	9,374	9,465	9,515
MERS02	6,763	6,820	6,891
MERS03	3,668	3,790	3,797
MERS04	9,480	9,825	9,834
Total	29,285	29,900	30,027

The final GIS check shows that there is a 127m discrepancy in the 30-kilometre reach. This represents less than 0.5% chainage error and represents an improvement on the 2.5% chainage error in the 2012 model.

1D Roughness

Channel and floodplain roughness values are represented by Manning's 'n' values that remain unchanged from the existing Upper Mersey (2012) model. The user should refer to previous model documentation for discussion of values.

1D Model Updates

Other than changes that arose from the node relabelling exercise, changes made to the 1D component of the model were largely the routine changes necessary to remove 1D floodplain representation from the model (i.e. removing reservoirs and later spills and deactivating/ trimming cross extended sections). Some additional LIDAR elevations were added to some sections where the adjusted section did not meet the width requirements of the 2D inactive code layer. These changes are marked with comments labelled with 'JBA 2017'.

A list of additional changes to the 1D component of the model is provided in Section 5.2.1 of the main Upper Mersey Model Update (2018) report.

Unit Count

Unit	Sub-unit	Count
BERNOULLI		3
BRIDGE	USBPR1978	13
BRIDGE	ARCH	13
CONDUIT	CIRCULAR	4
CONDUIT	SECTION	2
CRUMP		1
CULVERT	INLET	1
CULVERT	OUTLET	1
INTERPOLATE		56
OUTFALL	FLAPPED	2
RIVER	SECTION	319
RNWEIR		2
SLUICE	VERTICAL	7
SPILL		31
WEIR		3

List of 1D Structures	**Upper Mersey** A560 Knightsbridge -- MERS4_9737bu – USBPR1978 Bridge Warren Street Culvert -- MERS4_9621CU – Symmetrical Conduit King Street West Bridge -- MERS4_8849bu – Arch Bridge New Road Bridge – MERS4_8311bu -- USBPR1978 Bridge Brinksway Bridge – MERS4_8243bu – Arch Bridge Brinksway Weir – MERS4_8093wu – Broad crested weir Heaton Mersey Bleachworks – MERS4_6494wu – General Weir Cheadle Bridge – MERS4_ 5087lu – Benoulli loss Kingsway Railway Bridge – MERS4_4222bu – Arch Bridge Didsbury flood basin inlet – didbas1u – Vertical Sluice Northenden Weir – MERS3_3768u – Crump weir Didsbury flood basin outlets – didnorOd & didnor2d – Vertical Sluices Didsbury FSA floodplain sensor – DIDS_1751sd – (Dummy) vertical sluice Palatine Road Bridge – MERS3_3459bu – USBPR1978 Bridge Borrowdale Crescent Rubble Weir – MERS_1735su – Spill unit Princess Parkway Bridge – MERS3_0779bu -- Arch Bridge Princess Pkwy downstream rubble weir – MERS3_0699su – Spill unit Chorlton Water Park Rubble Weir – MERS3_0179su – Spill unit Bailey Bridge – MERS2_6874bu – USBPR1978 Bridge Sale Ees flood basin inlets – salbas1u & salbas2d – Vertical Sluice Sale Ees Rubble Weir – MERS2_4000su – Spill unit Rubble weir u/s Barfoot Aqueduct – MERS2_3065su – Spill unit Metrolink Rail Bridge – MERS2_2994u – USBPR1978 Bridge Barfoot Aqueduct – MERS2_2962lu – Benoulli loss Sale Ees flapped outfall culvert – salecv1 to salecv4 – Circular Conduit Sale Ees flood basin outfall – flapup – Vertical Sluice M63 Bridge at Sale – MERS2_2702bu – USBPR1978 Bridge Crossford Bridge – MERS2_2354bu – Arch Bridge Rubble Weir at New Manor Farm – MERS02_1733u – Spill unit Rubble Weir at Stretford STW – MERS02_1013u – Spill unit Rubble Weir at Ashton CC – MERS02_0622u – Spill unit Ashton Weir, right side – MERS_9510s1 – Spill unit Ashton Weir, left side – MERS_9510w2 – General Weir Ashton Weir, central weir – MERS_9510w1 – General Weir Flixton Bridge – MERS1_3152bu – Arch Bridge Irlam Weir – MERS_0012su – Spill unit

	River Tame Footbridge – BRDG001560 – USBPR1978 Bridge Tiviot Way Bridge – BRDG000725 – USBPR1978 Bridge M60 Bridge – TAME000058 – USBPR1978 Bridge
	River Goyt B6104 Bridge – BRDG002070 -- USBPR1978 Bridge B6104 Bridge – BRDG001448 -- Arch Bridge A626 Bridge – BRDG000852 – USBPR1978 Bridge Weir u/s of A560 Bridge – 335WeirUS – Broad Crested weir Bridge – BRDG000322 – Arch Bridge A560 Bridge – BRDG000211 – Arch Bridge Spill – 211SU – Spill unit Howard Street Bridge – BRDG000057 – Arch Bridge Spill – GOYT000032 – Spill unit
	Chorlton Platt Gore Benoulli loss – gore1u – Benoulli loss unit Weir to connect to Mersey – chorconu – Spill unit
	Overflow Channel Metrolink Rail Bridge – OFXS18U – Arch Bridge Bridgewater Canal Bridge – OFXS17U – Arch Bridge Cheshire Road Bridge – OFXS14U – Arch Bridge M60 Bridge – OFXS11AU – USBPR1978 Bridge Conduit Outfall – OFXS5U
	Old Eas Brook Spill – OLDE01_0010 – Spill unit
	Didsbury FSA outlet channel Outfall - didbasOu - Flapped outfall
ESTRY components	A small number of floodplain culverts (the M60 culverts within the Didsbury FSA, the Palatine Road culvert within the Didsbury FSA and two culverts beneath the railway in Flixton) are modelled via the following GIS layers; 1d_nwk_M60_Culverts_002 1d_nwk_fp_culverts_002 The M60 culvert geometries are based on survey points picked up in the JBA (2017) survey. The geometry of the Palatine Road Culvert is taken from the existing (2012) Upper Mersey model. The geometries of the railway culverts in Flixton are based on LIDAR. These 1d_nwk layers are defined within a 1D Domain clause within the tcf file and are connected to 2D via SX boundaries.

2.2 2D model overview

Area of 2D domain	27.5km^2	DTM data source	Upper_Mersey_DTM(1m)_230218.txt LIDAR (flown March 2016)
Resolution of grid	8m	DTM resolution	1m
Active Code Layers	2d_code_Upper Mersey_003	Inactive Code Layers	2d_bc_HX_MERSEY_002 2d_bc_HX_TAME_001 2d_bc_HX_GOYT_001 2d_bc_HX_DIDS_002 2d_bc_HX_GORE_001 2d_bc_HX_OFXS_001 2d_bc_HX_OLDE_001
Modifications to topography and reasons	2d_zpt_NULL_override_001 2d_zsh_NULL_override_001		Fill in NULL areas in the raw LIDAR DTM that was supplied at project start-up (and are now potentially not essential to the model following the later downloading of tiles from the EA Survey Open Data Web Site).
	2d_zsh_Bridge_Decks_002		Patches bridge decks on top of the LIDAR based model grid where the decks were filtered out of the LIDAR DTM.
	2d_zlr_fp_embankments_001.MIF 2d_zlr_fp_embankments_002.MIF 2d_zlr_fp_embankments_003.MIF		Z-line layers representing lateral floodplain embankments. Read in using THICK option. Each taking elevation data from a different dataset (001 – 2008 survey; 002 – LIDAR and 003 – 2017 survey)
	2d_bc_HX_MERSEY_002_pts 2d_bc_HX_TAME_001_pts 2d_bc_HX_GOYT_001_pts 2d_bc_HX_DIDS_002_pts 2d_bc_HX_GORE_001_pts 2d_bc_HX_OFXS_001_pts 2d_bc_HX_OLDE_001_pts		Bank crest elevations (including raised sections for the defended scenario). Read into the model using the “Read GIS Z HX Line ==” command.
	2d_zsh_EA_embankment_removal_010 2d_zsh_private_embankment_removal_001		Only read into the model for the undefended (UNDEF07) model scenario. Contain GIS polygons aimed at reducing raised defences to surrounding ground levels.
	2d_zln_wall_removal_001.MIF		Only read into the model for the undefended (UNDEF07) model scenario. Contain z-lines aimed at reducing raised defences to surrounding ground levels. Read in using THICK option.
Approach to modelling bank crests	The approach taken to the modelling of bank crests was one of the most important decisions that had to be taken as part of the Upper Mersey Model Update (2018) study due to the extensive nature of the Upper Mersey defences. There are two main datasets that contain detailed bank crest information; the 2008 bank crest survey and the 2016 LIDAR. In general survey is normally preferred ahead of LIDAR but LIDAR is more recent and can provide a higher resolution dataset, given that the 2008 point spacing was often greater than 100 metres. For this reason, the two datasets were compared by both point inspecting the original (2008) survey points with the LIDAR DTM and subjectively assessing the goodness of fit. 1. The first pass bank crest lines were created using the 2008 survey points as a guide to the defended reaches and a combination of map		

backgrounds and the cross-section extremities as a guide to the bank crest locations along undefended reaches.

2. A set of initial bank crest elevations was obtained by point inspecting the LIDAR (2016) DTM at 25 metre intervals along the bank crest lines and the initial bank crest layer was created using a combination of these LIDAR points with 2008 survey points along defended reaches. LIDAR points were deleted from any reaches lined by formal flood walls so that these were based solely on survey.
3. To ensure that a suitable elevation had been applied to LIDAR based bank crests, the points were manually inspected against LIDAR by viewing sections through the LIDAR topography in GIS. This enabled corrections to be made for the following situations;
    - Where the initial bank crest lines did not quite correspond to the actual crest along defended reaches, these checks ensured that the crest level apparent in LIDAR was applied to embankment,
    - When the initial bank crest line was close to a vertical bank along undefended reaches, the point inspected LIDAR would occasionally provide elevations that had been influenced by the LIDAR filtering algorithm. The above approach prevented anomalously low elevations being allocated to the bank crest points.

    As part of this validation exercise, further manual edits to the bank crest layer were made, as follows;
    - If the bank crest was more than 5 metres distance from the original bank crest layer, the bank crest line was relocated to the bank crest line. This should have ensured that bank widths are accurate to within ±5 metres.
    - If the bank crest elevation was more than 0.05 metres different from the elevation in the initial bank layer, then the elevation was changed to reflect the value evident in the LIDAR cross-section profile. This should ensure accuracy of the bank crest elevation layer relative to the LIDAR DTM of ±0.05 metres.
4. The extent and nature of the raised flood defences was assumed to be as was provided in the supplied AIMS data. However, on the site visit it was noticed that a local reconfiguration of the defences has recently taken place in the Northenden area. These changes were incorporated into the model on the basis of a local bank crest survey that was undertaken in November 2017.

The dataset that was used to define the bank crests in the final model is therefore a combination of 2008 survey, 2016 LIDAR and 2017 survey. The data sources that contribute to the final model are colour coded in the MapInfo 2d_HX_XXXX_pts layer as follows; 2008 LIDAR (dark green). 2016 LIDAR (yellow) and 2017 survey (pink). This is illustrated in the figure (overleaf).



Contains Ordnance Survey Data © Crown copyright and database right (2018)

2D boundary Layers	**bc dbase** Mode Inflows & DSBDY are in FM so no TUFLOW bc dbase is defined	**SX – 1D-2D structures** 2d_bc_SX_MERSEY_002 2d_bc_M60_Culverts_001 2d_bc_SX_fp_culverts_002
	HX – 1D-2D bank crests 2d_bc_HX_MERSEY_002 2d_bc_HX_TAME_001 2d_bc_HX_GOYT_001 2d_bc_HX_DIDS_002 2d_bc_HX_GORE_001 2d_bc_HX_OFXS_001 2d_bc_HX_OLDE_001	**HQ – Bridgwater Canal** 2d_bc_canal_HQ_001
Hydraulic roughness	2d_mat_OS_Mastermap_001	Main 2D roughness map based on OS Mastermap Land Use categories.
	2d_mat_Q1000_stability_002	Additional roughness polygons to improve stability. Conditional on Scenario and Event. Defended Q1000 / Q1000CC30/ Q100CC70
	2d_mat_Q1000+_stability_001	Additional roughness polygons to improve stability. Conditional on Scenario and Event. Defended Q1000CC30
	2d_mat_UNDEF_stability_001	Additional roughness polygons to improve stability. Conditional on Scenario and Event. Undefended Q100CC30 / Q100CC35/ Q100CC70 / Q1000 / Q1000CC30
	2d_mat_UNDEF+_stability_001	Additional roughness polygons to improve stability. Conditional on Scenario and Event. Undefended Q100CC70 / Q1000 / Q1000CC30
	Manning's n values have been used to represent hydraulic roughness in the 2D.	

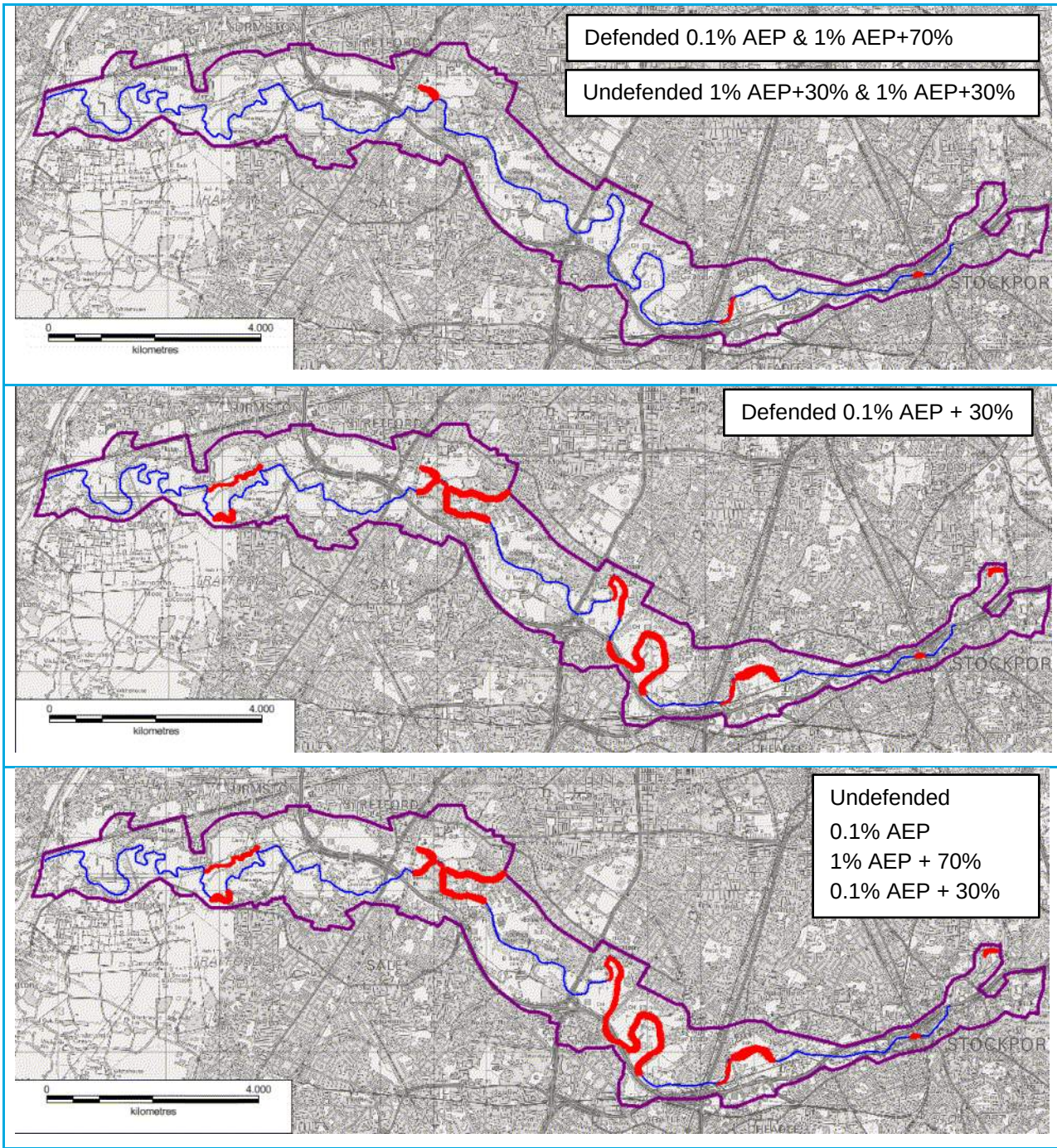
	Land Use Category	**Manning's 'n'**
	Buildings	0.2
	Gardens	0.05
	Fields (including agricultural land)	0.035
	Trees	0.08
	Rail features	0.04
	Road	0.025
	Inland water	0.015
	Roads, tracks and paths	0.025
	Manmade landform	0.04
	Unclassified land	0.05
	Paths	0.025
	Structures including roadside structures	0.06
	General surface	0.05
	Glasshouse	0.05
	Natural Landform	0.05
	Combined manmade/natural landforms	0.045
	Structures	0.06
	Roads, tracks and paths	0.025
	Tidal Water (Estuary bed)	0.02
	Tidal Foreshore	0.02
	Structure (undefined)	0.05
	Stability	0.2 or 0.4
2D Initial Water Level(s)	Default (i.e. ground level).	
Other 2D files (s)	1d_isis_nodes_Upper_Mersey_005	
	1d_nwk GIS Layers 1d_nwk_MERSEY_002 1d_nwk_Tame_001 1d_nwk_Goyt_001 1d_nwk_DIDS_002 1d_nwk_GORE_001 1d_nwk_OFXS_001 1d_nwk_OLDE_001	**1d_WLL GIS Layers** 1d_WLL_MERSEY_002 1d_WLL_Tame_001 1d_WLL_Goyt_001 1d_WLL_DIDS_001 1d_WLL_GORE_001 1d_WLL_OFXS_001 1d_WLL_OLDE_001
Check files enabled	Yes (for all scenarios 1% AEP model event only)	
Map save options	Map Output Data Types == d V h ZUK0 MB1 MB2 Start Map Output == 0 Map Output Interval == 900 (every 15 minutes) Store Maximums and Minimums == ON MAXIMUMS ONLY Map Output Format == XMDF ASC Maximums and Minimums == ON MAXIMUMS ONLY	
Hazard map option	ZUK0 Uses the TUFLOW default UK Hazard Land Use of Conservative. Uses the default UK Hazard Formula of D*(V+0.5)+DF Therefore, uses depth varying (conservative) debris factor.	
Time series (PO) lines	None	
Other commands	screen/log display interval == 75 (for 8m scenario) XMDF Output Compression == ON (Default compression)	

Use of roughness patches for improving 1D-2D stability

Roughness patches were locally placed across the river banks to improve model stability for the more extreme events when the conventional configuration was insufficient on its own to prevent noticeable oscillation between 1D and 2D domains.

The extent of the patches used and their roughness value (0.2 or 0.4) were conditional on the scenario and event being modelled. The figure below shows the extent of the roughness patches for each of the scenario/event combinations, for which they were required.

Extent of roughness patches (red) used to improve model stability for specified scenarios and events



Contains Ordnance Survey Data © Crown copyright and database right (2018)

2.3 1D-2D linking Overview

A standard approach has been adopted for linking the 1D (ISIS) and 2D (TUFLOW) models.

For enabling overtopping of the river banks, HX boundaries are defined along both left and right banks and the channel area in-between is modelled as 'inactive' 2D domain. The HX boundaries are linked to the respective ISIS nodes using 'CN' connection lines. which are discontinued at bridge, culvert, sluice and weir structures (amongst others). Along these boundaries, water levels in the channel and floodplain interact dynamically and thus control floodplain wetting and drying.

For enabling flow through 1D structures (e.g. FSA inlets and outlets) between the 1D and 2D domains, SX boundaries have been defined, which are linked, according to Flood Modeller (FM) convention, to a DUMMY HTBDY boundary that is attached to the downstream side of the 1D (FM) structure. A small number of floodplain culverts that are not directly linked to the main channel have also been modelled as 1D (ESTRY) structures linked to the 2D domain via SX boundaries.

Output from the 1D (FM) model has been incorporated into the 2D map outputs using 1D Water Levels Lines (WLLs). This allows easier viewing of results and the ability to animate the 1D results in combination with the 2D results. A WLL is essentially a line of horizontal water level, and is digitised on this basis (i.e. perpendicular to the flow direction).

3. Model runs

3.1 Design event runs – Defended

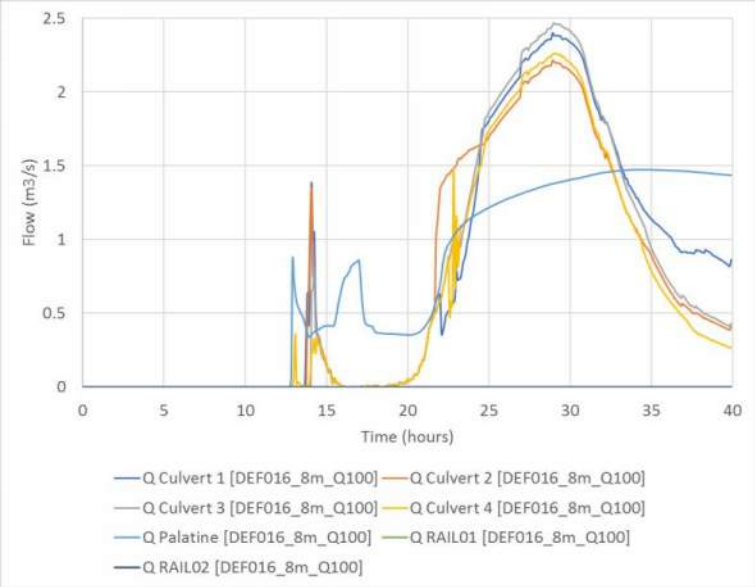
Model Scenario	DEF016
Purpose of Runs:	Defended design fluvial flood events.
File names:	**Flood Modeller** UM_ISTUF_DEF_015(Deact).DAT Each defended model run has a separate associated IED and IEF file corresponding to the modelled return period (see below). **Run Files (IEF)** DEF016_8m_Q2.IEF – Defended 50% AEP DEF016_8m_Q5.IEF – Defended 20% AEP DEF016_8m_Q10.IEF – Defended 10% AEP DEF016_8m_Q20.IEF – Defended 5% AEP DEF016_8m_Q25.IEF – Defended 4% AEP DEF016_8m_Q50.IEF – Defended 2% AEP DEF016_8m_Q75.IEF – Defended 1.3% AEP DEF016_8m_Q100.IEF – Defended 1% AEP DEF016_8m_Q100CC30.IEF – Defended 1% AEP (+30% CC) DEF016_8m_Q100CC35.IEF – Defended 1% AEP (+35% CC) DEF016_8m_Q100CC70.IEF – Defended 1% AEP (+70% CC) DEF016_8m_Q200.IEF – Defended 0.5% AEP DEF016_8m_Q1000.IEF – Defended 0.1% AEP DEF016_8m_Q1000CC30.IEF – Defended 0.1% AEP (+30% CC) **Inflow Files (within IED_winter directory)** Q002.IED - 50% AEP Q005.IED - 20% AEP Q010.IED - 10% AEP Q020.IED - 5% AEP Q025.IED - 4% AEP Q030.IED - 3.3% AEP Q050.IED - 2% AEP Q075.IED – 1.3% AEP Q100.IED - 1% AEP Q100CC30.IED - 1% AEP (+30% CC) Q100CC35.IED - 1% AEP (+35% CC) Q100CC70.IED - 1% AEP (+70% CC) Q200.IED - 0.5% AEP Q1000.IED - 0.1% AEP Q1000CC30.IED - 0.1% AEP (+30% CC)
	TUFLOW ~s1~_~s2~_~e1~.tcf (Use is made of TUFLOW scenarios and events to avoid multiple control files) Upper_Mersey_001.tbc Upper_Mersey_002.tgc Upper_Mersey_001.tmf Note that blockage scenarios were run via a separate tcf (~s1~_~s2~_~e1~_~e2~.tcf) that allowed specification of blockage location and proportion.

Model timestep:	**Flood Modeller** 1 second (most events) 2 seconds (0.1% AEP/ 01% AEP + 30%) **TUFLOW** 2 seconds (all events) **ESTRY** 1 second (all events)
Run Time:	Model event duration: 40 hours. Simulation run time: ~10 to 13 hours.
AEP event(s)	50%, 20%, 10%, 5%, 4%, 3.33%, 2%, 1.33% 1%, 1% plus 30% climate change, 1% plus 35% climate change, 1% plus 70% climate change, 0.5%, and 0.1%, and 0.1% AEP plus 30% climate change
Boundary Conditions:	Model Inflows as supplied. Downstream boundary is normal operating level on the Manchester Ship Canal (as supplied). Initial water level on the floodplain (and inside FSAs) assumed to be LIDAR ground levels.
Run Settings:	All models run Double Precision (FM and TUFLOW) Initial conditions read in from FM DAT file. Default model run parameters used except as follows; • Automated Preissmann slot (as supplied). • minitr (originally 2) raised to 4 (all runs) • maxitr (originally 13) reduced to 11 (most runs) or increased to 17 (1%+30CC, 1%+70CC & 0.1% AEP events only) • dflood (originally 3) raised to 11 (1%+30CC, 1%+70CC & 0.1% AEP events only)
Comments on stability:	**Flood Modeller** FM convergence is discussed in the main report (Section 5.7.1). There were initially some longer periods of poor convergence associated with the flapped outfalls from the Didsbury FSA to the west of Palatine Road (node didbasOu) and the overflow channel (node OFXS5U) during some events. This situation was improved by raising maxitr for some events (mostly for the undefended scenario) and any remaining non-convergence at these structures is not seen as a critical issue because the returning flow through these outflows is almost negligible when compared with the flow on the Upper Mersey. During all model runs in which the FSAs were operational, several occurrences of the following message occurred; Model time 10.4167 hrs: *** warning W2027 *** at label: didbas1u No rules are currently valid for RULES unit associated with label didbas1u at model time 10.4167 hrs. Unit will use previous setting of 0.1500. This message also appeared at a similar time in the supplied (1D only) models so are not a consequence of the current model update. Figure 5.2 of the main report demonstrates that the operation of the FSA inlets is consistent with the previous model performance. **TUFLOW** TUFLOW (2D) stability is discussed in Section 5.7.2 of the main report. There are a small number of negative depth warnings in extreme (0.1% AEP) events, no evidence of either global or local MBEs or dVol adversely influencing the model results. Roughness stability patches were required to dampen oscillatory flow at some locations during events in excess of 1% AEP (as discussed in Section 2.2).

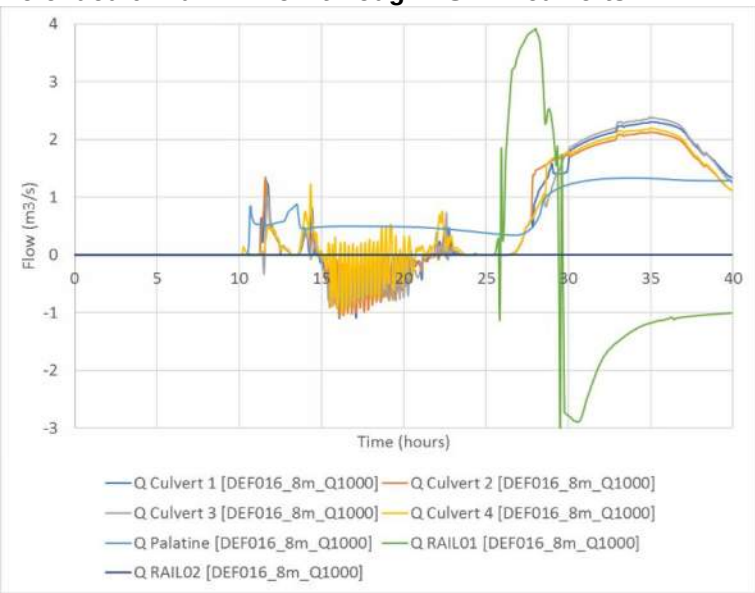
ESTRY

ESTRY stability is not discussed in the main report. There are no 1D negative depth warnings and the 1D MBE is within tolerance. However, there is evidence of some spikes and/or oscillation in the ESTRY flow (see figure overleaf). However, since the ESTRY culverts were included largely to allow water to pass through the embankment and did not require the highest precision due to the small volumes being transferred, the ESTRY stability is considered sufficient.

Defended 1% AEP flow through ESTRY culverts



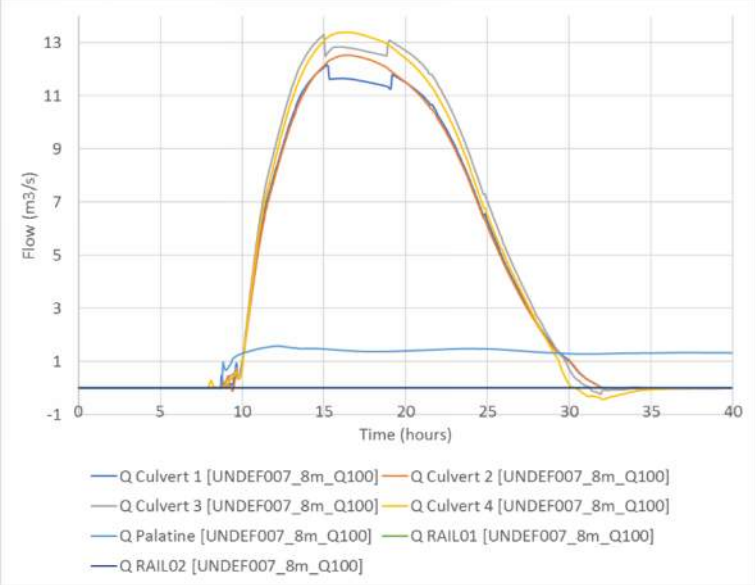
Defended 0.1% AEP flow through ESTRY culverts



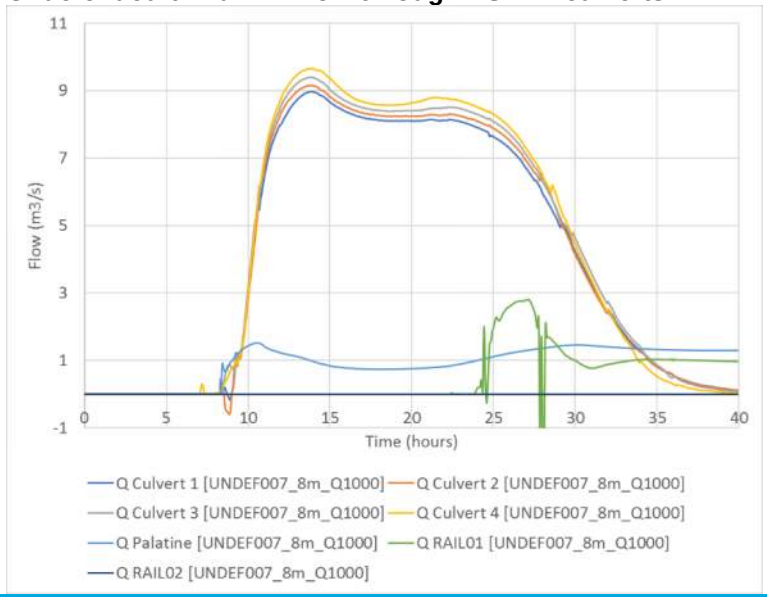
TUFLOW / ESTRY WARNINGS & CHECKS PRIOR TO SIMULATION DEFENDED Scenario			
	No.	Type	Explanation
Warnings	18	WARNING 2118 - Lowered SX ZC Zpt by 0.55m to 1D node bed level.	Consequence of applying a 'z' flag to SX boundary cells. >0.3m records a Warning; <0.3m records a check. High values have been checked and are a consequence of surveyed inverts being applied to an 8m grid that does not capture the floodplain inverts to a high level of accuracy.
Checks	6	CHECK 2118 - Lowered SX ZC Zpt by 0.10m to 1D node bed level.	Acceptable consequence of applying a 'z' flag to SX boundary cells.
	1	CHECK 1393 - Node Palatine.2 linked to external 1D scheme Node DIDS01_2382 using a X1DH link.	Standard check when using direct linking of 1D nodes between FM and ESTRY.

3.2 Design event runs – Undefended

Model Scenario	UNDEF007
Purpose of Runs:	Undefended design fluvial flood events.
File names:	**Flood Modeller** UM_ISTUF_DEF_015(Deact).DAT **Undefended sluice option (within IED_UNDEF directory)** Mersey_undef_sluice.IED – Disables FSA inlets and outfalls **Undefended stability (within IED_STAB directory)** OFXS_STAB_001.IED – Stabilises flow across spill into overflow channel (extreme events only) Each undefended model run has a separate associated IED and IEF file corresponding to the modelled return period (see below). **Run Files (IEF)** UNDEF007_8m_Q2.IEF – Undefended 50% AEP UNDEF007_8m_Q5.IEF – Undefended 20% AEP UNDEF007_8m_Q10.IEF – Undefended 10% AEP UNDEF007_8m_Q20.IEF – Undefended 5% AEP UNDEF007_8m_Q25.IEF – Undefended 4% AEP UNDEF007_8m_Q50.IEF – Undefended 2% AEP UNDEF007_8m_Q75.IEF – Undefended 1.3% AEP UNDEF007_8m_Q100.IEF – Undefended 1% AEP UNDEF007_8m_Q100CC30.IEF – Undefended 1% AEP (+30% CC) UNDEF007_8m_Q100CC35.IEF – Undefended 1% AEP (+35% CC) UNDEF007_8m_Q100CC70.IEF – Undefended 1% AEP (+70% CC) UNDEF007_8m_Q200.IEF – Undefended 0.5% AEP UNDEF007_8m_Q1000.IEF – Undefended 0.1% AEP UNDEF007_8m_Q1000CC30.IEF – Undefended 0.1% AEP (+30% CC) **Inflow (IED) Files** (same as for defended scenario)
	TUFLOW (tcf, tbc, tgc & tmf) (same as for defended scenario) (Use is made of TUFLOW scenarios and events to avoid multiple control files)
Model timestep:	**Flood Modeller** 2 seconds (all events) **TUFLOW** 2 seconds (all events) **ESTRY** 1 second (all events)
Run Time:	Model event duration: 40 hours. Simulation run time: ~10 to 18 hours.
AEP event(s)	50%, 20%, 10%, 5%, 4%, 3.33%, 2%, 1.33% 1%, 1% plus 30% climate change, 1% plus 35% climate change, 1% plus 70% climate change, 0.5%, and 0.1%, and 0.1% AEP plus 30% climate change

Boundary Conditions:	Model Inflows as supplied. Downstream boundary is normal operating level on the Manchester Ship Canal (as supplied). Initial water level on the floodplain (and inside FSAs) assumed to be LIDAR ground levels.
Run Settings:	All models run Double Precision (FM and TUFLOW) Initial conditions read in from FM DAT file. Default model run parameters used except as follows; • Automated Preissmann slot (as supplied). • minitr (originally 2) raised to 4 (all runs) • maxitr (originally 13) raised to 17 (all events) • dflood (originally 3) raised to 11 (most events)
Comments on stability:	Model stability is generally similar to the defended scenarios. FM poor convergence was more obvious in the undefended scenario at the Didsbury FSA outfall so maxitr was raised for the undefended scenario. More roughness patches were needed across the river banks for the undefended scenario in response to the lowering of the bank crests. Flow through ESTRY culverts were generally smooth (see plots) and more water flows through the M60 culverts in the absence of the flood defences. **Undefended 1% AEP flow through ESTRY culverts** 

Undefended 0.1% AEP flow through ESTRY culverts



TUFLOW / ESTRY WARNINGS & CHECKS PRIOR TO SIMULATION
UNDEFENDED Scenario; Same as Defended Scenario

3.3 Design event runs – Blockage

Model Scenario	BLOCK01
Purpose of Runs:	Impact of Structure Blockage during 1% AEP and 1% AEP + 30% events.
File names:	**Flood Modeller** UM_ISTUF_DEF_015(Deact)_blockage.DAT (NB This is the defended model with 0% blockage units inserted) **Blockage IEDs (within IED_BLOCK01 directory)** Each Blockage model run has a separate associated IED and IEF file corresponding to the blockage proportion and modelled return period (see below). A560_25%_blockage A560_50%_blockage A560_75%_blockage Brinksway_25%_blockage Brinksway_50%_blockage Brinksway_75%_blockage Crossford_25%_blockage Crossford_50%_blockage Crossford_75%_blockage Flixton_25%_blockage Flixton_50%_blockage Flixton_75%_blockage Princess_25%_blockage Princess_50%_blockage Princess_75%_blockage Warren_25%_blockage Warren_50%_blockage Warren_70%_blockage **Blockage stability (within IED_BLOCK01 directory)** Warren_topslot - top slot added to the Warren Street conduit units to aid the stability of the 'high blockage proportion' model run All run files were set up in the format below, with corresponding blockage location names (the same as the IED names) **Run Files (.IEF)** **Example:** BLOCK01_8m_A560_25pct_Q100 BLOCK01_8m_A560_25pct_Q100CC30 BLOCK01_8m_A560_50pct_Q100 BLOCK01_8m_A560_50pct_Q100CC30 BLOCK01_8m_A560_75pct_Q100 BLOCK01_8m_A560_75pct_Q100CC30 **Inflow (IED) Files** (same as for defended scenario) Q100.IED Q100CC30.IED
	TUFLOW (tcf, tbc, tgc & tmf) ~s1~_~s2~_~e1~_~e2~.tcf (Use is made of TUFLOW scenarios and events to avoid multiple control files) For the blockage runs note that -e1 was used to define the particular blockage.

	For example, -e1 A560_25pct sets the 25% blockage of the A560 bridge Upper_Mersey_001.tbc Upper_Mersey_002.tgc Upper_Mersey_001.tmf
Model timestep:	**Flood Modeller** 2 seconds (all events) **TUFLOW** 2 seconds (all events) **ESTRY** 1 second (all events)
Run Time:	As defended
AEP event(s)	1%, 1% plus 30% climate change
Boundary Conditions:	As defended
Run Settings:	All models run Double Precision (FM and TUFLOW) Initial conditions read in from FM DAT file. Default model run parameters used except as follows; • Automated Preissmann slot (as supplied). • minitr (originally 2) raised to 4 (all runs) • maxitr (originally 13) raised to 23 (Brinksway events) • dflood (originally 3) raised to 7 (Brinksway events)
Comments on stability:	Model stability is generally similar to the defended and undefended scenarios Some stability issues were experienced for the Brinksway Bridge and Warren Street Culvert blockage runs. These were overcome for the Brinksway Bridge by adding roughness patches upstream of Brinksway Bridge and at the confluence of the Goyt, Tame and the Mersey. However, for the Warren Street culvert, it was not possible to stabilise a 75% blockage so a 70% blockage was run to obtain 'high blockage proportion' results for the 1% AEP event but it was not possible to obtain 'high blockage proportion' results for the 1% AEP + 30% event.

TUFLOW / ESTRY WARNINGS & CHECKS PRIOR TO SIMULATION
BLOCKAGE Scenarios; Identical to Defended Scenario

3.4 Model Structure

This section has been written to help future model users to understand the hydraulic model, access its results and, if necessary, re-run the model. The Figure overleaf shows the structure of the Upper Mersey model and the following points should be noted:

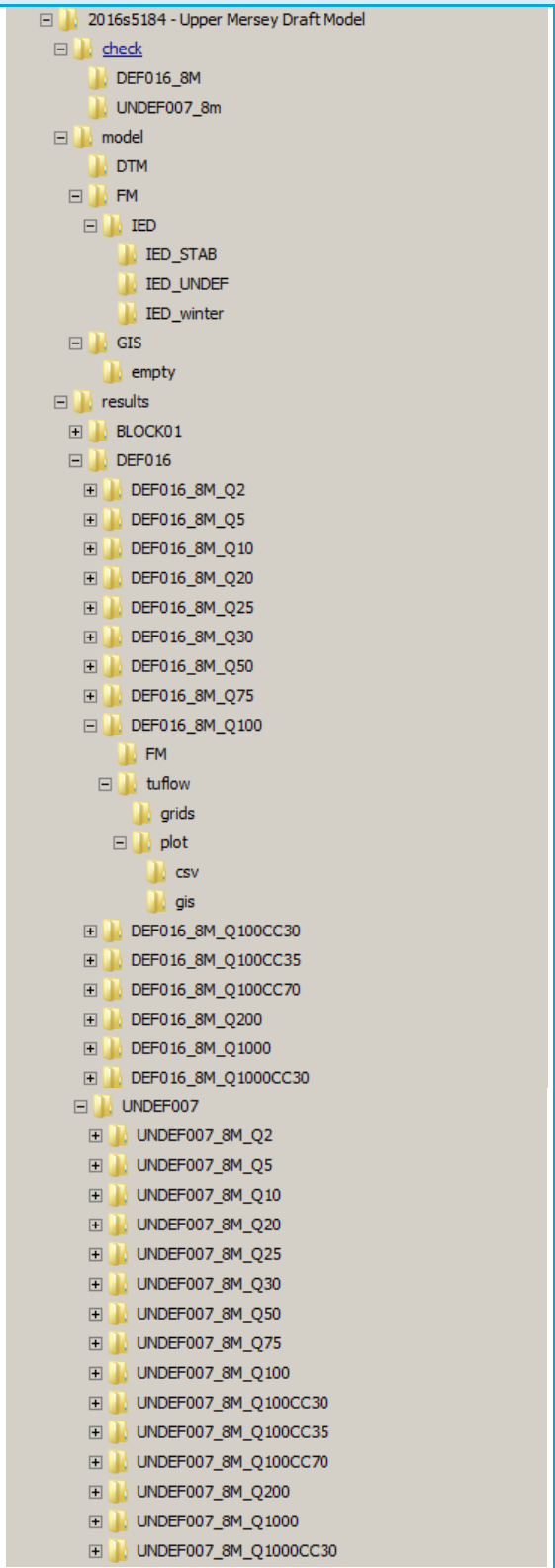
- Before re-running the models, the supplied model will need to be uncompressed.
- The models were run from FM IEF files that individually define the scenarios and event data to be run. These are stored within the relevant individual *runs*\ *directory*.
- The design runs have been run via a single TUFLOW tcf control file using the IEF file to call specific scenarios and events via appropriate (~s1~ and ~e1~) switches in the TUFLOW Run Options box.
- The model scenario used for the design runs were;
    - ~s1~ =DEF016 (Defended scenario identifier).
    - ~s1~ =UNDEF007 (Undefended scenario identifier).
- The TUFLOW part of the model has been configured to run on the basis of relative path links. However, the ISIS model component will need the absolute paths resetting in order to re-run the models.
- The model uses the following key TUFLOW text files, which can be found in their conventional (TUFLOW model) locations:

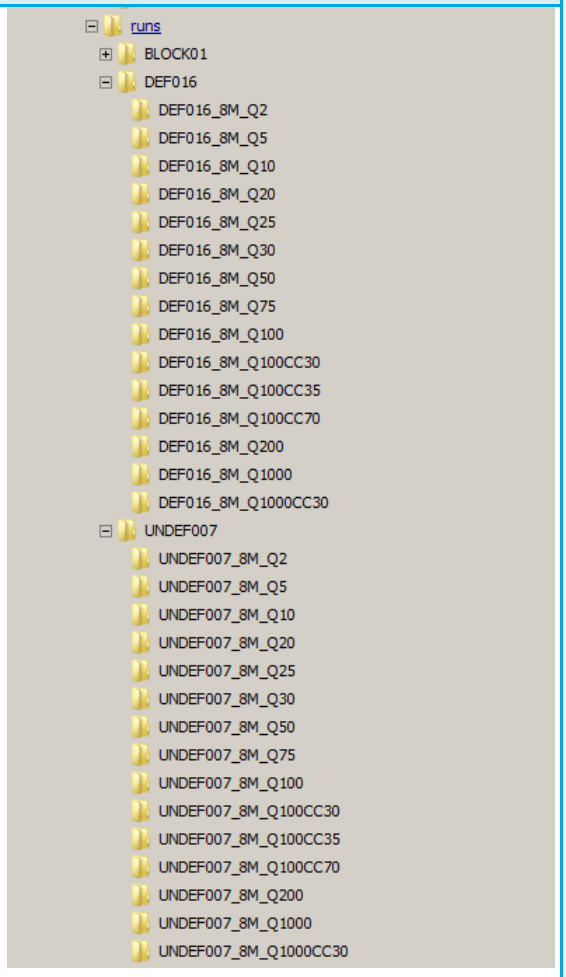
.tcf = TUFLOW Control File .tgc = TUFLOW Geometry Control file

.tbc = TUFLOW Boundary Condition file .tmf = TUFLOW Material File

- The log files for each run (e.g. Defended, 1% AEP) are saved to an individual folder in the runs directory that should be easily traceable (e.g. *runs*\ *DEF016**DEF016_8M_Q100*\).
- The results for each run (e.g. Defended, 1% AEP) are saved in an individual results_scenario directory that mirrors the log file for this particular run (e.g. *results*\ *DEF016**DEF016_8M_Q100*\). Separate results folders are used for FM and TUFLOW outputs noting that, by default, TUFLOW 2017 also creates separate \grids and \plot folders for the TUFLOW results.
- ESTRY commands (for the small number of floodplain culverts) are contained with a 'Start 1D Domain' clause in the TUFLOW tcf file and ESTRY check files and results are saved to the same folders as the respective 2D (TUFLOW) results.
- ASCII grid files have been automatically saved for each model run and can be found in the *grids* folder within each *tuflow* results folder.

Model folder structure





4. Model Proving

4.1 Model Calibration

Model verification is discussed in the Main Upper Mersey Update Report (Section 5.5).

4.2 Sensitivity testing

Sensitivity testing demonstrates the variation in model results that can arise from varying certain key model parameters and/or inputs within potentially realistic ranges. The parameters and inputs tested within the Upper Mersey model as part of the scoped sensitivity tests are shown in Table 4-1. The tests were restricted to a 1% AEP design event.

Table 4-1; Sensitivity analysis parameters and how they will be altered in the model

Parameter	Channel
Manning's n roughness coefficient	±20% change in roughness in 1D open channel and 2D domains
Model Inflow	±20% change in all model inflows
Downstream boundary	Water levels from the 10% and 1% AEP event on the Upper Mersey at the confluence with the Manchester Ship Canal

Various model parameters were tested during the model configuration. One of the more important of these was the 2D cell size since the definition of the model can have a significant influence on the model results. This test is also reported in this Section to demonstrate that a significant improvement in results would not have been gained by reducing the final cell size from 8 metres to 6 metres.

The sensitivity of the model to these parameters in terms of the modelled changes to i) the maximum 1% AEP flood extent, and ii) the maximum 1% AEP river levels are described in the subsections below. Tabulated peak river results for the three formal sensitivity tests are also included in Appendix A of the main modelling report.

4.2.1 Hydraulic Roughness

The hydraulic roughness of the channel and floodplain is represented in the model by specifying Manning's 'n' roughness coefficients with the 1D (channel) and 2D (floodplain) components of the model. The Manning's 'n' vales in the baseline Upper Mersey model are outlined in Section 2 of this report. For testing the sensitivity of the model to hydraulic roughness, both the open channel (1D) and floodplain (2D) roughness coefficients were varied by ±20%.

Figure 4-1 shows that altering hydraulic roughness by ±20% cause some localised changes in the 1% AEP flood extent on the Upper Mersey (Figure 4-1). Increasing the roughness by 20% causes a 12% increase in the 1% AEP flood outline, which most notably occurs alongside the Upper Mersey at Cheadle Bridge, Millgate Farm, Northenden Golf Course and Sale Golf Course. Decreasing roughness by 20% causes a 28% decrease in the overall 1% AEP flood outline but some small localised increases are modelled occurred along Chorlton Platt Gore at Chorlton Ees Nature reserve and along Kickety Brook (Figure 4-2).

Figure 4-1; Modelled variation in the 1% AEP flood extent due to changing hydraulic roughness.

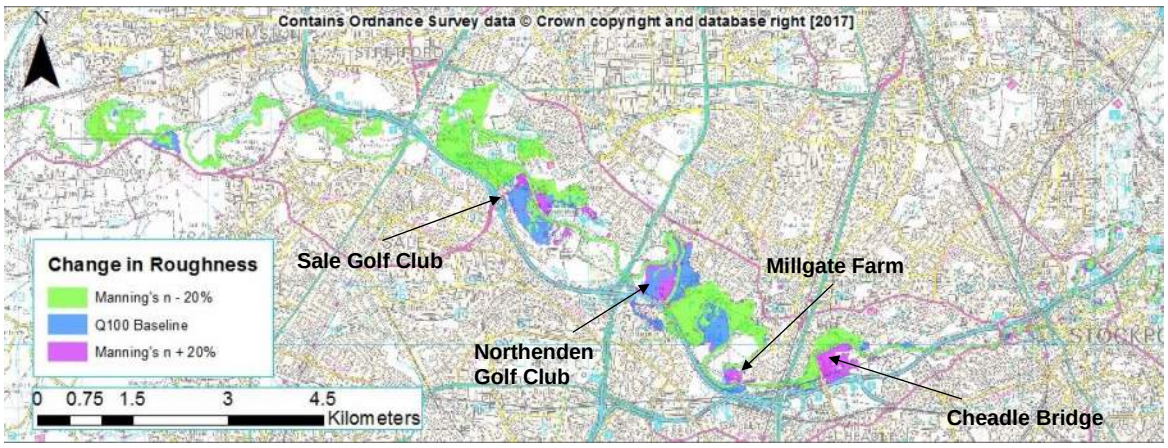


Figure 4-2; localised increase in extent when decreasing roughness (Chorlton Platt Gore – left, Kickety Brook – right)

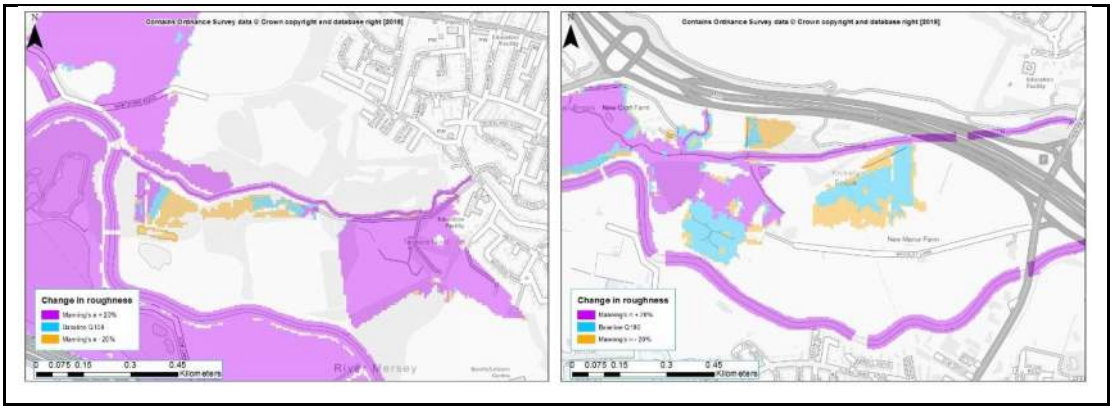
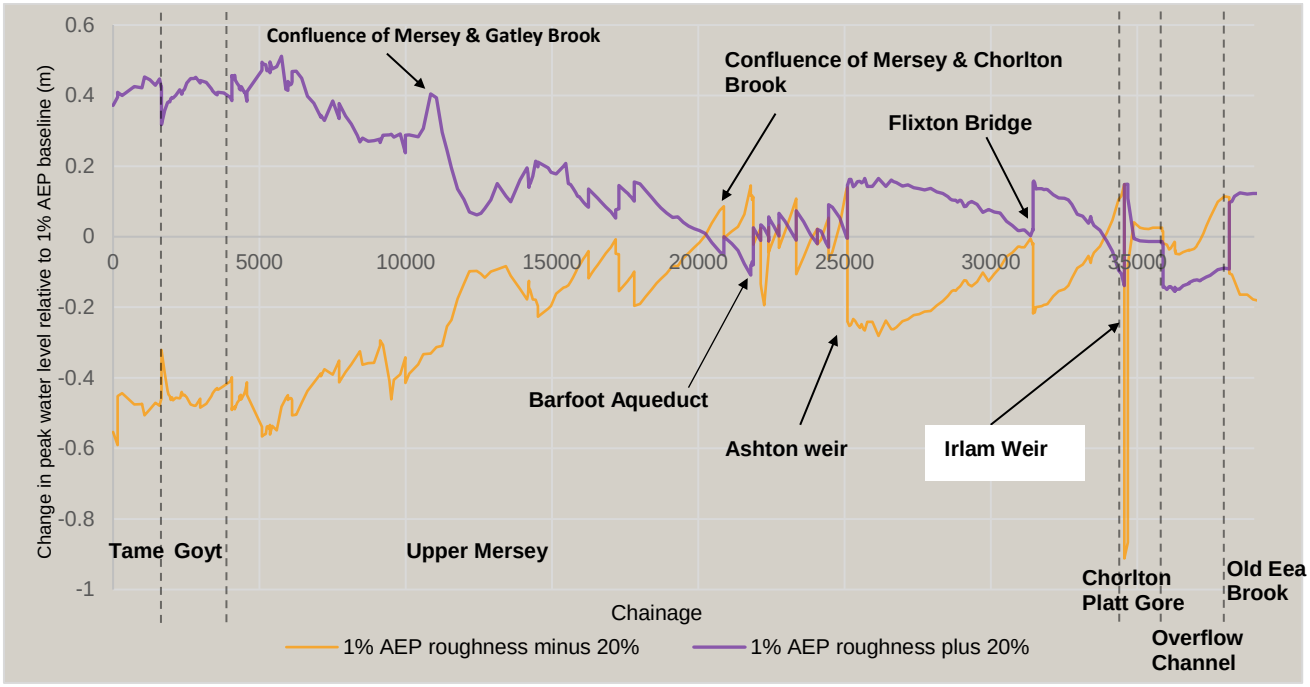


Figure 4-3, illustrates the modelled change in peak river level due to changing the roughness. Increasing the roughness leads to higher water levels within the channel, as would normally be expected from an increase in channel friction and decreasing the roughness leads to lower water levels within the channel. Generally, the peak water levels resulting from increased roughness follow a 'mirror image' pattern to the peak water levels cause by decreased roughness. The structures along the Upper Mersey are shown to exert a strong control on the water level, specifically downstream of the Gatley Brook confluence. Increasing roughness by 20% leads to an average increase of 0.16 metres, with localised increases of up to 0.5 metres. Decreasing the roughness by 20% leads to an average decrease of 0.2 metres, with localised decreases of up to 0.9 metres.

Figure 4-3; Modelled change in peak river level in response to changing hydraulic roughness



4.2.2 Model Inflows

Uncertainties in model inflows are often considered to be one of the main causes of model uncertainty when modelling flood events. To investigate the potential impact of uncertainty in model inflows, the 1% AEP model inflows were varied by ± 20%.

Figure 4-4, shows that changing the model inflows by ± 20% leads to changes in the 1% AEP flood extent on the Upper Mersey. Increasing the inflows by 20% causes a 31% increase in the 1% AEP flood outline, whereas reducing the inflows by 20% results in a 38% decrease in 1% AEP flood outline. The 1% AEP flood outline would, therefore, appear to be sensitive to moderate changes in the model inflows.

Figure 4-4; Modelled variation in 1% AEP flood extent due to changing the model inflows

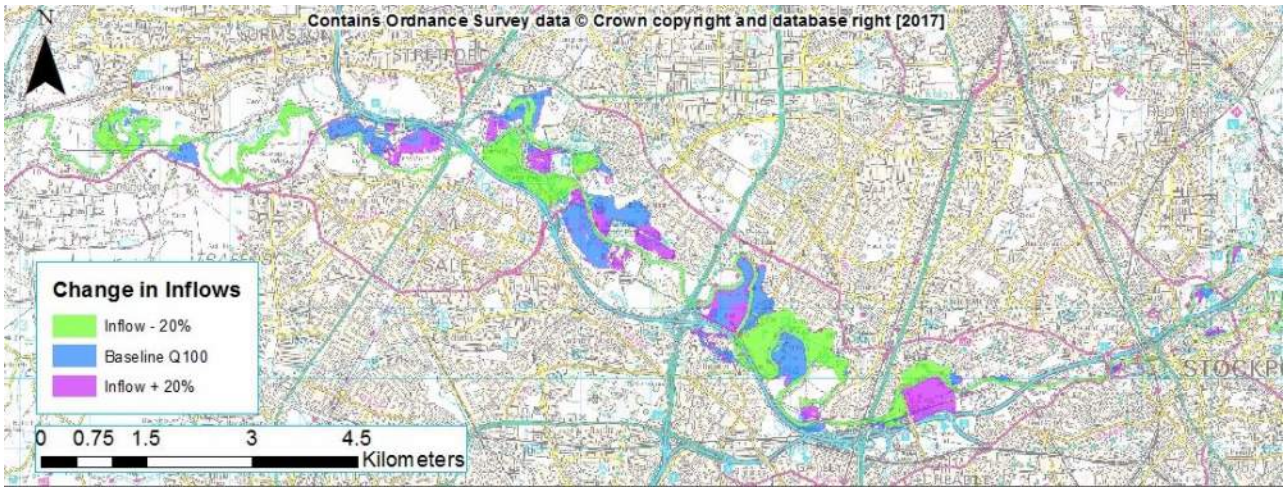
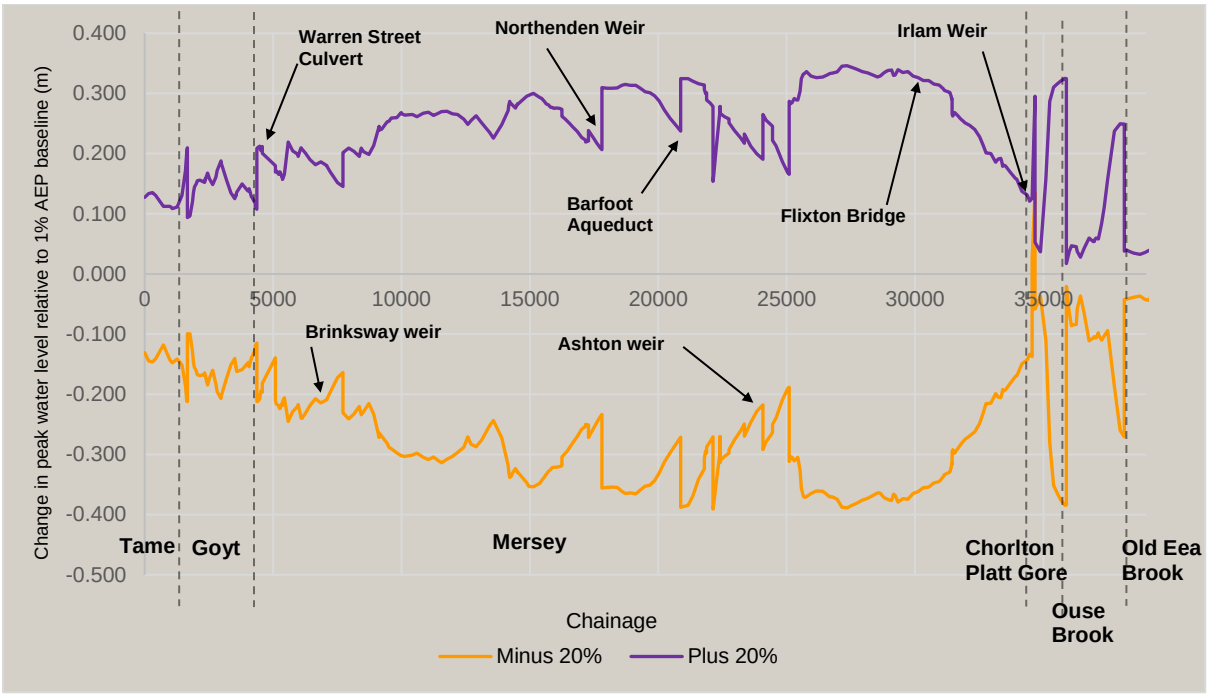


Figure 4-5 illustrates the modelled change in peak river levels due to changing model inflows. Increasing the model inflows by 20% generally leads to an average increase of 0.25m with increases of up to 0.34m. Decreasing the model inflows by 20% mirrors the response of increasing model inflows, with a similar average of around 25% decrease, but marginally larger decreases of up to 0.39m. There are some structural controls on the peak river level differences along the modelled reaches.

Figure 4-5; Modelled variation in peak river level response to changing model inflows



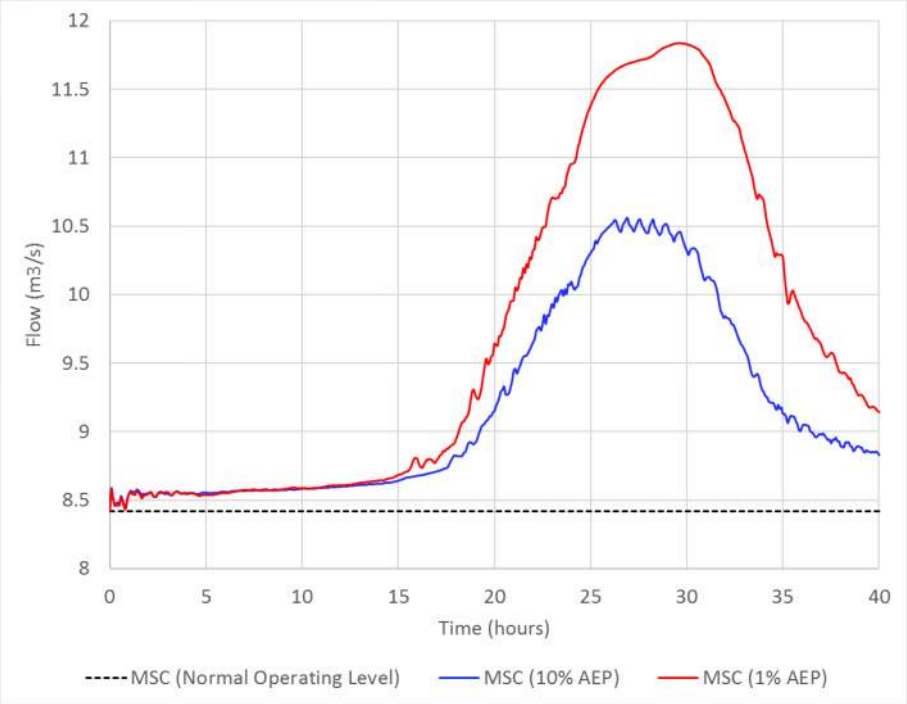
4.2.3 Downstream boundary

Uncertainty in downstream boundary conditions can lead to flood risk potentially being misrepresented. Therefore, it is normally appropriate to demonstrate that the flood risk being modelled within the study reach, particularly in any key areas of interest, is insensitive to the downstream boundary condition. The sensitivity of the 1% AEP flood risk to the 1D downstream boundary was tested by changing the design level at the downstream boundary of the River Mersey model to the results of two different design events obtained from the Environment Agency's Manchester Ship Canal (2018) model. The current downstream boundary on the Upper Mersey model is unchanged from the previous (2012) Upper Mersey model as the normal operating level on the Manchester Ship Canal of 8.42m AOD. The events tested were 10% AEP and 1% AEP (as shown in Figure 4.6).

Both the 10% and 1% AEP downstream boundaries produced no noticeable difference, when compared to the baseline model, in either 1D river level and 2D flood extent during a 1% AEP event along the Upper Mersey. This is attributed to the presence of Irlam Weir at the downstream extent of the Upper Mersey, which produces a 1% AEP design level at the weir crest of 12.46m AOD, which is higher than either of the two tested boundary conditions (Figure 4.6). In addition, the Upper Mersey floodplain is generally higher than either of the two imposed boundary conditions.

While a 0.1% AEP event of the Manchester Ship Canal would potentially have a more significant impact on the lowest reaches of the Upper Mersey, this corresponds to an extreme event and was not tested in this study and the Upper Mersey model is considered to be insensitive to a realistic range of downstream conditions on the Manchester Ship Canal.

Figure 4.6; Downstream boundaries tested with the Upper Mersey model



4.2.4 2D Cell Size

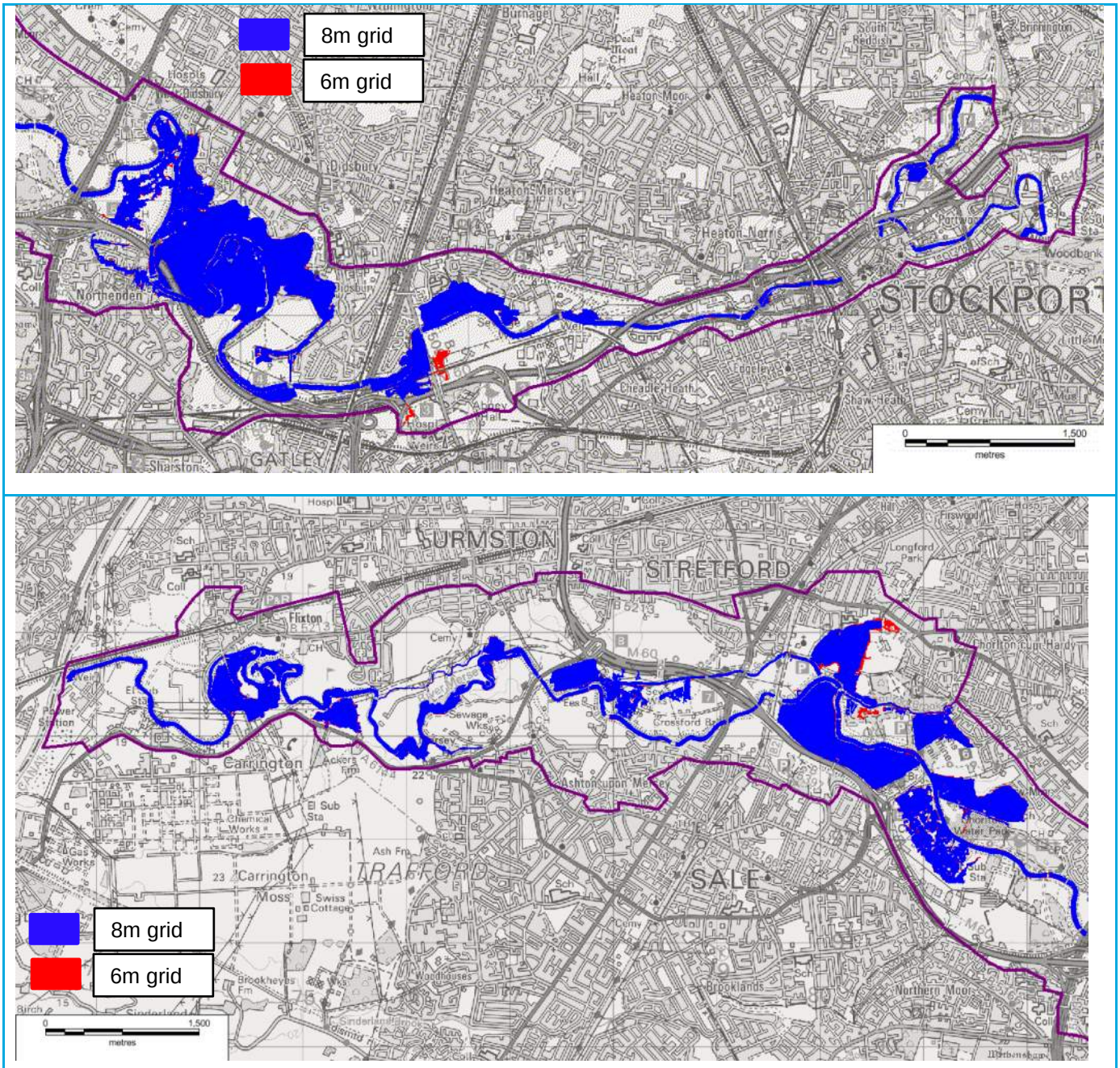
Preliminary draft versions of the model (DEF015 and UNDEF005) were tested with both 6 and 8 metre TUFLOW grids. Initial runs used a 2D timestep of 2 seconds for both models but the 0.1% AEP, 6m grid models were subsequently tested with a 2D timestep of 1.5 seconds due to significant stability issues when run at 2 seconds.

The run times and outcomes are listed in Table 4.2. This shows that, although a stable 1% AEP model could be achieved using a 6m grid, suitably stable 0.1% AEP models could not be achieved at a pre-draft stage even when dropping the 2D timestep with a subsequent tripling of the model run time. This had the implication that a 6m model was unlikely to be very practical for future use so the cell size testing was then required to demonstrate that an 8m model was able to simulate floodplain flow routes to a precision similar to that of a 6m model. Figure 4.7 and Figure 4.8 show a comparison of the 1% AEP outlines for both the defended and undefended scenarios, respectively. These have been plotted with the results of the 6m model grid outputted beneath the results of the 8m grid to show that the 6m grid model does not simulate any significant 1% AEP flow routes that are not picked up by the 8m model grid. Although, there are some differences in the outlines, these do not correspond with important urban flow routes and the practicalities of achieving a full set of 6m model results ultimately validated the decision to use an 8m grid.

Table 4.2; Outcome of (pre-draft) cell size sensitivity tests

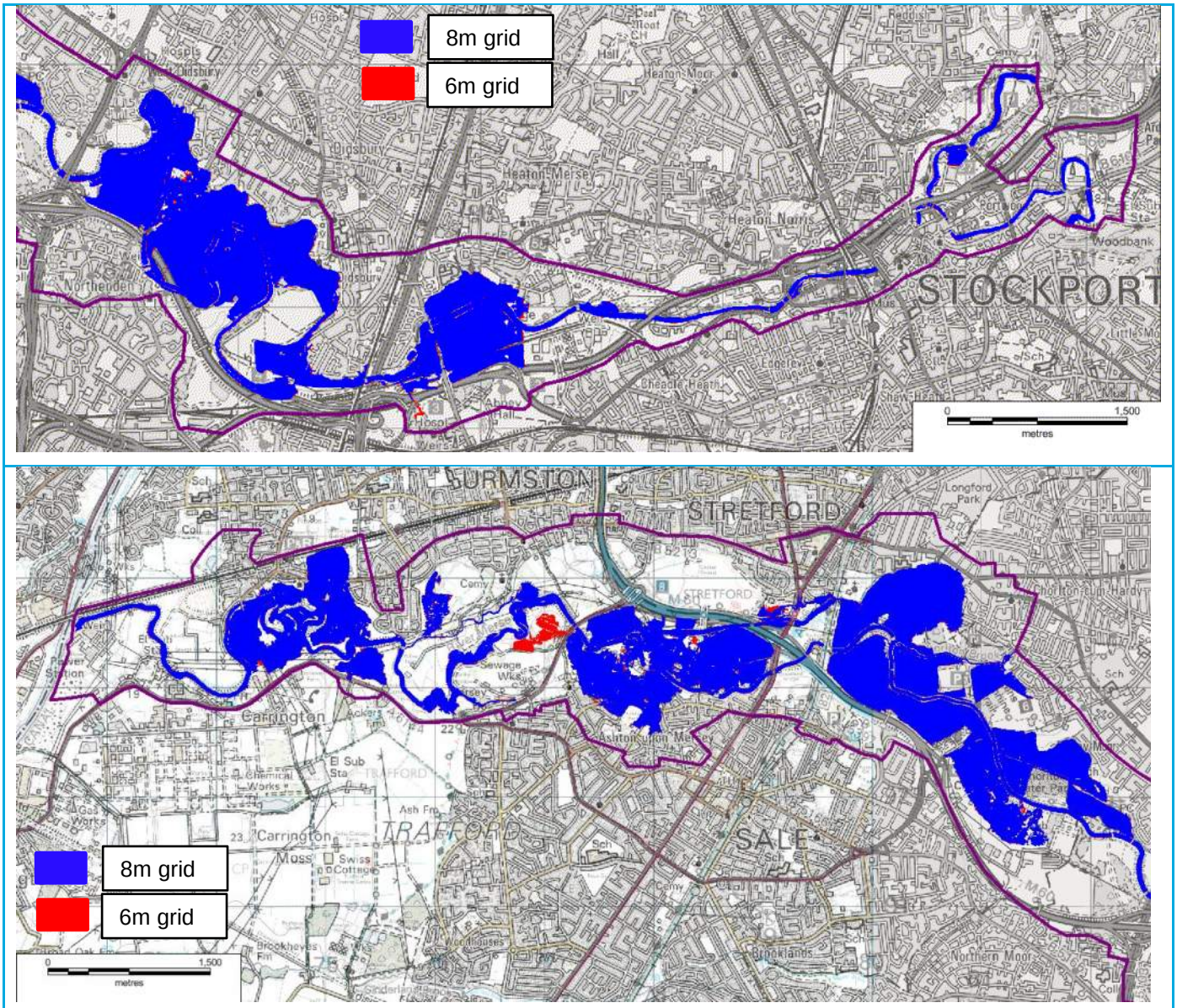
Cell Size	Defended				Undefended			
	1% AEP		0.1% AEP		1% AEP		0.1% AEP	
	Run Time (hrs)	Stable	Run Time (hrs)	Stable	Run Time (hrs)	Stable	Run Time (hrs)	Stable
8m	10	Yes	14	Yes	10	Yes	12	Yes
6m	16	Yes	30	No	18	Yes	29	No

Figure 4.7; 1% AEP defended flood outlines from 6m and 8m model grids



Contains Ordnance Survey Data © Crown copyright and database right (2018)

Figure 4.7; 1% AEP undefended flood outlines from 6m and 8m model grids



Contains Ordnance Survey Data © Crown copyright and database right (2018)

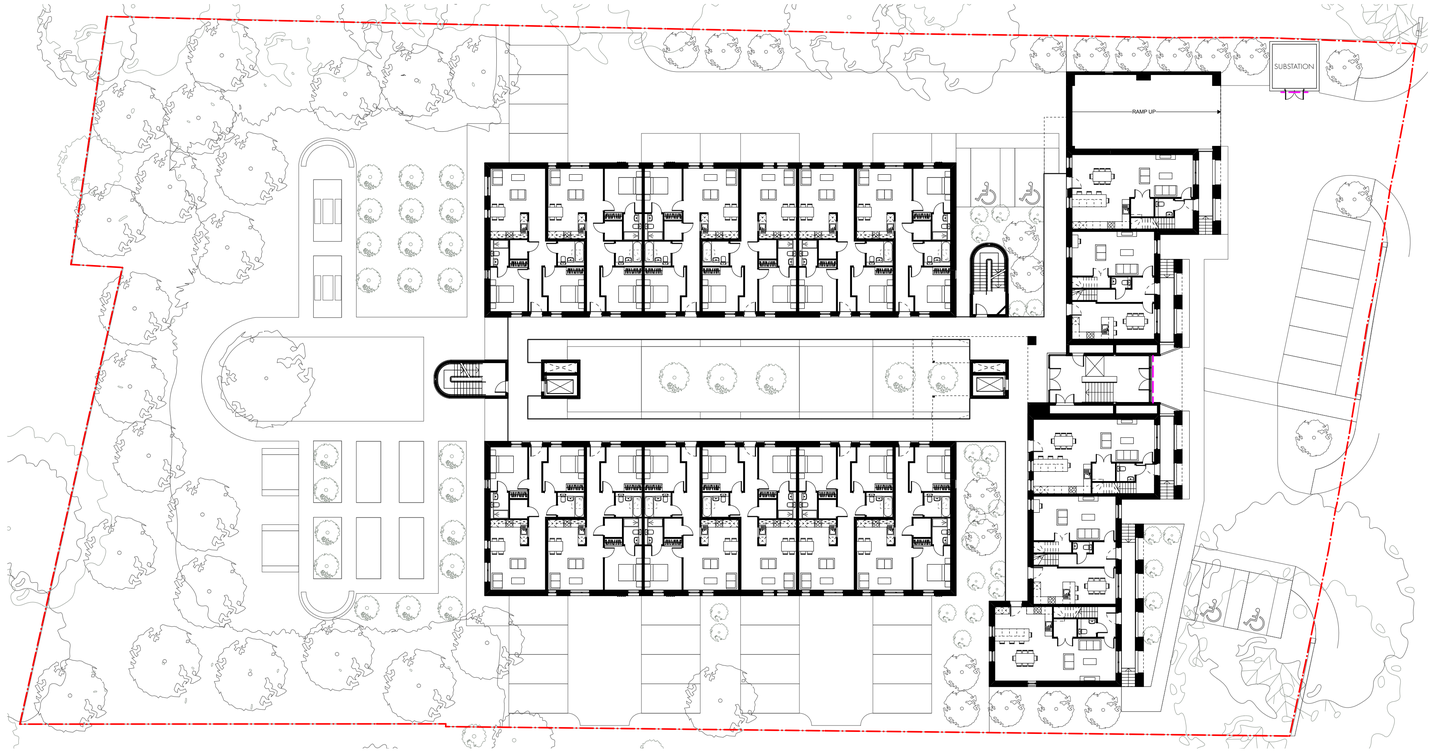
4.2.5 Summary of Model Sensitivities

- Varying hydraulic roughness by ±20% causes variations in 1% AEP levels of up to 0.6m with localised changes of up to 0.9m. the locations for the largest variation are generally reaches along the Mersey controlled by structures. The flood extents vary by around ±12-28%, with the model showing greater variation to decreases in hydraulic roughness than increases.
- Varying model inflows by ±20% causes variations in 1% AEP peak river levels of up to 2.2m from the baseline, with average variations of between ±0.5-0.7m. The flood outlines vary by around ±31-38%, with the model showing greater sensitivity to a decrease in in model inflow than an increase.
- The modelled 1% AEP river levels and flood extents are insensitive to the design events used at the downstream boundary on the Upper Mersey.

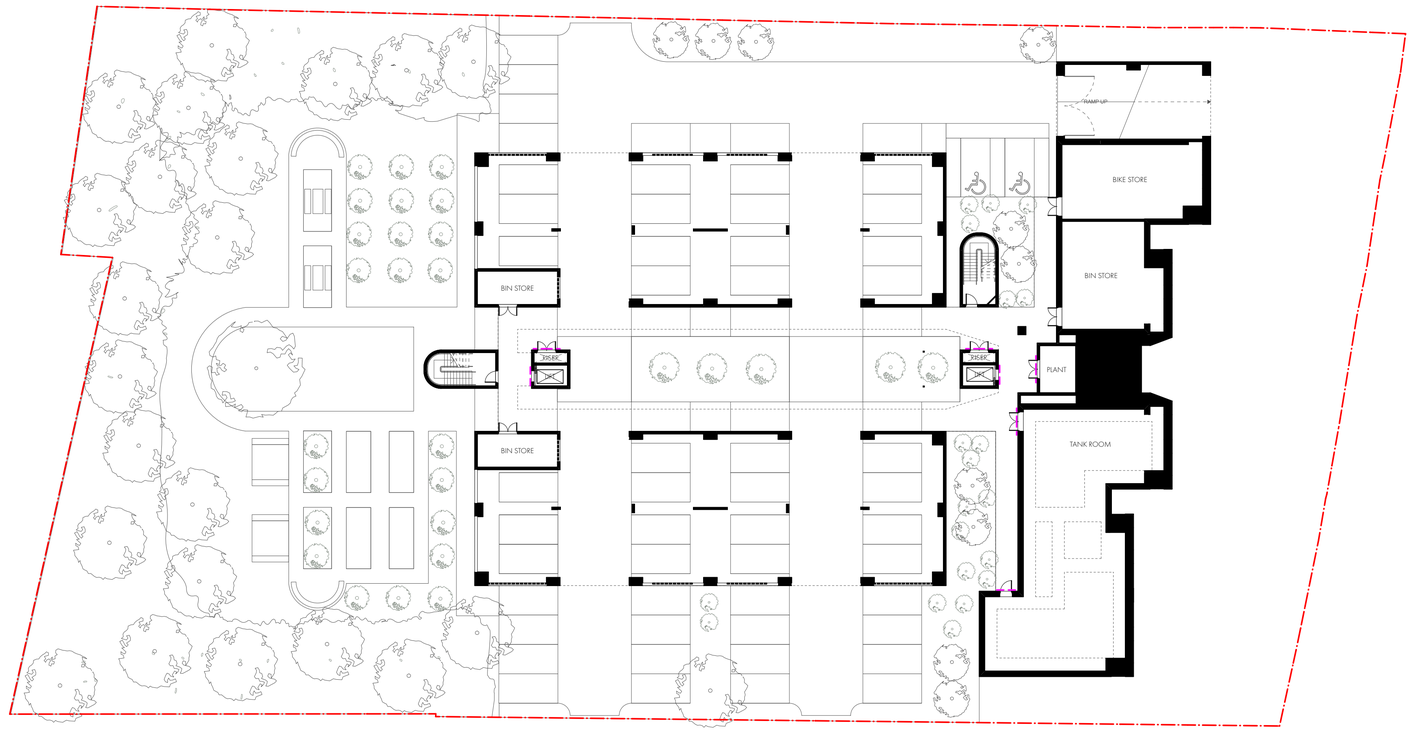
- The Upper Mersey model is not especially sensitive to a variation of the 2D cell sizes in the range of 6 to 8 metres, which enables the design models to be based on an 8-metre grid.

13.5. Appendix E – Proposed Development & Drainage Plans

© Clancy Consulting 2026



PROPOSED GROUND FLOOR PLAN



PROPOSED BASEMENT FLOOR PLAN

REVISION	DATE	DESCRIPTION
P01	13/08/26	Issued for information
P02	24/08/26	Barriers added to basement lifts

KEY

Application Boundary

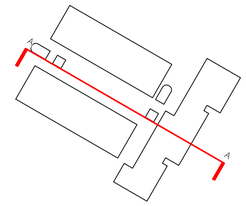
Temporary flood barriers (spec TBC by Civil Engineer)

OMI Architects

31 Blackfriars Road, Salford, Manchester, M3 7AQ
+44(0)161 832 3242 / info@omiarchitects.com / www.omiarchitects.com

PROJECT	MARCO LIVING, PALATINE ROAD				
DRAWING	FLOOD PROTECTION STRATEGY				
DATE	AUG '26	DRAWN BY	HF	SCALE	1:250 @A1
JOB NO.	1459	DWG.NO.	1459-OMI-XX-ZZ-DR-A-L1013-P02		

REVISION	DATE	DESCRIPTION
P01	05/05/26	Preliminary Issue
P02	08/05/26	Draft planning issue for consultant coordination
P03	22/05/26	Planning Issue
P04	13/08/26	Levels and existing ground line added



KEY

1. Building Entrance
2. Landscaped Courtyard
3. Access Walkway
4. Circulation 'Bridge'
5. Resident Landscape Amenity

Existing ground line



PALATINE ROAD — APPLICATION SITE — CAR PARK

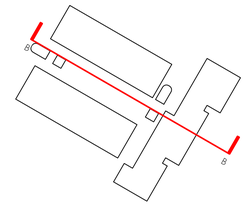
AA SECTION

OMIArchitects

31 Blackfriars Road, Salford, Manchester, M3 7AQ
+44(0)161 832 3242 / info@omiarchitects.com / www.omiarchitects.com

PROJECT	MARCO LIVING, PALATINE ROAD				
DRAWING	PROPOSED SITE SECTION AA				
DATE	MAY' 26	DRAWN BY	HF	SCALE	1:200 @A1
JOB NO.	1459	DWG NO.	1459-OMI-ZZ-00-DR-A-L1500-P04		

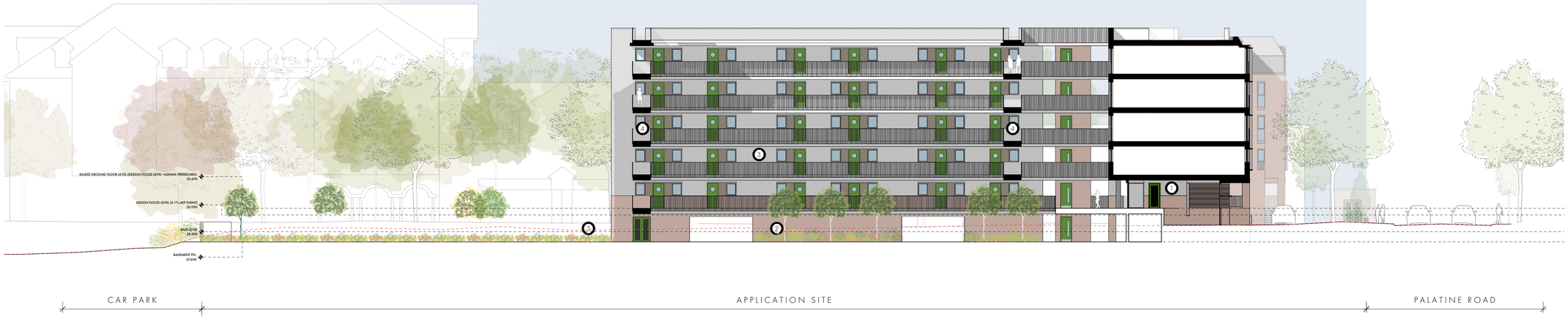
REVISION	DATE	DESCRIPTION
P01	05/05/26	Preliminary Issue
P02	08/05/26	Draft planning issue for consultant coordination
P03	22/05/26	Planning Issue
P04	13/08/26	Levels and existing ground line added



KEY

1. Building Entrance
2. Landscaped Courtyard
3. Access Walkway
4. Circulation 'Bridge'
5. Resident Landscape Amenity

Existing ground line



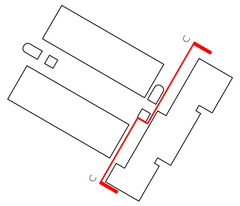
BB SECTION

OMIArchitects

31 Blackfriars Road, Salford, Manchester, M3 7AQ
+44(0)161 832 3242 / info@omiarchitects.com / www.omiarchitects.com

PROJECT	MARCO LIVING, PALATINE ROAD				
DRAWING	PROPOSED SITE SECTION BB				
DATE	MAY '26	DRAWN BY	HF	SCALE	1:200 @A1
JOB NO.	1459	DWG NO.	1459-OMI-ZZ-00-DR-A-L1501-P04		

REVISION	DATE	DESCRIPTION
P01	05/05/26	Preliminary Issue
P02	08/05/26	Draft planning issue for consultant coordination
P03	22/05/26	Planning Issue
P04	13/08/26	Levels and existing ground line added



KEY

1. Building Entrance
2. Landscaped Courtyard
3. Access Walkway
4. Circulation 'Bridge'
5. Resident Landscape Amenity

Existing ground line



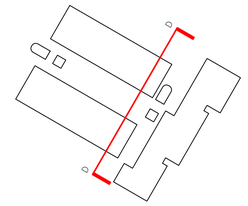
CC SECTION

OMIArchitects

31 Blackfriars Road, Salford, Manchester, M3 7AQ
+44(0)161 832 3242 / info@omiarchitects.com / www.omiarchitects.com

PROJECT	MARCO LIVING, PALATINE ROAD				
DRAWING	PROPOSED SITE SECTION CC				
DATE	MAY '26	DRAWN BY	HF	SCALE	1:200 @A1
JOB NO.	1459	DWG NO.	1459-OMI-ZZ-00-DR-A-L1502-P04		

REVISION	DATE	DESCRIPTION
P01	22/05/26	Planning Issue
P02	13/08/26	Levels and existing ground line added



KEY

1. Building Entrance
2. Landscaped Courtyard
3. Access Walkway
4. Circulation 'Bridge'
5. Resident Landscape Amenity

Existing ground line



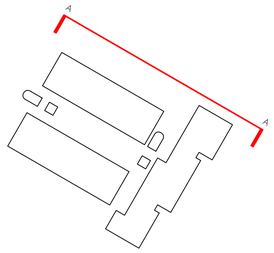
DD SECTION

OMI Architects

31 Blackfriars Road, Salford, Manchester, M3 7AQ
+44(0)161 832 3242 / info@omiarchitects.com / www.omiarchitects.com

PROJECT	MARCO LIVING, PALATINE ROAD				
DRAWING	PROPOSED SITE SECTION DD				
DATE	MAY '26	DRAWN BY	HF	SCALE	1:200 @A1
JOB NO.	1459	DWG NO.	1459-OMI-ZZ-00-DR-A-L1503-P02		

REVISION	DATE	DESCRIPTION
P01	30/04/26	Preliminary Issue
P02	08/05/26	Draft planning issue for consultant coordination
P03	12/05/26	Parking layout revised
P04	22/05/26	Planning Issue
P05	13/08/26	Levels and existing ground line added



KEY

1. Red/ Buff Brickwork
2. Metal Standing Seam
3. Light Brickwork
4. Chevron Brickwork Detailing
5. Metal Cladding
6. Chevron Brickwork Side Panel
7. Metal-framed Window
8. Dormer Window
9. Hit + Miss Brickwork
10. Soldier Course Brickwork
11. Metal Juliette Balcony

----- Existing ground line



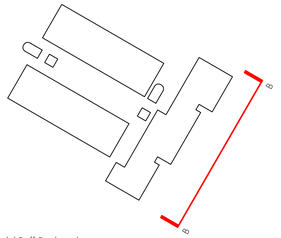
NORTH ELEVATION

OMIArchitects

31 Blackfriars Road, Salford, Manchester, M3 7AQ
+44(0)161 832 3242 / info@omiarchitects.com / www.omiarchitects.com

PROJECT	MARCO LIVING, PALATINE ROAD				
DRAWING	PROPOSED SITE ELEVATION - NORTH				
DATE	APR' 26	DRAWN BY	HF	SCALE	1:200 @A1
JOB NO.	1459	DWG.NO.	1459-OMI-ZZ-00-DR-A-L1600-P05		

REVISION	DATE	DESCRIPTION
P01	30/04/26	Preliminary Issue
P02	08/05/26	Draft planning issue for consultant coordination
P03	22/05/26	Planning Issue
P04	13/08/26	Levels and existing ground line added



KEY

1. Red/ Buff Brickwork
2. Metal Standing Seam
3. Light Brickwork
4. Chevron Brickwork Detailing
5. Metal Cladding
6. Chevron Brickwork Side Panel
7. Metal-framed Window
8. Dormer Window
9. Hit + Miss Brickwork
10. Soldier Course Brickwork
11. Metal Juliette Balcony

----- Existing ground line



BROOKSIDE | APPLICATION SITE | BRITANNIA HOTEL SITE

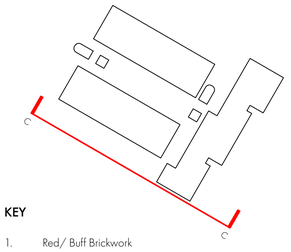
EAST ELEVATION

OMI Architects

31 Blackfriars Road, Salford, Manchester, M3 7AQ
+44(0)161 832 3242 / info@omiarchitects.com / www.omiarchitects.com

PROJECT	MARCO LIVING, PALATINE ROAD				
DRAWING	PROPOSED SITE ELEVATION - EAST				
DATE	APR '26	DRAWN BY	HF	SCALE	1:200 @A1
JOB NO.	1459	DWG NO.	1459-OMI-ZZ-00-DR-A-L1601-P04		

REVISION	DATE	DESCRIPTION
P01	30/04/26	Preliminary Issue
P02	08/05/26	Draft planning issue for consultant coordination
P03	22/05/26	Planning Issue
P04	13/08/26	Levels and existing ground line added



KEY

1. Red/ Buff Brickwork
2. Metal Standing Seam
3. Light Brickwork
4. Chevron Brickwork Detailing
5. Metal Cladding
6. Chevron Brickwork Side Panel
7. Metal-framed Window
8. Dormer Window
9. Hit + Miss Brickwork
10. Soldier Course Brickwork
11. Metal Juliette Balcony

Existing ground line



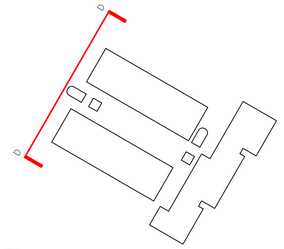
SOUTH ELEVATION

OMIArchitects

31 Blackfriars Road, Salford, Manchester, M3 7AQ
+44(0)161 832 3242 / info@omiarchitects.com / www.omiarchitects.com

PROJECT	MARCO LIVING, PALATINE ROAD				
DRAWING	PROPOSED SITE ELEVATION - SOUTH				
DATE	APR '26	DRAWN BY	HF	SCALE	1:200 @A1
JOB NO.	1459	DWG NO.	1459-OMI-ZZ-00-DR-A-L1602-P04		

REVISION	DATE	DESCRIPTION
P01	30/04/26	Preliminary Issue
P02	08/05/26	Draft planning issue for consultant coordination
P03	22/05/26	Planning Issue
P04	13/08/26	Levels and existing ground line added



KEY

1. Red/ Buff Brickwork
2. Metal Standing Seam
3. Light Brickwork
4. Chevron Brickwork Detailing
5. Metal Cladding
6. Chevron Brickwork Side Panel
7. Metal-framed Window
8. Dormer Window
9. Hit + Miss Brickwork
10. Soldier Course Brickwork
11. Metal Juliette Balcony

Existing ground line



WEST ELEVATION

OMIArchitects

31 Blackfriars Road, Salford, Manchester, M3 7AQ
+44(0)161 832 3242 / info@omiarchitects.com / www.omiarchitects.com

PROJECT	MARCO LIVING, PALATINE ROAD				
DRAWING	PROPOSED SITE ELEVATION - WEST				
DATE	APR '26	DRAWN BY	HF	SCALE	1:200 @A1
JOB NO.	1459	DWG NO.	1459-OMI-ZZ-00-DR-A-L1603-P04		



SURFACE TREATMENTS

Paving Flags 1
300 x 150/200/300 x 50mm flags - Magma granite appearance. To be laid stretcher bond. Supplied by www.marshscape.co.uk or similar approved manufacturer

Resin Bound Gravel - Winter Pearl
6mm natural aggregate resin bound gravel in winter pearl colour. Supplied by www.sureset.co.uk or similar approved manufacturer

Self Binding Gravel - Cedec or similar

Loose pea gravel

Bitmac

TTI
Paving system with gravel infill. sales@geosyn.co.uk or similar approved

Area of 'Roof bridge' construction

Concrete Blocks
200 x 100 concrete permeable blocks laid in herringbone pattern

EDGES

Corten edging
corten steel edging. Supplied by Kinley sales@kinley.co.uk or similar approved

FEATURES

Backless Bench
Timber Backless Beam Seat Supplied by Woodscape www.woodscape.co.uk or similar approved manufacturer

Corten Steel Planter
Corten steel modular linear planter system 450 mm above ground level. Supplied by Bailey Street Furniture Group www.baileystreetscene.co.uk or similar approved

Timber Pergola Arches
Pressure and fire retardent treated hardwood timber

Boundary Treatments

Timber boundary fence
2100mm high tongue and groove timber fence with 300mm trellis inset

Existing low stone wall repaired and retained as necessary

1.8m high Paladin mesh security fencing

SOFTWORKS

Multistemmed Trees
Native tree species to be planted as 3m high Multi-stemmed specimens.

Proposed Medium/ Large Trees
Native and Trees to be planted as 14-16cm girth Extra Heavy Standards within the development. Trees to be planted and secured in place with double timber stakes, cross bar and tree ties.

Native Trees
Native Trees to be planted as feathered whips 175-250 cm height within the development. Trees to be planted and secured in place with double timber stakes, cross bar and tree ties.

Native scrub understorey
40-80cm Bare root shrubs planted at 1/m2

Fruit Trees
Trees to be planted and secured in place with double timber stakes, cross bar and tree ties.

Proposed Specimen Shrubs
Native and Ornamental shrubs to be planted as 10L pots

Ornamental Shrubs
Raised planters and shrub beds to be planted with a mixture of shrubs in 5L pots at 3 per sq.m, grasses and herbaceous perennials in 1L pots at 5 per sq.m and 25L specimens to be planted in the beds to provide instant height and structure. Beds to be mulched with a small grade bark mulch.

Proposed Wildflower Turf
Areas to be laid with wildflower turf EM1 General purpose meadow mixture. To be regularly maintained.

Native Hedgerow

Amenity grass

DEP LANDSCAPE ARCHITECTURE LTD

2 COMMERCIAL STREET
MANCHESTER, M15 4RQ
T: 0161 2419878
E: info@dep.co.uk
W: www.dep.co.uk

Client
Atzaro Real Estate

Project
Palatine Road

Description
Landscape Proposals

Status
For Planning

Scale
1:200@A1

Drawn
BH

Job number
6008

Drawing number
01

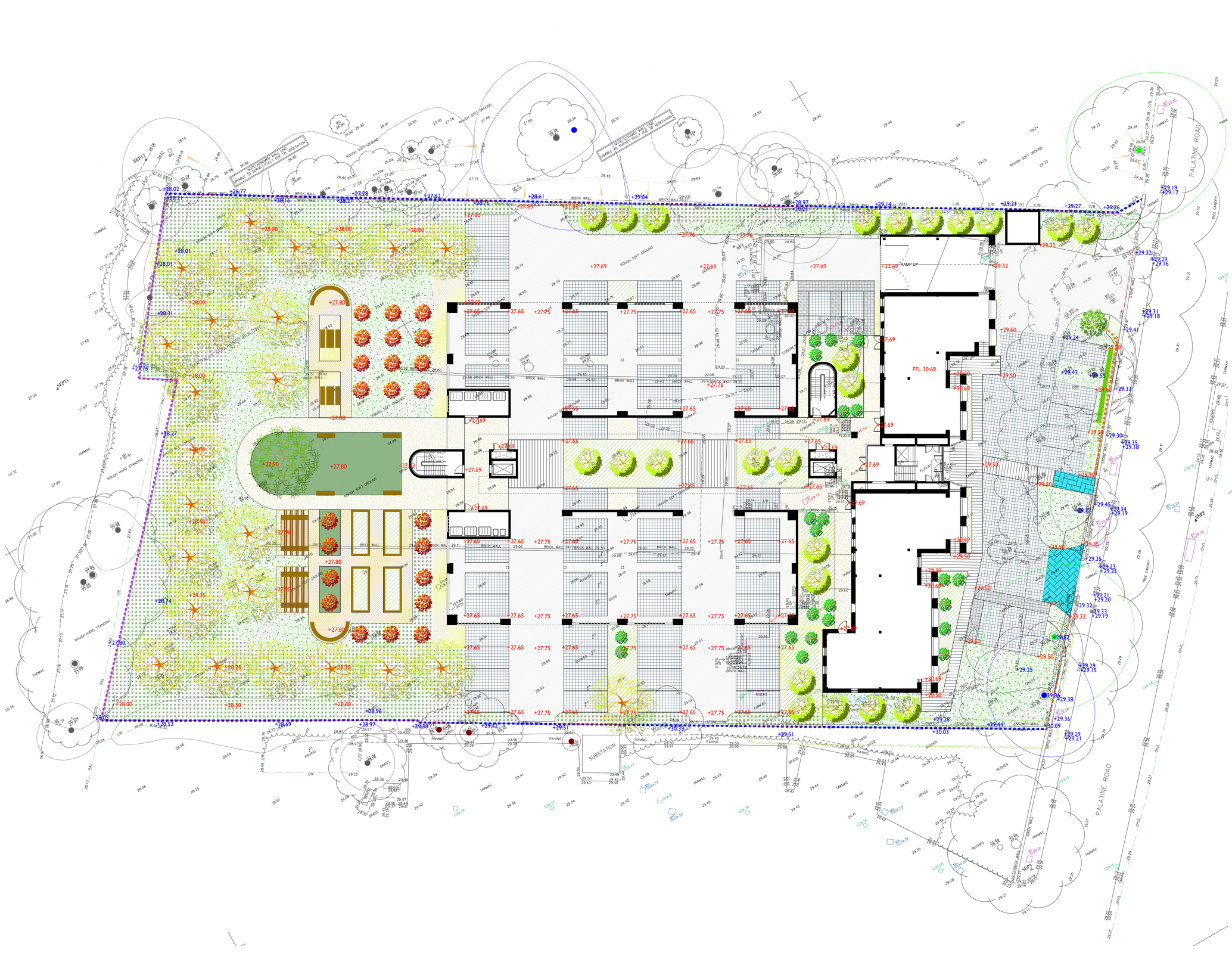
Date
14.10.26

Revision
D

Copyright DEP Landscape Architecture Ltd

All levels and dimensions to be checked on site by contractor prior to commencement; Any variations to be reported to the client. This drawing is to be read in conjunction with all others relating to the project and all information derived accordingly; any anomolies to be reported to the client. Do not scale from this drawing. Use figured dimensions only. Work shown on this drawings to be carried out in accordance with current British Standards and Codes of Practice.

© Copyright to DEP Landscape Architecture Limited. The information shown on this drawing shall not be reproduced or copied in any form without prior written consent from DEP Landscape Architecture Limited.



SURFACE TREATMENTS

Paving Flags 1
300 x 150/200/300 x 50mm flags - Magma granite appearance. To be laid stretcher bond. www.woodscape.co.uk or similar approved manufacturer

Resin Bound Gravel - Winter Pearl
6mm natural aggregate resin bound gravel in winter pearl colour. Supplied by www.woodscape.co.uk or similar approved manufacturer.

Self Binding Gravel - Cedec or similar

Loose pea gravel

Bitmac

TTE
Paving system with gravel infill. sales@aeorus.co.uk or similar approved

Area of 'Roof bridge' construction

Concrete Blocks
200 x 100 concrete permeable blocks laid in herringbone pattern

EDGES

Corten edging
corten steel edging. Supplied by Kinley sales@kinley.co.uk or simiar approved

FEATURES

Backless Bench
Hardwood Beam bed Supplied by Woodscape www.woodscape.co.uk or similar approved manufacturer.

Corten Steel Planter
Corten steel modular linear planter system 450 mm above ground level. Supplied by Bailey Street sales@baileystreetcarre.co.uk or similar approved

Timber Pergola Arches
Pressure and fire retardent treated hardwood timber.

Boundary Treatments

Timber boundary fence
2100mm High tongue and groove timber fence with 300mm trellis insert

Existing low stone wall repaired and retained as necessary

1.8m high Paladin mesh security fencing

SOFTWORKS

Multistemmed Trees
Native tree species to be planted as 3m high multi-demmed specimens.

Proposed Medium/ Large Trees
Native and Trees to be planted as 14-16cm girth Extra Heavy Standards within the development. Trees to be planted and secured in place with double timber stakes, cross bar and tree ties.

Native Trees
Native Trees to be planted as feathered whips 175-200 cm height within the development. Trees to be planted and secured in place with double timber stakes, cross bar and tree ties.

Native scrub understorey
40-80cm Bare root shrubs planted at 1/m2

Fruit Trees
Trees to be planted and secured in place with double timber stakes, cross bar and tree ties.

Proposed Specimen Shrubs
Native and Ornamental shrubs to be planted as 10L pots

Ornamental Shrubs
Raised planters and shrub beds to be planted with a mixture of shrubs in 5L pots at 3 per sq.m, grasses and herbaceous perennials in 1L pots at 3 per sq.m and 20L specimens to be planted at 1 per sq.m to provide year round visual interest. All beds to be mulched with a small grade bark mulch.

Proposed Wildflower Turf
Areas to be laid with wildflower turf EM1 General purpose meadow mixture. To be regularly maintained.

Native Hedgerow

Amenity grass

Levels

Existing Levels +29.19

Indicative proposed spot heights +29.19

DEP LANDSCAPE ARCHITECTURE LTD
2 COMMERCIAL STREET
MANCHESTER, M15 4RQ
T: 0161 2419878
E: info@dep.co.uk
W: www.dep.co.uk

Client
Atzaro Real Estate

Project
Palatine Road

Description
Landscape Levels for Clancy

Status
For Information

Scale	Drawn
1:200@A1	BH

Job number	Drawing number	Date	Revision
6008	04	19.08.26	

Copyright DEP Landscape Architecture Ltd

All levels and dimensions to be checked on site by contractor prior to commencement; Any variations to be reported to the client. This drawing is to be read in conjunction with all others relating to the project and all information derived accordingly; any anomolies to be reported to the client. Do not scale from this drawing. Use figured dimensions only. Work shown on this drawings to be carried out in accordance with current British Standards and Codes of Practice.

© Copyright to DEP Landscape Architecture Limited. The information shown on this drawing shall not be reproduced or copied in any form without prior written consent from DEP Landscape Architecture Limited.

NATURAL FREE DRAINING STONE FILTER TRENCH TO ALLOW FLOOD WATER TO DRAIN DOWN FROM LOW POINT ON SITE TO OFF SITE.

MINIMUM FFL OF ALL HABITABLE DWELLINGS TO BE 30.690m AOD. 600mm ABOVE THE 0.1% AEP LEVEL OF 30.090m AOD.

PROPOSED DRAINAGE TO AVOID EXISTING TREE ROOTS.

RE 3.0
CL: 27.700
IL: 27.100

FW 4.0
CL: 27.700
IL: 27.000
450Ø

SW 3.0
CL: 27.70
IL: 26.875
600Ø

FW 1.6 PACKAGE PUMPING STATION
CL: 27.700
IL: 26.105
1200Ø
RISING MAIN HEAD: 1.227m
RISING MAIN LENGTH: 23m
NO. OF UNITS: 70

24 HOUR STORAGE & DUAL PUMP REQUIRED

SW 1.5 HYDROBRAKE MANHOLE
CL: 29.300
IL: 26.742
1200Ø

RESTRICTING FLOWS TO 5.0l/s FOR ALL STORM EVENTS UP TO AND INCLUDING THE 1% AEP + 45% CLIMATE CHANGE ALLOWANCE EVENT

2250 @ 1:200
100Ø @ 1:47
100Ø @ 1:51
100Ø @ 1:80
2250 @ 1:175
RM 100Ø @ -122
FFL: 30.690
2250 @ 1:145
150Ø @ 1:100
600Ø @ 1:55
600Ø @ 1:697

FW 3.0
CL: 27.700
IL: 27.000
450Ø

FW 2.0
CL: 27.700
IL: 27.000
450Ø

FW 1.0
CL: 27.650
IL: 27.100
450Ø

FW 1.1
CL: 27.650
IL: 26.695
450Ø

FW 1.2
CL: 27.700
IL: 26.590
450Ø

FW 1.3
CL: 27.700
IL: 26.433
450Ø

FW 1.4
CL: 27.700
IL: 26.337
450Ø

FW 1.5
CL: 27.700
IL: 26.296
450Ø

SW 1.2
CL: 29.450
IL: 27.520
600Ø

SW 1.3

FW 1.8
CL: 29.280
IL: 26.630
CONNECTION INVERT: 27.130
1800Ø

FW 1.7
CL: 29.300
IL: 27.332
450Ø

SW 1.6
CL: 29.250
IL: 25.750
CONNECTION INVERT: 26.125

SW 1.4
CL: 29.400
IL: 26.771
600Ø

SW 1.3
CL: 29.450
IL: 27.483
600Ø

GEOCELLULAR ATTENUATION TANK
GL: 29.400
IL: 26.817
INLET INVERT: 27.467
PLAN AREA: 88m²
DEPTH: 800mm
FINAL POSITION TO AVOID TREE ROOT AREAS.

SW 2.2 VORTEX SEPARATOR
CL: 29.400
IL: 27.485
1200Ø

SW 2.1
CL: 29.450
IL: 27.522
600Ø

SW 2.0
CL: 29450
IL: 27.619
600Ø

SW 1.0
CL: 29.450
IL: 27.885
600Ø

SW 1.1
CL: 29.450
IL: 27.719
600Ø

RE 1.0
CL: 27.750
IL: 27.300

RE 2.0
CL: 27.750
IL: 27.300

NATURAL FREE DRAINING STONE FILTER TRENCH TO ALLOW FLOOD WATER TO DRAIN DOWN FROM LOW POINT ON SITE TO OFF SITE.

SCALE 1:200m
0m 2m 4m 6m 8m 10m 12m 14m 16m 18m 20m

PRELIMINARY DRAWING

THIS DRAWING IS FOR PRELIMINARY INFORMATION PURPOSES ONLY AND MUST NOT BE READ AS A CONSTRUCTION ISSUE. IT INDICATES DESIGN INTENT ONLY AND IS SUBJECT TO AMENDMENT DURING FINAL DESIGN DEVELOPMENT

DRAWING REFERENCE LIST

DRAWING NUMBER	REV	DATE	CREATOR
S25503-2dT 6008-01	B B	OCT 24 14.10.26	SURVEY & ENGINEERING PROJECTS DEP LANDSCAPE ARCHITECTURE

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER ENGINEER'S AND ARCHITECT'S DRAWINGS, DETAILS AND SPECIFICATIONS
2. REFER TO THE ARCHITECT & SERVICES ENGINEER FOR FINAL SETTING OUT OF ALL BUILDINGS & INTERNAL DOWN PIPES & RWPS
3. REFER TO SERVICE ENGINEER FOR ABOVE GROUND PLUMBING ROUTES FROM APPLIANCES TO STUB STACKS ETC
4. EXISTING DRAINAGE THAT IS TO BE ABANDONED TO BE 'PLUGGED' IN WITH MASS CONCRETE (150mm MIN) OR REMOVED ENTIRELY
5. ANY EXISTING SERVICES TO BE LOCATED AND CLEARLY MARKED PRIOR TO EXCAVATIONS BY CONTRACTOR
6. ALL LEVELS ARE TO BE CONFIRMED BY THE CONTRACTOR ON SITE PRIOR TO CONSTRUCTION
7. IT IS ASSUMED THAT ALL RWPS, SINK AND TOILET DRAINAGE POINTS WILL HAVE RODDING ACCESS AT THE APPLIANCE BASE
8. CONTRACTOR TO AVOID UNDERMINING ANY EXISTING FOOTPATHS/BUILDINGS DURING WORKS BY ALLOWING ADEQUATE PROTECTION ADJACENT TO THESE AREAS
9. ALL BELOW GROUND DRAINAGE PIPES WITH LESS THAN 900mm COVER TO SOFFIT LEVEL IN TRAFFICKED AREAS I.E. CAR PARK AND SERVICE YARD, TO HAVE CLASS Z BEDDING SURROUND. REFER TO THE MANHOLE SCHEDULE AND DETAIL SHEETS FOR FURTHER DETAILS
10. ALL BELOW GROUND DRAINAGE WITHIN THE SITE BOUNDARY HAS BEEN DESIGNED TO BSEN 752:2008 AND BUILDING REGULATIONS - PART H 2015. THE OFF SITE DRAINAGE TO THE PUBLIC SEWER ARE DESIGNED TO THE SEWERAGE SECTOR GUIDANCE

HEALTH SAFETY AND ENVIRONMENTAL RISKS BOX

CONSTRUCTION RISKS	MAINTENANCE RISKS	DEMOLITION/ ADAPTATION RISKS
1. DUE TO THE STEEP GRADIENT OF THE SITE, CONSIDERATION TO SAFETY MUST BE GIVEN TO EACH CONSTRUCTION TASK. 2. REFER TO EXISTING SERVICES DRAWING AND TO ARCHITECTS SERVICES DRAWINGS FOR DETAILS & LOCATION OF EXTG AND PROPOSED DRAINAGE & SERVICES. 3. DRAINAGE CONNECTION REQUIRES DEEP EXCAVATION, TEMP WORKS REQUIRED 4. EXISTING DRAINS NOT SHOWN ON PLAN TO EITHER BE REMOVED OR GRUBBED UP. 5. CONSTRUCTING NEW CONNECTIONS DRAINAGE POTENTIAL FOR HAZARDOUS GASES. PERMIT TO ENTER EXISTING MANHOLES SHOULD BE OBTAINED FROM ANGLIAN WATER BEFORE UNDERTAKING THE WORK. RELEVANT P.P.E SHOULD BE WORN AT ALL TIMES. IF ANY ASBESTOS CEMENT PIPES ARE FOUND, THEN SAFE SYSTEM OF WORK NEED TO BE PUT IN PLACE WITH ATTENTION DRAWN TO THE CONTROL ASBESTOS AT WORK (AMENDMENT) REGULATIONS 1992.	1. PERMEABLE PAVING, CHANNEL DRAINS, GEOCELLULAR CRATES AND CHAMBERS REQUIRE THE STANDARD PERIODIC INSPECTION REGIME AND CLEANING ROUTINE TO ENSURE CONTINUED PERFORMANCE. 2. CONFINED SPACE ENTRY. 3. ALL MAINTENANCE MUST COMPLY WITH THE LEAD LOCAL FLOOD AUTHORITYS REGULATIONS.	1. APPARATUS LOCATED IN LANDSCAPED AREAS HAS NOT BEEN DESIGNED TO SUPPORT HEAVY VEHICLE LOADING. 2. THE SURFACE WATER DRAINAGE APPARATUS HAS BEEN DESIGNED TO ACCOMMODATE THE DESIGNED CATCHMENT AREA. NO ADDITIONAL AREAS OF HARDSTANDING CAN BE CONNECTION INTO THE SYSTEM WITHOUT RISK OF LOCALIZED FLOODING ON SITE. 3. THE SURFACE WATER DRAINAGE HAS BEEN DESIGNED TO BE CONTROLLED TO A RATE OF 5.0ls BEFORE DISCHARGE INTO THE PUBLIC NETWORK. PENDING APPROVAL FROM UNITED UTILITIES BEFORE ANY CONNECTION IS MADE. 4. HAZARDOUS WASTE MATERIALS

IN ADDITION TO THE HAZARDS & RISKS NORMALLY ASSOCIATED WITH THE TYPE OF WORK DETAILED ON THIS DRAWING, TAKE NOTE OF THE ABOVE. IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR, WORKING WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT.

LEGEND:

SW	NEW SURFACE WATER SEWER PIPE AND MANHOLE PIPE. 100Ø U.N.O
FW	NEW FOUL WATER SEWER PIPE AND MANHOLE PIPE. 100Ø U.N.O
	PROPOSED FOUL WATER RISING MAIN
	PROPOSED PERFORATED PIPE
	PERMEABLE PAVED SURFACE WITH SUBBASE SURFACE WATER ATTENUATION STORAGE.
	PROPOSED RAIN GARDEN
R	PROPOSED RAINWATER DOWNPIPES
CG	CHANNEL DRAIN
	PROPOSED RODDING EYE
FS	PROPOSED FOUL STACK
FG	PROPOSED FOUL FLOOR GULLY

Rev	Date	Description	By	Check	App.
P02	08.09.2026	UPDATED TO SUIT LA LAYOUT	CD	CB	CB
P01	22/05/2026	ISSUE FOR PLANNING	CN	KE	KE

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE DRAWINGS, DETAILS AND SPECIFICATION FROM THE ARCHITECT, OTHER RELEVANT ENGINEERS AND ANY SPECIALIST SUPPLIER INFORMATION. THE COPYRIGHT OF THIS DRAWING IS VESTED IN CLANCY CONSULTING. IT SHALL NOT BE USED WITHOUT PERMISSION BY ANYONE FOR ANY PURPOSE. DO NOT SCALE THIS DRAWING ELECTRONICALLY OR MANUALLY. WORK TO FIGURED DIMENSIONS ONLY. ALL DIMENSIONS in mm UNLESS NOTED OTHERWISE. ALL LEVELS IN m A.O.D (UNO). IF IN DOUBT ABOUT THE INFORMATION SHOWN ON THIS DRAWING OR ANY RELATED DRAWING - ASK

Client: MARCO LIVING 3 LTD

Project: 232-236 PALATINE ROAD
DIDSBURY

Office: NORWICH - 01603 305 190

Title: DRAINAGE STRATEGY
GENERAL ARRANGEMENT

Scale @ A1: 1:200

Status: PRELIMINARY

clancy consulting
www.clancy.co.uk

Project Ref	Originator	Volume	Level
21724	CCL	XX	XX
File Type	**Discipline**	**Drawing No.**	**Revision**
DR	C	02510	P02

Date of Print - Sep 09 2026, File Name = S:\S25\CCL\XX\XX\DR-C\02510 P02_DRAINAGE STRATEGY.dwg

13.6. Appendix F Drainage Related Drawings

Proposed Catchment Plans

Proposed Drainage Details

© Clancy Consulting 2026



PRELIMINARY DRAWING

THIS DRAWING IS FOR PRELIMINARY INFORMATION PURPOSES ONLY AND MUST NOT BE READ AS A CONSTRUCTION ISSUE. IT INDICATES DESIGN INTENT ONLY AND IS SUBJECT TO AMENDMENT DURING FINAL DESIGN DEVELOPMENT

DRAWING REFERENCE LIST

DRAWING NUMBER	REV	DATE	CREATOR
S25503-2dT	B	OCT 24	SURVEY & ENGINEERING PROJECTS

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE CCL REPORT 21724-CCL-XX-XX-RP-C-02500

Rev	Date	Description	By	Check	App.
P01	22/05/2026	ISSUE FOR PLANNING	CN	KE	KE

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE DRAWINGS, DETAILS AND SPECIFICATION FROM THE ARCHITECT, OTHER RELEVANT ENGINEERS AND ANY SPECIALIST SUPPLIER INFORMATION. THE COPYRIGHT OF THIS DRAWING IS VESTED IN CLANCY CONSULTING. IT SHALL NOT BE USED WITHOUT PERMISSION BY ANYONE FOR ANY PURPOSE. DO NOT SCALE THIS DRAWING ELECTRONICALLY OR MANUALLY. WORK TO FIGURED DIMENSIONS ONLY. ALL DIMENSIONS IN mm UNL ALL LEVELS IN m A.O.D.(NN). IF IN DOUBT ABOUT THE INFORMATION SHOWN ON THIS DRAWING OR ANY RELATED DRAWING - ASK

Client: MARCO LIVING 3 LTD

Project: 232-236 PALATINE ROAD DIDSBURY

Office: NORWICH - 01603 305 190

Title: CATCHEMENT PLAN EXISTING AREAS

Scale @ A1: 1:200

Status: PRELIMINARY

clancy consulting
www.clancy.co.uk

Project Ref	Originator	Volume	Level
21724	CCL	XX	XX
File Type	Discipline	Drawing No.	Revision
DR	C	02520	P01

Date of Print = May-22-2026, File Name = 21724-CCL-XX-DR-C-02520 [P01_CATCHMENT PLAN.dwg



PRELIMINARY DRAWING

THIS DRAWING IS FOR PRELIMINARY INFORMATION PURPOSES ONLY AND MUST NOT BE READ AS A CONSTRUCTION ISSUE. IT INDICATES DESIGN INTENT ONLY AND IS SUBJECT TO AMENDMENT DURING FINAL DESIGN DEVELOPMENT

DRAWING REFERENCE LIST

DRAWING NUMBER	REV	DATE	CREATOR
6008-01	B	14.10.26	DEP LANDSCAPE ARCHITECTURE

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE CCL REPORT 21724-CCL-XX-XX-RP-C-02500

Rev	Date	Description	By	Check	App.
P01	22/05/2026	ISSUE FOR PLANNING	CN	KE	KE

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE DRAWINGS, DETAILS AND SPECIFICATION FROM THE ARCHITECT, OTHER RELEVANT CONSULTANTS AND ANY SPECIALIST SUPPLIER INFORMATION. THE COPYRIGHT OF THIS DRAWING IS VESTED IN CLANCY CONSULTING. IT SHALL NOT BE USED WITHOUT PERMISSION BY ANYONE FOR ANY PURPOSE. DO NOT SCALE THIS DRAWING ELECTRONICALLY OR MANUALLY. WORK TO FIGURED DIMENSIONS ONLY. ALL DIMENSIONS IN mm UNI. ALL LEVELS IN m A.O.D UNO. IF IN DOUBT ABOUT THE INFORMATION SHOWN ON THIS DRAWING OR ANY RELATED DRAWING - ASK

Client: MARCO LIVING 3 LTD

Project: 232-236 PALATINE ROAD DIDSBURY

Office: NORWICH - 01603 305 190

Title: CATCHEMENT PLAN PROPOSED AREAS

Scale @ A1: 1:200

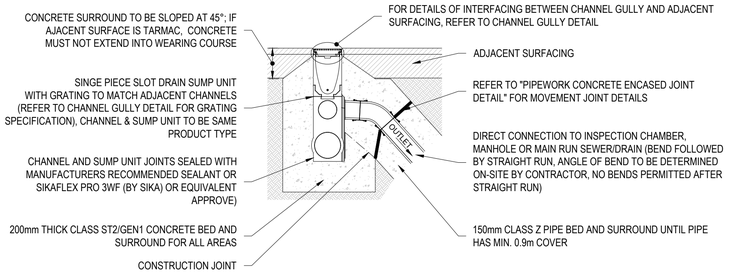
Status: PRELIMINARY

SCALE 1:200m
0m 2m 4m 6m 8m 10m 12m 14m 16m 18m 20m

clancy consulting
www.clancy.co.uk

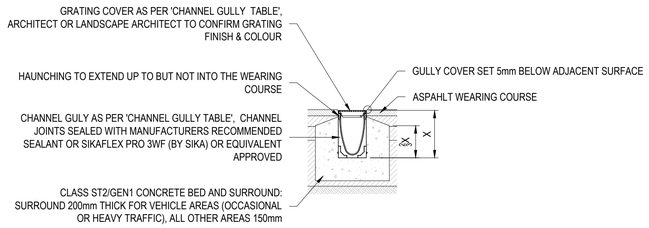
Project Ref	Originator	Volume	Level
21724	CCL	XX	XX
File Type	Discipline	Drawing No.	Revision
DR	C	02521	P01

Date of Print = May 22 2026, File Name = 6-3335-CCL-XX-XX-DR-C-02521-P01_CATCHMENT PLAN.dwg



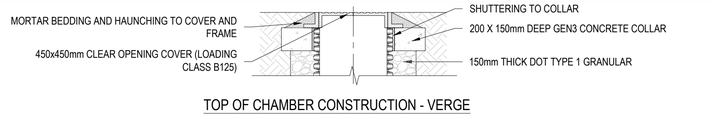
CHANNEL GULLY SUMP UNIT

SCALE 1:20

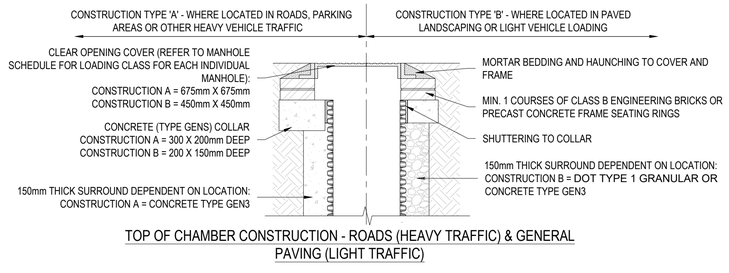


CHANNEL GULLY IN ASPHALT PAVEMENT

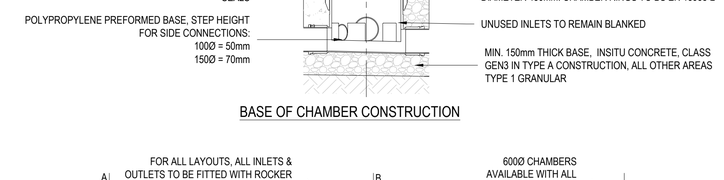
SCALE 1:20



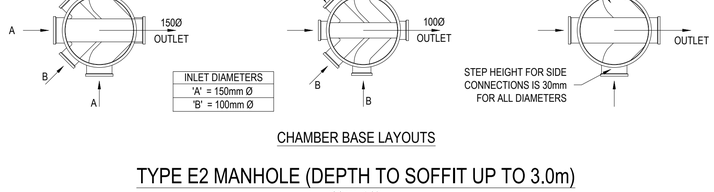
TOP OF CHAMBER CONSTRUCTION - VERGE



TOP OF CHAMBER CONSTRUCTION - ROADS (HEAVY TRAFFIC) & GENERAL PAVING (LIGHT TRAFFIC)



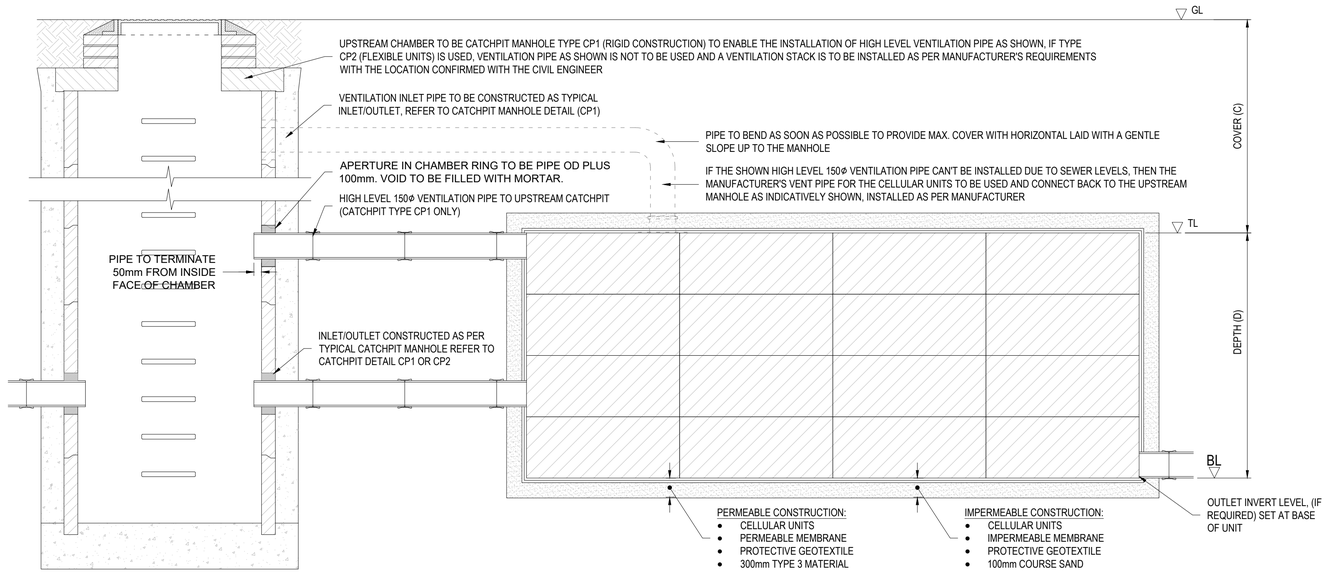
BASE OF CHAMBER CONSTRUCTION



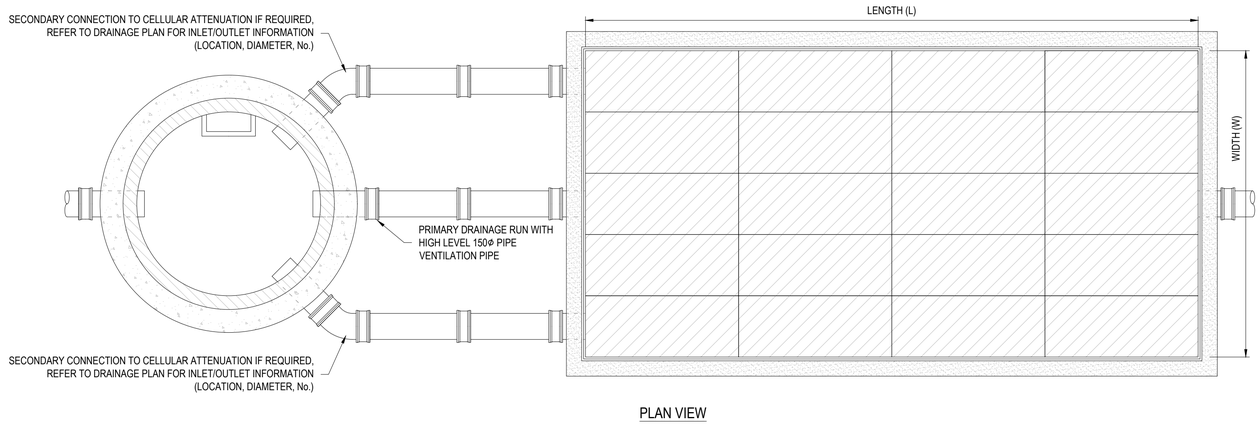
CHAMBER BASE LAYOUTS

TYPE E2 MANHOLE (DEPTH TO SOFFIT UP TO 3.0m)

SCALE 1:20



SECTIONAL VIEW



PLAN VIEW

CELLULAR UNITS COVER DEPTHS & LOADINGS

UNIT TYPE	SIZE	COVER	MIN. & MAX.* COVER LOCATION / LOADING TYPE L1	V1	V2	V3	V4
AUQUACELL ECO	ALL SINGLE UNITS 1.0x0.6x0.4m (LxWxDEPTH)	MIN.	0.50				
		MAX A.W.T.	1.53	N/A	N/A	N/A	N/A
		MAX. B.W.T.	N/A				
AUQUACELL CORE		MIN.	0.50	0.50	0.75		
		MAX A.W.T.	2.53	2.53	2.53	N/A	N/A
		MAX. B.W.T.	1.99	1.99	1.99		
AUQUACELL PRIME		MIN.	0.30	0.71	0.71	0.71	
		MAX A.W.T.	1.98	1.73	1.73	1.73	N/A
		MAX. B.W.T.	1.78	1.60	1.60	1.60	
AUQUACELL PLUS		MIN.	0.50	0.50	0.75	0.75	1.30
		MAX A.W.T.	3.21	3.21	3.21	3.21	2.96
		MAX. B.W.T.	1.99	1.99	1.99	1.99	2.24

TABLE DEFINITIONS:
*MAX COVER BASED ON SOIL TYPE BEING CLAY, MAX. DEPTH MAY BE INCREASED DEPENDANT ON SOIL TYPES USED AS BACKFILL. SEE MANUFACTURER RECOMMENDATIONS

L1 = LANDSCAPING WITH NO VEHICLE LOADING IN EXCESS OF DRIVE-ON MOWERS
V1 = CAR PARK WITH VEHICLE MASS <3,000kg GVW
V2 = CAR PARK WITH OCCASIONAL VEHICLE MASS <9,000kg GVW
V3 = CAR PARK WITH OCCASIONAL VEHICLE MASS <12,000kg; LIGHT ACCESS ROADS
V4 = CAR PARK WITH OCCASIONAL VEHICLE MASS <60,000kg GVW; ROADS <15mph
MAX. A.W.T. = BASE OF UNITS ABOVE WATER TABLE
MAX. B.W.T. = BASE OF UNITS BELOW WATER TABLE

CELLULAR ATTENUATION

SCALE 1:20

PRELIMINARY DRAWING

THIS DRAWING IS FOR PRELIMINARY INFORMATION PURPOSES ONLY AND MUST NOT BE READ AS A CONSTRUCTION ISSUE. IT INDICATES DESIGN INTENT ONLY AND IS SUBJECT TO AMENDMENT DURING FINAL DESIGN DEVELOPMENT

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER ENGINEER'S AND ARCHITECT'S DRAWINGS, DETAILS & SPECIFICATIONS.
2. LOCATION OF MANHOLE LOCATIONS PROVIDED ON DRAINAGE PLANS, REF 12724-CCL-XX-XX-DR-C-02510.
3. ALL DRAINAGE TO COMPLETED AS PER THE LATEST EDITION OF SEWERS FOR ADOPTION AND BUILDING REGULATIONS DOCUMENT H
4. SUPPLIER DETAILS TO SUPERCEDE DETAILS SHOWN HERE IF APPLICABLE.

Rev	Date	Description	By	Check	App.
P01	22/05/2026	ISSUE FOR PLANNING	CN	KE	KE

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE DRAWINGS, DETAILS AND SPECIFICATION FROM THE ARCHITECT, OTHER RELEVANT ENGINEERS AND ANY SPECIALIST SUPPLIER INFORMATION. THE COPYRIGHT OF THIS DRAWING IS VESTED IN CLANCY CONSULTING. IT SHALL NOT BE USED WITHOUT PERMISSION BY ANYONE FOR ANY PURPOSE. DO NOT SCALE THIS DRAWING ELECTRONICALLY OR MANUALLY. WORK TO FIGURED DIMENSIONS ONLY. ALL DIMENSIONS IN mm UNL ALL LEVELS IN m A.O.D.)NO. IF IN DOUBT ABOUT THE INFORMATION SHOWN ON THIS DRAWING OR ANY RELATED DRAWING ASK

Client: MARCO LIVING 3 LTD

Project: 232-236 PALATINE ROAD DIDSBURY

Office: NORWICH - 01603 305 190

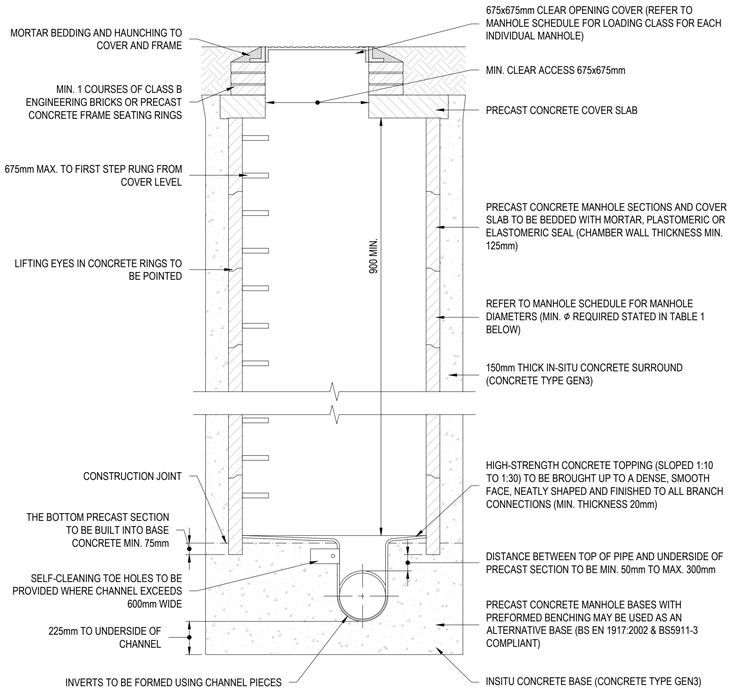
Title: DRAINAGE DETAILS SHEET 2

Scale @ A1: 1:20 | Status: PRELIMINARY

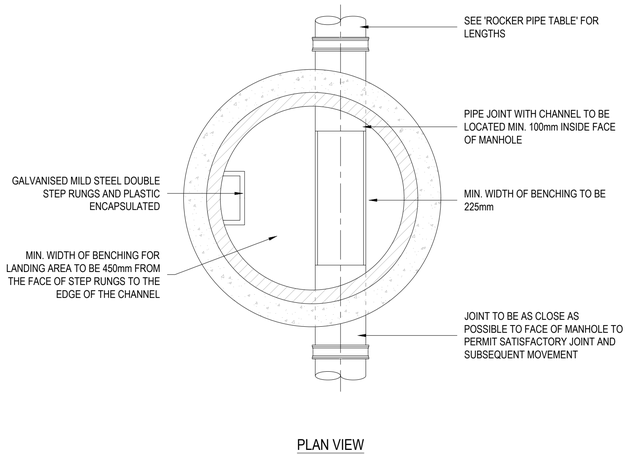
clancy consulting
www.clancy.co.uk

Project Ref	Originator	Volume	Level
21724	CCL	XX	XX
File Type	Discipline	Drawing No.	Revision
DR	C	02512	P01

Date of Print = May-22-2026, File Name = 8335-CCL-XX-XX-DRC-02512_P01_[DRN]DETAILS.dwg



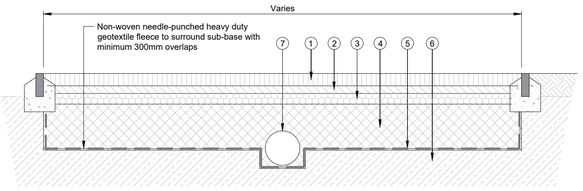
SECTIONAL VIEW



PLAN VIEW

TYPE B MANHOLE (DEPTH TO SOFFIT 1.5 - 3.0m)

SCALE 1:20

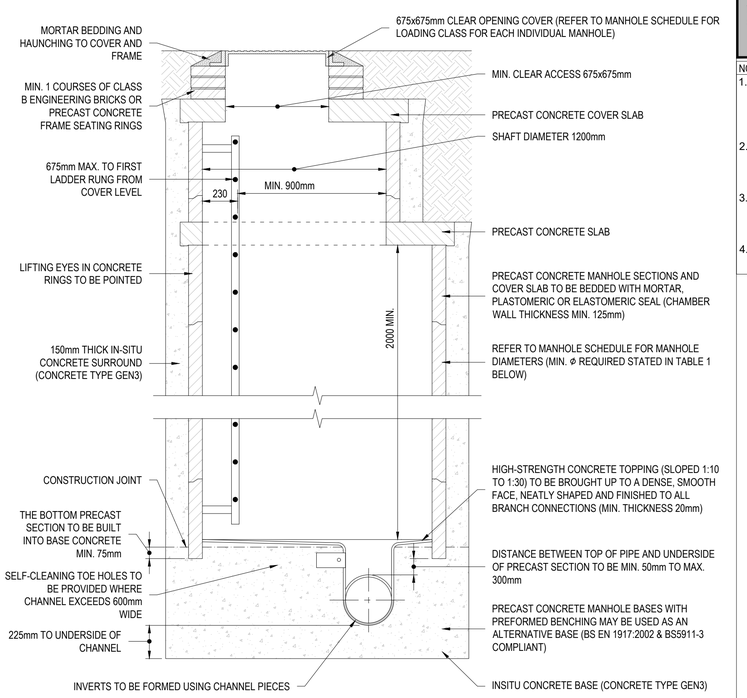


	LAYER	SPECIFICATION	THICKNESS
PERMEABLE PAVING	1 SURFACE COURSE	Permeable block pavers and laying pattern to landscape architects specification	80 mm
	2 LAYING COURSE	2-6.3mm Laying grit	50 mm
	3 BASE COURSE	AC32 dense base 40/60 in accordance with BS EN 13108-1 to be cored or perforated with 75mm diameter holes on a 750mm orthogonal grid to form a cored asphalt concrete	70mm
	4 SUB-BASE	DoT Type 3 open-graded granular sub-base, spread evenly on the formation in layers not exceeding 150mm compacted thickness.	300mm
	5 GEOTEXTILE	Impermeable Fabric non-woven geotextile overlapping 300mm and taped at joints.	-
	6 GENERAL FILL	Class 1B or 1C general fill material to Table 6/1[2] and Clause 613[2] compacted in layers in accordance with Table 6/4[2] to achieve a minimum CBR value of 5% or crushed concrete certified to Clause 803 as Type 1.	As required to raise levels
	7 PERFORATED PIPE	Perforated pipe laid within 300mm wide trench at the base of permeable type 3 sub-base with depth of trench adjusted to suit pipe gradient/levels	225Ø

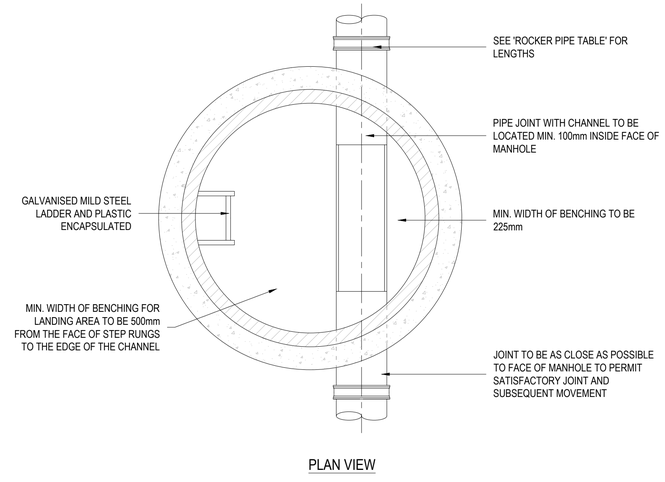
CONSTRUCTION SPECIFICATION FOR CONCRETE PERMEABLE BLOCK PAVING WITH SUB-BASE STORAGE

NOTES

1. *BS EN 12620 grading/tolerance category Gc80/20, GTc20/15*
2. *Highways England Specification for Highway Works.*
3. *The design is based on an assumed CBR value of >5.0%. Should on site testing demonstrate a CBR value of <5.0% then the Engineer should be informed and the design adjusted appropriately.*
4. *All soft spots and voids in formation to be excavated and filled with class 1B or 1C general fill, compacted as per 'General Fill' above.*



SECTIONAL VIEW



PLAN VIEW

TYPE A1 MANHOLE (DEPTH TO SOFFIT 3.0 - 6.0m)

SCALE 1:20

PRELIMINARY DRAWING

THIS DRAWING IS FOR PRELIMINARY INFORMATION PURPOSES ONLY AND MUST NOT BE READ AS A CONSTRUCTION ISSUE. IT INDICATES DESIGN INTENT ONLY AND IS SUBJECT TO AMENDMENT DURING FINAL DESIGN DEVELOPMENT

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER ENGINEER'S AND ARCHITECT'S DRAWINGS, DETAILS & SPECIFICATIONS.
2. LOCATION OF MANHOLE LOCATIONS PROVIDED ON DRAINAGE PLANS, REF 12724-CCL-XX-XX-DR-C-02510.
3. ALL DRAINAGE TO COMPLETED AS PER THE LATEST EDITION OF SEWERS FOR ADOPTION AND BUILDING REGULATIONS DOCUMENT H
4. SUPPLIER DETAILS TO SUPERCEDE DETAILS SHOWN HERE IF APPLICABLE.

Rev	Date	Description	By	Check	App.
P01	22/05/2026	ISSUE FOR PLANNING	CN	KE	KE

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE DRAWINGS, DETAILS AND SPECIFICATION FROM THE ARCHITECT, OTHER RELEVANT ENGINEERS AND ANY SPECIALIST SUPPLIER INFORMATION. THE COPYRIGHT OF THIS DRAWING IS VESTED IN CLANCY CONSULTING. IT SHALL NOT BE USED WITHOUT PERMISSION BY ANYONE FOR ANY PURPOSE. DO NOT SCALE THIS DRAWING ELECTRONICALLY OR MANUALLY. WORK TO FIGURED DIMENSIONS ONLY. ALL DIMENSIONS IN mm UNO. ALL LEVELS IN m A.O.D.UNO. IF IN DOUBT ABOUT THE INFORMATION SHOWN ON THIS DRAWING OR ANY RELATED DRAWING - ASK

Client: MARCO LIVING 3 LTD

Project: 232-236 PALATINE ROAD DIDSBURY

Office: NORWICH - 01603 305 190

Title: DRAINAGE DETAILS SHEET 3

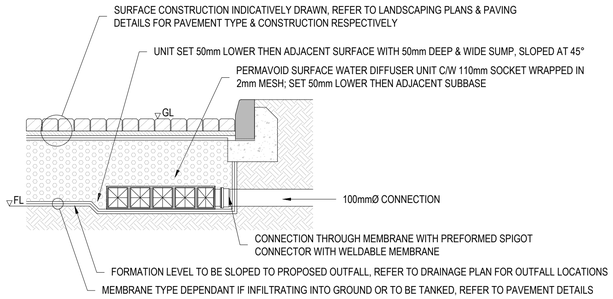
Scale @ A1: 1:20

Status: PRELIMINARY

clancy consulting
www.clancy.co.uk

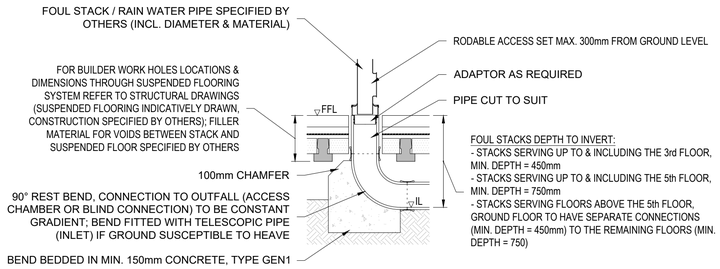
Project Ref	Originator	Volume	Level
21724	CCL	XX	XX
File Type	Discipline	Drawing No.	Revision
DR	C	02513	P01

Date / Print = May 22 2026, File Name = 8335-CCL-XX-XX-DRC-DET-C_P01_DRN DETAILS.dwg



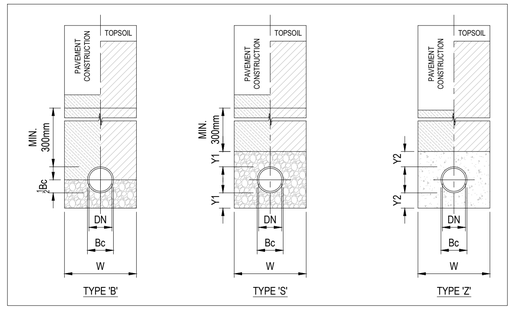
VOIDED SUBBASE DIFFUSER UNIT

SCALE 1:20



INTERNAL STACK PASSING THROUGH SUSPENDED FLOORING

SCALE 1:20



RIGID PIPES

FLEXIBLE PIPES

HATCHING LEGEND:

- SELECTED AS-DUG MATERIAL (MAX. AGGREGATE SIZE 40mm)
- TYPE 1 GRANULAR MATERIAL TO SHW CLAUSE 803
- GRANULAR MATERIAL, REFER TO GRANULAR FILL TABLE FOR DETAILS
- GEN1 CONCRETE (18mm COMPRESSIBLE BOARDS TO BE INSERTED AT ALL PIPE JOINTS).

DIMENSIONS LEGEND:

DN = PIPE INSIDE DIAMETER
Bc = PIPE OUTSIDE DIAMETER (BARREL)
W = TRENCH WIDTH (SEE TABLE 1)
Y1 = 1/6Bc OR MIN. 100mm ALONG BARRELS & 50mm AT SOCKETS
Y2 = 1/4DN OR MIN. 100mm ALONG BARRELS & 50mm AT SOCKETS
Y3 = 100mm ALONG BARRELS & SOCKETS

TRENCH WIDTH & GRANULAR FILL TABLE:

PIPE SIZE (DN)	TRENCH WIDTH (W)		GRANULAR FILL SINGLE STONE SIZE
	PIPE TYPE: A, B	PIPE TYPE: C	
100	500	500	10mm NOMINAL SIZE
150	550	550	10, 14mm NOMINAL SIZE
225 - 300	800	900	10, 14, 20mm NOMINAL SIZE
375 - 450	1150	1250	
525 - 675	1400	1500	
750 - 900	1750	1900	
1050 - 1200	2050	2200	
1350 - 1500	2500	2700	
1600 - 1800	2800	3000	

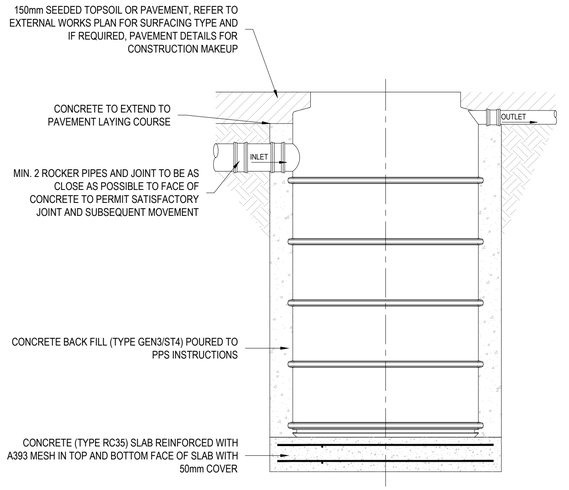
PIPE TYPE A - PLASTIC PIPEWORK
PIPE TYPE B - CLAYWARE PIPEWORK
PIPE TYPE C - CONCRETE PIPEWORK
ALL DIMENSIONS ARE IN mm
BASED FROM BS EN 1610

BEDDING LOCATION & DEPTH TABLE

	PIPE BEDDING TYPE & LOCATION	COVER DEPTH (mm)
B	- LOCATED UNDER BUILDINGS (REFER TO PIPEWORK UNDER BUILDING DETAILS FOR MIN. DEPTH)	-
	- ADOPTABLE DRAINAGE IN ANY LOCATION	NOT PERMITTED
	- NONADOPTABLE DRAINAGE LOCATED WITHIN VERGE AREAS NOT SUBJECTED TO VEHICLE LOADS (AS NOTED ON DRAINAGE PLANS OR UPON THE APPROVAL OF SPECIFIC REQUESTED LOCATIONS)	-
S	- LOCATED UNDER BUILDINGS (REFER TO PIPEWORK UNDER BUILDING DETAILS FOR MIN. DEPTH)	--
	- LOCATED WITHIN PAVED AREAS SUBJECTED TO VEHICLE LOADS (ADOPTABLE / PRIVATE)	>600 / >600
	- LOCATED WITHIN PAVED AREAS NOT SUBJECTED TO VEHICLE LOADS (ADOPTABLE / PRIVATE)	>900 / >750
Z	- LOCATED UNDER BUILDINGS (REFER TO PIPEWORK UNDER BUILDING DETAILS FOR MIN. DEPTH)	--
	- LOCATED WITHIN PAVED AREAS SUBJECTED TO VEHICLE LOADS (ADOPTABLE / PRIVATE)	<1200 / <900
	- LOCATED WITHIN PAVED AREAS NOT SUBJECTED TO VEHICLE LOADS (ADOPTABLE / PRIVATE)	<900 / <750

PIPE BEDDING

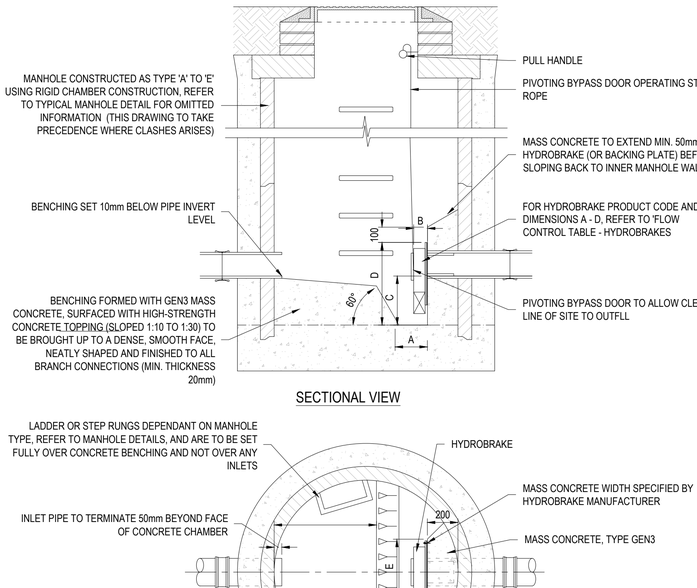
SCALE 1:20



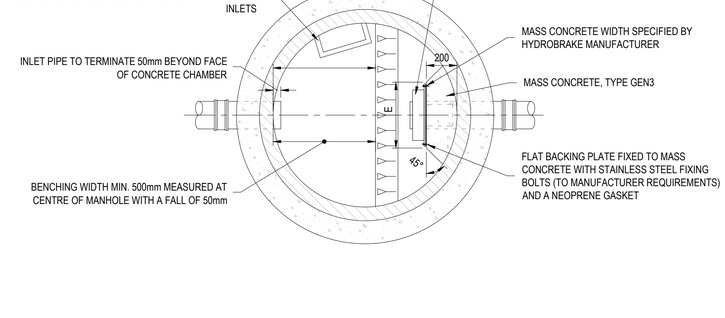
UNIT DIMENSIONS TO BE CONFIRMED DURING DETAILED DESIGN

PRE-FABRICATED UNIT - PACKAGE PUMPING STATION

SCALE 1:20

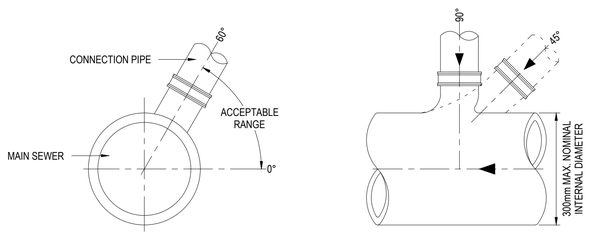


SECTIONAL VIEW



FLOW CONTROL CHAMBER - HYDROBRAKE (FLAT BACKING PLATE)

SCALE 1:20

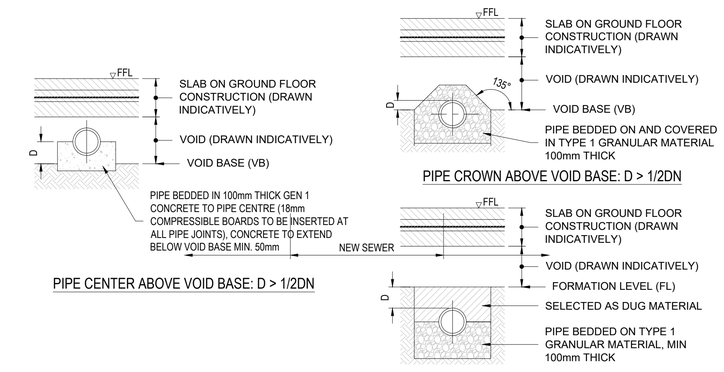


CROSS-SECTIONAL VIEW OF SEWER

SIDE VIEW OF SEWER

SADDLE CONNECTION

SCALE 1:20



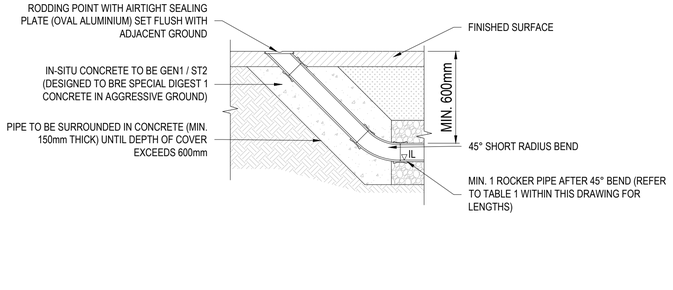
PIPE CENTER ABOVE VOID BASE: D > 1/2DN

PIPE CROWN ABOVE VOID BASE: D > 1/2DN

PIPE CROWN BELOW VOID BASE: D > 100mm

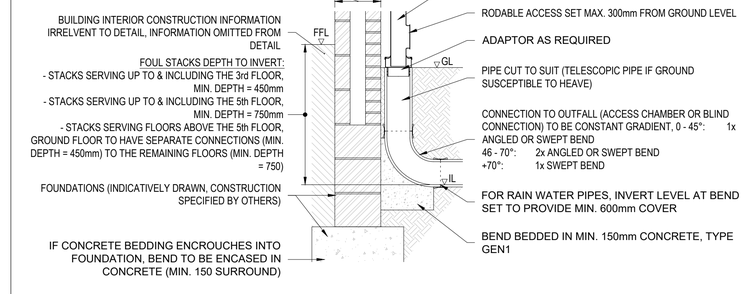
PIPEWORK BELOW SUSPENDED FLOORING

SCALE 1:20



RODDING EYE

SCALE 1:20



EXTERNAL STACK DIRECT TO A SEWER

SCALE 1:20

PRELIMINARY DRAWING

THIS DRAWING IS FOR PRELIMINARY INFORMATION PURPOSES ONLY AND MUST NOT BE READ AS A CONSTRUCTION ISSUE. IT INDICATES DESIGN INTENT ONLY AND IS SUBJECT TO AMENDMENT DURING FINAL DESIGN DEVELOPMENT

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER ENGINEER'S AND ARCHITECT'S DRAWINGS, DETAILS & SPECIFICATIONS.
2. LOCATION OF MANHOLE LOCATIONS PROVIDED ON DRAINAGE PLANS, REF 12724-CCL-XX-XX-DR-C-02510.
3. ALL DRAINAGE TO COMPLETED AS PER THE LATEST EDITION OF SEWERS FOR ADOPTION AND BUILDING REGULATIONS DOCUMENT H
4. SUPPLIER DETAILS TO SUPERCEDE DETAILS SHOWN HERE IF APPLICABLE.

Rev	Date	Description	By	Check	App.
P01	22/05/2026	ISSUE FOR PLANNING	CN	KE	KE

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE DRAWINGS, DETAILS AND SPECIFICATION FROM THE ARCHITECT, OTHER RELEVANT ENGINEERS AND ANY SPECIALIST SUPPLIER INFORMATION. THE COPYRIGHT OF THIS DRAWING IS VESTED IN CLANCY CONSULTING. IT SHALL NOT BE USED WITHOUT PERMISSION BY ANYONE FOR ANY PURPOSE. DO NOT SCALE THIS DRAWING ELECTRONICALLY OR MANUALLY. WORK TO FIGURED DIMENSIONS ONLY. ALL DIMENSIONS IN mm UNL ALL LEVELS IN m A.O.D.(N0. IF IN DOUBT ABOUT THE INFORMATION SHOWN ON THIS DRAWING OR ANY RELATED DRAWING ASK

Client: MARCO LIVING 3 LTD

Project: 232-236 PALATINE ROAD DIDSBURY

Office: NORWICH - 01603 305 190

Title: DRAINAGE DETAILS SHEET 1

Scale @ A1: 1:20 | Status: PRELIMINARY

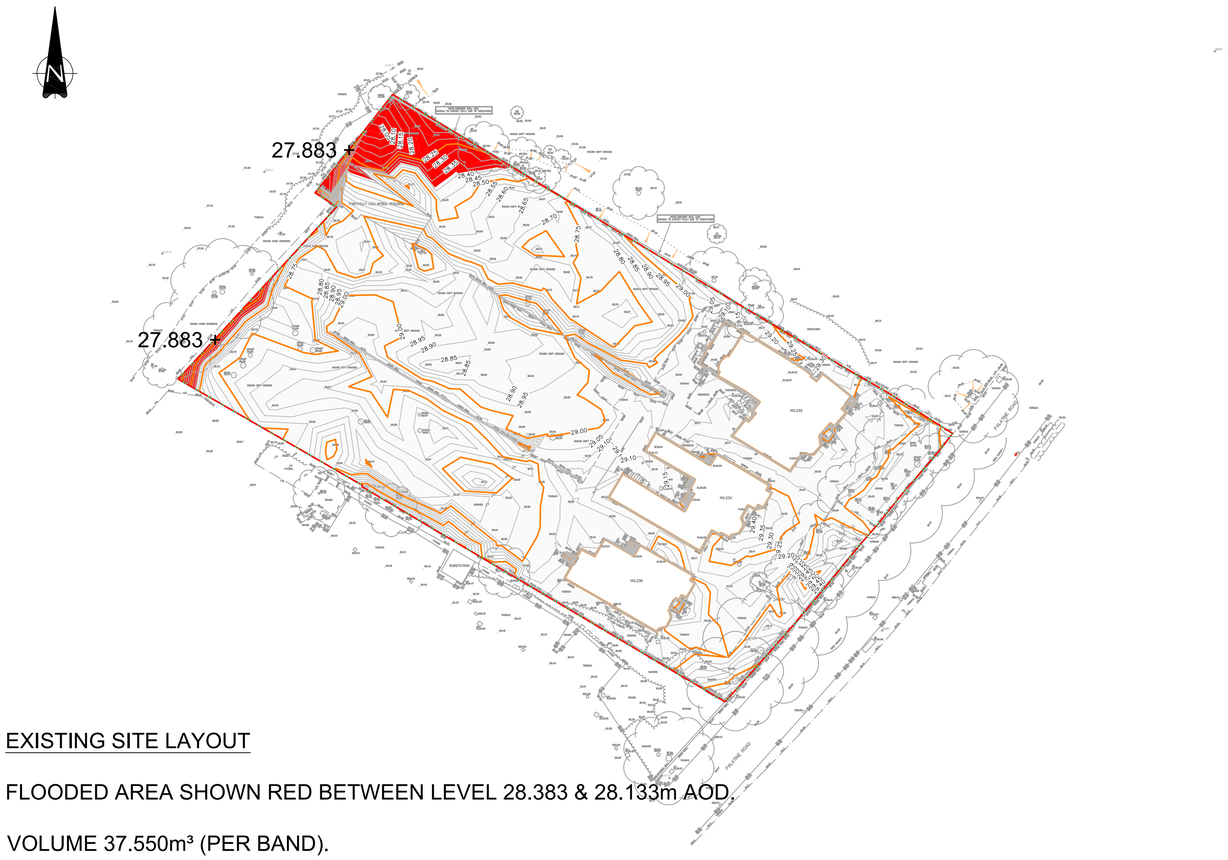
clancy consulting
www.clancy.co.uk

Project Ref	Originator	Volume	Level
21724	CCL	XX	XX
File Type	Discipline	Drawing No.	Revision
DR	C	02511	P01

Date of Print = May-22-2026, File Name = 8.3(SS)-CCL-XX-XX-DR-C-02512_P01_[DRN] DETAILS.dwg

13.7. Appendix G1 Flood Plain Compensation and Hydraulic Assessment

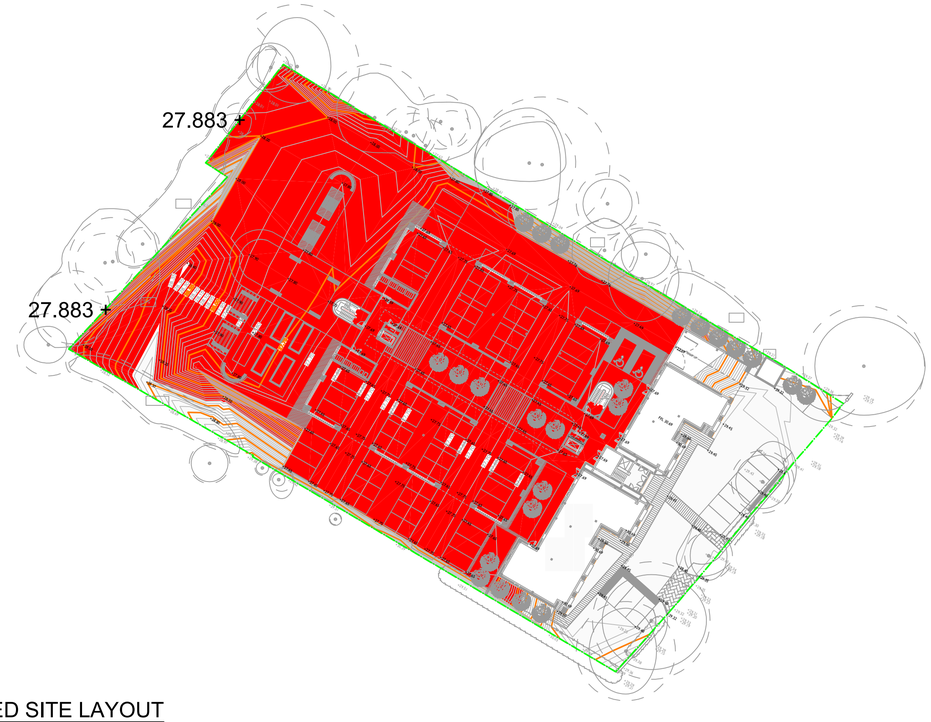
© Clancy Consulting 2026



EXISTING SITE LAYOUT

FLOODED AREA SHOWN RED BETWEEN LEVEL 28.383 & 28.133m AOD.

VOLUME 37.550m³ (PER BAND).



PROPOSED SITE LAYOUT

FLOODED AREA SHOWN RED BETWEEN LEVEL 28.383 & 28.133m AOD.

VOLUME 1038.390m³ (PER BAND).

PALATINE ROAD FLOOD COMPENSATION MODELLING

	BAND DEPTH (m)	LVL (m AOD)	EXISTING VOLUME FL TO EG (m3)	E - EXISTING VOLUME PER BAND (m3)	PROPOSED VOLUME FL TO PG (m3)	P - PROPOSED VOLUME PER BAND (m3)	BETTERMENT PER BAND P-E (m3)	
LOWEST SITE LEVEL	0.000	27.883	0.000	0.000	0.000	0.000		
	0.250	28.133	7.360	7.360	1481.710	1481.710	1474.350	+
	0.250	28.383	44.910	37.550	2520.090	1038.380	1000.830	+
	0.250	28.633	136.520	91.610	3610.790	1090.700	999.090	+
	0.250	28.883	421.020	284.500	4741.280	1130.490	845.990	+
	0.250	29.133	1135.330	714.310	5864.720	1123.440	409.130	+
	0.250	29.383	2297.380	1162.050	7035.700	1170.980	8.930	+
	0.250	29.633	3606.940	1309.560	8370.570	1334.870	25.310	+
	0.250	29.883	4929.440	1322.500	9743.270	1372.700	50.200	+
0.1% AEP (FLOOD LEVEL)	0.207	30.090	6030.550	1101.110	10879.920	1136.650	35.540	+
						OVERALL BETTERMENT	4849.370	+

Rev	Date	Description	By	Check	App.
P01	28.08.26	FOR PLANNING	SJT	CD	CB

COPYRIGHT: THE COPYRIGHT OF THIS DRAWING IS VESTED IN CLANCY CONSULTING.
IT SHALL NOT BE USED WITHOUT PERMISSION BY ANYONE FOR ANY PURPOSE.
DO NOT SCALE THIS DRAWING ELECTRONICALLY OR MANUALLY.
WORK TO FIGURED DIMENSIONS ONLY.
ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
DO NOT TURN ON LAYERS THAT HAVE BEEN TURNED OFF.
DO NOT THAW LAYERS THAT HAVE BEEN FROZEN.

Client: MARCO LIVING 3 LTD.

Project: PALATINE ROAD, DIDSBURY.

Office: MANCHESTER

Discipline: CIVILS

Title: FLOOD COMPENSATION MODELLING
SHEET 2

Scale @ A1: 1:500

Status: PLANNING

clancy consulting
www.clancy.co.uk

Birmingham 0121 200 3500 · Glasgow 0141 222 2720 · Liverpool 0151 227 5300 · London 020 3377 0970 · Manchester 0161 619 8000 · Newcastle 0191 221 0702 · Norwich 01603 305100 · Prestwich 01204 475375 · Reading 0118 941 7888

Originator	Job Number	Discipline	Building/Zone
CCE	21724	C	XX

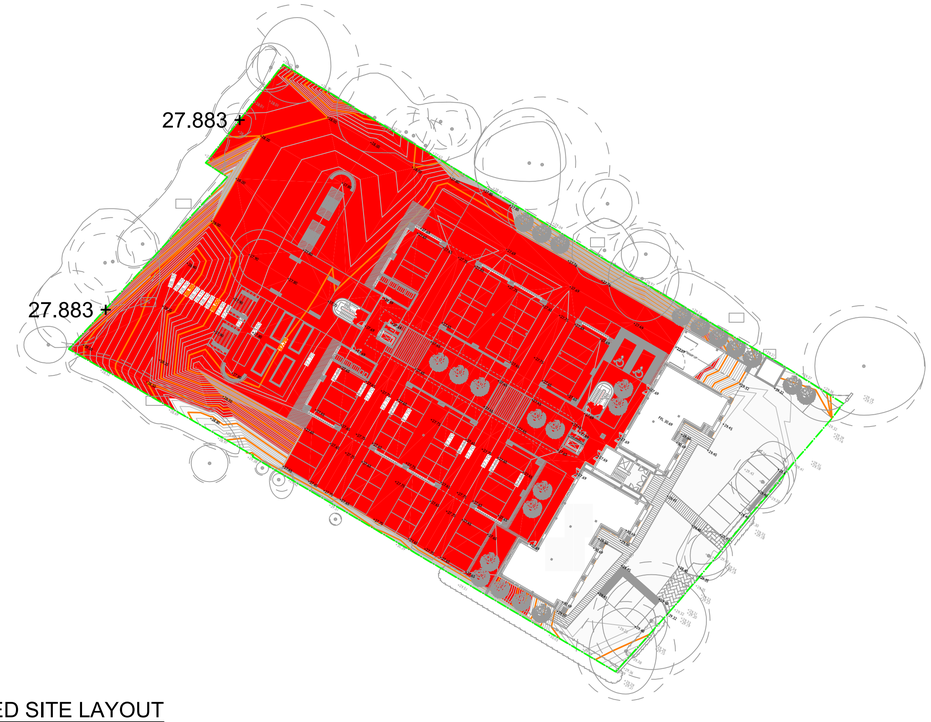
Type	Level	Drawing No.	Revision
DR	XX	00002	P01



EXISTING SITE LAYOUT

FLOODED AREA SHOWN RED BETWEEN LEVEL 28.633 & 28.383m AOD.

VOLUME 91.610m³ (PER BAND).



PROPOSED SITE LAYOUT

FLOODED AREA SHOWN RED BETWEEN LEVEL 28.633 & 28.383m AOD.

VOLUME 1090.700m³ (PER BAND).

PALATINE ROAD FLOOD COMPENSATION MODELLING

	BAND DEPTH (m)	LVL (m AOD)	EXISTING VOLUME FL TO EG (m3)	E - EXISTING VOLUME PER BAND (m3)	PROPOSED VOLUME FL TO PG (m3)	P - PROPOSED VOLUME PER BAND (m3)	BETTERMENT PER BAND P-E (m3)	
LOWEST SITE LEVEL	0.000	27.883	0.000	0.000	0.000	0.000		
	0.250	28.133	7.360	7.360	1481.710	1481.710	1474.350	+
	0.250	28.383	44.910	37.550	2520.090	1038.380	1000.830	+
	0.250	28.633	136.520	91.610	3610.790	1090.700	999.090	+
	0.250	28.883	421.020	284.500	4741.280	1130.490	845.990	+
	0.250	29.133	1135.330	714.310	5864.720	1123.440	409.130	+
	0.250	29.383	2297.380	1162.050	7035.700	1170.980	8.930	+
	0.250	29.633	3606.940	1309.560	8370.570	1334.870	25.310	+
	0.250	29.883	4929.440	1322.500	9743.270	1372.700	50.200	+
0.1% AEP (FLOOD LEVEL)	0.207	30.090	6030.550	1101.110	10879.920	1136.650	35.540	+
						OVERALL BETTERMENT	4849.370	+

Rev	Date	Description	By	Check	App.
P01	28.08.26	FOR PLANNING	SJT	CD	CB

COPYRIGHT: THE COPYRIGHT OF THIS DRAWING IS VESTED IN CLANCY CONSULTING.
IT SHALL NOT BE USED WITHOUT PERMISSION BY ANYONE FOR ANY PURPOSE.
DO NOT SCALE THIS DRAWING ELECTRONICALLY OR MANUALLY.
WORK TO FIGURED DIMENSIONS ONLY.
ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
DO NOT TURN ON LAYERS THAT HAVE BEEN TURNED OFF.
DO NOT THAW LAYERS THAT HAVE BEEN FROZEN.

Client: MARCO LIVING 3 LTD.

Project: PALATINE ROAD, DIDSBURY.

Office: MANCHESTER

Discipline: CIVILS

Title: FLOOD COMPENSATION MODELLING
SHEET 3

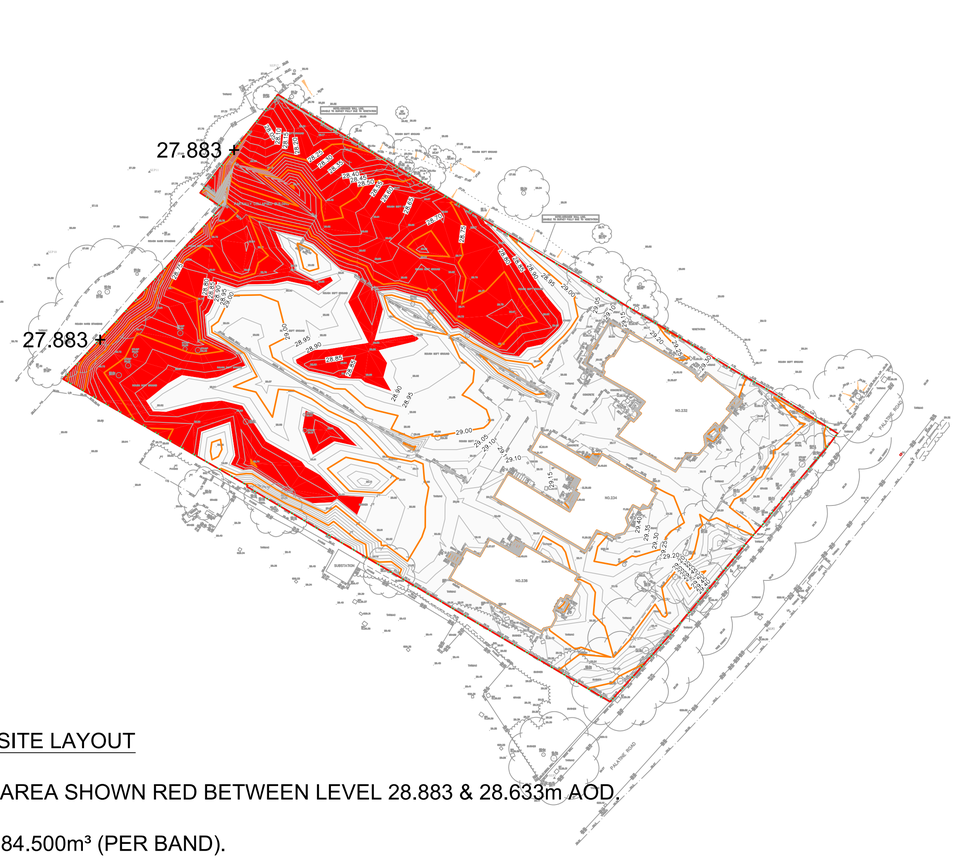
Scale @ A1: 1:500

Status: PLANNING

clancy consulting
www.clancy.co.uk
Birmingham 0121 200 3500 · Glasgow 0141 222 2720 · Liverpool 0151 227 5300 · London 020 3377 0970 · Manchester 0161 619 8000 · Newcastle 0191 221 0702 · Norwich 01603 305100 · Prestwick 01292 475375 · Reading 0118 941 7888

Originator	Job Number	Discipline	Building/Zone
CCE	21724	C	XX

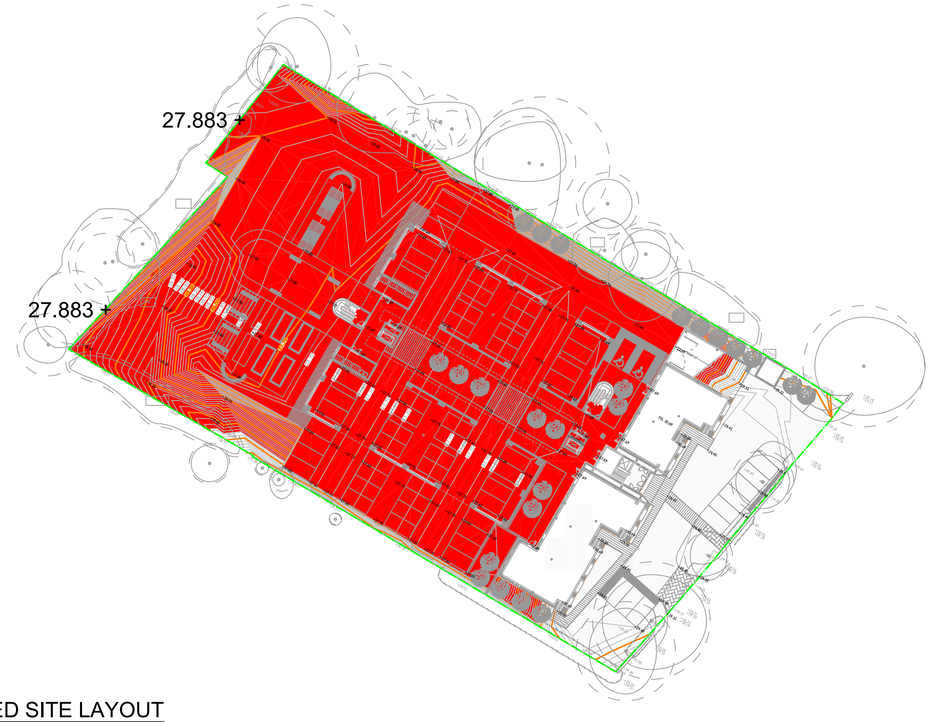
Type	Level	Drawing No.	Revision
DR	XX	00003	P01



EXISTING SITE LAYOUT

FLOODED AREA SHOWN RED BETWEEN LEVEL 28.883 & 28.633m AOD.

VOLUME 284.500m³ (PER BAND).



PROPOSED SITE LAYOUT

FLOODED AREA SHOWN RED BETWEEN LEVEL 28.883 & 28.633m AOD.

VOLUME 1130.490m³ (PER BAND).

PALATINE ROAD FLOOD COMPENSATION MODELLING

	BAND DEPTH (m)	LVL (m AOD)	EXISTING VOLUME FL TO EG (m3)	E - EXISTING VOLUME PER BAND (m3)	PROPOSED VOLUME FL TO PG (m3)	P - PROPOSED VOLUME PER BAND (m3)	BETTERMENT PER BAND P-E (m3)	
LOWEST SITE LEVEL	0.000	27.883	0.000	0.000	0.000	0.000		
	0.250	28.133	7.360	7.360	1481.710	1481.710	1474.350	+
	0.250	28.383	44.910	37.550	2520.090	1038.380	1000.830	+
	0.250	28.633	136.520	91.610	3610.790	1090.700	999.090	+
	0.250	28.883	421.020	284.500	4741.280	1130.490	845.990	+
	0.250	29.133	1135.330	714.310	5864.720	1123.440	409.130	+
	0.250	29.383	2297.380	1162.050	7035.700	1170.980	8.930	+
	0.250	29.633	3606.940	1309.560	8370.570	1334.870	25.310	+
	0.250	29.883	4929.440	1322.500	9743.270	1372.700	50.200	+
0.1% AEP (FLOOD LEVEL)	0.207	30.090	6030.550	1101.110	10879.920	1136.650	35.540	+
						OVERALL BETTERMENT	4849.370	+

Rev	Date	Description	By	Check	App.
P01	28.08.26	FOR PLANNING	SJT	CD	CB

COPYRIGHT: THE COPYRIGHT OF THIS DRAWING IS VESTED IN CLANCY CONSULTING.
IT SHALL NOT BE USED WITHOUT PERMISSION BY ANYONE FOR ANY PURPOSE.
DO NOT SCALE THIS DRAWING ELECTRONICALLY OR MANUALLY.
WORK TO FIGURED DIMENSIONS ONLY.
ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
DO NOT TURN ON LAYERS THAT HAVE BEEN TURNED OFF.
DO NOT THAW LAYERS THAT HAVE BEEN FROZEN.

Client: MARCO LIVING 3 LTD.

Project: PALATINE ROAD, DIDSBURY.

Office: MANCHESTER

Discipline: CIVILS

Title: FLOOD COMPENSATION MODELLING
SHEET 4

Scale @ A1: 1:500

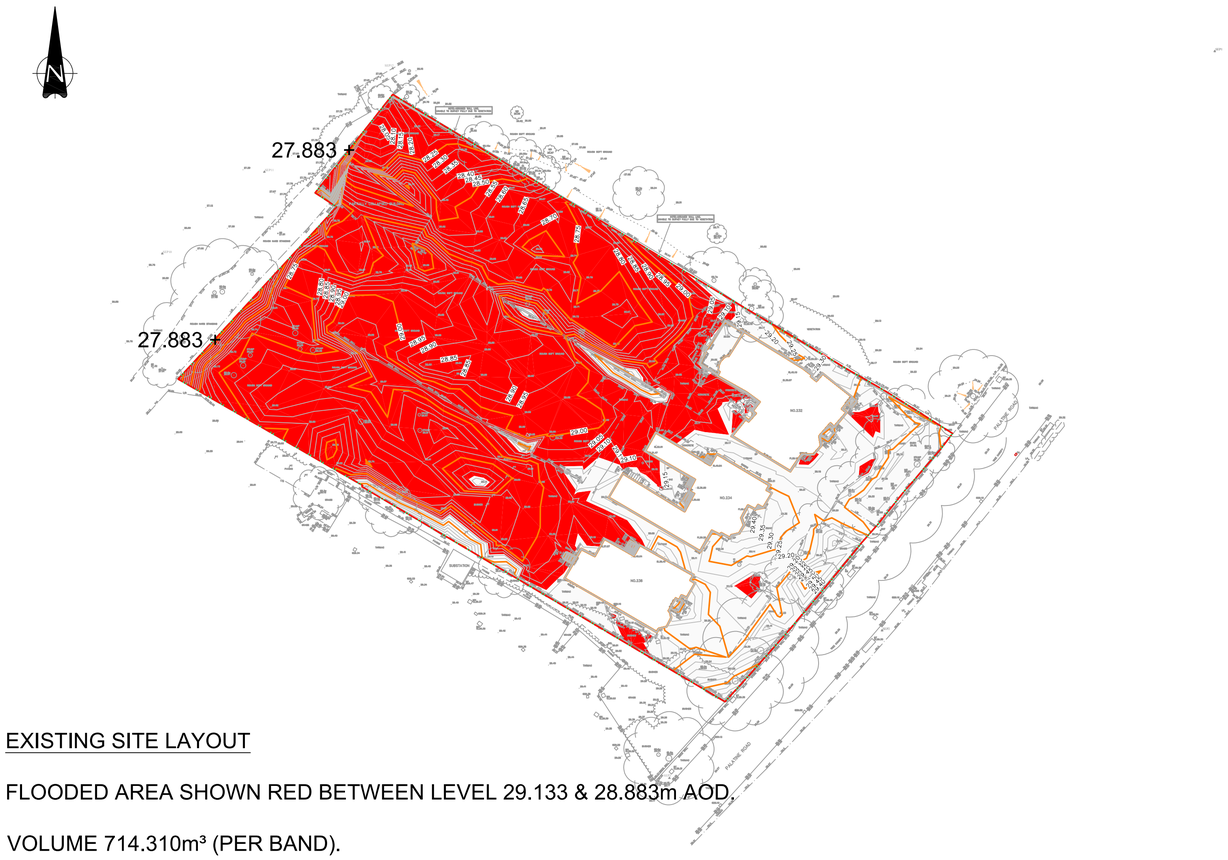
Status: PLANNING

clancy consulting
www.clancy.co.uk

Birmingham 0121 200 3500 · Glasgow 0141 222 2720 · Liverpool 0151 227 5300 · London 020 3377 0970 · Manchester 0161 619 8000 · Newcastle 0191 221 0702 · Norwich 01603 305100 · Prestwich 01204 475375 · Reading 0118 941 7888

Originator	Job Number	Discipline	Building/Zone
CCE	21724	C	XX

Type	Level	Drawing No.	Revision
DR	XX	00004	P01



EXISTING SITE LAYOUT

FLOODED AREA SHOWN RED BETWEEN LEVEL 29.133 & 28.883m AOD.

VOLUME 714.310m³ (PER BAND).



PROPOSED SITE LAYOUT

FLOODED AREA SHOWN RED BETWEEN LEVEL 29.133 & 28.883m AOD.

VOLUME 1123.440m³ (PER BAND).

PALATINE ROAD FLOOD COMPENSATION MODELLING

	BAND DEPTH (m)	LVL (m AOD)	EXISTING VOLUME FL TO EG (m3)	E - EXISTING VOLUME PER BAND (m3)	PROPOSED VOLUME FL TO PG (m3)	P - PROPOSED VOLUME PER BAND (m3)	BETTERMENT PER BAND P-E (m3)	
LOWEST SITE LEVEL	0.000	27.883	0.000	0.000	0.000	0.000		
	0.250	28.133	7.360	7.360	1481.710	1481.710	1474.350	+
	0.250	28.383	44.910	37.550	2520.090	1038.380	1000.830	+
	0.250	28.633	136.520	91.610	3610.790	1090.700	999.090	+
	0.250	28.883	421.020	284.500	4741.280	1130.490	845.990	+
	0.250	29.133	1135.330	714.310	5864.720	1123.440	409.130	+
	0.250	29.383	2297.380	1162.050	7035.700	1170.980	8.930	+
	0.250	29.633	3606.940	1309.560	8370.570	1334.870	25.310	+
	0.250	29.883	4929.440	1322.500	9743.270	1372.700	50.200	+
0.1% AEP (FLOOD LEVEL)	0.207	30.090	6030.550	1101.110	10879.920	1136.650	35.540	+
						OVERALL BETTERMENT	4849.370	+

Rev	Date	Description	By	Check	App.
P01	28.08.26	FOR PLANNING	SJT	CD	CB

COPYRIGHT: THE COPYRIGHT OF THIS DRAWING IS VESTED IN CLANCY CONSULTING.
IT SHALL NOT BE USED WITHOUT PERMISSION BY ANYONE FOR ANY PURPOSE.
DO NOT SCALE THIS DRAWING ELECTRONICALLY OR MANUALLY.
WORK TO FIGURED DIMENSIONS ONLY.
ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
DO NOT TURN ON LAYERS THAT HAVE BEEN TURNED OFF.
DO NOT THAW LAYERS THAT HAVE BEEN FROZEN.

Client: MARCO LIVING 3 LTD.

Project: PALATINE ROAD, DIDSBURY.

Office: MANCHESTER

Discipline: CIVILS

Title: FLOOD COMPENSATION MODELLING
SHEET 5

Scale @ A1: 1:500

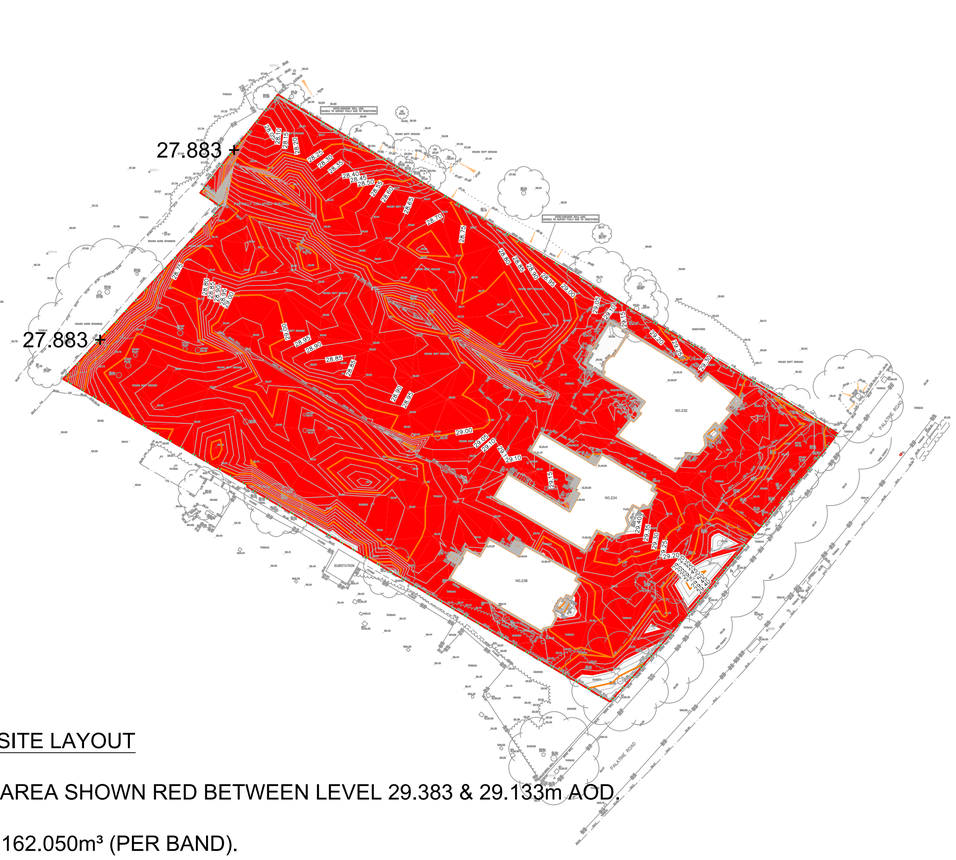
Status: PLANNING

clancy consulting
www.clancy.co.uk

Birmingham 0121 200 3500 · Glasgow 0141 222 2720 · Liverpool 0151 227 5300 · London 020 3377 0970 · Manchester 0161 619 8000 · Newcastle 0191 221 0702 · Norwich 01603 305100 · Prestwich 01204 478375 · Reading 0118 941 7888

Originator	Job Number	Discipline	Building/Zone
CCE	21724	C	XX

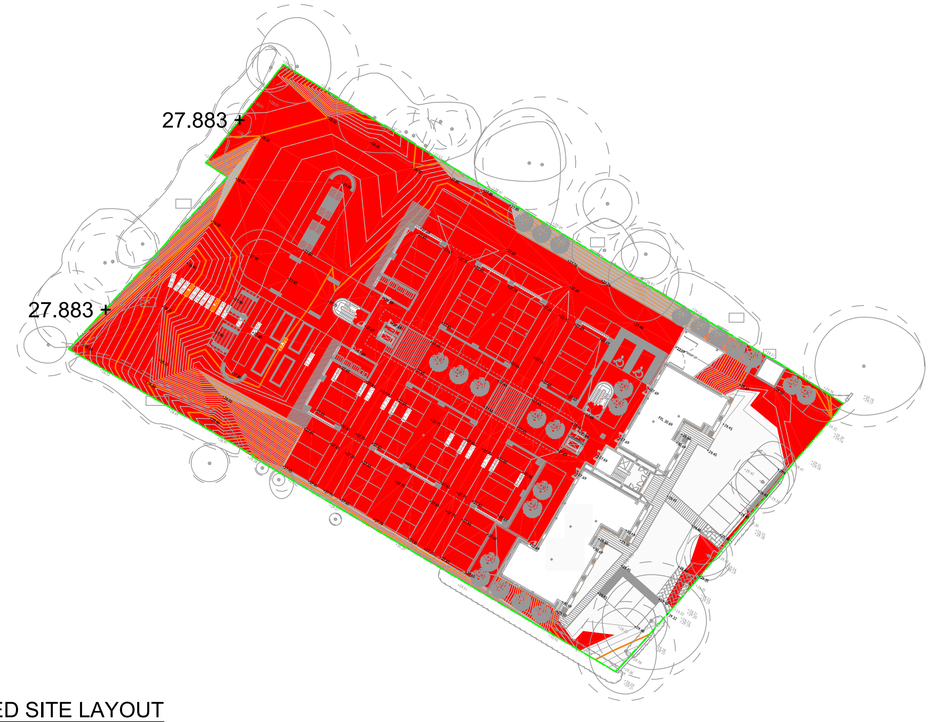
Type	Level	Drawing No.	Revision
DR	XX	00005	P01



EXISTING SITE LAYOUT

FLOODED AREA SHOWN RED BETWEEN LEVEL 29.383 & 29.133m AOD.

VOLUME 1162.050m³ (PER BAND).



PROPOSED SITE LAYOUT

FLOODED AREA SHOWN RED BETWEEN LEVEL 29.383 & 29.133m AOD.

VOLUME 1170.980m³ (PER BAND).

PALATINE ROAD FLOOD COMPENSATION MODELLING

	BAND DEPTH (m)	LVL (m AOD)	EXISTING VOLUME FL TO EG (m3)	E - EXISTING VOLUME PER BAND (m3)	PROPOSED VOLUME FL TO PG (m3)	P - PROPOSED VOLUME PER BAND (m3)	BETTERMENT PER BAND P-E (m3)	
LOWEST SITE LEVEL	0.000	27.883	0.000	0.000	0.000	0.000		
	0.250	28.133	7.360	7.360	1481.710	1481.710	1474.350	+
	0.250	28.383	44.910	37.550	2520.090	1038.380	1000.830	+
	0.250	28.633	136.520	91.610	3610.790	1090.700	999.090	+
	0.250	28.883	421.020	284.500	4741.280	1130.490	845.990	+
	0.250	29.133	1135.330	714.310	5864.720	1123.440	409.130	+
	0.250	29.383	2297.380	1162.050	7035.700	1170.980	8.930	+
	0.250	29.633	3606.940	1309.560	8370.570	1334.870	25.310	+
	0.250	29.883	4929.440	1322.500	9743.270	1372.700	50.200	+
0.1% AEP (FLOOD LEVEL)	0.207	30.090	6030.550	1101.110	10879.920	1136.650	35.540	+
						OVERALL BETTERMENT	4849.370	+

Rev	Date	Description	By	Check	App.
P01	28.08.26	FOR PLANNING	SJT	CD	CB

COPYRIGHT: THE COPYRIGHT OF THIS DRAWING IS VESTED IN CLANCY CONSULTING.
IT SHALL NOT BE USED WITHOUT PERMISSION BY ANYONE FOR ANY PURPOSE.
DO NOT SCALE THIS DRAWING ELECTRONICALLY OR MANUALLY.
WORK TO FIGURED DIMENSIONS ONLY.
ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
DO NOT TURN ON LAYERS THAT HAVE BEEN TURNED OFF.
DO NOT THAW LAYERS THAT HAVE BEEN FROZEN.

Client: MARCO LIVING 3 LTD.

Project: PALATINE ROAD, DIDSBURY.

Office: MANCHESTER

Discipline: CIVILS

Title: FLOOD COMPENSATION MODELLING
SHEET 6

Scale @ A1: 1:500

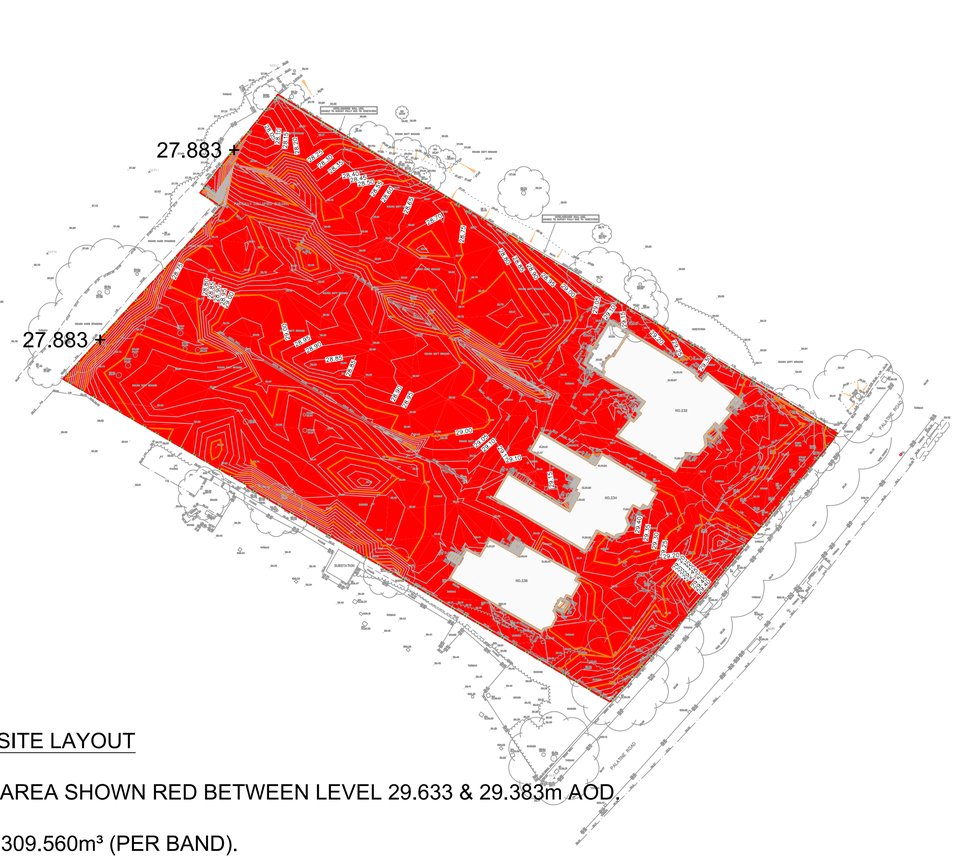
Status: PLANNING

clancy consulting
www.clancy.co.uk

Birmingham 0121 200 3500 · Glasgow 0141 222 2720 · Liverpool 0151 227 5300 · London 020 3377 0970 · Manchester 0161 619 8000 · Newcastle 0191 221 0702 · Norwich 01603 305100 · Prestwich 01204 478375 · Reading 0118 941 7888

Originator	Job Number	Discipline	Building/Zone
CCE	21724	C	XX

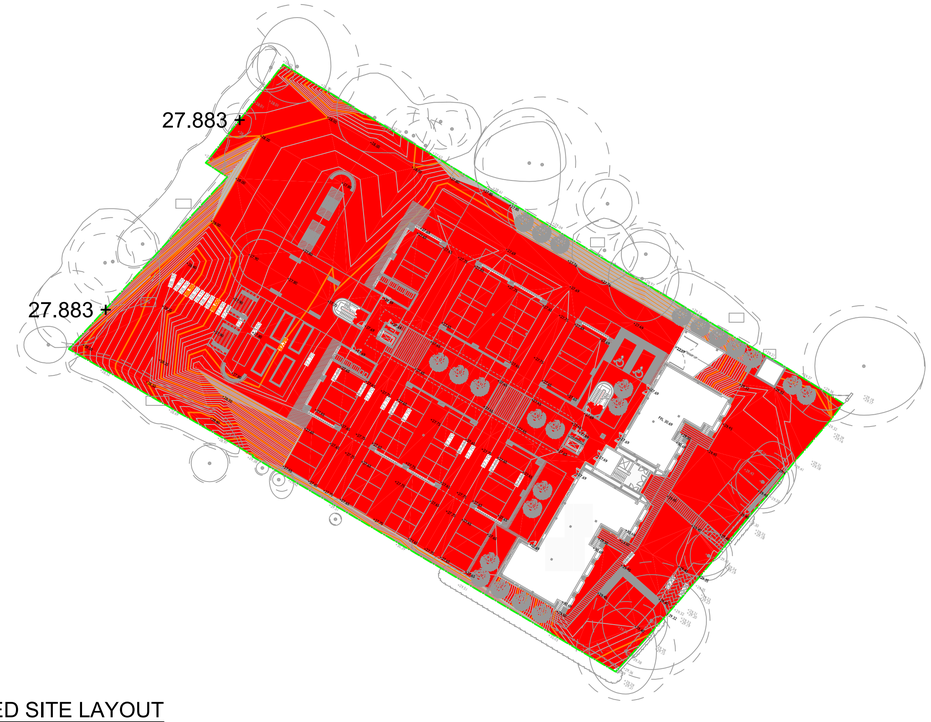
Type	Level	Drawing No.	Revision
DR	XX	00006	P01



EXISTING SITE LAYOUT

FLOODED AREA SHOWN RED BETWEEN LEVEL 29.633 & 29.383m AOD.

VOLUME 1309.560m³ (PER BAND).



PROPOSED SITE LAYOUT

FLOODED AREA SHOWN RED BETWEEN LEVEL 29.633 & 29.383m AOD.

VOLUME 1334.870m³ (PER BAND).

PALATINE ROAD FLOOD COMPENSATION MODELLING

	BAND DEPTH (m)	LVL (m AOD)	EXISTING VOLUME FL TO EG (m3)	E - EXISTING VOLUME PER BAND (m3)	PROPOSED VOLUME FL TO PG (m3)	P - PROPOSED VOLUME PER BAND (m3)	BETTERMENT PER BAND P-E (m3)	
LOWEST SITE LEVEL	0.000	27.883	0.000	0.000	0.000	0.000		
	0.250	28.133	7.360	7.360	1481.710	1481.710	1474.350	+
	0.250	28.383	44.910	37.550	2520.090	1038.380	1000.830	+
	0.250	28.633	136.520	91.610	3610.790	1090.700	999.090	+
	0.250	28.883	421.020	284.500	4741.280	1130.490	845.990	+
	0.250	29.133	1135.330	714.310	5864.720	1123.440	409.130	+
	0.250	29.383	2297.380	1162.050	7035.700	1170.980	8.930	+
	0.250	29.633	3606.940	1309.560	8370.570	1334.870	25.310	+
	0.250	29.883	4929.440	1322.500	9743.270	1372.700	50.200	+
0.1% AEP (FLOOD LEVEL)	0.207	30.090	6030.550	1101.110	10879.920	1136.650	35.540	+
						OVERALL BETTERMENT	4849.370	+

Rev	Date	Description	By	Check	App.
P01	28.08.26	FOR PLANNING	SJT	CD	CB

COPYRIGHT: THE COPYRIGHT OF THIS DRAWING IS VESTED IN CLANCY CONSULTING.
IT SHALL NOT BE USED WITHOUT PERMISSION BY ANYONE FOR ANY PURPOSE.
DO NOT SCALE THIS DRAWING ELECTRONICALLY OR MANUALLY.
WORK TO FIGURED DIMENSIONS ONLY.
ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
DO NOT TURN ON LAYERS THAT HAVE BEEN TURNED OFF.
DO NOT THAW LAYERS THAT HAVE BEEN FROZEN.

Client: MARCO LIVING 3 LTD.

Project: PALATINE ROAD, DIDSBURY.

Office: MANCHESTER

Discipline: CIVILS

Title: FLOOD COMPENSATION MODELLING
SHEET 7

Scale @ A1: 1:500

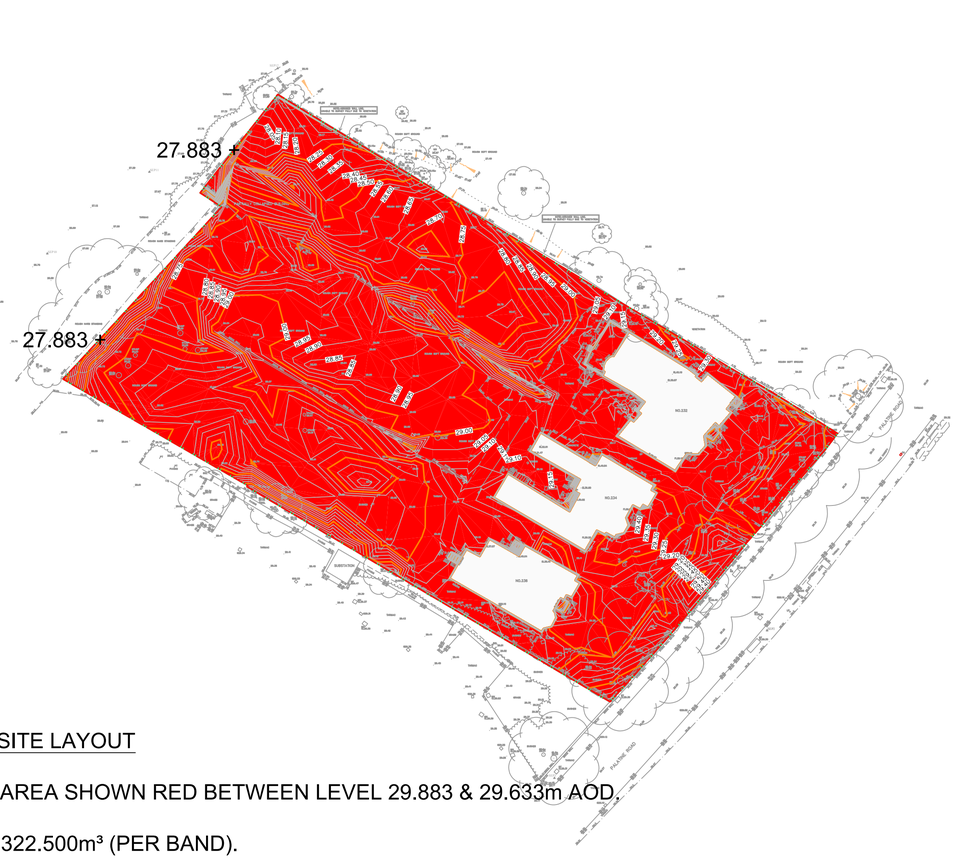
Status: PLANNING

clancy consulting
www.clancy.co.uk

Birmingham 0121 200 3500 · Glasgow 0141 222 2720 · Liverpool 0151 227 5300 · London 020 3377 0970 · Manchester 0161 619 8000 · Newcastle 0191 221 0702 · Norwich 01603 305100 · Prestwich 01204 478375 · Reading 0118 941 7888

Originator	Job Number	Discipline	Building/Zone
CCE	21724	C	XX

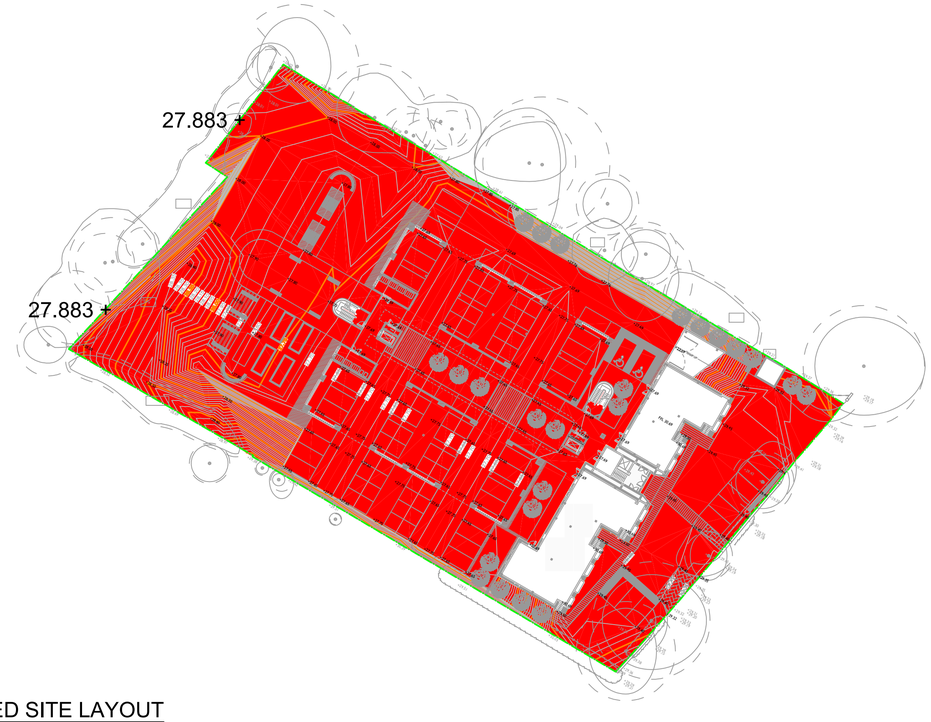
Type	Level	Drawing No.	Revision
DR	XX	00007	P01



EXISTING SITE LAYOUT

FLOODED AREA SHOWN RED BETWEEN LEVEL 29.883 & 29.633m AOD.

VOLUME 1322.500m³ (PER BAND).



PROPOSED SITE LAYOUT

FLOODED AREA SHOWN RED BETWEEN LEVEL 29.883 & 29.633m AOD.

VOLUME 1372.700m³ (PER BAND).

PALATINE ROAD FLOOD COMPENSATION MODELLING

	BAND DEPTH (m)	LVL (m AOD)	EXISTING VOLUME FL TO EG (m3)	E - EXISTING VOLUME PER BAND (m3)	PROPOSED VOLUME FL TO PG (m3)	P - PROPOSED VOLUME PER BAND (m3)	BETTERMENT PER BAND P-E (m3)	
LOWEST SITE LEVEL	0.000	27.883	0.000	0.000	0.000	0.000		
	0.250	28.133	7.360	7.360	1481.710	1481.710	1474.350	+
	0.250	28.383	44.910	37.550	2520.090	1038.380	1000.830	+
	0.250	28.633	136.520	91.610	3610.790	1090.700	999.090	+
	0.250	28.883	421.020	284.500	4741.280	1130.490	845.990	+
	0.250	29.133	1135.330	714.310	5864.720	1123.440	409.130	+
	0.250	29.383	2297.380	1162.050	7035.700	1170.980	8.930	+
	0.250	29.633	3606.940	1309.560	8370.570	1334.870	25.310	+
	0.250	29.883	4929.440	1322.500	9743.270	1372.700	50.200	+
0.1% AEP (FLOOD LEVEL)	0.207	30.090	6030.550	1101.110	10879.920	1136.650	35.540	+
						OVERALL BETTERMENT	4849.370	+

Rev	Date	Description	By	Check	App.
P01	28.08.26	FOR PLANNING	SJT	CD	CB

COPYRIGHT: THE COPYRIGHT OF THIS DRAWING IS VESTED IN CLANCY CONSULTING.
IT SHALL NOT BE USED WITHOUT PERMISSION BY ANYONE FOR ANY PURPOSE.
DO NOT SCALE THIS DRAWING ELECTRONICALLY OR MANUALLY.
WORK TO FIGURED DIMENSIONS ONLY.
ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
DO NOT TURN ON LAYERS THAT HAVE BEEN TURNED OFF.
DO NOT THAW LAYERS THAT HAVE BEEN FROZEN.

Client: MARCO LIVING 3 LTD.

Project: PALATINE ROAD, DIDSBURY.

Office: MANCHESTER

Discipline: CIVILS

Title: FLOOD COMPENSATION MODELLING
SHEET 8

Scale @ A1: 1:500

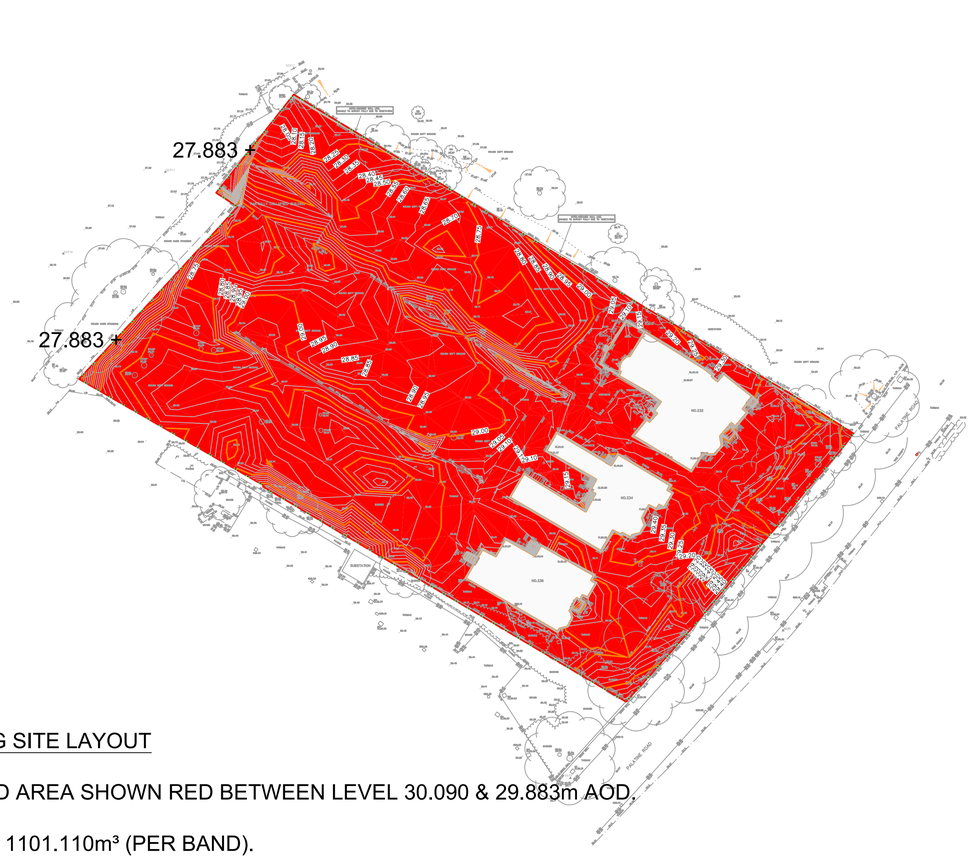
Status: PLANNING

clancy consulting
www.clancy.co.uk

Birmingham 0121 200 3500 · Glasgow 0141 222 2720 · Liverpool 0151 227 5300 · London 020 3377 0970 · Manchester 0161 619 8000 · Newcastle 0191 221 0702 · Norwich 01603 305100 · Prestwich 01204 478375 · Reading 0118 941 7888

Originator	Job Number	Discipline	Building/Zone
CCE	21724	C	XX

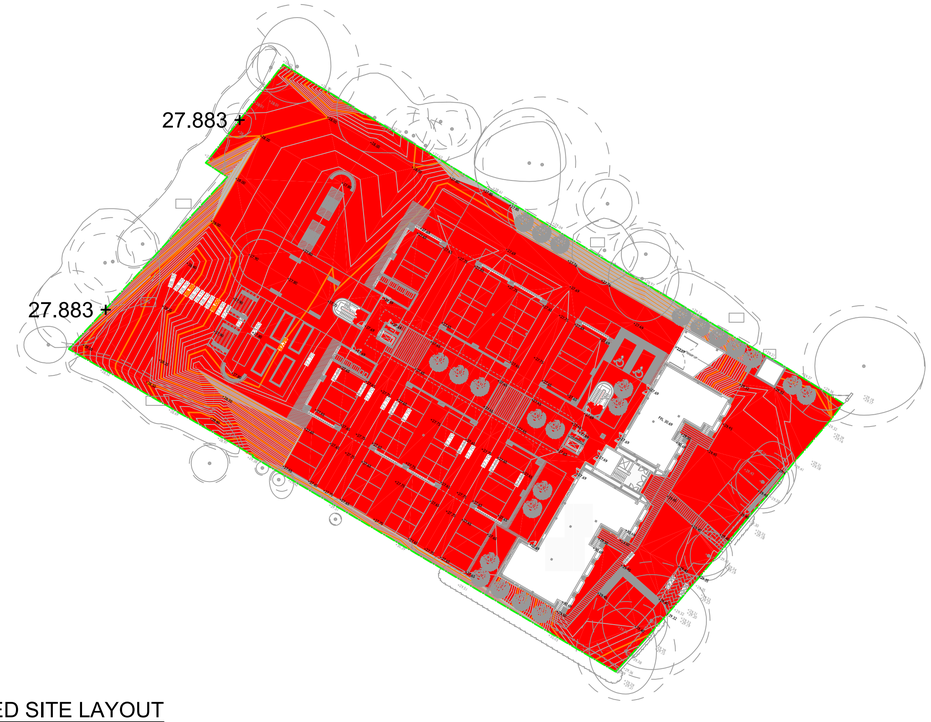
Type	Level	Drawing No.	Revision
DR	XX	00008	P01



EXISTING SITE LAYOUT

FLOODED AREA SHOWN RED BETWEEN LEVEL 30.090 & 29.883m AOD.

VOLUME 1101.110m³ (PER BAND).



PROPOSED SITE LAYOUT

FLOODED AREA SHOWN RED BETWEEN LEVEL 30.090 & 29.883m AOD.

VOLUME 1136.650m³ (PER BAND).

PALATINE ROAD FLOOD COMPENSATION MODELLING

	BAND DEPTH (m)	LVL (m AOD)	EXISTING VOLUME FL TO EG (m3)	E - EXISTING VOLUME PER BAND (m3)	PROPOSED VOLUME FL TO PG (m3)	P - PROPOSED VOLUME PER BAND (m3)	BETTERMENT PER BAND P-E (m3)	
LOWEST SITE LEVEL	0.000	27.883	0.000	0.000	0.000	0.000		
	0.250	28.133	7.360	7.360	1481.710	1481.710	1474.350	+
	0.250	28.383	44.910	37.550	2520.090	1038.380	1000.830	+
	0.250	28.633	136.520	91.610	3610.790	1090.700	999.090	+
	0.250	28.883	421.020	284.500	4741.280	1130.490	845.990	+
	0.250	29.133	1135.330	714.310	5864.720	1123.440	409.130	+
	0.250	29.383	2297.380	1162.050	7035.700	1170.980	8.930	+
	0.250	29.633	3606.940	1309.560	8370.570	1334.870	25.310	+
	0.250	29.883	4929.440	1322.500	9743.270	1372.700	50.200	+
0.1% AEP (FLOOD LEVEL)	0.207	30.090	6030.550	1101.110	10879.920	1136.650	35.540	+
						OVERALL BETTERMENT	4849.370	+

Rev	Date	Description	By	Check	App.
P01	28.08.26	FOR PLANNING	SJT	CD	CB

COPYRIGHT: THE COPYRIGHT OF THIS DRAWING IS VESTED IN CLANCY CONSULTING.
IT SHALL NOT BE USED WITHOUT PERMISSION BY ANYONE FOR ANY PURPOSE.
DO NOT SCALE THIS DRAWING ELECTRONICALLY OR MANUALLY.
WORK TO FIGURED DIMENSIONS ONLY.
ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
DO NOT TURN ON LAYERS THAT HAVE BEEN TURNED OFF.
DO NOT THAW LAYERS THAT HAVE BEEN FROZEN.

Client: MARCO LIVING 3 LTD.

Project: PALATINE ROAD, DIDSBURY.

Office: MANCHESTER

Discipline: CIVILS

Title: FLOOD COMPENSATION MODELLING
SHEET 9

Scale @ A1: 1:500

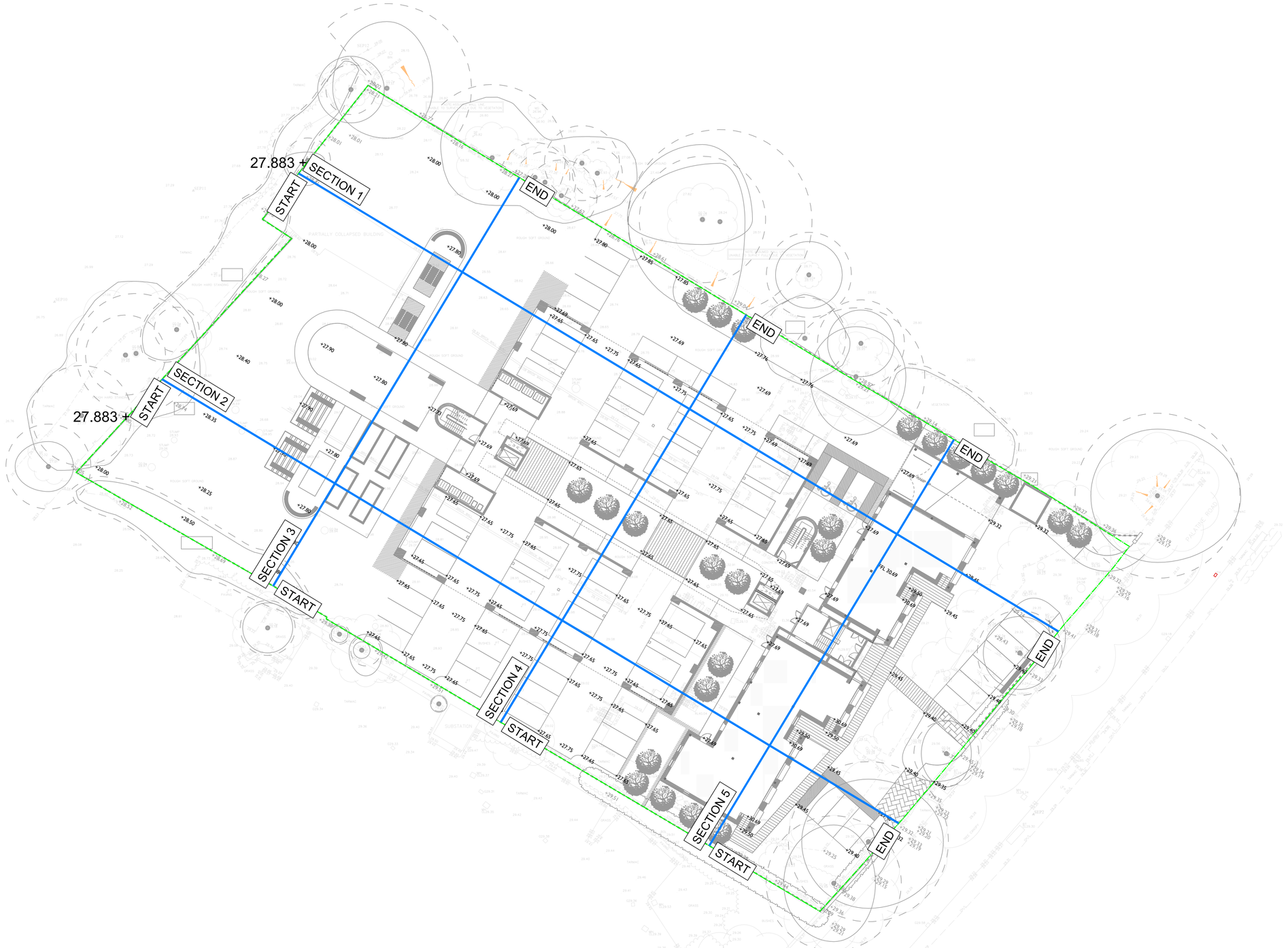
Status: PLANNING

clancy consulting
www.clancy.co.uk

Birmingham 0121 200 3500 · Glasgow 0141 222 2720 · Liverpool 0151 227 5300 · London 020 3377 0970 · Manchester 0161 619 8000 · Newcastle 0191 221 0702 · Norwich 01603 305100 · Prestwich 01204 478375 · Reading 0118 941 7888

Originator	Job Number	Discipline	Building/Zone
CCE	21724	C	XX

Type	Level	Drawing No.	Revision
DR	XX	00009	P01



Rev	Date	Description	By	Check	App.
P01	28.08.26	FOR PLANNING	SJT	CD	CB

COPYRIGHT: THE COPYRIGHT OF THIS DRAWING IS VESTED IN CLANCY CONSULTING.
IT SHALL NOT BE USED WITHOUT PERMISSION BY ANYONE FOR ANY PURPOSE.
DO NOT SCALE THIS DRAWING ELECTRONICALLY OR MANUALLY.
WORK TO FIGURED DIMENSIONS ONLY.
ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
DO NOT TURN ON LAYERS THAT HAVE BEEN TURNED OFF.
DO NOT THAW LAYERS THAT HAVE BEEN FROZEN.

Client
MARCO LIVING 3 LTD.

Project
PALATINE ROAD, DIDSBURY.

Office
MANCHESTER

Discipline
CIVILS

Title
PLAN SHOWING SECTION LINES

Scale @ A1
250

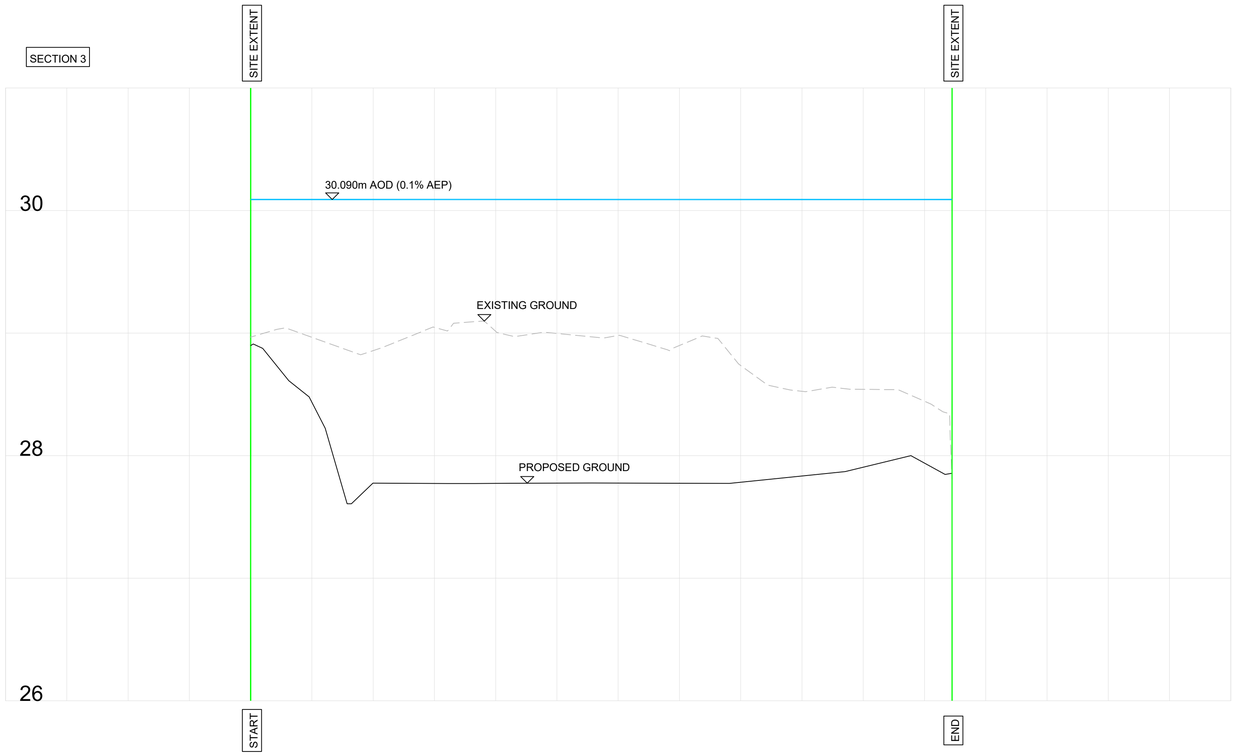
Status
PLANNING

clancy consulting
www.clancy.co.uk
Manchester 0161 613 0000 Newcastle 0191 231 0702 Norwich 01603 305 950 Prestwick 01292 475375 Reading 0118 941 1866
Birmingham 0121 200 3500 Glasgow 0141 222 2220 Liverpool 0151 227 3300 London 020 3077 6370

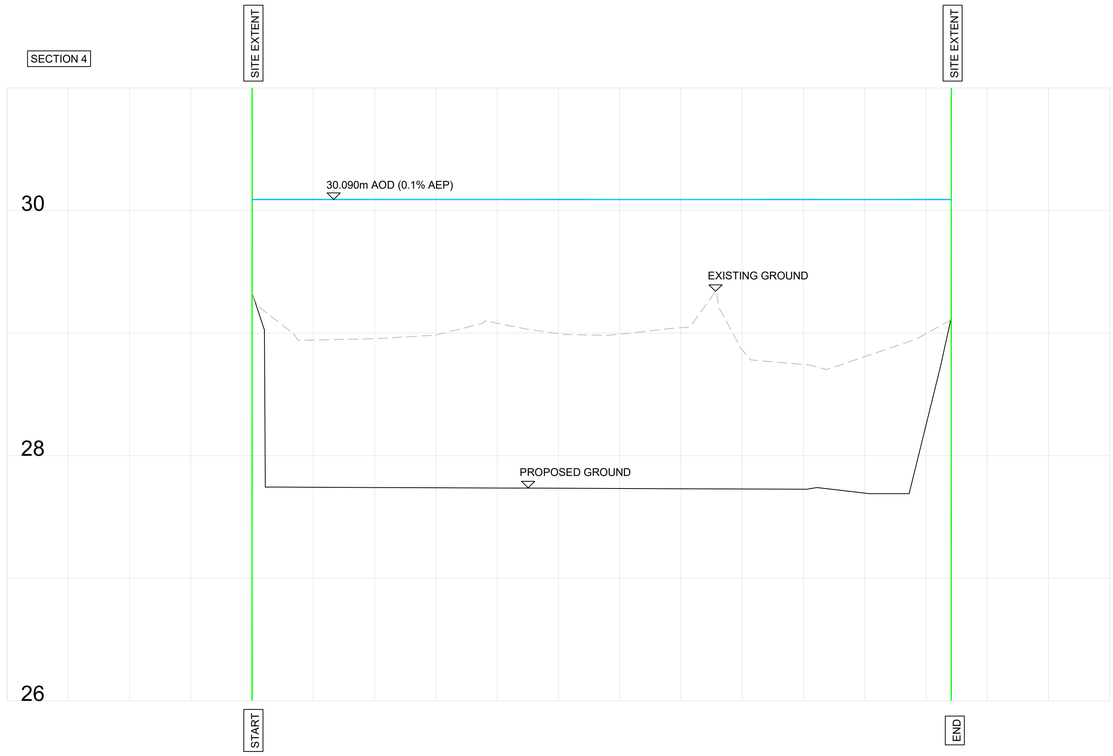
Originator	Job Number	Discipline	Building/Zone
CCE	21724	C	XX

Type	Level	Drawing No.	Revision
DR	XX	00010	P01

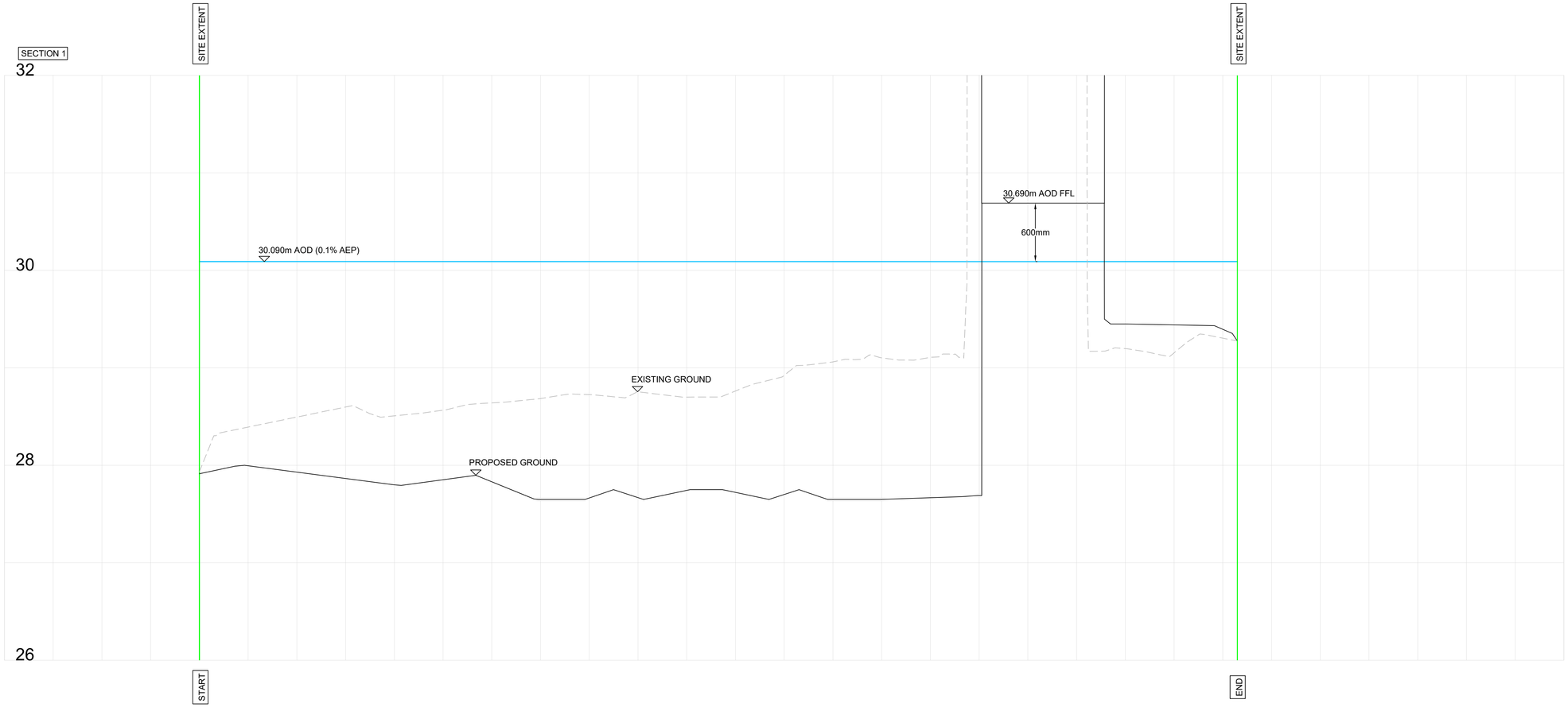
SECTION 3



SECTION 4



SECTION 1



Rev	Date	Description	By	Check	App.
P01	28.08.26	FOR PLANNING	SJT	CD	CB

COPYRIGHT: THE COPYRIGHT OF THIS DRAWING IS VESTED IN CLANCY CONSULTING.
IT SHALL NOT BE USED WITHOUT PERMISSION BY ANYONE FOR ANY PURPOSE.
DO NOT SCALE THIS DRAWING ELECTRONICALLY OR MANUALLY.
WORK TO FIGURED DIMENSIONS ONLY.
ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
DO NOT TURN ON LAYERS THAT HAVE BEEN TURNED OFF.
DO NOT THAW LAYERS THAT HAVE BEEN FROZEN.

Client
MARCO LIVING 3 LTD.

Project
PALATINE ROAD, DIDSBURY.

Office
MANCHESTER

Discipline
CIVILS

Title
SITE SECTION LINES
SHEET 1

Scale @ A1
250

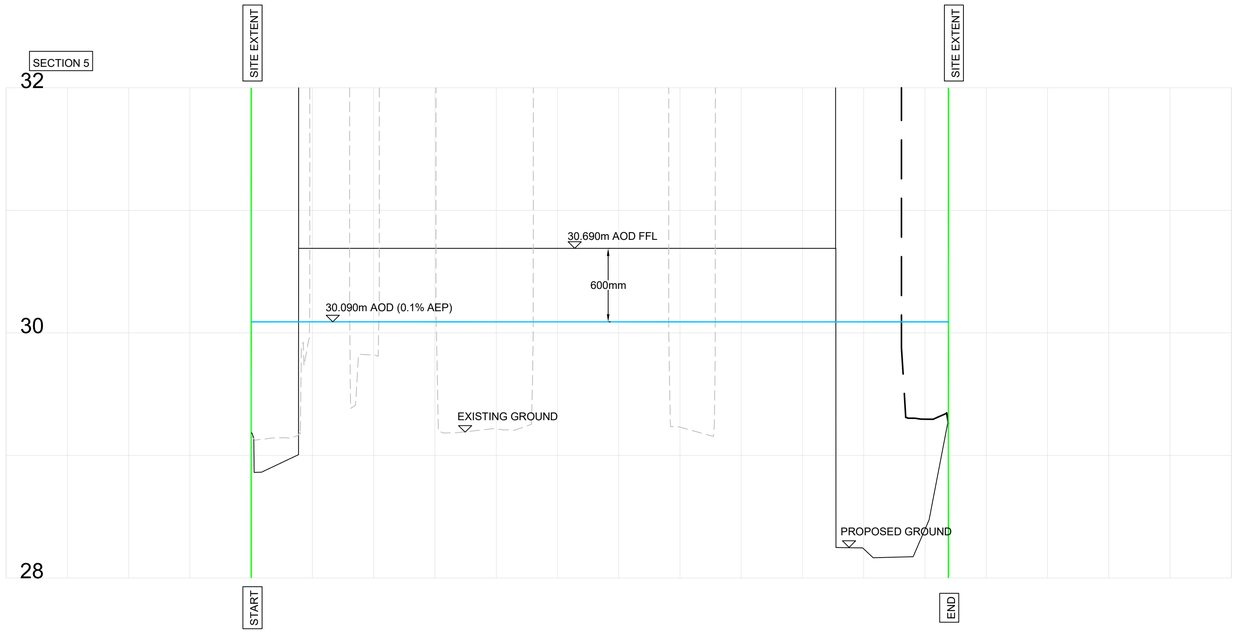
Status
PLANNING

clancy consulting
www.clancy.co.uk
Birmingham 0121 329 7900 Glasgow 0141 222 2720 Liverpool 0151 227 5300 London 020 3977 0950 Manchester 0161 613 9000 Newcastle 0191 221 2702 Norwich 01603 306100 Prestwich 0330 4783575 Reading 0118 941 1868

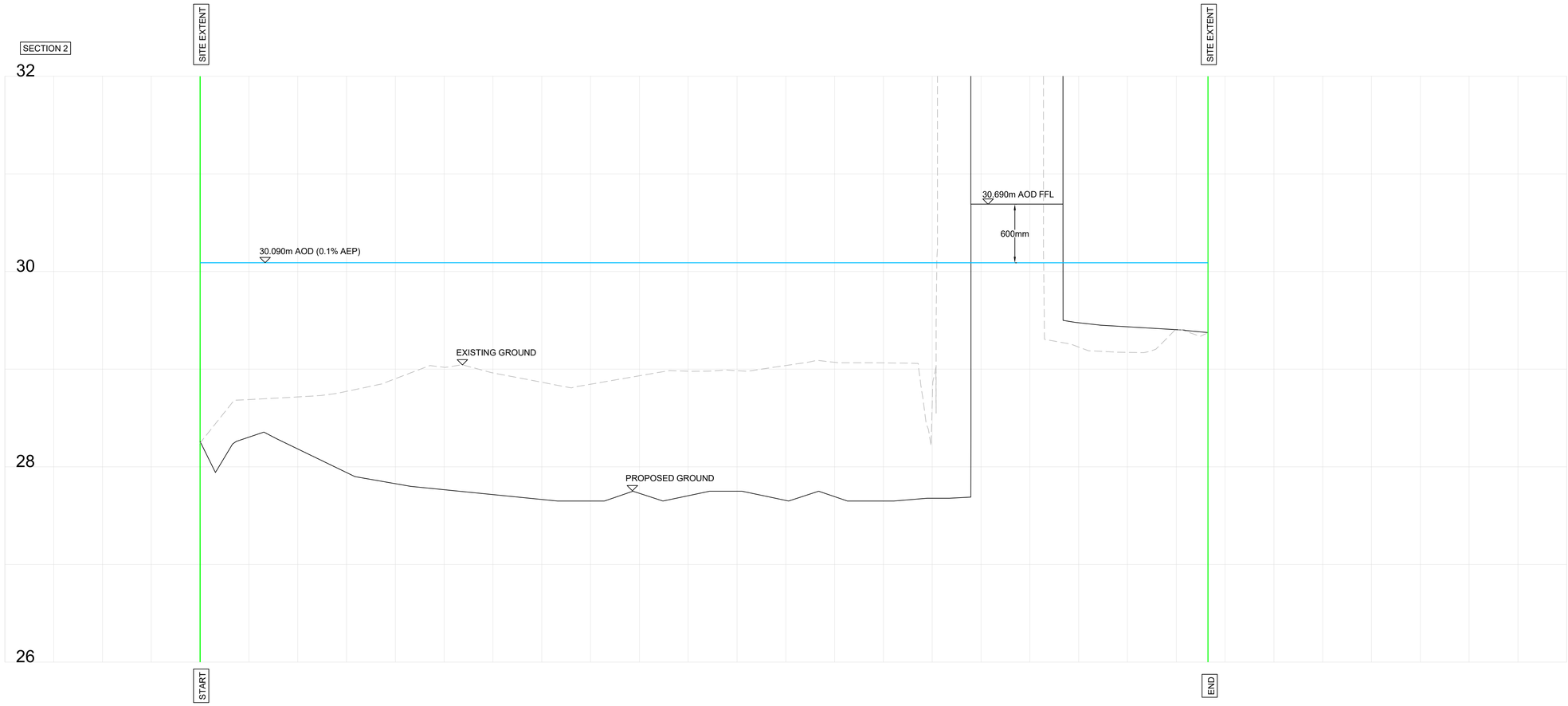
Originator	Job Number	Discipline	Building/Zone
CCE	21724	C	XX

Type	Level	Drawing No.	Revision
DR	XX	00011	P01

SECTION 5



SECTION 2



Rev	Date	Description	By	Check	App.
P01	28.08.26	FOR PLANNING	SJT	CD	CB

COPYRIGHT: THE COPYRIGHT OF THIS DRAWING IS VESTED IN CLANCY CONSULTING.
IT SHALL NOT BE USED WITHOUT PERMISSION BY ANYONE FOR ANY PURPOSE.
DO NOT SCALE THIS DRAWING ELECTRONICALLY OR MANUALLY.
WORK TO FIGURED DIMENSIONS ONLY.
ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
DO NOT TURN ON LAYERS THAT HAVE BEEN TURNED OFF.
DO NOT THAW LAYERS THAT HAVE BEEN FROZEN.

Client: MARCO LIVING 3 LTD.

Project: PALATINE ROAD, DIDSBURY.

Office: MANCHESTER

Discipline: CIVILS

Title: SITE SECTION LINES
SHEET 2

Scale @ A1: 250

Status: PLANNING

clancy consulting
www.clancy.co.uk
Manchester 0161 613 6000 Liverpool 0151 227 3300 London 020 3077 0301 Newcastle 0191 231 0701 Norwich 01603 309 090 Prestwich 01292 475370 Reading 0118 941 1866
Birmingham 0121 250 1900 Glasgow 0141 222 1720

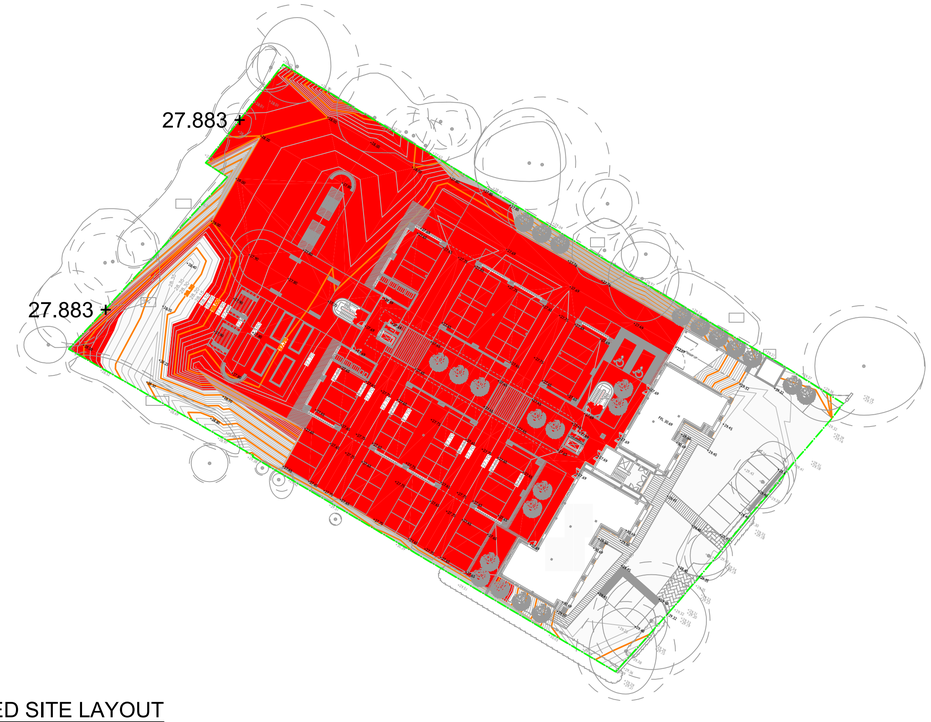
Originator	Job Number	Discipline	Building/Zone
CCE	21724	C	XX
Type	**Level**	**Drawing No.**	**Revision**
DR	XX	00012	P01



EXISTING SITE LAYOUT

FLOODED AREA SHOWN RED BETWEEN LEVEL 27.883 & 28.133m AOD.

VOLUME 7.360m³ (PER BAND).



PROPOSED SITE LAYOUT

FLOODED AREA SHOWN RED BETWEEN LEVEL 27.883 & 28.133m AOD.

VOLUME 1481.710m³ (PER BAND).

PALATINE ROAD FLOOD COMPENSATION MODELLING

	BAND DEPTH (m)	LVL (m AOD)	EXISTING VOLUME FL TO EG (m3)	E - EXISTING VOLUME PER BAND (m3)	PROPOSED VOLUME FL TO PG (m3)	P - PROPOSED VOLUME PER BAND (m3)	BETTERMENT PER BAND P-E (m3)	
LOWEST SITE LEVEL	0.000	27.883	0.000	0.000	0.000	0.000		
	0.250	28.133	7.360	7.360	1481.710	1481.710	1474.350	+
	0.250	28.383	44.910	37.550	2520.090	1038.380	1000.830	+
	0.250	28.633	136.520	91.610	3610.790	1090.700	999.090	+
	0.250	28.883	421.020	284.500	4741.280	1130.490	845.990	+
	0.250	29.133	1135.330	714.310	5864.720	1123.440	409.130	+
	0.250	29.383	2297.380	1162.050	7035.700	1170.980	8.930	+
	0.250	29.633	3606.940	1309.560	8370.570	1334.870	25.310	+
	0.250	29.883	4929.440	1322.500	9743.270	1372.700	50.200	+
0.1% AEP (FLOOD LEVEL)	0.207	30.090	6030.550	1101.110	10879.920	1136.650	35.540	+
						OVERALL BETTERMENT	4849.370	+

Rev	Date	Description	By	Check	App.
P01	28.08.26	FOR PLANNING	SJT	CD	CB

COPYRIGHT: THE COPYRIGHT OF THIS DRAWING IS VESTED IN CLANCY CONSULTING.
IT SHALL NOT BE USED WITHOUT PERMISSION BY ANYONE FOR ANY PURPOSE.
DO NOT SCALE THIS DRAWING ELECTRONICALLY OR MANUALLY.
WORK TO FIGURED DIMENSIONS ONLY.
ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
DO NOT TURN ON LAYERS THAT HAVE BEEN TURNED OFF.
DO NOT THAW LAYERS THAT HAVE BEEN FROZEN.

Client: MARCO LIVING 3 LTD.

Project: PALATINE ROAD, DIDSBURY.

Office: MANCHESTER

Discipline: CIVILS

Title: FLOOD COMPENSATION MODELLING
SHEET 1

Scale @ A1: 1:500

Status: PLANNING

clancy consulting
www.clancy.co.uk
Birmingham 0121 200 3500 · Glasgow 0141 222 2720 · Liverpool 0151 227 5300 · London 020 3377 0970 · Manchester 0161 619 8000 · Newcastle 0191 221 0702 · Norwich 01603 305100 · Prestwich 01204 478375 · Reading 0118 941 7888

Originator	Job Number	Discipline	Building/Zone
CCE	21724	C	XX

Type	Level	Drawing No.	Revision
DR	XX	00001	P01

13.8. Appendix G2 Surface Water Drainage Calculations and Model

© Clancy Consulting 2026

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Detailed	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	1.000	Drain Down Time (mins)	1440	Check Discharge Volume	✓
Winter CV	1.000	Additional Storage (m³/ha)	0.0	100 year 360 minute (m³)	28

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	0	0	0
100	45	0	0

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)	0.345	Storm Duration (mins)	360
Soil Index	1	Betterment (%)	0
SPR	0.10	PR	0.135
CWI	124.580	Runoff Volume (m³)	28

Flow+ v18.0 Copyright © 1988-2026 Causeway Technologies Ltd

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	4.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	200.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
SW 3.0			27.700	600	383597.108	390980.464	0.825	26.875
SW 1.0	0.016	4.00	29.450	600	383581.175	390935.240	1.565	27.885
TANK	0.000	4.00	29.400		383608.465	390960.222	2.583	26.817
SW 1.1	0.017	4.00	29.450	600	383592.299	390947.511	1.731	27.719
SW 1.2	0.015	4.00	29.450	600	383602.136	390964.872	1.930	27.520
SW 1.5 HYDROBRAKE	0.000	4.00	29.300	1200	383617.142	390968.611	2.558	26.742
SW 1.6			29.250	1800	383620.840	390956.894	3.125	26.125
SW 1.3			29.450	600	383605.316	390963.016	1.967	27.483
SW 2.0	0.023	4.00	29.450	600	383593.657	390945.978	1.831	27.619
SUB-BASE STORAGE	0.226	4.00	27.700		383572.411	390981.718	0.500	27.200
SW 2.1	0.023	4.00	29.450	600	383598.508	390954.385	1.928	27.522
SW 2.2	0.022	4.00	29.400	1200	383601.687	390952.560	1.915	27.485
SW 1.4			29.400	600	383612.284	390967.254	2.629	26.771

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
3.000	SUB-BASE STORAGE	SW 3.0	24.729	0.600	27.200	26.875	0.325	76.1	225	4.27	52.8
1.005	SW 1.4	SW 1.5 HYDROBRAKE	5.044	0.600	26.771	26.742	0.029	173.9	225	5.00	52.8
1.006	SW 1.5 HYDROBRAKE	SW 1.6	12.287	0.600	26.742	26.125	0.617	19.9	225	5.07	52.6
2.000	SW 2.0	SW 2.1	9.706	0.600	27.619	27.522	0.097	100.1	150	4.16	52.8
2.001	SW 2.1	SW 2.2	3.651	0.600	27.522	27.485	0.037	98.7	150	4.22	52.8
1.004	TANK	SW 1.4	8.002	0.600	26.817	26.771	0.046	174.0	225	4.92	52.8
2.002	SW 2.2	TANK	10.241	0.600	27.485	27.467	0.018	568.9	150	4.63	52.8
1.000	SW 1.0	SW 1.1	16.563	0.600	27.885	27.719	0.166	99.8	150	4.27	52.8
1.001	SW 1.1	SW 1.2	19.937	0.600	27.719	27.520	0.199	100.2	150	4.61	52.8
1.002	SW 1.2	SW 1.3	3.712	0.600	27.520	27.483	0.037	100.3	150	4.67	52.8

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
3.000	1.500	59.7	43.1	0.275	0.600	0.226	0.0	142	1.630
1.005	0.988	39.3	22.1	2.404	2.333	0.116	0.0	121	1.017
1.006	2.945	117.1	65.0	2.333	2.900	0.342	0.0	120	3.021
2.000	1.004	17.7	4.4	1.681	1.778	0.023	0.0	51	0.833
2.001	1.011	17.9	8.8	1.778	1.765	0.046	0.0	74	1.006
1.004	0.988	39.3	22.1	2.358	2.404	0.116	0.0	121	1.017
2.002	0.414	7.3	13.0	1.765	1.783	0.068	0.0	150	0.422
1.000	1.006	17.8	3.1	1.415	1.581	0.016	0.0	42	0.752
1.001	1.004	17.7	6.3	1.581	1.780	0.033	0.0	62	0.920
1.002	1.003	17.7	9.2	1.780	1.817	0.048	0.0	76	1.011

Flow+ v18.0 Copyright © 1988-2026 Causeway Technologies Ltd

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.003	SW 1.3	TANK	4.210	0.600	27.483	27.467	0.016	263.1	150	4.78	52.8
3.001	SW 3.0	SW 1.5 HYDROBRAKE	23.278	0.600	26.875	26.742	0.133	175.0	225	4.67	52.8

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.003	0.615	10.9	9.2	1.817	1.783	0.048	0.0	106	0.688
3.001	0.985	39.2	43.1	0.600	2.333	0.226	0.0	225	1.003

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
3.000	24.729	76.1	225	Circular	27.700	27.200	0.275	27.700	26.875	0.600
1.005	5.044	173.9	225	Circular	29.400	26.771	2.404	29.300	26.742	2.333
1.006	12.287	19.9	225	Circular	29.300	26.742	2.333	29.250	26.125	2.900
2.000	9.706	100.1	150	Circular	29.450	27.619	1.681	29.450	27.522	1.778
2.001	3.651	98.7	150	Circular	29.450	27.522	1.778	29.400	27.485	1.765
1.004	8.002	174.0	225	Circular	29.400	26.817	2.358	29.400	26.771	2.404
2.002	10.241	568.9	150	Circular	29.400	27.485	1.765	29.400	27.467	1.783
1.000	16.563	99.8	150	Circular	29.450	27.885	1.415	29.450	27.719	1.581
1.001	19.937	100.2	150	Circular	29.450	27.719	1.581	29.450	27.520	1.780
1.002	3.712	100.3	150	Circular	29.450	27.520	1.780	29.450	27.483	1.817
1.003	4.210	263.1	150	Circular	29.450	27.483	1.817	29.400	27.467	1.783
3.001	23.278	175.0	225	Circular	27.700	26.875	0.600	29.300	26.742	2.333

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
3.000	SUB-BASE STORAGE		Junction		SW 3.0	600	Manhole	Adoptable
1.005	SW 1.4	600	Manhole	Adoptable	SW 1.5 HYDROBRAKE	1200	Manhole	Adoptable
1.006	SW 1.5 HYDROBRAKE	1200	Manhole	Adoptable	SW 1.6	1800	Manhole	Adoptable
2.000	SW 2.0	600	Manhole	Adoptable	SW 2.1	600	Manhole	Adoptable
2.001	SW 2.1	600	Manhole	Adoptable	SW 2.2	1200	Manhole	Adoptable
1.004	TANK		Junction		SW 1.4	600	Manhole	Adoptable
2.002	SW 2.2	1200	Manhole	Adoptable	TANK		Junction	
1.000	SW 1.0	600	Manhole	Adoptable	SW 1.1	600	Manhole	Adoptable
1.001	SW 1.1	600	Manhole	Adoptable	SW 1.2	600	Manhole	Adoptable
1.002	SW 1.2	600	Manhole	Adoptable	SW 1.3	600	Manhole	Adoptable
1.003	SW 1.3	600	Manhole	Adoptable	TANK		Junction	
3.001	SW 3.0	600	Manhole	Adoptable	SW 1.5 HYDROBRAKE	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW 3.0	383597.108	390980.464	27.700	0.825	600	1	3.000	26.875	225
						0	3.001	26.875	225
SW 1.0	383581.175	390935.240	29.450	1.565	600	0	1.000	27.885	150

Flow+ v18.0 Copyright © 1988-2026 Causeway Technologies Ltd

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
TANK	383608.465	390960.222	29.400	2.583		1	2.002	27.467	150
						2	1.003	27.467	150
						0	1.004	26.817	225
SW 1.1	383592.299	390947.511	29.450	1.731	600	1	1.000	27.719	150
						0	1.001	27.719	150
SW 1.2	383602.136	390964.872	29.450	1.930	600	1	1.001	27.520	150
						0	1.002	27.520	150
SW 1.5 HYDROBRAKE	383617.142	390968.611	29.300	2.558	1200	1	3.001	26.742	225
						2	1.005	26.742	225
						0	1.006	26.742	225
SW 1.6	383620.840	390956.894	29.250	3.125	1800	1	1.006	26.125	225
SW 1.3	383605.316	390963.016	29.450	1.967	600	1	1.002	27.483	150
						0	1.003	27.483	150
SW 2.0	383593.657	390945.978	29.450	1.831	600	0	2.000	27.619	150
SUB-BASE STORAGE	383572.411	390981.718	27.700	0.500		0	3.000	27.200	225
SW 2.1	383598.508	390954.385	29.450	1.928	600	1	2.000	27.522	150
						0	2.001	27.522	150
SW 2.2	383601.687	390952.560	29.400	1.915	1200	1	2.001	27.485	150
						0	2.002	27.485	150
SW 1.4	383612.284	390967.254	29.400	2.629	600	1	1.004	26.771	225
						0	1.005	26.771	225

Node SW 1.5 HYDROBRAKE Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	26.742	Product Number	CTL-SHE-0087-5000-2508-5000
Design Depth (m)	2.508	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Flow+ v18.0 Copyright © 1988-2026 Causeway Technologies Ltd

Node TANK Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	26.817
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	915

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	88.0	88.0	0.800	88.0	114.6	0.801	0.0	114.6

Node SUB-BASE STORAGE Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	27.200
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	660

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1910.0	1910.0	0.300	1910.0	1956.5	0.301	0.0	1956.5

Flow+ v18.0 Copyright © 1988-2026 Causeway Technologies Ltd

Results for 1 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute summer	SW 3.0	320	26.955	0.080	3.4	0.0226	0.0000	OK
15 minute summer	SW 1.0	10	27.919	0.034	2.0	0.0096	0.0000	OK
480 minute summer	TANK	320	26.955	0.138	3.0	11.5091	0.0000	OK
15 minute summer	SW 1.1	10	27.769	0.050	4.2	0.0140	0.0000	OK
15 minute summer	SW 1.2	10	27.592	0.072	6.1	0.0203	0.0000	OK
480 minute summer	SW 1.5 HYDROBRAKE	320	26.955	0.213	3.4	0.2408	0.0000	OK
480 minute summer	SW 1.6	320	26.151	0.026	3.4	0.0000	0.0000	OK
15 minute summer	SW 1.3	10	27.562	0.079	6.1	0.0224	0.0000	OK
15 minute summer	SW 2.0	10	27.660	0.041	2.9	0.0116	0.0000	OK
360 minute summer	SUB-BASE STORAGE	216	27.237	0.037	7.3	21.0006	0.0000	OK
15 minute summer	SW 2.1	10	27.603	0.081	5.8	0.0230	0.0000	OK
15 minute summer	SW 2.2	10	27.599	0.114	8.6	0.1290	0.0000	OK
480 minute summer	SW 1.4	320	26.955	0.184	1.7	0.0520	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
480 minute summer	SW 3.0	3.001	SW 1.5 HYDROBRAKE	3.3	0.177	0.084	0.6000
15 minute summer	SW 1.0	1.000	SW 1.1	2.0	0.505	0.113	0.0666
480 minute summer	TANK	1.004	SW 1.4	1.7	0.333	0.044	0.2408
15 minute summer	SW 1.1	1.001	SW 1.2	4.2	0.628	0.236	0.1334
15 minute summer	SW 1.2	1.002	SW 1.3	6.1	0.683	0.342	0.0329
480 minute summer	SW 1.5 HYDROBRAKE	1.006	SW 1.6	3.4	1.289	0.029	0.0320
15 minute summer	SW 1.3	1.003	TANK	6.0	0.684	0.555	0.0371
15 minute summer	SW 2.0	2.000	SW 2.1	2.9	0.466	0.163	0.0662
360 minute summer	SUB-BASE STORAGE	3.000	SW 3.0	3.5	0.706	0.058	0.1912
15 minute summer	SW 2.1	2.001	SW 2.2	5.8	0.486	0.322	0.0440
15 minute summer	SW 2.2	2.002	TANK	8.5	0.684	1.157	0.1262
480 minute summer	SW 1.4	1.005	SW 1.5 HYDROBRAKE	1.8	0.157	0.045	0.1858

Flow+ v18.0 Copyright © 1988-2026 Causeway Technologies Ltd

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	SW 3.0	228	27.312	0.437	12.0	0.1237	0.0000	SURCHARGED
15 minute summer	SW 1.0	10	27.965	0.080	7.8	0.0226	0.0000	OK
240 minute winter	TANK	228	27.312	0.495	15.5	41.3498	0.0000	SURCHARGED
15 minute summer	SW 1.1	10	27.948	0.229	15.8	0.0647	0.0000	SURCHARGED
15 minute summer	SW 1.2	10	27.783	0.263	22.0	0.0745	0.0000	SURCHARGED
240 minute winter	SW 1.5 HYDROBRAKE	228	27.311	0.569	11.7	0.6441	0.0000	SURCHARGED
60 minute winter	SW 1.6	39	26.152	0.027	3.6	0.0000	0.0000	OK
15 minute summer	SW 1.3	10	27.685	0.202	21.7	0.0572	0.0000	SURCHARGED
15 minute summer	SW 2.0	11	28.065	0.446	11.1	0.1261	0.0000	SURCHARGED
240 minute winter	SUB-BASE STORAGE	232	27.312	0.112	17.0	64.3350	0.0000	OK
15 minute summer	SW 2.1	11	28.023	0.501	20.9	0.1417	0.0000	SURCHARGED
15 minute summer	SW 2.2	11	27.939	0.454	30.5	0.5138	0.0000	SURCHARGED
240 minute winter	SW 1.4	228	27.312	0.541	7.9	0.1530	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
240 minute winter	SW 3.0	3.001	SW 1.5 HYDROBRAKE	11.7	0.295	0.299	0.9258
15 minute summer	SW 1.0	1.000	SW 1.1	7.6	0.695	0.428	0.2249
240 minute winter	TANK	1.004	SW 1.4	-7.7	0.372	-0.196	0.3182
15 minute summer	SW 1.1	1.001	SW 1.2	14.7	0.837	0.830	0.3510
15 minute summer	SW 1.2	1.002	SW 1.3	21.7	1.230	1.222	0.0653
240 minute winter	SW 1.5 HYDROBRAKE	1.006	SW 1.6	3.6	1.321	0.031	0.0339
15 minute summer	SW 1.3	1.003	TANK	21.4	1.217	1.970	0.0717
15 minute summer	SW 2.0	2.000	SW 2.1	10.1	0.575	0.570	0.1709
240 minute winter	SUB-BASE STORAGE	3.000	SW 3.0	12.0	0.720	0.202	0.7364
15 minute summer	SW 2.1	2.001	SW 2.2	20.2	1.145	1.128	0.0643
15 minute summer	SW 2.2	2.002	TANK	29.7	1.689	4.061	0.1785
240 minute winter	SW 1.4	1.005	SW 1.5 HYDROBRAKE	-7.9	0.278	-0.201	0.2006

Flow+ v18.0 Copyright © 1988-2026 Causeway Technologies Ltd

Results for 100 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	SW 3.0	232	27.367	0.492	13.7	0.1393	0.0000	SURCHARGED
15 minute summer	SW 1.0	11	28.166	0.281	9.8	0.0794	0.0000	SURCHARGED
240 minute winter	TANK	232	27.367	0.550	20.2	45.9699	0.0000	SURCHARGED
15 minute summer	SW 1.1	11	28.116	0.397	18.7	0.1124	0.0000	SURCHARGED
15 minute summer	SW 1.2	11	27.872	0.352	26.5	0.0996	0.0000	SURCHARGED
240 minute winter	SW 1.5 HYDROBRAKE	232	27.367	0.625	13.3	0.7066	0.0000	SURCHARGED
30 minute winter	SW 1.6	21	26.152	0.027	3.6	0.0000	0.0000	OK
15 minute summer	SW 1.3	11	27.732	0.249	25.9	0.0705	0.0000	SURCHARGED
15 minute summer	SW 2.0	11	28.318	0.699	14.1	0.1978	0.0000	SURCHARGED
240 minute winter	SUB-BASE STORAGE	236	27.368	0.168	24.8	96.0590	0.0000	OK
15 minute summer	SW 2.1	11	28.253	0.731	26.2	0.2068	0.0000	SURCHARGED
15 minute summer	SW 2.2	11	28.123	0.638	37.8	0.7216	0.0000	SURCHARGED
240 minute winter	SW 1.4	232	27.367	0.596	9.4	0.1686	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
240 minute winter	SW 3.0	3.001	SW 1.5 HYDROBRAKE	13.3	0.335	0.340	0.9258
15 minute summer	SW 1.0	1.000	SW 1.1	8.7	0.703	0.491	0.2916
240 minute winter	TANK	1.004	SW 1.4	-9.2	0.383	-0.234	0.3182
15 minute summer	SW 1.1	1.001	SW 1.2	17.9	1.019	1.011	0.3510
15 minute summer	SW 1.2	1.002	SW 1.3	25.9	1.473	1.463	0.0653
240 minute winter	SW 1.5 HYDROBRAKE	1.006	SW 1.6	3.6	1.321	0.031	0.0339
15 minute summer	SW 1.3	1.003	TANK	26.1	1.481	2.401	0.0731
15 minute summer	SW 2.0	2.000	SW 2.1	12.6	0.714	0.709	0.1709
240 minute winter	SUB-BASE STORAGE	3.000	SW 3.0	13.7	0.721	0.230	0.8841
15 minute summer	SW 2.1	2.001	SW 2.2	25.1	1.425	1.404	0.0643
15 minute summer	SW 2.2	2.002	TANK	37.0	2.105	5.060	0.1785
240 minute winter	SW 1.4	1.005	SW 1.5 HYDROBRAKE	-9.4	0.249	-0.240	0.2006

Flow+ v18.0 Copyright © 1988-2026 Causeway Technologies Ltd

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.83%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute winter	SW 3.0	585	27.548	0.673	8.6	0.1903	0.0000	FLOOD RISK
15 minute summer	SW 1.0	11	28.663	0.778	14.2	0.2201	0.0000	SURCHARGED
600 minute winter	TANK	585	27.547	0.730	10.7	61.0613	0.0000	SURCHARGED
15 minute summer	SW 1.1	11	28.571	0.852	26.0	0.2411	0.0000	SURCHARGED
15 minute summer	SW 1.2	11	28.112	0.592	36.4	0.1674	0.0000	SURCHARGED
600 minute winter	SW 1.5 HYDROBRAKE	585	27.547	0.805	8.4	0.9108	0.0000	SURCHARGED
30 minute summer	SW 1.6	542	26.152	0.027	3.6	0.0000	0.0000	OK
15 minute summer	SW 1.3	11	27.844	0.361	35.8	0.1021	0.0000	SURCHARGED
15 minute summer	SW 2.0	11	28.964	1.345	20.5	0.3805	0.0000	SURCHARGED
600 minute winter	SUB-BASE STORAGE	585	27.548	0.348	17.3	172.1865	0.0000	FLOOD RISK
15 minute summer	SW 2.1	11	28.840	1.318	36.7	0.3730	0.0000	SURCHARGED
15 minute summer	SW 2.2	11	28.593	1.108	52.5	1.2530	0.0000	SURCHARGED
600 minute winter	SW 1.4	585	27.547	0.776	6.1	0.2197	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
600 minute winter	SW 3.0	3.001	SW 1.5 HYDROBRAKE	8.4	0.212	0.215	0.9258
15 minute summer	SW 1.0	1.000	SW 1.1	11.9	0.711	0.668	0.2916
600 minute winter	TANK	1.004	SW 1.4	6.1	0.340	0.155	0.3182
15 minute summer	SW 1.1	1.001	SW 1.2	24.5	1.394	1.383	0.3510
15 minute summer	SW 1.2	1.002	SW 1.3	35.8	2.036	2.022	0.0653
600 minute winter	SW 1.5 HYDROBRAKE	1.006	SW 1.6	3.6	1.321	0.031	0.0339
15 minute summer	SW 1.3	1.003	TANK	35.9	2.039	3.304	0.0734
15 minute summer	SW 2.0	2.000	SW 2.1	17.3	0.982	0.974	0.1709
600 minute winter	SUB-BASE STORAGE	3.000	SW 3.0	8.6	0.671	0.145	0.9835
15 minute summer	SW 2.1	2.001	SW 2.2	34.6	1.965	1.935	0.0643
15 minute summer	SW 2.2	2.002	TANK	51.2	2.909	6.992	0.1785
600 minute winter	SW 1.4	1.005	SW 1.5 HYDROBRAKE	6.1	0.160	0.155	0.2006

Flow+ v18.0 Copyright © 1988-2026 Causeway Technologies Ltd

13.9. Appendix G3 Existing Drainage Assessment

	Palatine Road Didsbury Existing Drainage	
Date 01/12/2024 File EXISTING SW NET 10 28-1...	Designed by Clancy Consultig... Checked by CD	
XP Solutions	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for EXISTING SW NET 10 28-11-24.SWS

Pipe Sizes SW 28-11-24 Manhole Sizes SW 28-11-24

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.376	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for EXISTING SW NET 10 28-11-24.SWS

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.140	4-8	0.050

Total Area Contributing (ha) = 0.190

Total Pipe Volume (m³) = 2.257

Network Design Table for EXISTING SW NET 10 28-11-24.SWS

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	7.021	0.088	79.8	0.020	5.00	0.0	0.600	o	100	Pipe/Conduit	
1.001	18.287	0.258	70.9	0.020	0.00	0.0	0.600	o	100	Pipe/Conduit	
2.000	17.820	0.246	72.4	0.020	5.00	0.0	0.600	o	100	Pipe/Conduit	
1.002	16.489	0.160	103.1	0.020	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	50.00	5.14	28.380	0.020	0.0	0.0	0.0	0.86	6.8	2.7
1.001	50.00	5.47	28.292	0.040	0.0	0.0	0.0	0.92	7.2	5.4
2.000	50.00	5.33	28.280	0.020	0.0	0.0	0.0	0.91	7.1	2.7
1.002	50.00	5.75	27.984	0.080	0.0	0.0	0.0	0.99	17.5	10.8

©1982-2020 Innovyze

	Palatine Road Didsbury Existing Drainage	
Date 01/12/2024 File EXISTING SW NET 10 28-1...	Designed by Clancy Consultig... Checked by CD	
XP Solutions	Network 2020.1.3	

Network Design Table for EXISTING SW NET 10 28-11-24.SWS

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
3.000	15.577	0.496	31.4	0.020	5.00	0.0	0.600	o	100	Pipe/Conduit	
1.003	18.543	0.180	103.0	0.020	0.00	0.0	0.600	o	150	Pipe/Conduit	
4.000	12.236	0.119	102.8	0.020	5.00	0.0	0.600	o	100	Pipe/Conduit	
4.001	14.273	0.537	26.6	0.020	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.004	24.367	0.269	90.6	0.030	0.00	0.0	0.600	o	225	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)
3.000	50.00	5.19	28.370	0.020	0.0	0.0	0.0	1.38	10.9	2.7
1.003	50.00	6.06	27.824	0.120	0.0	0.0	0.0	0.99	17.5	16.2
4.000	50.00	5.27	28.350	0.020	0.0	0.0	0.0	0.76	6.0	2.7
4.001	50.00	5.43	28.231	0.040	0.0	0.0	0.0	1.50	11.8	5.4
1.004	50.00	6.35	27.569	0.190	0.0	0.0	0.0	1.37	54.6	25.7

©1982-2020 Innovyze

	Palatine Road Didsbury Existing Drainage	
Date 01/12/2024 File EXISTING SW NET 10 28-1...	Designed by Clancy Consultig... Checked by CD	
XP Solutions	Network 2020.1.3	

Manhole Schedules for EXISTING SW NET 10 28-11-24.SWS

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)
1	29.180	0.800	Open Manhole	600	1.000	28.380	100				
2	29.150	0.858	Open Manhole	600	1.001	28.292	100	1.000	28.292	100	
3	29.080	0.800	Open Manhole	600	2.000	28.280	100				
4	29.090	1.106	Open Manhole	600	1.002	27.984	150	1.001	28.034	100	
								2.000	28.034	100	
5	29.170	0.800	Open Manhole	600	3.000	28.370	100				
6	29.210	1.386	Open Manhole	600	1.003	27.824	150	1.002	27.824	150	
								3.000	27.874	100	
7	29.150	0.800	Open Manhole	600	4.000	28.350	100				
8	29.260	1.029	Open Manhole	600	4.001	28.231	100	4.000	28.231	100	
9	29.130	1.561	Open Manhole	600	1.004	27.569	225	1.003	27.644	150	
								4.001	27.694	100	
10	29.250	1.950	Open Manhole	1800		OUTFALL		1.004	27.300	225	

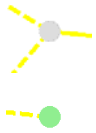
MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
1	383571.967	390940.001	383571.967	390940.001	Required	
2	383577.844	390936.160	383577.844	390936.160	Required	
3	383573.999	390953.756	383573.999	390953.756	Required	
4	383591.102	390948.753	383591.102	390948.753	Required	
5	383588.490	390968.969	383588.490	390968.969	Required	
6	383601.967	390961.157	383601.967	390961.157	Required	
7	383591.441	390988.725	383591.441	390988.725	Required	
8	383601.938	390982.436	383601.938	390982.436	Required	

©1982-2020 Innovyze

	Palatine Road Didsbury Existing Drainage	
Date 01/12/2024 File EXISTING SW NET 10 28-1...	Designed by Clancy Consultig... Checked by CD	
XP Solutions	Network 2020.1.3	

Manhole Schedules for EXISTING SW NET 10 28-11-24.SWS

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
9	383614.185	390975.106	383614.185	390975.106	Required	
10	383638.412	390972.501			No Entry	



©1982-2020 Innovyze

	Palatine Road Didsbury Existing Drainage	
Date 01/12/2024 File EXISTING SW NET 10 28-1...	Designed by Clancy Consultig... Checked by CD	
XP Solutions	Network 2020.1.3	

PIPELINE SCHEDULES for EXISTING SW NET 10 28-11-24.SWS

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	100	1	29.180	28.380	0.700	Open Manhole	600
1.001	o	100	2	29.150	28.292	0.758	Open Manhole	600
2.000	o	100	3	29.080	28.280	0.700	Open Manhole	600
1.002	o	150	4	29.090	27.984	0.956	Open Manhole	600
3.000	o	100	5	29.170	28.370	0.700	Open Manhole	600
1.003	o	150	6	29.210	27.824	1.236	Open Manhole	600
4.000	o	100	7	29.150	28.350	0.700	Open Manhole	600
4.001	o	100	8	29.260	28.231	0.929	Open Manhole	600
1.004	o	225	9	29.130	27.569	1.336	Open Manhole	600

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	7.021	79.8	2	29.150	28.292	0.758	Open Manhole	600
1.001	18.287	70.9	4	29.090	28.034	0.956	Open Manhole	600
2.000	17.820	72.4	4	29.090	28.034	0.956	Open Manhole	600
1.002	16.489	103.1	6	29.210	27.824	1.236	Open Manhole	600
3.000	15.577	31.4	6	29.210	27.874	1.236	Open Manhole	600
1.003	18.543	103.0	9	29.130	27.644	1.336	Open Manhole	600
4.000	12.236	102.8	8	29.260	28.231	0.929	Open Manhole	600
4.001	14.273	26.6	9	29.130	27.694	1.336	Open Manhole	600
1.004	24.367	90.6	10	29.250	27.300	1.725	Open Manhole	1800

Free Flowing Outfall Details for EXISTING SW NET 10 28-11-24.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.004	10	29.250	27.300	0.000	1800	0

©1982-2020 Innovyze

	Palatine Road Didsbury Existing Drainage	
Date 01/12/2024 File EXISTING SW NET 10 28-1...	Designed by Clancy Consultig... Checked by CD	
XP Solutions	Network 2020.1.3	

Simulation Criteria for EXISTING SW NET 10 28-11-24.SWS

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.376		

©1982-2020 Innovyze

	Palatine Road Didsbury Existing Drainage	
Date 01/12/2024 File EXISTING SW NET 10 28-1...	Designed by Clancy Consultig... Checked by CD	
XP Solutions	Network 2020.1.3	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for EXISTING SW NET 10 28-11-24.SWS

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

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.380
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	450.0	DVD Status	ON
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	15 Winter	1	+0%	30/15 Summer	100/15 Summer		
1.001	2	15 Winter	1	+0%	30/15 Summer			
2.000	3	15 Winter	1	+0%	30/15 Summer			
1.002	4	15 Winter	1	+0%	30/15 Summer			
3.000	5	15 Winter	1	+0%	100/15 Summer			
1.003	6	15 Winter	1	+0%	2/15 Winter			
4.000	7	15 Winter	1	+0%	30/15 Summer			
4.001	8	15 Winter	1	+0%	30/15 Summer			
1.004	9	15 Winter	1	+0%	100/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	28.424	-0.056	0.000	0.40			2.4	OK	3
1.001	2	28.352	-0.040	0.000	0.65			4.5	OK	
2.000	3	28.322	-0.058	0.000	0.35			2.4	OK	
1.002	4	28.064	-0.070	0.000	0.55			9.0	OK	
3.000	5	28.403	-0.067	0.000	0.24			2.4	OK	

©1982-2020 Innovyze

	Palatine Road Didsbury Existing Drainage	
Date 01/12/2024 File EXISTING SW NET 10 28-1...	Designed by Clancy Consultig... Checked by CD	
XP Solutions	Network 2020.1.3	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for EXISTING SW NET 10 28-11-24.SWS

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.003	6	27.928	-0.046	0.000	0.82			13.4	OK	
4.000	7	28.396	-0.054	0.000	0.43			2.4	OK	
4.001	8	28.275	-0.056	0.000	0.40			4.5	OK	
1.004	9	27.670	-0.124	0.000	0.41			20.8	OK	

©1982-2020 Innovyze

	Palatine Road Didsbury Existing Drainage	
Date 01/12/2024 File EXISTING SW NET 10 28-1...	Designed by Clancy Consultig... Checked by CD	
XP Solutions	Network 2020.1.3	

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for EXISTING SW NET 10 28-11-24.SWS

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

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.380
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	450.0	DVD Status	ON
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	15 Winter	2	+0%	30/15 Summer	100/15 Summer		
1.001	2	15 Winter	2	+0%	30/15 Summer			
2.000	3	15 Winter	2	+0%	30/15 Summer			
1.002	4	15 Winter	2	+0%	30/15 Summer			
3.000	5	15 Winter	2	+0%	100/15 Summer			
1.003	6	15 Winter	2	+0%	2/15 Winter			
4.000	7	15 Winter	2	+0%	30/15 Summer			
4.001	8	15 Winter	2	+0%	30/15 Summer			
1.004	9	15 Winter	2	+0%	100/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	1	28.431	-0.049	0.000	0.52			3.2	OK
1.001	2	28.364	-0.028	0.000	0.84			5.8	OK
2.000	3	28.328	-0.052	0.000	0.46			3.1	OK
1.002	4	28.079	-0.055	0.000	0.72			11.7	OK
3.000	5	28.408	-0.062	0.000	0.31			3.2	OK

©1982-2020 Innovyze

	Palatine Road Didsbury Existing Drainage	
Date 01/12/2024 File EXISTING SW NET 10 28-1...	Designed by Clancy Consultig... Checked by CD	
XP Solutions	Network 2020.1.3	

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for EXISTING SW NET 10 28-11-24.SWS

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.003	6	27.979	0.005	0.000	1.02			16.8	SURCHARGED
4.000	7	28.404	-0.046	0.000	0.56			3.1	OK
4.001	8	28.283	-0.048	0.000	0.52			5.8	OK
1.004	9	27.685	-0.109	0.000	0.52			26.2	OK

PN	US/MH Name	Level Exceeded
1.000	1	3
1.001	2	
2.000	3	
1.002	4	
3.000	5	
1.003	6	
4.000	7	
4.001	8	
1.004	9	

©1982-2020 Innovyze

	Palatine Road Didsbury Existing Drainage	
Date 01/12/2024 File EXISTING SW NET 10 28-1...	Designed by Clancy Consultig... Checked by CD	
XP Solutions	Network 2020.1.3	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for EXISTING SW NET 10 28-11-24.SWS

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.380
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	450.0	DVD Status	ON
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	15 Winter	30	+0%	30/15 Summer	100/15 Summer		
1.001	2	15 Winter	30	+0%	30/15 Summer			
2.000	3	15 Winter	30	+0%	30/15 Summer			
1.002	4	15 Winter	30	+0%	30/15 Summer			
3.000	5	15 Winter	30	+0%	100/15 Summer			
1.003	6	15 Winter	30	+0%	2/15 Winter			
4.000	7	15 Winter	30	+0%	30/15 Summer			
4.001	8	15 Winter	30	+0%	30/15 Summer			
1.004	9	15 Winter	30	+0%	100/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	1	28.958	0.478	0.000	0.79			4.8	FLOOD RISK
1.001	2	28.908	0.516	0.000	1.28			8.8	FLOOD RISK
2.000	3	28.644	0.264	0.000	0.75			5.1	FLOOD RISK
1.002	4	28.518	0.384	0.000	1.11			18.0	SURCHARGED
3.000	5	28.457	-0.013	0.000	0.56			5.8	OK

©1982-2020 Innovyze

	Palatine Road Didsbury Existing Drainage	
Date 01/12/2024 File EXISTING SW NET 10 28-1...	Designed by Clancy Consultig... Checked by CD	
XP Solutions	Network 2020.1.3	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for EXISTING SW NET 10 28-11-24.SWS

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.003	6	28.322	0.348	0.000	1.70			27.9	SURCHARGED
4.000	7	28.479	0.029	0.000	1.02			5.7	SURCHARGED
4.001	8	28.359	0.028	0.000	1.02			11.5	SURCHARGED
1.004	9	27.743	-0.051	0.000	0.94			47.4	OK

PN	US/MH Name	Level Exceeded
1.000	1	3
1.001	2	
2.000	3	
1.002	4	
3.000	5	
1.003	6	
4.000	7	
4.001	8	
1.004	9	

©1982-2020 Innovyze

	Palatine Road Didsbury Existing Drainage	
Date 01/12/2024 File EXISTING SW NET 10 28-1...	Designed by Clancy Consultig... Checked by CD	
XP Solutions	Network 2020.1.3	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for EXISTING SW NET 10 28-11-24.SWS

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

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.380
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	450.0	DVD Status	ON
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	15 Winter	100	+0%	30/15 Summer	100/15 Summer		
1.001	2	15 Winter	100	+0%	30/15 Summer			
2.000	3	15 Winter	100	+0%	30/15 Summer			
1.002	4	15 Winter	100	+0%	30/15 Summer			
3.000	5	15 Winter	100	+0%	100/15 Summer			
1.003	6	15 Winter	100	+0%	2/15 Winter			
4.000	7	15 Winter	100	+0%	30/15 Summer			
4.001	8	15 Winter	100	+0%	30/15 Summer			
1.004	9	15 Winter	100	+0%	100/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	1	29.180	0.700	0.400	1.15			7.1	FLOOD
1.001	2	29.143	0.751	0.000	1.53			10.6	FLOOD RISK
2.000	3	29.002	0.622	0.000	0.95			6.5	FLOOD RISK
1.002	4	28.814	0.680	0.000	1.24			20.1	FLOOD RISK
3.000	5	28.755	0.285	0.000	0.64			6.6	FLOOD RISK

©1982-2020 Innovyze

	Palatine Road Didsbury Existing Drainage	
Date 01/12/2024 File EXISTING SW NET 10 28-1...	Designed by Clancy Consultig... Checked by CD	
XP Solutions	Network 2020.1.3	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for EXISTING SW NET 10 28-11-24.SWS

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.003	6	28.568	0.594	0.000	1.98			32.5	SURCHARGED
4.000	7	28.764	0.314	0.000	1.24			7.0	FLOOD RISK
4.001	8	28.594	0.263	0.000	1.17			13.1	SURCHARGED
1.004	9	27.844	0.050	0.000	1.09			54.9	SURCHARGED

PN	US/MH Name	Level Exceeded
1.000	1	3
1.001	2	
2.000	3	
1.002	4	
3.000	5	
1.003	6	
4.000	7	
4.001	8	
1.004	9	

©1982-2020 Innovyze

13.10. Appendix H Drainage Maintenance & Management Plan (O&M)

Gullies

Description

Surface Water is drained over impermeable areas towards grated gullies at low points and water is carried to below ground pipework.

Maintenance Issues

Gullies can become blocked by silt or debris, causing flooding.

Gullies include integral silt traps which can cause siltation of downstream drainage infrastructure if the appropriate maintenance is not undertaken.

Gullies frequently include a trapped outlet which prevents liquids lighter than water (ie oil and fuel) departing the gully. If silt and light liquids do not get removed regularly silt and oil will move downstream to other areas of the drainage network, some of which may be difficult to access, or totally inaccessible.

Maintenance Regime

Schedule	Action Required	Frequency
Routine/regular maintenance (inc. inspections and monitoring)	Inspect to ensure that there are no blockages at surface level, and that the outfall is operating efficiently. Inspect and identify any parts that are not operating correctly and resolve.	For 3 months after installation
	Check that there are no blockages at surface level.	Monthly
	Remove covers to check for blockages or siltation.	Every 6 months and following the leaf fall in autumn.
Occasional maintenance	Remove oil and silt using specialist vacuum extraction plant.	1 – 2 Years
Remedial maintenance	• Silt removal • Inlet/outlet repair • Erosion repairs • System rehabilitation following a pollution event • Cover replacement • Structural failure of gully pot • Ensure that impermeable surfaces surrounding linear drains have not settled below top of gully cover level, causing ponding	When required (tasks to repair problems due to wear, damage or vandalism)

Pipework

Description

Below ground drainage pipework connects drainage inlets (gullies, linear drains etc) to manholes as well as providing connections between manholes.

Maintenance Issues

Pipes could become blocked by silt, debris fat, grease, or collapse. In addition, it's possible for pipe joints to become displaced or for roots to grow from the surrounding ground into the pipes.

These factors can cause a reduction in, or loss of, the hydraulic capability of the pipes which could cause flooding to land and buildings.

Defects in pipes could cause a reduction in stability to ground underlying foundations, thus, causing settlement and damage to buildings and external surfaces.

The material of pipes and associated couplings can be damaged if aggressive liquids are passed through the pipes.

It is recommended that trees are not planted within 3m of pipes to reduce the risk of root ingress.

Maintenance Regime

Schedule	Action Required	Frequency
Routine/regular maintenance (inc. inspections and monitoring)	Inspect and identify any parts that are not operating correctly and resolve.	For 3 months after installation.
	Monitor working of drainage at ground level. The indications damaged pipework's may include localised flooding or emission of smells.	Monthly
	Remove manholes covers to check for blockages.	Every 6 months
Occasional maintenance	CCTV pipework, clean to WRC Sewer Jetting Code of Practice. Resolve issues as appropriate.	1 – 2 Years
Remedial maintenance	• Silt removal. • Fat and Grease removal. • Erosion repairs. • Joint displacement. • Structural failure, cracking or collapse. • System rehabilitation following a pollution event.	When required (tasks to repair problems due to wear, damage or vandalism)

Vortex Controls

Description

Vortex controls, often called Hydrobrakes, are installed in some manholes to limit the rate of flow. Vortex controls are normally constructed in steel and installed in a manhole with a sump.

Maintenance Issues

Vortex controls could become blocked by debris, plastic bags or other sheet material. If silt is allowed to build up in the sump the operation of the device could be impeeded causing flooding upstream.

Maintenance Regime

Schedule	Action Required	Frequency
Routine/regular maintenance (inc. inspections and monitoring)	Check manufacturer's specification. Inspect and identify any parts that are not operating, consult supplier and remediate as required.	For 3 months after installation
	Monitor working of drainage at ground level. Where localised flooding occurs, check the condition of all system elements.	Monthly
	Remove manholes covers to check for blockages. Remove sediment from pre-treatment structures, gullies, catchpits etc.	Every 6 months and following the leaf fall in autumn.
Occasional maintenance	Clean to WRC Sewer Jetting Code of Practice. Resolve issues as appropriate.	1 – 2 Years
Remedial maintenance	Inspect, and remedy to ensure that the features are in fully working order.	As required (tasks to repair problems due to wear, damage or vandalism).

Geocellular Attenuation Storage

Description

Attenuation storage tanks are used to create a below-ground space for the temporary storage of surface water before infiltration, controlled release or use. Geocellular storage crates are advantageous as they allow for spatial versatility as opposed to in situ concrete tanks.

Maintenance Issues

For Geocellular attenuation tanks typical issues relate to the build-up of silt within the tank, causing a decrease in capacity over time.

Maintenance Regime

Schedule	Action Required	Frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. Take remedial action as appropriate	For 3 months after installation, then annually.
	Remove debris from the catchment surface (where it may cause a risk to performance)	Monthly
	For systems where rainfall infiltrate into the tank from above, check surface of filter for blockage by sediment, algae or other matter. Remove blockage and replace surface infiltration medium as appropriate.	Annually
	Remove Sediment from pre-treatment structures and/or internal forebays.	Annual, or as needed
Remedial Actions	Repair/rehabilitate inlets, outlets, overflows and vents.	As needed
Monitoring	Check all inlets, outlets, vents and overflows to ensure that they are working as designed.	Annually
	Survey inside of tank for sediment build-up and remove as appropriate.	Every 5 years or as needed.

Permeable Pavements

Description

Pervious pavements provide a pavement suitable for pedestrian and vehicular traffic, while allowing rainwater to infiltrate through the surface and into the underlying structural layers. The water is temporarily stored beneath the overlying surface and into the underlying structural layers.

Maintenance Issues

For permeable pavements typical issues relate to the build-up of silt within the voids, causing a decrease in capacity and porosity over time.

Maintenance Regime

Schedule	Action Required	Frequency
Regular Maintenance	Surface brushing for appearance and to reduce silt accumulation.	Monthly
	Brushing and suction sweep or jet wash and suction sweep particularly for block pavement in autumn after leaf fall.	Annually
	Mow grass edges to paving at 35-50mm and remove weeds and leaves.	As required
	Check outlets and control structures.	Monthly depending on detail
Occasional tasks	Jetting and suction where silt has accumulated in joints or voids. Replace grit and vibrate surface to lock for permeable block paving	As required
Remedial Work	Where sinkage or surface damage occurs uplift blocks, remove grit bedding layer, geotextile if present and reinstate to design profile	As required

Table XX – Permeable Pavements Maintenance Information (Anglian Water Sustainable drainage systems (SuDS) adoption Manual)

Rain Garden

Description

Rain Gardens are landscaped depressions which allow runoff to pond temporarily on the surface, before filtering through vegetation and underlying soils prior to collection or infiltration. Rain gardens provide visual, ecological and biodiversity benefits as well as providing a small level of attenuation to the drainage system by collecting the first 5mm of a storm event.

Maintenance Issues

Rain gardens will require regular maintenance, with vegetation to be pruned and weeded on weekly or fortnightly basis during the growing season.

Maintenance during the rain garden establishment period is most likely undertaken by an appointed maintenance company.

Activity	Action Required	Frequency
Regular inspections	Inspect all components, including where appropriate, soil substrate, vegetation, drains, irrigation systems and membranes for accurate operation and reliability of waterproofing.	On an annual basis and after severe storms
	Inspect soil substrate for evidence of erosion channels and determine any sediment sources	On an annual basis and after severe storms
	Inspect drain inlets to ensure clear runoff from the drainage layer to main drainage network	On an annual basis and after severe storms
Regular Maintenance	Remove debris and litter to avert clogging of inlet drains and obstruction by plant growth	6 monthly, annually or as required
	During establishment (first year and dry spells), replace dead plants and mulch as needed.	Monthly (but usually responsibility of manufacturer)
	After establishment, replace dead plants as required (where > 5% of coverage)	On an annual basis in autumn
	Remove debris from deciduous plant foliage	6 monthly or as required
	Remove nuisance and invasive foliage, including weeds	6 monthly or as required
	Mow grasses, prune shrubs and manage other planting (as necessary).	6 monthly or as required
	Water the rain garden during dry spells to promote plant growth (especially during first two years).	As required
	If erosion channels are evident, these should be stabilised with extra soil substrate like the original material, and sources of erosion damage should be identified and controlled.	As appropriate

Remedial actions	If drain inlet has settled, cracked or moved, investigate and resolve as necessary.	As appropriate

Pumped Systems

Description

Pumped systems come in the form of package pump systems, sump pumps, or stand alone products. The need for a pump comes when a pipe falling by gravity is too deep when compared to the outfall.

Maintenance Issues

It is recommended that maintenance is proactive, rather than reactive. The party responsible for maintenance, usually the owner or occupier, should consult the manufacturer to identify a suitable maintenance regime.

Maintenance Regime

Activity	Action Required	Frequency
Routine/regular maintenance (inc. inspections and monitoring)	Check manufacturer's specification. Inspect and identify any parts that are not operating correctly. Take remedial action as appropriate	For 3 months after installation
	Monitor working of drainage at ground level. Where localised flooding occurs, check the condition of all system elements.	Monthly
Routine/regular maintenance (inc. inspections and monitoring)	• Check manufacturer's specification • Check the function of the warning device (if fitted)	Every 6 months and following the leaf fall in autumn.
Occasional maintenance	• Check manufacturer's specification. • Check watertightness of system • Check structural condition • Check internal coatings • Check built-in parts • Check electrical devices and installations	5 Yearly maximum
Remedial maintenance	Inspect, and carry out remedial actions to ensure that the features are in working order.	As required

Manholes and Inspection Chambers

Description

Manholes providing rodding and jetting access to pipe work.

Normally manholes, in similarity to inspection chambers, are designed for access by operatives. Manholes must only be accessed after a risk assessment, and the implementation of a safe system of work, which identifies the specific risk to confined space.

Maintenance Issues

It is not likely that Manholes will present maintenance issues. However, they allow both the access to the drainage infrastructure and allow visual inspection from the surface of any key maintenance issues.

Schedule	Action Required	Frequency
Routine/regular maintenance (inc. inspections and monitoring)	Remove covers and ensure that there are no blockages. Inspect and ascertain any parts that are not operating correctly and resolve.	For 3 months after installation
	Check covers do not need repairing.	Monthly
	Check drainage is running freely by inspecting manholes and inspection chambers.	Every 6 months and following the leaf fall in autumn.
Occasional maintenance	Suction jetting and cleansing (to Water Jetting Association standards) and CCTV where appropriate.	2 – 4 Years
Remedial maintenance	• Silt removal • Inlet/outlet repair • Erosion repairs • System recovery following a pollution event • Manhole Cover replacement • Repairs to brickwork or concrete • Chanel repair	When required (tasks to repair problems due to wear, damage or vandalism)

Linear Drains

Description

Surface Water is drained over impermeable sections towards grated, or slot-type linear drains at low points and water is carried to below ground pipework.

Maintenance Issues

Linear drains could get blocked by silt or debris, causing flooding.

Linear drains frequently include silt traps at outlets which can cause siltation of downstream drainage infrastructure if the appropriate maintenance is not undertaken.

Maintenance Regime

Schedule	Action Required	Frequency
Routine/regular maintenance (inc. inspections and monitoring)	Inspect linear drains to make sure that there are no blockages at surface level. Remove covers to outflow boxes and check for blockages or siltation. Inspect and identify any parts that are not operating correctly and resolve.	For 3 months after installation
	Inspect linear drains to make sure that there are no blockages at surface level.	Monthly
	Remove covers to outflow boxes and check for blockages or siltation.	Every 6 months and following the leaf fall in autumn.
Occasional maintenance	Jetting of linear drains and suction vacuuming of outlet boxes (to Water Jetting Association standards) and CCTV where appropriate.	1 – 2 Years
Remedial maintenance	• Silt removal • Inlet/outlet repair • Erosion repairs • System rehabilitation following a pollution event • Linear drain cover replacement • Chanel repair • Ensure that impermeable surfaces surrounding linear drains have not settled below top of linear drain level, causing ponding	When required (tasks to repair problems due to wear, damage or vandalism)

13.11. Appendix I Sequential Test

© Clancy Consulting 2026

AshtonHale

Sequential Test for Flood Risk Assessment

232-236 Palatine Road, Didsbury

1.1 This note has been prepared on behalf of Marco Living in relation to the proposed redevelopment of 232-236 Palatine Road, Didsbury ("the Site") for residential use. It considers alternative sites for the development in the context of the flood risk and sequential approach set out in planning policy.

1.2 The site is currently occupied by 3 detached houses which have been converted and extended to accommodate 22 separate apartments in total. It is proposed to demolish the existing buildings and create 83 no. apartments, and 5 no. townhouses.

Planning Policy Context

1.3 Paragraph 181 of the National Planning Policy Framework states:

> *When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:*
>
> *a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;*
> *b) the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;*
> *c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;*
> d) any residual risk can be safely managed; and
> e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

1.4 Paragraph 174 of the NPPF states:

[The] aim of the sequential test is to steer new development to areas with the lowest risk of flooding from any source. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying this test.

1.5 Paragraph 175 further notes:

The sequential test should be used in areas known to be at risk now or in the future from any form of flooding, except in situations where a site-specific flood risk assessment demonstrates that no built development within the site boundary, including access or escape routes, land raising or other potentially vulnerable elements, would be located on an area that would be at risk of flooding from any source, now and in the future (having regard to potential changes in flood risk).

1.6 Planning Practice Guidance 'The sequential approach to the location of development' provides further guidance on the matter. It states:

"Where it is not possible to locate development in low-risk areas, the Sequential Test should go on to compare reasonably available sites:

- *Within medium risk areas; and*
- *Then, only where there are no reasonably available sites in low and medium risk areas, within high-risk areas[1].*

1.7 With reference to who has responsibility for deciding whether the Sequential Test is passed, it states:

Relevant decision makers need to consider whether the test is passed, with reference to the information it holds on land availability. The planning authority will need to determine an appropriate area of search, based on the development type proposed and relevant spatial policies. The applicant will need to identify whether there are any other 'reasonably available' sites within the area of search, that have not already been identified by the planning authority in site allocations or relevant housing and/or economic land availability assessments, such as sites currently available on the open market.

1.8 PPG defines 'reasonably available sites'[2] if they ''*are able to meet the same development needs and they have a reasonable prospect of being developed at the same time as the proposal. In considering whether alternative lower-risk sites (which could, where relevant, be a series of two or more smaller sites) would be capable of accommodating the proposed development, such alternative sites do not need to be owned by the applicant to be considered 'reasonably available''*.

1.1 ———————————

1.1 [1] Paragraph: 024 Reference ID: 7-024-20220825
1.2 [2] Paragraph: 028 Reference ID: 7-028-20220825

1.9 The remainder of this document undertakes the exercise in line with the methodology described above.

Area of Search

1.10 It has been agreed with Manchester City Council that the appropriate search area for other suitable alternative sites for the development proposed on the Site would be the West Didsbury Ward. The Ward Boundary is indicated on the attached Plan (Appendix I).

Reasonably Available Sites Allocated in Adopted Development Plans

1.11 The Proposals Map at Appendix II shows allocations in Places for Everyone (adopted 2024), the Core Strategy (adopted 2012) and any saved from the Unitary Development Plan (UDP).

1.12 It can be seen that no 'New Housing' sites are located within the West Didsbury ward. As such, it can be concluded there are no reasonably available sites identified in Adopted Development Plans.

Reasonably Available Sites Identified in Land Availability Assessments

1.13 The most recent Strategic Housing Land Availability Assessment was published in 2025. A map of the identified sites within the West Didsbury Ward is shown at Appendix III, outlined in light blue.

1.14 Out of 17 sites:

- 4 are 'under construction', and are therefore not reasonably available
- 2 are 'capacity sites', i.e. do not have planning permission but could have the potential to be developed for housing
- 11 have planning permission for residential development

1.15 The 13 sites that could reasonably be available are set out below with their assessed capacity.

1. Land to the South of Cavendish Road- 2 dwellings
2. 19 Old Lansdowne Road- 1 dwelling
3. 78 Clyde Road- 2 dwellings
4. Former Car Park area of Greenfinch pub (now Wren House), 108 Palatine Road- 37 dwellings
5. 101A Lapwing Lane Manchester- 1 dwelling
6. 129 Barlow Moor Road- 1 dwelling
7. 123 Barlow Moor Road- 4 dwellings
8. Land Between 2A Crossway And 15 Barlow Moor Road- 1 dwelling
9. First Floor Barlow House 708 - 716 Wilmslow Road- 6 dwellings

10. 758A Wilmslow Road M20 2DW- 3 dwellings
11. 246 Palatine Road- 1 dwelling
12. 95 Palatine Road- 24 dwellings (capacity site)
13. 232-236 Palatine Road- 35 dwellings (capacity site)

1.16 The application site is identified within Manchester City Council's most recent Strategic Housing Land Availability Assessment with an indicative capacity of approximately 35 dwellings. It is important to note that SHLAA capacity assumptions are produced at a high-level and are intended to provide a broad indication of potential housing supply across the city, rather than to prescribe the quantum of development that may ultimately come forward through the planning application process.

1.17 In this case, the proposed development of 88 no. residential units reflects a more efficient and sustainable use of the site , consistent with the objectives of the National Planning Policy Framework to make effective use of land and to significantly boost the supply of homes. The scheme has been informed by a comprehensive appraisal of site constraints and opportunities, including flood risk, access, urban design, and amenity considerations.

1.18 The uplift from the SHLAA capacity figure does not represent an overdevelopment of the site, but rather a refinement based on detailed technical work and design development. The proposed density is appropriate to the site's context, accessibility, and policy framework, and delivers a significantly more efficient use of land while remaining fully compliant with flood risk policy and wider planning considerations.

1.19 Accordingly, the SHLAA capacity of 35 dwellings should be treated as a baseline or starting point for assessment, rather than a fixed quantum. The proposed scheme demonstrates that a higher density development can be successfully accommodated on the site in a safe, sustainable, and policy compliant manner.

Assessment of Need and Demand

1.20 The Places for Everyone Plan, adopted in March 2024, provides the following commentary on the housing market in South Manchester:

> "4.60 The southern areas of Greater Manchester are *typically characterised by high levels of demand and forecast growth and include some of the city region's most popular neighbourhoods. Large parts of the south, extending into north Cheshire, have high house prices and relatively high household incomes, but also significant issues of affordability."*

1.21 In summary, property in South Manchester is highly sought after and the market is very competitive. It is clear from the above exercise that there are very limited sites available for major residential development in the West Didsbury Ward. A major development of the scale proposed will increase the housing stock in the area, diversify the offer, and help address affordability issues by increasing supply.

1.22 The Manchester Housing Need Assessment 2023 is the most up to date study prepared by Manchester City Council to address housing need and demand.

1.23 The table below identifies the need in South Manchester by number of bedrooms:

Table ES4 Summary of overall dwelling mix by tenure : South Manchester

Number of bedrooms	Market	Social/ Affordable Rented	Affordable Home Ownership	Total
1	2-5%	20-25%	5-10%	5-10%
2	30-35%	50-55%	45-50%	35-40%
3	45-50%	20-25%	40-45%	40-45%
4 or more	15-20%	2-5%	0-2%	10-15%
Overall need for level-access dwellings	10-15%	25-30%	15-20%	15-20%

1.24 This identifies a high need for 2 and 4-bedroom dwellings, which collectively account for 94% and 6% of the proposed scheme. As such, it can be concluded that the proposed development on this site would address the dwelling mix identified as in need in South Manchester.

Exception Test

1.25 Where it is not possible to direct development to an area at lower risk of flooding, the Exception Test must be applied, supported by appropriate mitigation measures.

1.26 As set out in the NPPF, the purpose of the Exception Test is to demonstrate that, where sites at lower flood risk are not available, flood risk to people and property can be managed satisfactorily. To satisfy the test, it must be shown that:

- the development will deliver wider sustainability benefits to the community and the wider area that outweigh the flood risk; and
- the development will be safe for its lifetime, taking account of the vulnerability of its users, without increasing flood risk elsewhere and, where possible, will reduce flood risk overall.

1.27 The wider sustainability benefits of the proposed development, which satisfy the first limb of the Exception Test, are set out within the accompanying Planning Statement and include the efficient redevelopment of a previously developed residential site, the delivery of additional homes in a highly sustainable location, and a contribution towards identified housing need in South Manchester.

1.28 These benefits are considered to outweigh the flood risk, particularly where the development is supported by the mitigation measures set out in the accompanying Flood Risk and Drainage Report.

1.29 As detailed within the technical documents supporting this submission, a number of flood mitigation measures have been implemented to ensure the development is safe for its lifetime whilst avoiding increasing overall flood risk. The site is at low risk of flooding from all forms of flooding except fluvial flooding for which the measures above have been incorporated to mitigate the level of overall flood risk associated with the development.

For further details of mitigation measures applied to this development, please refer to the Flood Risk & Drainage Report prepared by Clancy Consulting.

Conclusion

1.30 The above analysis has demonstrated that there are no suitable or available sites in the defined search area of the West Didsbury Ward to accommodate the proposed development either together or in their distinct parts. The site has additionally been recognised within the latest SHLAA as a Capacity Site, capable of accommodating future housing requirements.

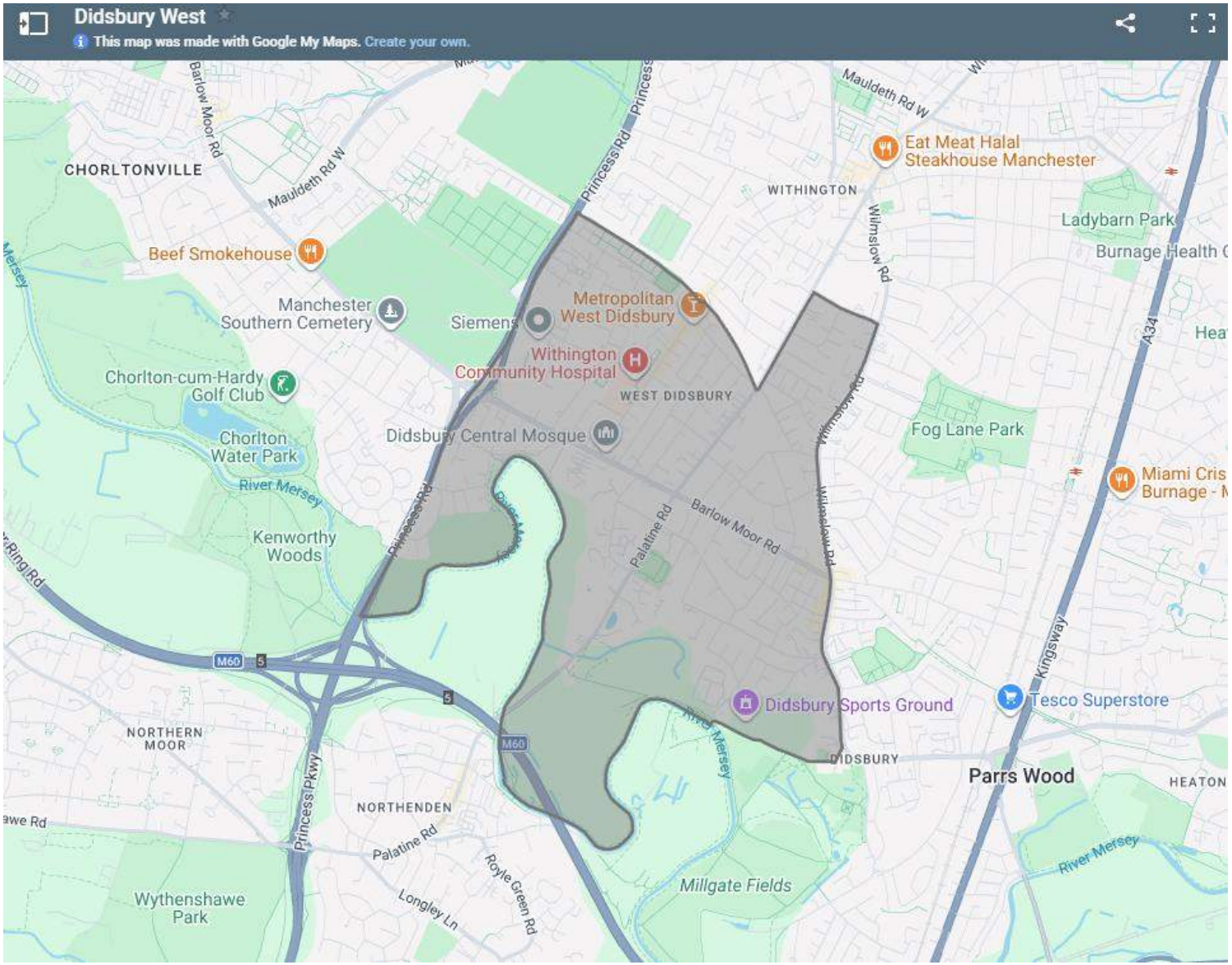
1.31 This is a site already used for residential development, and which is immediately adjacent to a block of apartments which are occupied at ground-floor level.

1.32 The proposed development addresses the high demand and identified need in terms of dwelling mix in the South Manchester area.

1.33 In the event of planning permission not being granted to redevelop the site, it will remain in its current state and an opportunity to improve the quality of the accommodation, the visual amenities of the area and the flood protection measures on site will be lost.

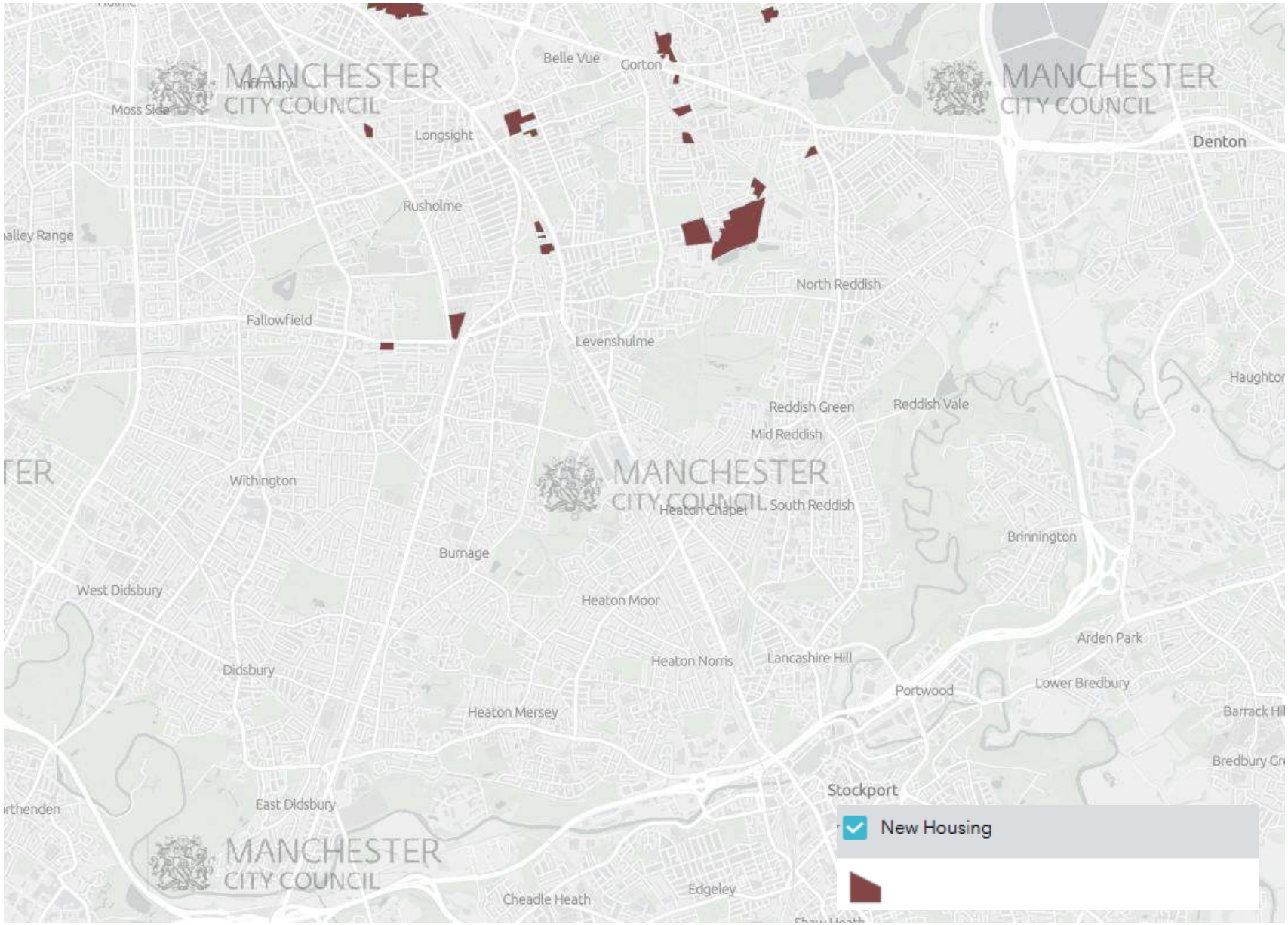
Appendix I

West Didsbury Ward Boundary Map


Didsbury West
This map was made with Google My Maps. Create your own.
CHORLTONVILLE
Barlow Moor Rd
Mauldeth Rd W
Princess Rd
Eat Meat Halal Steakhouse Manchester
WITHINGTON
Ladybarn Park
Burnage Health
Wilmslow Rd
Beef Smokehouse
Manchester Southern Cemetery
Siemens
Metropolitan West Didsbury
Withington Community Hospital
WEST DIDSBURY
A34
Chorlton-cum-Hardy Golf Club
Didsbury Central Mosque
Fog Lane Park
Chorlton Water Park
River Mersey
Palatine Rd
Barlow Moor Rd
Miami Cris
Burnage - M
Kenworthy Woods
Ring Rd
M60
Didsbury Sports Ground
Tesco Superstore
Kingsway
NORTHERN MOOR
DIDSBURY
Parrs Wood
HEATON
NORTHENDEN
Princess Pkwy
Palatine Rd
Royle Green Rd
Longley Ln
Millgate Fields
Wythenshawe Park

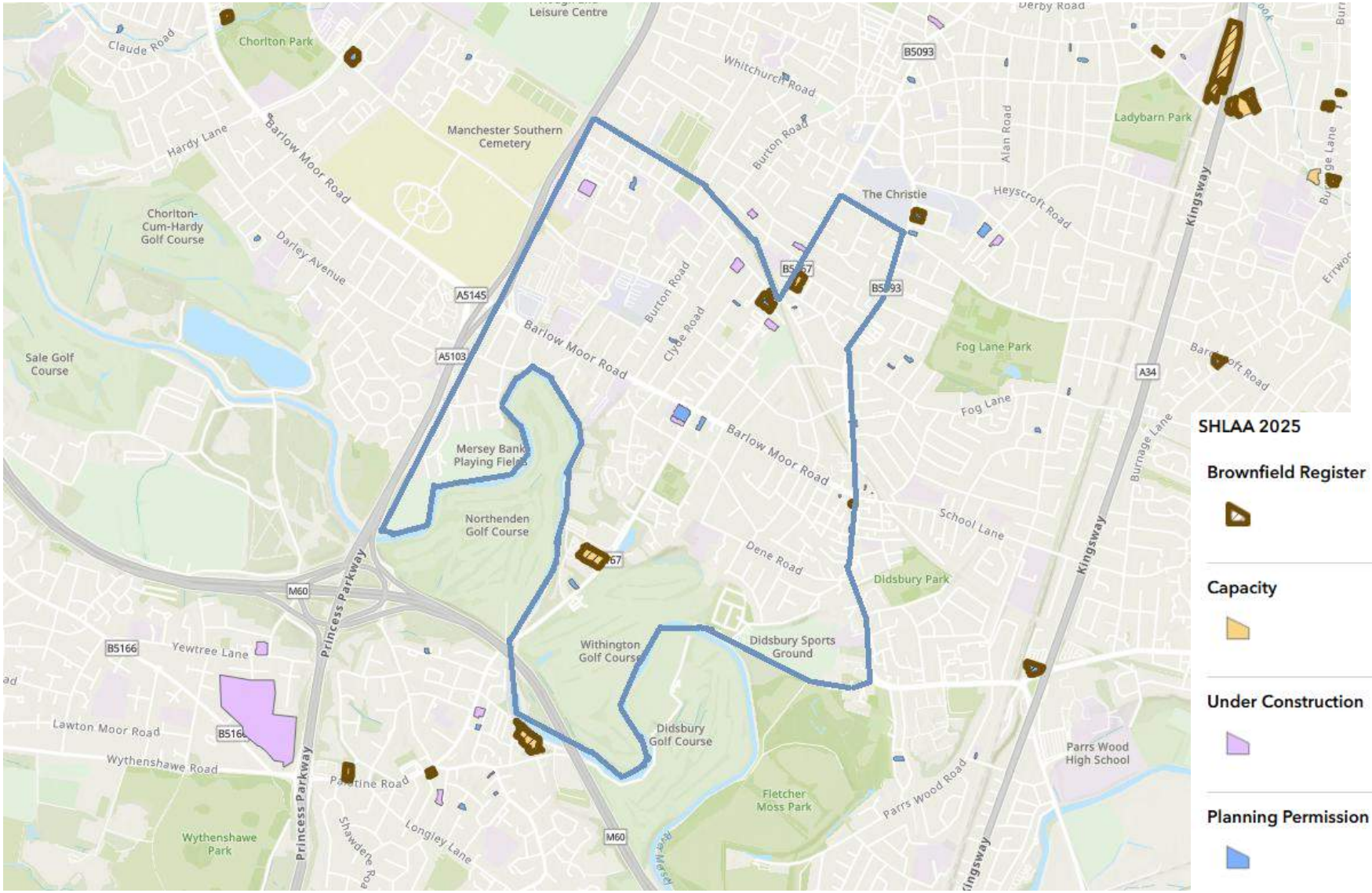
Appendix II

Proposals Map Extract


MANCHESTER
CITY COUNCIL
Belle Vue
Gorton
Moss Side
Longsight
Rusholme
Denton
North Reddish
Fallowfield
Levenshulme
Reddish Green
Reddish Vale
Mid Reddish
Withington
Heaton Chapel
South Reddish
Brinnington
Burnage
West Didsbury
Heaton Moor
Arden Park
Heaton Norris
Lancashire Hill
Didsbury
Portwood
Lower Bredbury
Heaton Mersey
Barrack Hill
Stockport
East Didsbury
Cheadle Heath
Edgeley
New Housing

Appendix III

SHLAA Map Extract



SHLAA 2025

Brownfield Register

Capacity

Under Construction

Planning Permission

13.12. Appendix J Flood Warning and Evacuation Plan

clancy consulting



232-236 Palatine Road, Didsbury

Flood Warning & Evacuation Plan

Project No: 1/21724
Date: 21/08/2026
Rev: 00
Ref: 21724-CCL-XX-XX-RP-C-02501

Carl Dawson
Principal Civil Engineer
Carl.dawson@clancy.co.uk
0161 613 6019

enquiries@clancy.co.uk
www.clancy.co.uk

Clancy Consulting Limited
4th Floor,
Windmill Green,
24 Mount Street,
Manchester,
M2 3NX

Caveat

This document has been prepared for the titled project, or named part thereof, and should not be relied upon or used for any other project, or part, without an independent check being made on it. Clancy Consulting Engineering Ltd (CCE Ltd) shall not be liable for the consequences of using this document other than for the purpose for which it was commissioned, and any user and any other person using or relying on this document for such other purpose, agrees and will be such use or reliance be taken to confirm this agreement to indemnify Clancy Consulting Engineering Ltd (CCE Ltd) for all loss or damage resulting therefrom.

Document Origin

Revision	Date	Revision Description		Name	Signature
00	21/08/26	Issued for Planning	Prepared	Carl Dawson	
			Checked	Carl Bebbington BSc (Hons), MSc, CEng MIStructE	
			Approved	Daniel Singh	

Contents

1 Introduction 4
1.1 Purpose of this Report 4
1.2 Structure of this Report 4
1.3 Relevant Documents 4
2 Site Details 6
2.1 Site Location 6
2.2 Flood Risk 6
2.3 Flood Risk Mitigation 7
2.4 Finished Floor Levels and Safe Refuge 8
2.5 Flood Depths and Velocities 8
2.6 Flood Duration 9
3 Planning & Procedures 10
3.1 Roles and Responsibilities 10
3.2 Signing up to Receive Flood Warnings 11
3.3 Reviewing and Updating the Plan 11
4 Flood Warnings 13
4.1 Environment Agency Flood Alert and Flood Warning Areas 13
4.2 Environment Agency Flood Warning Codes 13
5 Response to Flooding and Flood Warnings 16
5.1 Flood Response Actions 16
5.2 Evacuation Route and Safe Refuge Area 18
5.3 Vulnerable Residents and Reduced Mobility 20
5.4 Site Reoccupation 20
5.5 General Advice 22
6 Appendices 23
Appendix A – Flood Checklist 23
Appendix B – Roles and Responsibilities of Relevant Agencies 26
Appendix C – Flood Warning Notice 28

© Clancy Consulting 2026

1 Introduction

1.1 Purpose of this Report

This site-specific Flood Warning and Evacuation Plan (FWEP) has been prepared for the proposed redevelopment at 232-236 Palatine Road, Didsbury. The development comprises the demolition of the three existing residential buildings at 232, 234 and 236 Palatine Road and the construction of a new residential scheme comprising apartments and townhouses, with associated garden areas, landscaping, car parking and infrastructure.

The purpose of this FWEP is to set out the procedures to be followed before, during and after a potential flood event. It is intended to ensure that residents, occupants, tenants and visitors are aware of the flood risk at the site, understand the actions to be taken in response to flood warnings, and are provided with clear guidance on evacuation, identified safe-refuge area and post-flood recovery.

A Site Flood Response Manager will be appointed for the development. The Site Flood Response Manager will be responsible for coordinating the implementation of this FWEP, including monitoring flood warnings, communicating relevant flood-response actions, coordinating the deployment of flood-protection measures where required, and liaising with the site owner, freeholder, management company, residents, appointed competent contractors and emergency responders as appropriate.

Responsibilities relating to flood-protection equipment, building services, communal areas, plant, lifts, EV charging infrastructure, drainage infrastructure and post-flood recovery will rest with the Site Flood Response Manager, site owner, freeholder, management company and/or appointed competent contractors, as identified within this FWEP and the building operation and maintenance information.

The plan is intended to reduce risk to life and property by establishing clear responsibilities, warning triggers, communication procedures, evacuation arrangements, safe-refuge arrangements and response actions. It should be treated as a live management document and reviewed periodically, including following any flood event, material change to the development, change in responsible parties, or update to Environment Agency flood-warning information.

A Flood Checklist is included within Appendix A. The Site Flood Response Manager should ensure that the checklist is maintained, reviewed and made available to residents. Residents should familiarise themselves with the checklist and follow the relevant actions before, during and after a flood event.

1.2 Structure of this Report

This site specific FWEP is structured as follows: -

- Section 1 Introduction
  - Provides the introduction, purpose of the report and report structure.
- Section 2 Site Details
  - Provides background information relating to the site and an overview of the risk of flooding.
- Section 3 Planning and Procedures
  - Summarises the roles and responsibilities for flood response and management.
- Section 4 Flood Warnings
  - Describes the Environment Agency flood warning codes
- Section 5 Response to Flooding and Flood Warnings
  - Details the actions that should be taken if a flood alert or flood warning is issued, the recommended evacuation route, safe-refuge arrangements, reoccupation process and general advice regarding floodwater.

1.3 Relevant Documents

This Flood Warning and Evacuation Plan should be read in conjunction with the following reports: -

- 21724-CCL-XX-XX-RP-C-02500 Flood Risk Assessment & Drainage Strategy

© Clancy Consulting 2026

- 1459-Palatine-Road-Design-And-Access-Statement

© Clancy Consulting 2026

2 Site Details

2.1 Site Location

The site is located at Palatine Road, Didsbury, as illustrated in figure 2.1 below (red arrow). The postcode for the site is M20 2WF with central coordinates of E, 383557 N, 390984. Manchester City Council are the Local Planning Authority (LPA) and the Lead Local Flood Authority (LLFA) for this development.

The site is located approximately 90m east of the River Mersey.



Figure 2.1 Site Location Plan (Source: UK StreetMap)

2.2 Flood Risk

The site, identified by the red boundary in Figure 2.2, is located within Flood Zone 3, comprising land with a 1% or greater annual probability of fluvial flooding. The principal source of flood risk is fluvial flooding associated with high water levels in the River Mersey, including the potential overtopping and/or breach of the adjacent flood-defence and flood-storage infrastructure.

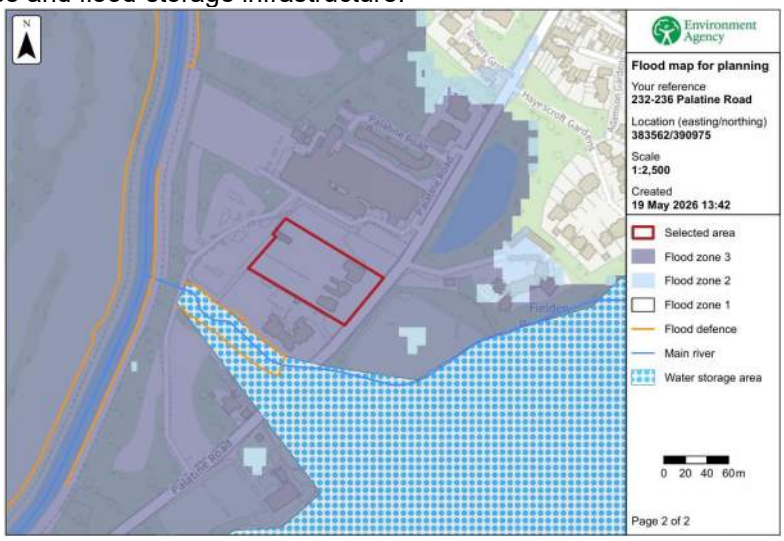


Figure 2.2: Flood Map (© Environment Agency)

The Environment Agency operates a flood-warning area for “River Mersey at West Didsbury, Northenden Golf Club and Palatine Road”. This flood-warning area includes properties on Palatine Road and is therefore considered directly relevant to the proposed development at 232-236 Palatine Road.

Public records confirm flooding within the wider Didsbury and Palatine Road area during January 2025, following an exceptional rainfall event which caused the River Mersey to reach its highest recorded level for 66 years. During this event, flood gates along the Mersey path adjacent to the M60 Manchester Outer Ring Road, near the weir, were opened, allowing floodwater to discharge onto Withington and Didsbury Golf Club. The event resulted in disruption along Palatine Road and damage to sections of the River Mersey flood-defence infrastructure.

This is considered to represent an exceptional flood event affecting the wider River Mersey corridor. Available public records confirm flooding and flood-management activity within the surrounding area, and site and project information indicates that floodwater has previously entered the Site. However, the precise extent, depth, duration and mechanism of historic flooding at the Site are not fully established by the available records. The site-specific Flood Risk Assessment and this FWEP have therefore been based primarily on the Environment Agency's current flood modelling and product data, supplemented by the available historic flood information. A further flood warning was issued for the Palatine Road area in September 2025.

The proposed development incorporates a flood-resilient strategy, including habitable finished floor levels set above the adopted design flood level with 600 mm freeboard, floodable undercroft areas, flood-protection measures to critical plant and infrastructure, safe isolation of flood-sensitive services where required, flood-warning and evacuation procedures, and floodplain-compensation measures where required.

2.3 Flood Risk Mitigation

The proposed development incorporates a range of flood-risk mitigation measures to reduce risk to residents, property and infrastructure during a potential flood event.

The principal mitigation measures include:

- habitable accommodation set above the adopted design flood level with 600 mm freeboard;
- lower-level undercroft, parking and external areas designed as floodable, non-habitable areas;
- flood-resilient materials and construction below the design flood level, where appropriate;
- permanent full-height flood doors to plant rooms, tank rooms, riser doors, substation areas and other protected service areas where required to protect life-safety or critical building systems below the design flood level;
- flood doors specified to provide suitable flood protection and fire performance where required by the fire strategy, building regulations and detailed design;
- demountable flood barriers to lift openings, the front entrance and other selected vulnerable openings where permanent flood doors are not proposed;
- watertight / tanked construction, sealed service penetrations and protected ventilation openings to plant rooms, tank rooms, risers, substations and other protected service areas;
- location of ventilation openings, louvres, ducts and other potential water-ingress points serving protected plant areas above the design flood level wherever practicable, or otherwise protected against floodwater ingress;
- safe isolation of lower-level electrical services, EV charging infrastructure, lift installations and non-essential equipment before floodwater reaches the affected areas, where it is safe and practicable to do so;
- restrictions on lift use during flood warnings and flood events, including procedures for taking lifts out of service where there is a risk of floodwater affecting lift pits or associated equipment;
- flood-warning, evacuation and safe-refuge procedures coordinated by the Site Flood Response Manager;
- restrictions on access to the undercroft and lower-level floodable areas during flood conditions; and
- post-flood inspection, cleaning, recommissioning and reoccupation procedures.

© Clancy Consulting 2026

It is recognised that a number of critical plant items, electrical infrastructure and building services are proposed below the adopted design flood level due to site layout constraints, servicing requirements and the need to accommodate the residential layout, parking and associated infrastructure. Where plant and services are located below the design flood level, the strategy is to protect these areas using appropriate flood-protection measures and to provide safe isolation and post-flood inspection / recommissioning procedures where required.

EV charging infrastructure within the undercroft parking area is not considered critical life-safety infrastructure and will not be relied upon during a flood event. EV charging equipment should be isolated in advance of flooding where it is safe and practicable to do so. Where EV charging equipment is affected by floodwater, it should not be returned to service until inspected, tested and recommissioned by a competent electrical specialist. Replacement may be required where equipment has been inundated.

Permanent full-height flood doors serving plant rooms, tank rooms, risers, substation areas and other protected service areas should be designed, specified, installed, maintained and inspected in accordance with the manufacturer's requirements, the fire strategy, building regulations, the building operation and maintenance information and the procedures set out within this FWEP.

Demountable flood barriers serving lift openings, the front entrance and other selected vulnerable openings should be stored, inspected, maintained and deployed in accordance with the manufacturer's requirements. Deployment should only be undertaken by the Site Flood Response Manager, management company, appointed maintenance contractor or another trained and authorised person.

This FWEP should be read in conjunction with the following report:

- 21724-CCL-XX-XX-RP-C-02500 Flood Risk Assessment & Drainage Strategy

2.4 Finished Floor Levels and Identified safe-refuge area

The proposed development has been designed so that habitable accommodation is located above the adopted design flood level.

The Flood Risk Assessment identifies the adopted design flood level for the site as 30.090 m AOD, based on the Environment Agency flood model data. The proposed minimum finished floor level for habitable accommodation is 30.690 m AOD, providing 600 mm freeboard above the adopted design flood level.

As a result, the residential accommodation is positioned above the design flood level and provides a place of identified safe-refuge area for residents during an extreme flood event. Lower-level undercroft, parking and external areas are non-habitable and are intended to be floodable. These areas should not be accessed during flood conditions.

Where evacuation can be undertaken safely, this should take place at an early stage following receipt of flood warnings and before floodwater affects the site access, surrounding highways or pedestrian routes. Where safe evacuation is no longer possible, residents should remain within the building and move to the upper floors / identified identified safe-refuge area area above the design flood level.

2.5 Flood Depths and Velocities

Environment Agency flood model data indicates that flood depths within and around the site may be significant during the design flood event. Flood depths are expected to be greatest within the lower-lying areas of the site, including the undercroft and areas closest to the River Mersey.

© Clancy Consulting 2026

Flood velocities are generally expected to be relatively low across parts of the site; however, localised areas of higher velocity may occur, particularly where floodwater enters, passes through or recedes from the site. Floodwater may also contain debris and may conceal hazards such as kerbs, drainage channels, open or displaced manhole covers, uneven ground, below-ground structures and changes in level.

Residents should therefore be aware that floodwater can pose a serious risk to life, even where it appears shallow or slow-moving. No attempt should be made to walk, cycle or drive through floodwater. Evacuation should only be undertaken before floodwater affects the evacuation route, or where specifically advised by the emergency services.

2.6 Flood Duration

The duration of flooding at the site will depend on the nature, severity and timing of the flood event, including River Mersey levels, local rainfall conditions and the performance of surrounding drainage and flood-defence infrastructure.

Following the peak of a flood event, the site and surrounding area may remain affected by standing floodwater for a period of time. Floodwater would be expected to recede generally back towards the River Mersey and through the local drainage network, subject to river levels and drainage capacity at the time of the event.

Floodwater may contain silt, vegetation, litter and other flood-borne debris. This material has the potential to obstruct gullies, drainage channels, permeable paving, drainage inlets, outfalls, flow-control chambers and other elements of the surface-water drainage network. Such blockages could delay the recession of floodwater from the undercroft and other lower-lying areas of the site following a flood event.

Residents should not attempt to clear drainage blockages during a flood event or while floodwater remains present. Any inspection or clearance of blocked drainage infrastructure should only be undertaken once it is safe to do so and by the site owner, freeholder, management company or appointed maintenance contractor, or other competent persons.

Residents should not assume that the site is safe to access immediately after flood levels begin to fall or after an Environment Agency warning is removed. Standing water, mud, debris, damaged utilities, contaminated water and hidden hazards may remain. The undercroft, parking areas and other lower-level floodable areas should not be re-entered until floodwater has cleared and it is safe to do so.

© Clancy Consulting 2026

3 Planning & Procedures

3.1 Roles and Responsibilities

Details regarding the roles and responsibilities of relevant external agencies are provided in Appendix B.

A Site Flood Response Manager will be appointed for the proposed development. The Site Flood Response Manager will be responsible for coordinating the implementation of this Flood Warning and Evacuation Plan before, during and after a potential flood event.

The appointment of a Site Flood Response Manager does not remove the need for residents and occupiers to understand the flood risk at the site, register for Environment Agency flood warnings, prepare for flooding, act promptly in response to warnings, and follow the actions set out in this FWEP.

The Site Flood Response Manager should:

- register to receive Environment Agency flood warnings for the relevant flood-warning area;
- monitor Environment Agency flood warnings and local weather forecasts during periods of heavy or prolonged rainfall;
- familiarise themselves with the flood-warning actions set out in this FWEP;
- ensure that relevant residents, occupiers and visitors are made aware of the flood-warning procedures, evacuation route, Flood Zone 1 transfer point and safe-refuge arrangements;
- maintain a copy of this FWEP and the Flood Checklist included in Appendix A;
- coordinate the inspection, maintenance and deployment of flood doors, demountable barriers or other flood-protection measures, where required;
- coordinate the safe isolation of lower-level electrical services, EV charging infrastructure, lift installations and other flood-sensitive equipment, where required and where safe to do so;
- restrict access to the undercroft and other lower-level floodable areas during flood conditions;
- coordinate with the site owner, freeholder, management company, appointed competent contractors and emergency responders as appropriate;
- coordinate post-flood inspection, cleaning, recommissioning and reoccupation procedures; and
- arrange for this FWEP to be reviewed and updated periodically, including following any flood event.

The Residents should:

- register to receive Environment Agency flood warnings for the relevant flood-warning area;
- monitor Environment Agency flood warnings and local weather forecasts during periods of heavy or prolonged rainfall;
- familiarise themselves with the flood-warning actions set out in this FWEP;
- follow instructions issued by the Site Flood Response Manager and emergency services;
- avoid entering the undercroft and other lower-level floodable areas during flood conditions;
- move vehicles and valuables from the undercroft / lower-level areas at an early stage, where it is safe to do so;
- prepare essential items, including medication, mobile phones, chargers, important documents, warm clothing and any items required for children, elderly residents, vulnerable occupants or pets;
- consider preparing a household flood kit and personal flood plan;
- move to upper floors / identified safe-refuge areas if safe evacuation from the site is no longer possible;
- not attempt to install flood barriers, isolate plant, operate building services, clear drainage blockages or re-enter floodable areas unless specifically authorised, trained and it is safe to do so;
- follow instructions issued by the emergency services; and
- call 999 if there is an immediate risk to life.

Responsibilities relating to communal flood-protection measures, building services, lift installations, EV charging infrastructure, drainage infrastructure, communal areas and post-flood inspection / recommissioning should be undertaken or coordinated by the Site Flood Response Manager, site owner, freeholder, management company and/or appointed competent contractors, as appropriate.

© Clancy Consulting 2026

These responsibilities should include, where applicable:

- inspection, maintenance and deployment of flood doors, demountable barriers or other flood-protection measures;
- safe isolation and recommissioning of lower-level electrical equipment, EV charging infrastructure, lift installations and other flood-sensitive building services;
- inspection and clearance of gullies, drainage channels, permeable paving, drainage inlets, outfalls, flow-control chambers and other site drainage infrastructure;
- inspection, cleaning and reinstatement of undercroft, parking, plant, refuse, cycle storage and other lower-level communal areas following a flood event;
- arranging specialist inspection of any affected structural, mechanical, electrical, lift, drainage, utility or life-safety systems before reoccupation or reuse; and
- updating the building operation and maintenance information where flood-response procedures or responsible parties change.

The actions to be taken in response to Environment Agency flood alerts and warnings are outlined in Section 5.

3.2 Signing up to Receive Flood Warnings

The Site Flood Response Manager and residents should sign up to receive flood warnings from the Environment Agency using the Floodline Warnings Direct service:

- https://www.gov.uk/sign-up-for-flood-warnings
- or telephone 0345 988 1188.

The relevant flood-warning area for the site is:

- **River Mersey at West Didsbury, Northenden Golf Club and Palatine Road**

The Site Flood Response Manager and residents should also check current flood warnings and river levels during periods of heavy or prolonged rainfall using the Environment Agency's online flood-warning service, which provides a live flood-warning map and five-day flood forecast information:

- https://check-for-flooding.service.gov.uk/

Residents should note that Environment Agency flood alerts and warnings primarily relate to flooding from rivers and the sea. For this site, the relevant flood-warning area relates to the River Mersey. Environment Agency flood alerts and warnings do not cover all possible sources of flooding, such as surface-water flooding, groundwater flooding, sewer flooding or local drainage exceedance. The Site Flood Response Manager and residents should therefore remain alert to local conditions, even where no formal Environment Agency warning has been issued.

3.3 Reviewing and Updating the Plan

This Flood Warning and Evacuation Plan should be treated as a live document. The Site Flood Response Manager should arrange for the plan to be reviewed periodically and following any material change affecting flood response arrangements. It is recommended that the plan is reviewed at least annually.

Residents should familiarise themselves with the plan when they first occupy the property and should review the plan periodically.

The plan should also be reviewed following:

- any flood event affecting the site or surrounding area;
- any change to Environment Agency flood-warning areas or procedures;
- any material change to the building layout, access arrangements or identified safe-refuge area strategy;
- any change to the proposed evacuation route or Flood Zone 1 transfer point;
- any change to the flood-protection measures, including flood doors, demountable barriers or protected plant areas;

© Clancy Consulting 2026

- any change to the operation, maintenance or isolation requirements for lifts, EV charging infrastructure, plant or critical building services;
- any change to the Site Flood Response Manager, management company, site owner, freeholder or other responsible party; and
- any update to the site-specific Flood Risk Assessment or Drainage Strategy.

Where the FWEP is provided to residents as part of the building handover or occupation information, the most up-to-date version should be retained with other property information and made available to future occupiers.

© Clancy Consulting 2026

4 Flood Warnings

4.1 Environment Agency Flood Alert and Flood Warning Areas

The site is located within the Environment Agency's flood-warning coverage for the River Mersey in the West Didsbury / Palatine Road area. The relevant Environment Agency flood warning area is:

- **River Mersey at West Didsbury, Northenden Golf Club and Palatine Road**

This flood-warning area includes Northenden Golf Club and properties on Palatine Road. It is therefore considered directly relevant to the proposed development at 232-236 Palatine Road.

The Site Flood Response Manager and residents should register to receive Environment Agency flood warnings for the specific flood-warning area noted above. The Site Flood Response Manager and residents should also monitor warnings issued for the River Mersey during periods of heavy or prolonged rainfall. On receipt of a Flood Alert, Flood Warning or Severe Flood Warning, the actions set out within this Flood Warning and Evacuation Plan should be followed.

Current flood warning information can be checked using the Environment Agency online service: -

- https://check-for-flooding.service.gov.uk/

The Environment Agency issues flood alerts and warnings to the public, media and partner agencies where flooding from rivers is possible or expected. Flood alerts and warnings are based on the likelihood, timing and potential impact of flooding within a specific community or catchment. For this site, the relevant warnings relate to fluvial flooding from the River Mersey. Environment Agency flood alerts and warnings do not cover all other sources of flooding, such as surface-water flooding, groundwater flooding, sewer flooding or local drainage exceedance. The Site Flood Response Manager and residents should therefore remain alert to local site conditions, even where no formal Environment Agency flood warning has been issued.

4.2 Environment Agency Flood Warning Codes

The Environment Agency issues flood warnings using the following set of codes:

- **Flood Alert – Flooding is Possible: Be Prepared**
  - A Flood Alert is issued when flooding is possible. Flood Alerts typically cover wider geographical areas and are intended to advise residents, occupiers and businesses that they should be prepared to act on their flood plan.
  - For this site, a Flood Alert should prompt the Site Flood Response Manager and residents to monitor Environment Agency updates, review this Flood Warning and Evacuation Plan, prepare essential items and consider moving vehicles and valuables away from the undercroft and lower-level areas where it is safe to do so.
- **Flood Warning – Flooding is Expected: Act Now**
  - A Flood Warning is issued when flooding is expected. Flood Warnings typically cover smaller geographical areas than Flood Alerts and may relate to flooding of homes, businesses, roads or other infrastructure.
  - For this Site, a Flood Warning should prompt residents to take immediate action in accordance with Section 5. Residents should avoid the undercroft and other floodable lower-level areas, move essential items to upper floors and evacuate early where instructed and where safe evacuation from the Site remains possible. Where safe evacuation is not possible, residents should remain within habitable accommodation or identified safe-refuge areas above the design flood level and await further instructions from the emergency services.
- **Severe Flood Warning – Severe Flooding: Danger to Life**
  - A Severe Flood Warning is issued when flooding poses a danger to life. Conditions during a severe flood event may include deep or fast-flowing water, hidden hazards, floating debris and widespread disruption to roads and services.
  - For this Site, residents should not attempt to evacuate through floodwater or walk or drive through affected areas. Residents should remain within habitable accommodation or identified

safe-refuge areas above the design flood level and follow the advice of the emergency services. Residents should call 999 if there is an immediate risk to life.

- **Warning No Longer in Force – No Further Flooding Expected**
  - A warning is removed when no further flooding is expected for the relevant warning area. However, standing floodwater, contaminated water, debris, damaged utilities, blocked drainage or unsafe access routes may still remain.
  - The Site Flood Response Manager and residents should continue to exercise caution after a warning is removed. Residents should not re-enter the undercroft or other floodable lower-level areas until it has been confirmed that it is safe to do so.

The specific actions that the Site Flood Response Manager and residents should take if a Flood Alert, Flood Warning or Severe Flood Warning is received are set out in Section 5.

The flood warning codes are pictorially presented in Figure 4.1 below.

EA Warning Type	Description / Meaning	Site-Specific Actions
Flood Alert		
	Flooding is possible. The Environment Agency may issue a Flood Alert where forecasts indicate possible flooding from rivers within the wider catchment. The Environment Agency usually issues a Flood Alert between 2 and 12 hours before flooding, where forecasting information allows. If a flood alert is issued, you should: • be ready to follow this FWEP; • have insurance documents and any medications ready • avoid walking, cycling or driving through any flood water • consider moving vehicles and valuables away from areas likely to flood, where it is safe to do so.	The Site Flood Response Manager and residents should monitor Environment Agency updates for the “River Mersey at West Didsbury, Northenden Golf Club and Palatine Road” flood-warning area. The Site Flood Response Manager should review this FWEP, check flood-protection measures and prepare to coordinate the response if conditions worsen. Residents should prepare essential items including medication, phone chargers, important documents and warm clothing. Residents should avoid walking, cycling or driving through floodwater and should consider moving vehicles and valuables from the undercroft and lower-level areas if safe to do so..

© Clancy Consulting 2026

Flood Warning		
	Flooding is expected. Immediate action is required. The Environment Agency may issue a Flood Warning where forecasts indicate that flooding is expected from rivers.. The Environment Agency usually issues a Flood Warning 30 minutes to 2 hours before flooding, where forecasting information allows. If a warning is issued, you should: • protect yourself and your loved ones • move your loved ones, pets and valuables to a safe place • move to higher ground or the upper floor of a building • turn off the gas, electricity and water in your home if it's safe • put flood-protection equipment in place where trained and authorised; • do as the emergency services tell you • help others if it's safe to do so	The Site Flood Response Manager should coordinate the flood response, including communication with residents, deployment of flood-protection measures where required, safe isolation of flood-sensitive building services where required, and liaison with emergency responders where appropriate. Residents should move people, pets and essential items away from the undercroft and lower-level floodable areas. Residents should move vehicles from the undercroft parking area if safe to do so. If safe evacuation from the site is still possible, residents should leave the site early and move away from the flood-risk area. If evacuation is no longer safe, residents should move to upper habitable floors or identified safe-refuge areas above the design flood level. Do not enter floodwater. Follow emergency-service advice.
Severe Flood Warning		
	Severe flooding. Danger to life. The Environment Agency may issue a Severe Flood Warning where flooding poses a significant risk to life or communities. If a severe warning is issued, you should: • stay in a safe place • be ready to evacuate your home • do as the emergency services tell you • call 999 if you are in immediate danger • if you are caught in a flash flood move to higher ground or the upper floor of a building if it's safe	Stay in a safe place. Do not attempt to leave through floodwater. The Site Flood Response Manager should continue to coordinate with residents and emergency responders where safe and practicable to do so. Residents should remain in upper habitable floors or identified safe-refuge areas above the design flood level. Call 999 if in immediate danger. Be prepared to evacuate only if instructed by the emergency services. Follow emergency-service advice at all times.

Figure 4.1 – Environment Agency Flood Alert and Warning Codes

The Site Flood Response Manager and residents should sign up to receive Environment Agency flood warnings using the following link:

- https://www.gov.uk/sign-up-for-flood-warnings

Residents are also encouraged to prepare a personal flood plan for their household. The Environment Agency provides a Personal Flood Plan template and associated guidance to assist residents in planning practical actions before, during and after a flood event.

© Clancy Consulting 2026

5 Response to Flooding and Flood Warnings

The following procedures should only be followed where it is safe to do so. Residents should not put themselves or others at risk. Advice provided by the emergency services, Environment Agency, Manchester City Council and other emergency responders should be followed at all times.

Residents should not walk, cycle or drive through floodwater. Floodwater may be deep, fast flowing, contaminated or conceal hazards such as lifted manhole covers, debris, kerbs, drainage channels or changes in ground level.

Permanent full-height flood doors are proposed to plant rooms, tank rooms, riser doors, substation areas and other protected service areas where required to protect life-safety or critical building systems located below the design flood level. These doors are intended to provide passive flood protection without relying on the installation of demountable barriers or intervention by residents or building-management personnel. Flood doors should remain closed during flood conditions except where access is required by authorised persons and it is safe to do so.

Demountable flood barriers may be provided to lift openings, the front entrance and other selected vulnerable openings where permanent full-height flood doors are not proposed. Demountable flood barriers should only be installed by the Site Flood Response Manager, site owner, freeholder, management company, appointed maintenance contractor or other person formally appointed and trained to do so. Residents should not attempt to install demountable flood barriers unless they have been specifically trained and authorised to do so and it is safe to do so. Demountable flood barriers should be installed at the earliest appropriate warning stage and before floodwater reaches the relevant area.

Where flood-sensitive building services are located below or close to the design flood level, including EV charging infrastructure, lift pits, lift controls, plant rooms or other lower-level electrical equipment, isolation should only be undertaken by the Site Flood Response Manager, management company, appointed maintenance contractor or other competent person in accordance with the building operation and maintenance information. Residents should not attempt to isolate building services unless they have been specifically trained and authorised to do so.

A flood warning notice, refer to Appendix C, detailing the evacuation route, Flood Zone 1 transfer point and safe-refuge arrangements should be permanently displayed in the car park and communal areas so that residents, tenants, occupants and visitors are familiar with the required actions.

5.1 Flood Response Actions

The response to Environment Agency flood warnings is set out below. The Site Flood Response Manager is responsible for coordinating the communal and managed flood-response actions. Residents remain responsible for taking personal flood-response actions, including preparing essential items, moving vehicles where safe, evacuating early where appropriate, moving to identified safe-refuge area where evacuation is no longer possible, and following instructions issued by the Site Flood Response Manager and emergency services.

If a **Flood Alert** is Received:

1. The Site Flood Response Manager and residents should monitor Environment Agency flood updates for the River Mersey at West Didsbury, Northenden Golf Club and Palatine Road flood-warning area.
2. The Site Flood Response Manager and residents should monitor local weather forecasts and updates from emergency responders.
3. The Site Flood Response Manager should review this FWEP and prepare to coordinate the site response if conditions worsen.
4. Residents should review this FWEP and prepare essential items, including medication, mobile phones, chargers, important documents, warm clothing and any items required for children, vulnerable occupants or pets.
5. Residents should consider moving vehicles and valuables from the undercroft and lower-level floodable areas, where it is safe to do so. Where practicable, vehicles should be moved to an area

© Clancy Consulting 2026

outside the predicted flood extent or to land within Flood Zone 1, as indicated in Figure 5.3 and Appendix C.
6. Residents should avoid parking in the undercroft or other lower-level areas if flooding is forecast.
7. Residents should avoid using EV charging equipment within the undercroft if flooding is forecast.
8. The Site Flood Response Manager should ensure that permanent full-height flood doors to plant rooms, tank rooms, risers, substation areas and other protected service areas are closed and remain closed, except where access is required by authorised persons and it is safe to do so.
9. The Site Flood Response Manager, management company or appointed competent contractor should arrange for demountable flood barriers to lift openings, the front entrance and other selected vulnerable openings to be installed, where required and where safe to do so.
10. The Site Flood Response Manager should check the location and operating requirements for isolating EV charging equipment, lift installations, lower-level electrical equipment and other flood-sensitive building services, where applicable.
11. Residents should check on vulnerable neighbours or visitors, where it is safe to do so.

If a **Flood Warning** is Received:

1. The Site Flood Response Manager and residents should continue to monitor Environment Agency updates and local conditions.
2. Residents should avoid entering the undercroft parking area and other lower-level floodable areas.
3. Residents should move people, pets and essential items to upper habitable floors or identified safe-refuge areas at or above 30.690 m AOD.
4. Residents should move vehicles from the undercroft parking area where this can be done safely and before floodwater affects access routes. Where practicable, vehicles should be moved to an area outside the predicted flood extent or to land within Flood Zone 1, as indicated in Figure 5.3 and Appendix C.
5. Residents should not attempt to move vehicles once floodwater is present or where access routes are unsafe.
6. Residents should not use EV charging equipment within the undercroft during flood conditions.
7. The Site Flood Response Manager, management company or appointed competent contractor should arrange for EV charging equipment, lift installations serving floodable lower-level areas, lower-level electrical equipment and other non-essential flood-sensitive building services to be isolated, where required and where safe to do so.
8. Permanent full-height flood doors to plant rooms, tank rooms, risers, substation areas and other protected service areas should remain closed during the flood event. These areas should not be accessed unless required by the emergency services or authorised competent persons and only where safe to do so.
9. Demountable flood barriers should already have been installed at the Flood Warning stage by the Site Flood Response Manager, management company or appointed competent contractor, where required and where safe to do so. Residents should not attempt to install, remove or adjust demountable flood barriers during a Severe Flood Warning.
10. Lifts serving areas at risk of flooding should be taken out of service where there is a risk of floodwater affecting lift pits, lift controls, power supplies or associated equipment. Residents should use stairs and should not use lifts during a flood event unless specifically advised that it is safe to do so.
11. Residents should evacuate the site early via the designated evacuation route, where it remains safe to do so.
12. If safe evacuation from the site is no longer possible, residents should remain within the building and move to upper habitable floors or identified safe-refuge areas above the design flood level.
13. Residents should follow advice issued by the Site Flood Response Manager and emergency services.
14. Residents should call 999 if there is an immediate risk to life.

If a **Severe Flood Warning** is Received:

1. Residents should not attempt to leave the site through floodwater unless instructed by the emergency services.
2. Residents should move to upper habitable floors or identified safe-refuge areas above the design flood level.
3. Residents should stay away from the undercroft, external lower-level areas, plant areas, substations and any areas affected by floodwater.

© Clancy Consulting 2026

4. Residents should not attempt to recover vehicles or belongings from the undercroft or other lower-level areas.
5. Residents should not attempt to install flood barriers, isolate services, access plant areas or operate flood-protection equipment.
6. Flood barriers should already have been installed at the Flood Warning stage by the Site Flood Response Manager, management company or appointed competent contractor, where required and where safe to do so.
7. EV charging equipment, lift installations serving floodable lower-level areas, lower-level electrical equipment and other non-essential flood-sensitive building services should already have been isolated by the Site Flood Response Manager, management company or appointed competent contractor, where required and where safe to do so.
8. Residents should not use lifts during a Severe Flood Warning unless specifically instructed by the emergency services.
9. The Site Flood Response Manager should continue to liaise with residents and emergency responders where safe and practicable to do so.
10. Residents should follow instructions issued by the emergency services.
11. Residents should call 999 if there is an immediate risk to life.
12. Residents should be prepared to evacuate only if instructed to do so by the emergency services.Do not attempt to leave the site through floodwater unless instructed by the emergency services.

5.2 Evacuation Route and Identified safe-refuge area Area

Residents and the Site Flood Response Manager should register for the Environment Agency Floodline Warnings Direct service. Where a Flood Alert or Flood Warning is issued and safe evacuation remains possible, residents should evacuate early before floodwater affects the site access, surrounding highway network or pedestrian routes.

The designated early evacuation route from the site is shown on Figure 5.3. Residents should leave the site via the main access onto Palatine Road and proceed north-east along Palatine Road, away from the River Mersey and Northenden Golf Club. Residents should continue along the identified route towards Mersey Road / Holme Road, where land is shown to be within Flood Zone 1. This location is identified as the Flood Zone 1 transfer point.

The transfer point is intended to provide a defined location outside the modelled floodplain where residents can gather, be collected, or receive further instruction from the emergency services. It is not intended to operate as a managed refuge or formal rest centre.

This route should only be used where evacuation can be undertaken safely and before floodwater affects Palatine Road, the surrounding footways or the onward route to the transfer point. Residents should not attempt to walk or drive through floodwater. If the route is affected by flooding, or if evacuation is no longer safe, residents should remain within the development and move to the upper habitable floors / identified identified safe-refuge area area above the design flood level.

The proposed development incorporates habitable accommodation above the adopted design flood level with 600 mm freeboard. The undercroft and other lower-level areas are floodable, non-habitable areas and should not be occupied during flood conditions.

Egress routes from the under-croft car park to areas above the design flood are proposed via several stair cores and the vehicle access ramp as indicated in Figure 5.1 below.

© Clancy Consulting 2026



Figure 5.1 – Basement Level Egress Routes

(Extracted from OMI Planning Drawing ref: L1000-MASTERPLAN - LEVEL BASEMENT)

The ground floor is elevated above the design flood level at +30.690 m AOD. Where evacuation from the ground floor is required, egress routes are via the elevated walkway serving the townhouses and the stair cores serving the apartment blocks, as indicated in Figure 5.2 below.



Figure 5.2 – Ground Floor Level Egress Routes

(Extracted from OMI Planning Drawing ref: L1000-MASTERPLAN - LEVEL BASEMENT)

The proposed evacuation route and defined Flood Zone 1 transfer point will be shown on the site-specific evacuation plan included within Appendix C. This plan identifies:

- the site access / exit route;

© Clancy Consulting 2026

- the early evacuation route away from the site;
- the defined transfer point within Flood Zone 1;
- the upper-floor / podium identified safe-refuge area area;
- the undercroft and other lower-level floodable areas; and
- areas of the site that should not be accessed during a flood event.

If safe evacuation is no longer possible, residents should not attempt to walk or drive through floodwater. Residents should instead move to upper habitable floors / the identified identified safe-refuge area area above the design flood level and await further instruction from the emergency services.



Figure 5.3 – Indicative early evacuation route from 232-236 Palatine Road to the Flood Zone 1 transfer point.

Note: Route to be followed only where safe to do so and prior to floodwater affecting the local highway network.

5.3 Vulnerable Residents and Reduced Mobility

Residents with reduced mobility, medical needs or other vulnerabilities should consider their flood response arrangements in advance. This may include:

- registering for Environment Agency flood warnings;
- preparing a personal flood plan;
- keeping medication and essential equipment readily accessible;
- arranging support from family, carers or neighbours during flood warnings;
- evacuating earlier than other residents where safe evacuation may take longer; and
- calling 999 where immediate assistance is required.

Residents should not rely on being able to evacuate through floodwater. Where early evacuation has not taken place and external routes have become unsafe, vulnerable residents should remain in the habitable upper floors / identified safe-refuge area and await assistance from the emergency services.

5.4 Site Reoccupation

Once the risk of further flooding has passed, the Environment Agency may issue a “Warning No Longer in Force” notice. Residents should note that this does not necessarily mean that the site or surrounding access routes are immediately safe.

Reoccupation of the buildings following a significant flood event should only take place once it has been confirmed that it is safe to do so. This may require input from relevant stakeholders, including the emergency services, Manchester City Council, the Environment Agency, utility providers, insurers, the site owner, freeholder, management company and suitably qualified professionals.

Standing floodwater, contaminated water, mud, silt, flood-borne debris, damaged utilities, unstable surfaces, blocked drains and hidden hazards may remain after the warning has been removed. Care should be taken when re-entering any buildings or lower-level areas, as floodwater may carry silt and debris which could

© Clancy Consulting 2026

obscure hazards. Floodwater may also have caused damage to building fabric, finishes, structure, services, plant, drainage infrastructure and electrical equipment.

Following a flood event, residents should:

1. Continue to avoid the undercroft and lower-level floodable areas until they are visibly clear of floodwater and safe to access.
2. Avoid contact with floodwater, mud and debris where possible.
3. Not switch electrical equipment or mains services, EV charging equipment or other services back on if they have been affected by floodwater. This is to be undertaken by a qualified engineer.
4. Not attempt to clear blocked gullies, drainage channels, permeable paving, drainage inlets, outfalls or other below-ground drainage infrastructure while floodwater remains present.
5. Report flooding or damage to relevant utility providers, insurers, landlords, freeholders, the management company or other responsible parties, as appropriate.
6. Keep a record of flood damage, including photographs or video footage where safe to do so.
7. Dispose of any food, soft furnishings or personal items that have been in contact with floodwater, where contamination is suspected.
8. Follow advice issued by the emergency services, Environment Agency, Manchester City Council and utility providers.

Following the flood event, the Site Flood Response Manager, site owner, freeholder, management company or appointed maintenance contractor should arrange, where applicable, for:

1. inspection of the undercroft, parking areas, external areas, communal circulation areas and other lower-level floodable areas before they are returned to normal use;
2. removal of accumulated mud, silt, debris and other flood-borne material from communal and external areas;
3. inspection and clearance of blocked gullies, drainage channels, permeable paving, drainage inlets, outfalls, flow-control chambers and other surface-water drainage infrastructure by competent persons, including removal of silt, vegetation, litter and other flood-borne debris deposited during the flood event;
4. inspection of attenuation tanks, permeable paving sub-base, hydrobrakes, non-return valves, penstocks, outfalls or other drainage-control features, where present, to confirm that they remain operational and have not become blocked, damaged or silted following the flood event;
5. inspection, testing and recommissioning of EV charging equipment affected by floodwater by a competent electrical specialist before re-use;
6. inspection, testing and recommissioning of affected plant, pumps, controls, switchgear, meters, life-safety systems and other building services by competent specialists before re-use;
7. inspection of lift pits, lift controls, lift power supplies and associated lift equipment affected by floodwater by a competent lift specialist before the lifts are returned to service;
8. inspection of the substation and any associated flood-protection measures, where these have been affected by floodwater;
9. nspection of permanent full-height flood doors, flood seals, thresholds, frames, ironmongery, closing mechanisms and associated fire / flood performance requirements, including repair or replacement where required;
10. inspection of demountable flood barriers, fixings, seals, storage arrangements and deployment equipment, including cleaning, repair, replacement and restocking where required;
11. assessment of internal finishes, doors, partitions, insulation and other building fabric affected by floodwater, with repair or replacement undertaken where required;
12. inspection of the building structure and lower-level supporting elements where structural damage, impact damage or undermining is suspected; and
13. confirmation that the buildings and affected areas are safe to re-enter and reoccupy.

Where any structural damage is suspected, residents should not re-enter the affected area until appropriate inspection has been undertaken by a suitably qualified professional and the area has been confirmed as safe.

© Clancy Consulting 2026

5.5 General Advice

- Do not walk through flowing water. Currents can be deceptive and shallow, fast-moving water can knock people off their feet. If you must walk in standing water, use a pole or stick to ensure that you do not step into deep water, open manholes or ditches.
- Do not drive through floodwater. Floodwater can be deeper than it appears and half a meter can carry a vehicle away.
- Do not enter the undercroft or other lower-level floodable areas during a flood event.
- Stay away from power lines, substations, electrical equipment and damaged utilities - electrical current can travel through water..
- Avoid contact with floodwater, mud and debris, which may be contaminated.
- Be careful when walking after a flood. Surfaces may be slippery and debris may include sharp objects.
- Do not allow children or pets to enter or play in floodwater.
- Follow the advice of the emergency services at all times.
- Call 999 if there is an immediate risk to life.

© Clancy Consulting 2026

6 Appendices

Appendix A – Flood Checklist

Flood Checklist

Address:
Date:

PART 1 – CONTACT DETAILS

Flood Response Manager(s)

Name	Contact Number(s)	Other Information

Category 1 Responders

Responder	Telephone
Manchester City Council	Contact: 0161 223 7222 (Civil Emergency) Contact: 0161 224 5001 (Social Services)
Greater Manchester Police (non-emergency)	101
Greater Manchester Fire & Rescue Service (non-emergency)	01482 565 333
Floodline	0345 988 1188

General Contact List

Contact	Name	Telephone
Electricity Provider		
Gas provider		
Water company		
Telephone provider		
Insurance company		
	Insurance policy number:	

Useful Contacts

Identify people who can help you before, during and after a flood. For example:

- Provision of flood products; provision of water pumping services
- Provision of emergency storage
- Building services

Company	Contact Name	Telephone

© Clancy Consulting 2026

PART 2 – PROCEDURES TO PROTECT THE BUILDING

Services

Service Cut-off	Description of Location
Electricity	
Gas	
Water	

Protective Actions

Identify actions to protect the site, for example:

- Switch off appliances and turn services off at the mains (gas, electricity and water)
- Move anything not fixed down into a safer location
- Install flood protection products
- Weigh down any manhole covers to prevent them floating away and leaving a hazardous hole

Item	Location	Action

© Clancy Consulting 2026

Appendix B – Roles and Responsibilities of Relevant Agencies

Site Flood Response Manager

- Register for Environment Agency flood warnings for the relevant flood-warning area;
- Monitor weather forecasts, river levels and Environment Agency flood alerts / warnings during periods of heavy or prolonged rainfall;
- Coordinate implementation of the Flood Warning and Evacuation Plan before, during and after a flood event;
- Communicate relevant flood-warning information and response actions to residents, occupants and visitors where practicable;
- Coordinate the inspection, maintenance and operation of permanent full-height flood doors serving plant rooms, tank rooms, riser doors, substation areas and other protected service areas;
- Coordinate the inspection, maintenance, storage and deployment of demountable flood barriers serving lift openings, the front entrance and other selected vulnerable openings where required;
- Coordinate the safe isolation of lower-level electrical equipment, EV charging infrastructure, lift installations and other flood-sensitive building services where required;
- Restrict access to the undercroft, plant areas, substation areas and other lower-level floodable areas during flood conditions;
- Liaise with the site owner, freeholder, management company, appointed competent contractors, utility providers and emergency responders as appropriate;
- Coordinate post-flood inspection, cleaning, recommissioning and reoccupation procedures; and
- Arrange for the FWEP to be reviewed and updated periodically, including following any flood event.

Environment Agency

- **Contact:** 0345 988 1188 (Floodline)
- Issues flood alerts and flood warnings for flooding from main rivers and the sea;
- Operates the flood-warning area relevant to the site: “River Mersey at West Didsbury, Northenden Golf Club and Palatine Road”;
- Monitors river levels and flood risk from main rivers;
- Receives and records details of flooding incidents
- Advises partner organisations during flood events; and
- Undertakes emergency works to Environment Agency-owned flood-defence assets and main river structures where required.

Local Authority (Manchester City Council)

- **Contact:** 0161 223 7222 (Civil Emergency)
- **Contact:** 0161 224 5001 (Social Services)
- Acts as Lead Local Flood Authority for local flood-risk matters, including surface-water, groundwater and ordinary watercourse flooding;
- Coordinates local emergency planning and response arrangements with partner agencies where required;
- Maintains safe conditions on adopted highways, where reasonably practicable;
- May arrange road closures, diversions and flood-warning signage on the highway during a flood event;
- May clear blockages from highway drainage systems where these are within its responsibility; and
- May take action where flooding from the adopted highway drainage system presents a risk to people or property.
- Developing a Strategy for managing local flood risk;
- Establishing and maintaining a register of flood risk management assets;
- Advising on sustainable drainage and flood risk in the Planning process;
- Investigating flooding incidents and assist in identifying the party responsible for resolving the problem; and
- Issuing Land Drainage Consents for works on ordinary watercourses.

Greater Manchester Police

- **Contact:** 101 (non emergency), 999 (emergency)

© Clancy Consulting 2026

- Coordinates the emergency response during major incidents where required;
- Assists with public safety, road closures, evacuation and traffic management;
- Supports communication between emergency services, local authorities and other responding agencies; and
- May advise residents to evacuate or remain in place depending on the circumstances of the incident.

Greater Manchester Fire and Rescue Service

- **Contact:** 01482 565 333
- Responds to emergency incidents where life or property is at risk;
- Assists with rescue, evacuation and public safety where required;
- May provide assistance using specialist equipment and trained personnel; and
- Should be contacted via 999 where there is immediate danger to life.

North West Ambulance Service

- **Contact:** 999 (Emergency)
- Responds to medical emergencies during a flood event;
- Provides emergency medical care and transport where required; and
- Should be contacted via 999 where there is a medical emergency or immediate risk to life.

United Utilities

- **Contact:** 0345 672 3723 (Wastewater Emergencies)
- **Contact:** 0345 672 3723 / 0345 672 2888 (Water & Wastewater Enquiries)
-
- Operates and maintains public sewerage and water-supply infrastructure;
- Responds to flooding associated with public sewers or water mains where these are within its responsibility;
- Clears blockages within public sewers where required; and
- Provides advice and emergency response relating to public water and wastewater assets.

Electricity, Gas and Telecommunications Providers

- **Contact:** 105 (Electricity network emergencies)
- **Contact:** 0800 111 9999 (for gas emergencies)
- Respond to emergencies affecting their service networks and infrastructure;
- Attend incidents where life may be at risk as a result of damage to electricity, gas or telecommunications infrastructure;
- Provide emergency isolation, repair or reinstatement of services where required; and
- Should be contacted directly in the event of service disruption, damaged equipment or suspected danger from utilities.

Residents

- Register for Environment Agency flood warnings for the relevant flood-warning area;
- Monitor weather forecasts, river levels and Environment Agency flood alerts / warnings during periods of heavy or prolonged rainfall;
- Follow the actions set out within this Flood Warning and Evacuation Plan;
- Follow instructions issued by the Site Flood Response Manager and emergency services;
- Avoid entering floodwater on foot or by vehicle;
- Move to upper habitable floors / the identified safe-refuge area if safe evacuation is no longer possible;
- Follow instructions issued by the emergency services; and
- Call 999 if there is an immediate risk to life.

© Clancy Consulting 2026

Appendix C – Flood Warning Notice

FLOOD WARNINGS

232-236 Palatine Road, Didsbury

This site is within Flood Zone 3 and is covered by the Environment Agency flood-warning area for the River Mersey at West Didsbury, Northenden Golf Club and Palatine Road. The Site Flood Response Manager and residents should register for flood warnings and follow the actions below if a Flood Alert, Flood Warning or Severe Flood Warning is issued.

Flood Warning Information

- **Call Floodline** on 0345 988 1188
- **Download** the Flood Alert App
- **Register for EA Flood Warnings** https://www.gov.uk/sign-up-for-flood-warnings
- **EA Warning Area:** EA Flood Warning Area: River Mersey at West Didsbury, Northenden Golf Club and Palatine Road

Resident / Site Actions

- Monitor EA warnings and weather forecasts & follow this FWEP.
- Avoid floodwater
- Move vehicles / valuables from the undercroft if safe to do so
- Move to upper habitable floors / identified safe-refuge areas if safe evacuation is no longer possible
- Permanent flood doors to protected plant, tank, riser and substation areas are to remain closed during flood conditions.
- Demountable barriers to lift openings and the front entrance are to be installed by trained authorised persons only.



Flooding is possible. Be prepared.

Monitor EA updates and weather forecasts.

Site Flood Response Manager to check flood-protection measures.

Prepare medication, documents, phone chargers and essential items.

Move vehicles / valuables from undercroft areas if safe to do so.



Flooding is expected. Immediate action required.

Follow this FWEP. Site Flood Response Manager to coordinate site response.

Avoid undercroft and lower-level floodable areas.

installed by trained authorised persons only.

Do not use EV charging equipment.



Severe flooding. Danger to life.

Stay in a safe place and do not enter floodwater.

Move to upper floors / identified safe-refuge areas.

Call 999 if in immediate danger.

Do not evacuate through floodwater unless instructed by emergency services. Take refuge within the building.



Flooding is no longer expected for the warning area.

Remain cautious: roads, footways, drainage, undercroft areas and building services may still be unsafe.

Do not re-enter floodable areas until confirmed safe.

Early Evacuation Route / Safe-Refuge Plan

If safe to do so, residents should leave the site via the main access onto Palatine Road and proceed north-east along Palatine Road, away from the River Mersey and Northenden Golf Club. Residents should continue along the identified route towards Mersey Road / Holme Road, where land is shown to be within Flood Zone 1. This location is identified as the Flood Zone 1 transfer point. If evacuation is no longer safe, residents should move to upper floors / identified safe-refuge areas.



General Advice

- Always follow the advice of the Emergency Services.
- Do not walk, cycle or drive through floodwater - shallow or fast-moving water can knock you off your feet.
- Do not drive through flooded areas – a half a metre of floodwater can carry a car away.
- Avoid the undercroft, plant areas, substation areas and other lower-level areas during flood conditions.
- Do not use EV charging equipment or lifts during flood conditions.
- Move to upper habitable floors / identified safe-refuge areas if evacuation is no longer safe.
- Assist vulnerable residents only where it is safe to do so.
- Keep away from power lines and damaged utilities – electrical current can travel through water.
- After flooding, avoid contact with mud, debris or contaminated water. Do not re-enter floodable areas, use EV charging equipment, use lifts or turn services back on until confirmed safe.

© Clancy Consulting 2026