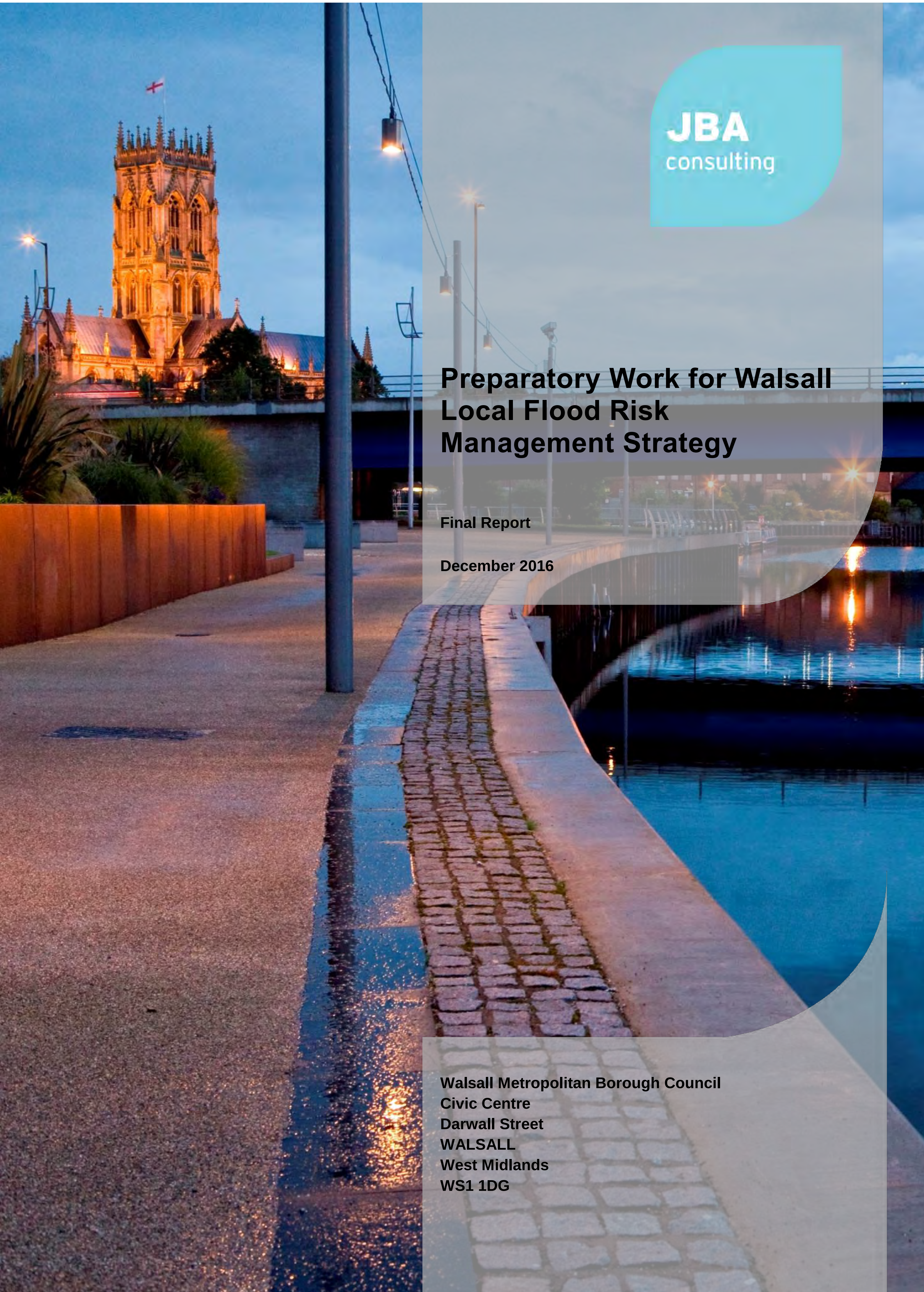

Preparatory Work for Walsall Local Flood Risk Management Strategy

Final Report

December 2016

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Revision History

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v0.1 April 2013	Draft	Hannah O'Callaghan
V2.0 December 2016	Final	Jag Raan

Contract

This report describes work commissioned by Hannah O'Callaghan, on behalf of Walsall Metropolitan Borough Council. Walsall Metropolitan Borough Council's representative for the contract was Hannah O'Callaghan. Jaroslav Petrovskij and David Kearney of JBA Consulting carried out this work.

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Purpose

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JBA Consulting has no liability regarding the use of this report except to the Walsall Metropolitan Borough Council.

Acknowledgements

We would like to acknowledge Hannah O'Callaghan for her assistance throughout the project.

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Executive Summary

Background

JBA Consulting was commissioned by Walsall Council in January 2013 to undertake an assessment of flood risk within Walsall Council's boundaries. This included an assessment of flood risk:

- along ordinary watercourses which were not modelled as part of the Environment Agency's Flood Zone study in 2004;
- from culverts and trash screens identified by Walsall Council; and
- from canal breach.

In order to understand the risk of flooding from culverts and trash screens, the study includes an assessment of culvert capacity to accommodate the 1 in 30-year and 1 in 100-year flows and effects of blockages of 90%, 75% and 50% at the aforementioned return periods.

In addition to improving understanding of flood risk through improved datasets, a GIS tool has been developed to allow Walsall Council to rapidly query property datasets against flood risk information to provide summaries of property at risk at varying reporting scales. This work is reported separately to the flood modelling.

Methodology

To assess the flood risk from watercourses, culverts and canals, hydraulic modelling has been carried out for each site using JBA's award winning 2D modelling software, JFlow+.

Given the urban nature of many of the contributing catchments, model inflows have been derived using the JFLUSH methodology, an implementation of the recently published urban extension to ReFH. Inflows to the canal breach models have been derived based on assumed breach volumes in a given canal pound length.

Visual inspections were undertaken of a number of locations where no data was available for a particular culvert or trash screen. The culvert locations were split in groups based on the availability of survey data and a number of other parameters. Different approaches were used to calculate or estimate the capacity of culverts; where dimensions were known (either surveyed, or provided by WMBC) it was calculated using a spreadsheet implementation of Manning's equation. The capacity of culverts with unknown dimensions were estimated to be equal to the upstream channel Median annual maxima flood (QMED).

The latest version of the 2D modelling software JFlow, JFlow+, and enhanced flood estimation methodologies were used, which together produced accurate flood extents and depth grids for each location.

Results

Depth grids as well as flood outlines were created for the required range of return periods and blockage scenarios for each location; these results were then carried forward to be analysed using the Flood Risk Assessment tool developed in parallel with this modelling study.

Contents

List of Figures

List of Tables

Abbreviations

2D .... Two-dimensional

DTM .... Digital Terrain Model

GPU .... Graphics Processing Unit

JBA .... JBA Consulting

LLPG .... Local Land and Property Gazetteer

QMED .... Median annual maxima flood

WMBC .... Walsall Metropolitan Borough Council

1 Introduction

JBA Consulting was commissioned by Walsall Council in January 2013 to undertake an assessment of flood risk within Walsall Council's boundaries. This included an assessment of flood risk:

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In addition to improving understanding of flood risk through improved datasets, a GIS tool has been developed to allow Walsall Council to rapidly query property datasets against flood risk information to provide summaries of property at risk at varying reporting scales. This work is reported separately to the flood modelling.

1.1 Study area

Figure 1-1: Study Location

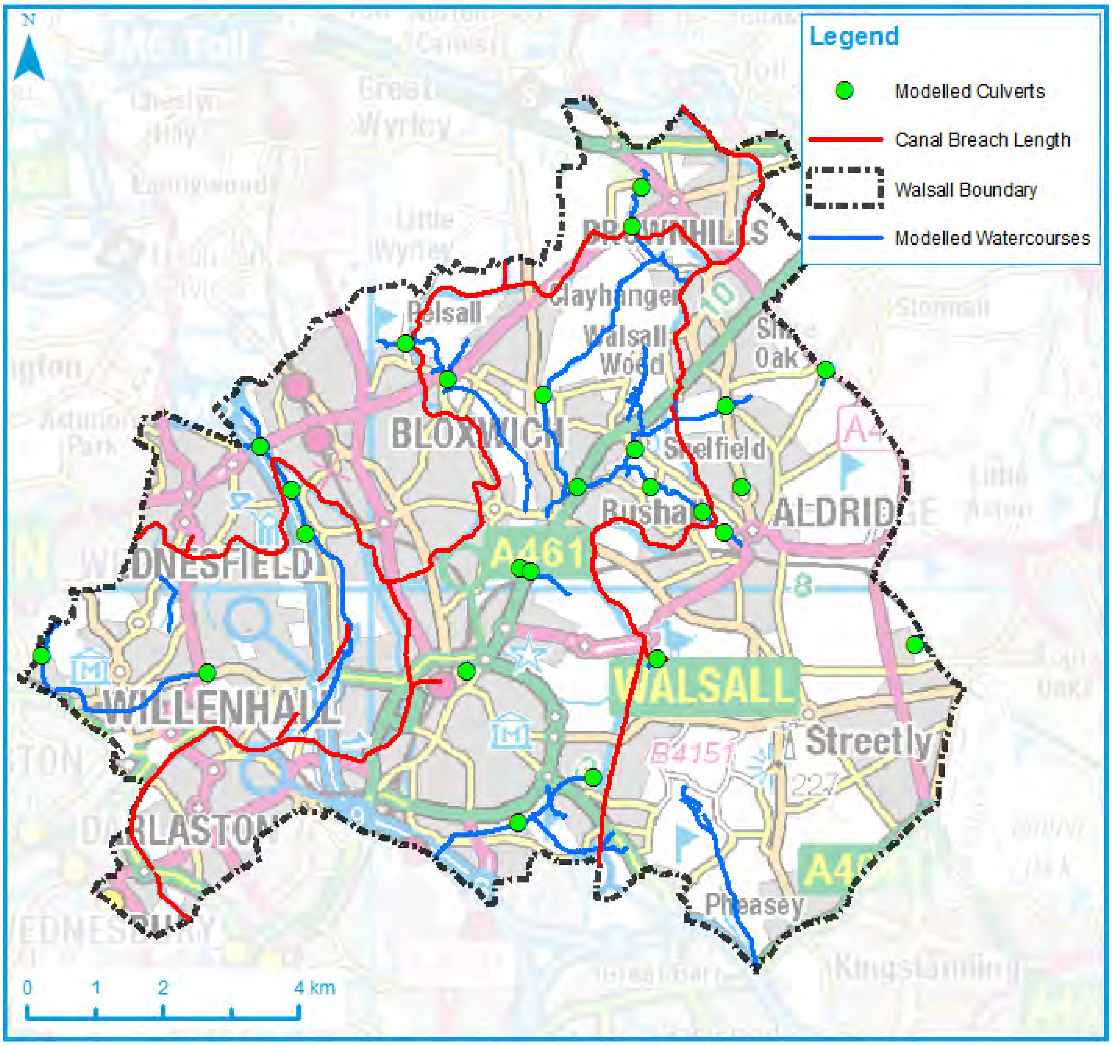


Figure 1-1 shows the locations of culverts and grids to be assessed throughout Walsall, along with the lengths of ordinary watercourse to be modelled and canals to be assessed for breach. 25 culverts have been assessed as part of this study; Table 1-1 lists these culverts and links them to a reference number for easier reference throughout this report.

Table 1-1: Culverts considered in this study

Reference number	Location
1	Middlemore Lane, Aldridge
2	Wharf Approach, Aldridge
3	Barns Lane, 290m south-west from intersection with Stubbers Green Road, Rushall
4	Lichfield Road A461, 20m south from the intersection with The Parkway, Shelfield
5	Hatherton Road, next to the Civic Centre, Walsall
6	Coppice Lane, 230m west from the intersection with Chester Road North A452
7	Pelsall Road A4124, 50m north from Croft Close
8	Vicarage Road, 70m east from Station Road, Pelsall
9	Stubbers Green Road, 70m south-east from Brook Meadow Road roundabout, Shelfield
10	Northgate, 70m south from the Fire Station, Vigo
11	Lake Avenue, Walsall
12	Delves Green Road, 180m south from Broadway, The Delves
13	Hardwick Wood, 130m east from Lindrosa Road, Streetly
14	Longwood Lane, 370m south from Aldridge Road A454 roundabout
15	Chester Road A452, next to the intersection with Lazy Hill
16	Lichfield Road A461, next to Lady Pool
17	Cartbridge Lane South, opposite the Works
18	Northgate, 90m south from Shenstone Drive, Leighswood
19	Fishley Lane, 60m north from Fishley Close, Fishley
20	Lichfield Road / Wolverhampton Road, 90m east from Livingstone Road, Little Bloxwich
21	Lichfield Road A4124, next to the intersection with Vernon Way, Dudley's Fields
22	Wood Lane, 200m west from Willenhall Lane, Leamore
23	Hatherton Primary School grounds, close to Bloxwich Lane
24	Northern end of Holman's Close, Neachells
25	Area between Warwick Avenue, Lincoln Avenue and Wolverhampton Road West, Willenhall

2 Fluvial modelling methodology

2.1 Modelling Software

Developed by JBA Consulting, JFlow is a 2D floodplain mapping model that provides fast, cost effective estimates of flood depth, velocity and extents. For this model, the version known as JFlow+ has been used.

Following on from the development and application of JBA's diffusion wave based model, (JFlow-GPU), JFlow+ solves the 2D Shallow Water Equations and, like JFlow-GPU, exploits GPU technology. Shallow water based models offer a number of benefits over the diffusion wave approach as more physics is incorporated into the model, including momentum effects. In addition velocity data is directly available, as both depth and velocity are solved by shallow water codes.

JFlow+ uses a finite volume formulation and combines the Riemann based solver of Roe with an upwind treatment of the source terms. The model is both conservative and shock capturing, and maintains water at rest over irregular topography. The code had been developed using CUDA which is a C based language, developed by NVIDIA to enable programmers to exploit the benefits of GPU programming.

The process of the model uses the DTM as a raster grid, where each cell has a ground level and a water depth. Water can move to any of the surrounding eight cells where the water level is lower. Water pond in low spots until the water level is high enough to spill into adjacent cells.

The model offers a suitable compromise between the greater details resulting from a 2D floodplain modelling package without the greater complexity associated with it. However, the model is only as accurate as the underlying DTM. There is a trade-off between greater topographic detail and the smaller time-step (and therefore longer runtime) that is needed with a smaller grid size.

2.2 JFlow Data Requirements

A JFlow+ project requires three types of data in order to model flow across a flood plain:

- Topographic information in the form of a Digital Terrain Model (DTM)
- Flow hydrograph for a inflow location, in order to simulate water flowing onto the flood plain
- Cross Sections per each of the inflow location, which define the area of the DTM over which to route the flow. Their orientation, width and length will play an important role on the model results.

2.3 DTM

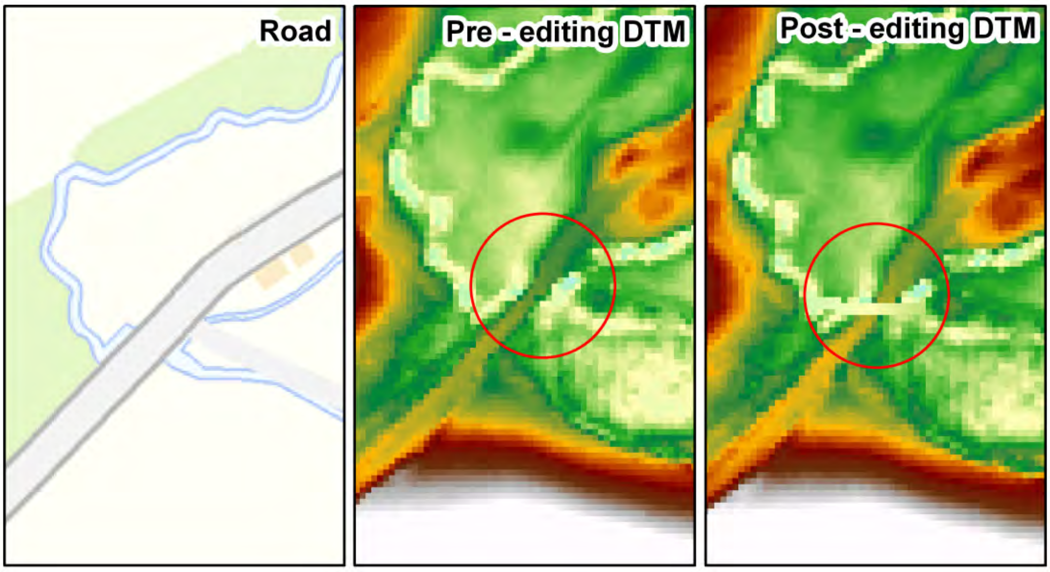
The Digital terrain Model is the basis of the JFlow model, the quality and or resolution of the DTM will determine the quality of the final results. Of course accurate flow data is vital, but ultimately it is the DTM that determines the results.

Two metre filtered LIDAR, in the form of a digital terrain model (DTM), was used as the underlying ground levels in this study. The LIDAR was supplied by the Environmental Agency in ASCII format. This product is constituted by data from different, overlapping surveys, at different resolutions that have been merged together. The newest, and highest resolution data, has had precedence in the merging process.

The actual coverage of the LIDAR data revealed some gabs on the DTM. These gaps were filled with SAR information provided also by the Environmental Agency. The SAR data was resampled to 2m and mosaic with the LIDAR.

This DTM required editing in order to rectify areas where no flow paths existed. These are caused mainly by raised structures, such as roads or bridges, represented in the DTM. In reality, there would be an opening such as a culvert where water can flow through which is not represented in the DTM (See Figure 2-1).

Figure 2-1: DTM Editing



2.4 Hydrology

The approach to flood estimation must be informed by the nature of the catchment, the type of problem and the data available.

The FEH provides methods for flood estimation at sites where there is insufficient data to estimate flood peaks for the return periods of interest. The FEH provides two basic approaches to flood estimation, the Statistical method and the Revitalised Flood Hydrograph (ReFH) method.

Detailed guidance on the choice of methods for flood frequency estimates and on restrictions in the applicability of the methods can be found in Volumes 1 and 4 of the FEH, and from the DEFRA report for the ReFH method. If there is a gauged record near the site then the statistical method is likely to be preferred over Rainfall-Runoff methods. The recent introduction of the ReFH seeks to reconcile differences between Statistical and Rainfall-Runoff results.

FEH flood frequency methods should not be routinely applied to heavily urbanised catchments. The FEH Statistical method's urban adjustment was calibrated using 34 heavily urbanised and 81 moderately urbanised catchments. This is substantially more than the ReFH method and can therefore be used with more confidence. However, it should be noted that the Statistical method is not suitable for catchments where there are significant cross-boundary transfers of water via sewers. The Statistical method treats a catchment as a lumped unit and does not represent the relationship between runoff and catchment area.

Heavily urbanised catchments can present significant problems for flood estimation. Their influence is affected not just by the proportion of urban area within a catchment, but also by factors such as the urban runoff rate, the type of development present, the spatial concentration of the urban area and the way in which it is drained. Because of the wide variety of factors one cannot expect a reliable estimate of flood flows using generalised methods. For example:

- FEH Statistical is not designed to cope with catchments where the contributing area is determined by the sewerage system (i.e. if sewers take water out of the topographic catchment)
- ReFH is poorly calibrated against urbanised catchments
- The Modified Rational procedure was only designed for events up to the 5-year return period
- IH 124 does not take account of complex sewer systems

The complex nature of the catchment requires a bespoke approach to the hydrological estimates within urban areas. To calculate flows within the urban areas a Revised Urban ReFH method (JFlush) has been used. Essentially, this approach uses the full ReFH model in rural areas and within the green portion of urban areas (gardens, parks etc.). In the portion of urban areas covered by hard surfaces, the ReFH losses model is not used; instead the percentage runoff is set to a fixed value (70% is suggested in Kjeldsen (2009) and has been adopted here). This avoids the need to depend on aspects of ReFH that are poorly calibrated for urban catchments:

- the regression equation for CMAX, which makes no allowance for urban extent and therefore does not represent the increase in runoff volume with urban extent;
- the way in which the initial soil moisture, Cini, is calculated for design events based on an equation calibrated from only seven catchments and which gives a physically unrealistic increase in CMAX as PROPWET decreases;
- the factor used to scale Cini to ensure that the resulting flood frequency curve is consistent with the results of the FEH statistical method - again, this factor was derived from analysis of only seven catchments.

2.4.1 Urban ReFH

Recent research by Kjeldsen, T.R. (2009) suggested an extension to the ReFH method for urban catchments[1]. It improves the way in which percentage runoff is calculated, although in the paper this is only applied to simulation of observed floods rather than the estimation of design events. This method may be used during the modelling stage if the design flows for the urban catchments derived from other methods are unsuitable.

At JBA the extension to the ReFH method would be carried out using the following four steps:

STEP 1 Subdivide catchments: Identify sub-catchments according to the catchment urban area drained by sewers (draining into and out of natural catchment) and rural area).

STEP 2 Assumed sewer capacity: Determine the return period below which it is assumed the sewer systems are working within capacity and can therefore sufficiently drain all rainfall. For events higher than this event, it is assumed excess water will drain topographically as the capacity of the sewer system will be exceeded

STEP 3: Create hydrographs using ReFH: derive a total of four hydrographs for each catchment using sub-catchment data

- Hydrograph 1 - urban area drained by sewers into catchment from surrounding catchments. Required for those return periods within sewer capacity
- Hydrograph 2 - urban area of natural catchment
- Hydrograph 3 - rural area of natural catchment
- Hydrograph 4 - urban area of natural catchment which is drained by sewers from surrounding catchments. Sewer capacity is exceeded. It is important to subtract the flow still being drained out of the catchment by the sewer system.

STEP 4: Hydrograph addition: the hydrographs produced are combined to represent the inflows into the urban catchment.

Full details of catchment descriptors and proportions of catchments classed as urban and rural are provided in Appendix D.

2.5 Model Parameters

- JFlow+ is a raster-based approach driven by an underlying DTM. Using a 2m spatial resolution DTM to run the model concluded in a very long runtime.
- To stop the JFlow+ run, two parameters are used: Hydrograph Duration Multiplier and Constant Wet Cell Time (h). For this model, values of 2 and 5 were used respectively.
- Box size varied in the different locations depending on the floodplain width. A 1000m box size is used in the majority of the models.
- A single Manning's n value of 0.05 was use over the entire study area.

[1] Kjeldsen, T.R.(2009). Modelling the impact of urbanisation on flood run off volume. In proceedings of the Institute of Civil Engineers, Water Management 162. Issue WM5.

2.6 Model assumptions

- Flow paths below bridges and culverts cannot be represented in the DTM. Where bridges and other structures (weirs and sluices) remain in the DTM, water does not spread through as high elevation values remain on DTM. Therefore where bridges and significant culverts exist, a path is opened on the DTM to allow water to flow through that path and not back up. The size of the path opened in the DTM depends on the structure size.
- Bridges and other structures (weirs and sluices) cannot normally be modelled; this can lead to underestimation of the flood extent/depth where a structure causes significant afflux.

2.7 Limitations of Approach

- The LIDAR composite data used is from October 2011. This composite includes the Environment Agency's LIDAR data archive containing digital elevation data derived from surveys carried out since 1998. However, ground levels may change due to ongoing development and these might not be represented in the current DTMs.
- In urban areas, culvers and drains are not represented on the DTM very precisely. This influence in the way flood risk from JFLOW in urban areas is going to be understood.

2.8 Results

Simulated flood risk along the ordinary watercourses has been modelled and the results have been provided digitally as part of this study. Flood extents are also presented in Appendix A.

3 Canal breach modelling methodology

To assess flood risk from canals, worst case canal inundation assessments have been identified based on areas of raised embankments. These assessments do not take the structural integrity of the embankment into account or quantify a risk of failure. Flooding may occur at any location along the canal system where there is a raised embankment. Canal inundation analysis is therefore indicative and digital plans only have been provided as part of this study.

3.1 Flood Risk from Canals

Canals do not generally pose a direct flood risk as they are a regulated water body. The residual risk from canals tends to be associated with lower probability events such as overtopping and embankment failure.

The residual risk associated with canals is more difficult to determine as it depends on a number of factors including, for example, the source and magnitude of surface water runoff into the canal, the size of the canal, construction materials and level of maintenance. The probability of a breach is managed by continued maintenance.

No attempt is made in this study to assess the probability of failure other than noting that such events are very rare. If a breach event were to occur then the consequences, to people and property, could be high. In order to understand the possible impacts, a series of inundation models have been generated for this study. It should be noted that the canal breach locations have been identified based on areas of the canal that includes raised embankments. The mapping is intended to provide an indication of the likely impact of selected failure scenarios.

3.2 Canal Inundation Methodology

Canal breaches can be caused by overtopping and erosion of canal embankments. In general, failure is more commonly caused by degradation of the canal lining and erosion within the embankment slope until failure occurs.

Flooding from a breach of a canal embankment is largely dictated by canal and ground levels, canal embankment construction, breach characteristics and the volume of water within the canal that can discharge into the lower lying areas behind the embankment. For this study, the potential maximum flood extent is limited by the maximum volume of water within a pound length. However, during a joint probability flood event or if there is an interaction between a canal and watercourse then the volume and extent of flooding may increase.

The potential breach outflow volume is either dictated by the upstream canal pound length or, for long pound lengths, how quickly the operating authorities can react to prevent further water loss. Pound lengths were calculated for the canal and possible breach locations were identified. Areas lower than the estimated minimum canal water levels were assumed to be at potential risk from a canal breach. Canal water levels and surrounding ground levels were determined using LIDAR data.

There are a number of uncertainties associated with the simulation of flooding from canals in either overtopping or breach conditions. A number of assumptions have been used in the simulation of flooding for Walsall:

- Generally the canal is 10 metres wide.
- The minimum depth of approximately 1.2metres
- The canal is typically shallow but variability in depth along the course has not been taken into account.
- That British Waterways would be notified of the break immediately and have engineers on site within one hour.

These assumptions should be considered when using and reviewing the mapping produced from the modelling.

A breach hydrograph was developed using a 1-D HECRAS model to represent the three stage mechanism with the starting water level as bank full. The respective pound lengths were applied to the model. The breach hydrographs obtained from HECRAS were fed into a two dimensional JFLOW model to assess potential flood inundation extents along the length of the canal. Inflows were applied to the JFLOW model along the canal at potential breach locations.

3.3 Data Availability

A series of worst case canal inundation appraisals have been undertaken at selected locations along the canal system in Walsall. Due to the potentially numerous locations for failure scenarios, the canal mapping is considered indicative only and will need to be reviewed and updated as part of any detailed site specific study. The location of inundation scenarios were based on the location of elevated canal systems and vulnerable infrastructure.

3.4 Inundation Results

Simulated inundation from the canal has been modelled and the results have been provided digitally as part of this study. The results of the breach analysis are also presented in Appendix B.

4 Culvert blockage modelling methodology

4.1 Culvert survey data

The survey data on culvert dimensions provided by WMBC proved to be incomplete, as there was no information regarding the dimensions of the majority of culverts considered in this study.

Based on the preliminary evaluation of the severity of possible effects of blockage and the availability of survey data, culverts were split in the following groups:

1. Culverts, the blockage of which was considered to be able to result in relatively serious consequences. The dimensions of these culverts were surveyed as part of this study
2. Culverts, the dimensions of which were derived from the data provided by WMBC
3. Culverts, for which no survey data were provided. The capacity of these culverts for modelling purposes was taken to be equal to the upstream channel Median annual maxima flood (QMED)

Figure 4-1 shows the approach taken to derive the culvert capacity for each of the culverts.

4.2 Calculating culvert capacity

Varied availability of survey data necessitated two distinct approaches to derive the capacity of culverts for the JFlow modelling purposes. These methods are described in Sections 4.2.1 and 4.2.2 below. Figure 4-2 shows the method used to derive the capacity of a particular culvert together with the locations of culverts that were excluded from the modelling process based on their calculated capacity (See Section 4.2.3 for details).

4.2.1 Calculating capacity using Manning's equation

The capacity of culverts with known dimensions (either surveyed, or provided by WMBC) was calculated using a spreadsheet implementation of Manning's equation.

For the no failure/partial blockage scenario the capacity of the culvert was used as the channel capacity for the JFlow+ simulation. In view of the relatively large number of culverts that needed to be assessed the calculation of channel capacity had to be simple, robust and rely on readily available data concerning a culvert. For these reasons the culvert capacity was calculated based on the Manning's equation for the culvert flowing at full bore. The only data needed are the culvert dimensions (width, height and shape), bed slope, roughness and length.

The culvert capacity is dependent on many other factors including, but not necessarily limited to: dimensions, the upstream and downstream channel conditions, siltation and debris depth, the degree of surcharging and the inlet/outlet conditions. The full range of information was unavailable for every structure, so where possible additional information on culvert dimensions and condition were collected during site visits and this was used to supplement the information provided by WMBC.

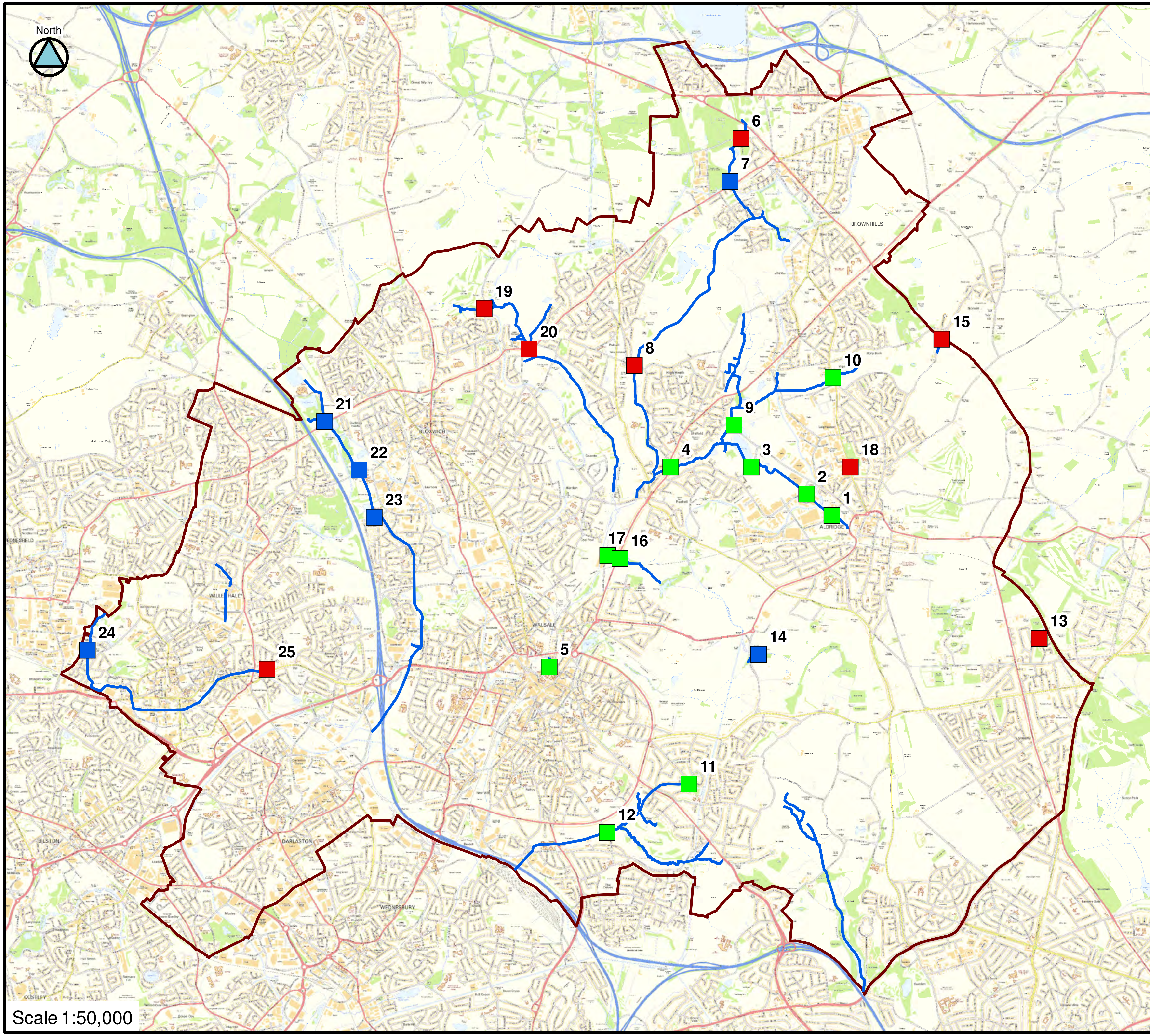
A complex approach was deemed to be beyond the remit of this study, and hence the approach taken is thought to be adequate bearing in mind the strategic nature of the study.

4.2.2 Capacity of culverts with unknown dimensions

There were eight culverts within the study area for which no survey data were provided (see Figure 4-2 for their location). Where the survey data for a particular culvert was missing, the capacity of the culvert for modelling purposes was taken to be equal to the upstream channel QMED. This is a conservative approach and it may result in overestimation of the potential consequences of the culvert blockage. Due to the lack of the survey data and the fact that using this method will generally result in conservative estimations of flood risk, the method is considered adequate and appropriate for this study.

4.2.3 Culverts excluded from the modelling process

The calculated capacity of four culverts was sufficiently large to exceed the 1 in 100-year peak flow even at 90% blockage. These culverts were excluded from the modelling process, as the flood risk from their blockage was considered insignificant. Figure 4-2 shows the location of the excluded culverts.



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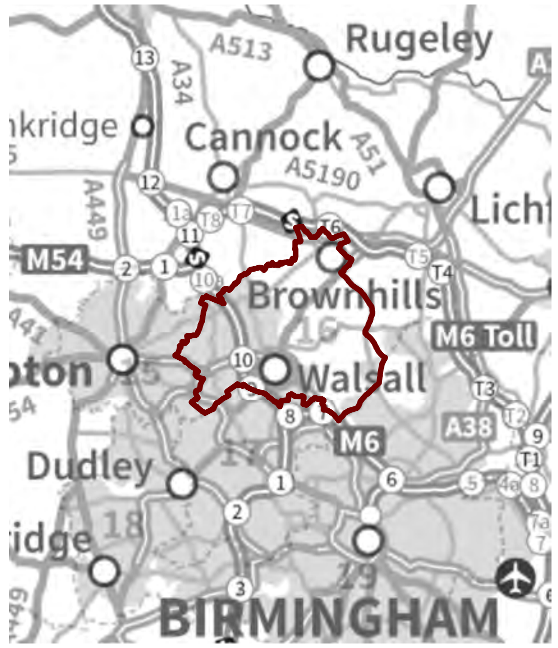

LEGEND

Modelled culverts

- Surveyed for this study
- WMBC data
- No survey data
- Modelled watercourses
- Walsall Borough boundary

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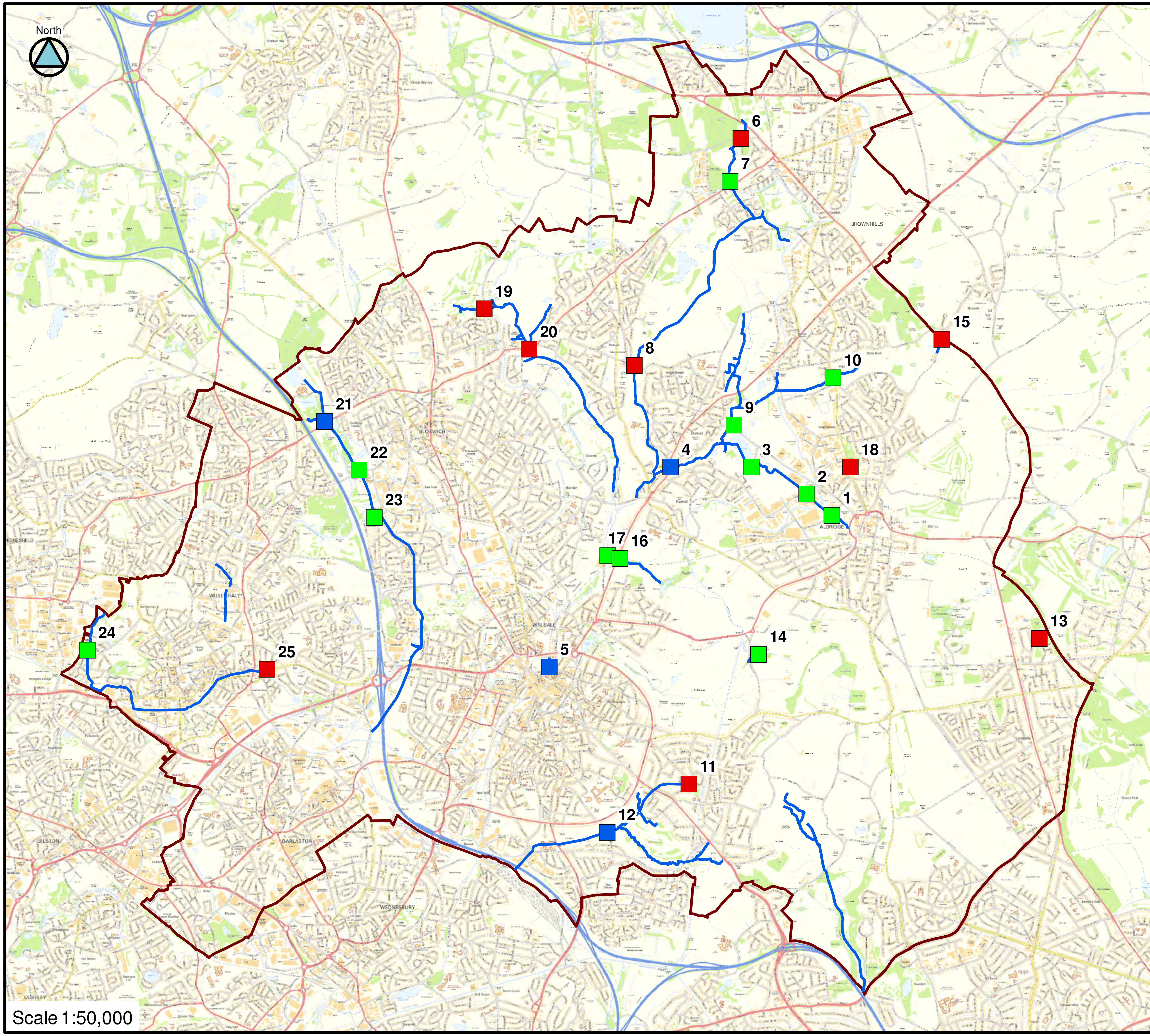
FIGURE 2-1
CULVERT SURVEY DATA



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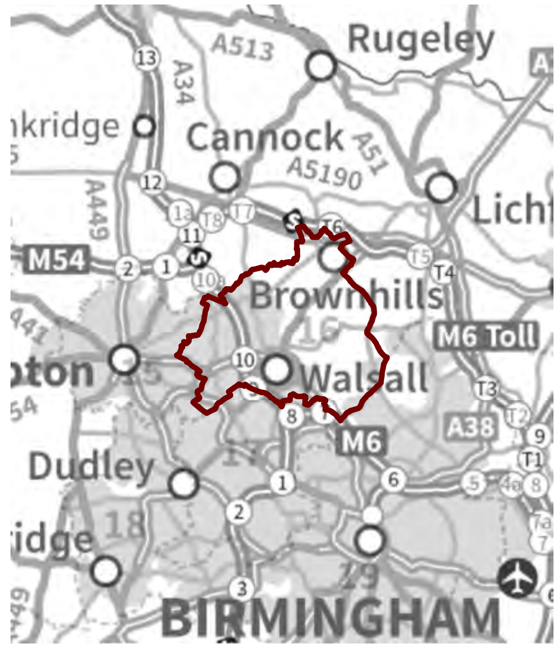

LEGEND

Modelled culverts

- Suveyed culvert capacity
- Culvert capacity as channel QMED
- Culvert excluded from the study
- Modelled watercourses
- Walsall Borough boundary

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FIGURE 2-2
CULVERT CAPACITY CALCULATION

4.3 Modelling choices for individual culverts

Table 4-1 summarizes the modelling approaches chosen for each individual culvert within the study extent.

Table 4-1: Modelling approaches for individual culverts

Reference number	Source of survey data	Modelling technique used
1	Surveyed by JBA	Modelled using calculated capacity
2	Surveyed by JBA	Modelled using calculated capacity
3	Surveyed by JBA	Modelled using calculated capacity
4	Surveyed by JBA	Excluded due to sufficient calculated capacity
5	Surveyed by JBA	Excluded due to sufficient calculated capacity
6	No data	Modelled using channel QMED as capacity
7	WMBC	Modelled using calculated capacity
8	No data	Modelled using channel QMED as capacity
9	Surveyed by JBA	Modelled using calculated capacity
10	Surveyed by JBA	Modelled using calculated capacity
11	Surveyed by JBA	Modelled using calculated capacity
12	Surveyed by JBA	Excluded due to sufficient calculated capacity
13	No data	Modelled using channel QMED as capacity
14	WMBC	Modelled using calculated capacity
15	No data	Modelled using channel QMED as capacity
16	Surveyed by JBA	Modelled using calculated capacity
17	Surveyed by JBA	Modelled using calculated capacity
18	No data	Modelled using channel QMED as capacity
19	No data	Modelled using channel QMED as capacity
20	No data	Modelled using channel QMED as capacity
21	WMBC	Excluded due to sufficient calculated capacity
22	WMBC	Modelled using calculated capacity
23	WMBC	Modelled using calculated capacity
24	WMBC	Modelled using calculated capacity
25	No data	Modelled using channel QMED as capacity

Table 4-2 lists the data on cross-section shape, dimensions, slope and material of individual culverts either provided by WMBC or surveyed as part of this study.

Table 4-2: Culvert dimensions

Reference number	Cross-section shape	Height (m)	Width (m)	Length (m)	Slope (radians)	Material
1	rectangle	0.5	0.7	356	0.022	concrete
2	rectangle	1.2	1.5	24	0.031	concrete
3	circle	1.2	1.2	48	0.002	concrete
4	2 x circle	1.2	1.2	225	0.008	concrete
5	2 x rectangle	1.6	1.2	unknown	0.01	concrete

7	circle	0.45	0.45	170	0.005	concrete
9	circle	0.7	0.7	12	0.006	masonry
10	2 x ellipse	0.57	0.92	26	0.005	steel
11	circle	0.6	0.6	20	0.01	concrete
12	circle	1.3	4.1	228	0.005	concrete
14	circle	0.9	0.9	29	0.011	concrete
16	2 x circle	0.8	0.8	75	0.014	concrete
17	circle	0.8	0.8	48	0.017	concrete
21	circle	1.375	1.375	32	0.077	concrete
22	circle	1.375	1.375	450	0.008	concrete
23	circle	1.375	1.375	1640	0.007	concrete
24	circle	1.8	1.8	320	0.004	concrete

Table 4-3 shows the calculated capacity of each modelled culvert as well as reduced capacity figures due to blockage.

Table 4-3: Calculated culvert capacities

Reference number	Full capacity (m^3/s)	50% blockage (m^3/s)	75% blockage (m^3/s)	90% blockage (m^3/s)
1	1.03	0.515	0.2575	0.103
2	10.92	5.46	2.73	1.092
3	1.65	0.825	0.4125	0.165
4	8.04	4.02	2.01	0.804
5	13.44	6.72	3.36	1.344
6	0.41	0.205	0.1025	0.041
7	0.19	0.095	0.0475	0.019
8	0.706	0.353	0.1765	0.0706
9	0.13	0.065	0.0325	0.013
10	1.34	0.67	0.335	0.134
11	0.57	0.285	0.1425	0.057
12	68.68	34.34	17.17	6.868
13	0.235	0.1175	0.05875	0.0235
14	1.74	0.87	0.435	0.174
15	0.349	0.1745	0.08725	0.0349
16	1.04	0.52	0.26	0.104
17	1.61	0.805	0.4025	0.161
18	0.71	0.355	0.1775	0.071
19	0.01	0.005	0.0025	0.001
20	0.301	0.1505	0.07525	0.0301
21	14.47	7.235	3.6175	1.447
22	4.6	2.3	1.15	0.46
23	4.36	2.18	1.09	0.436
24	6.43	3.215	1.6075	0.643
25	1.052	0.526	0.263	0.1052

4.4 Property count technique

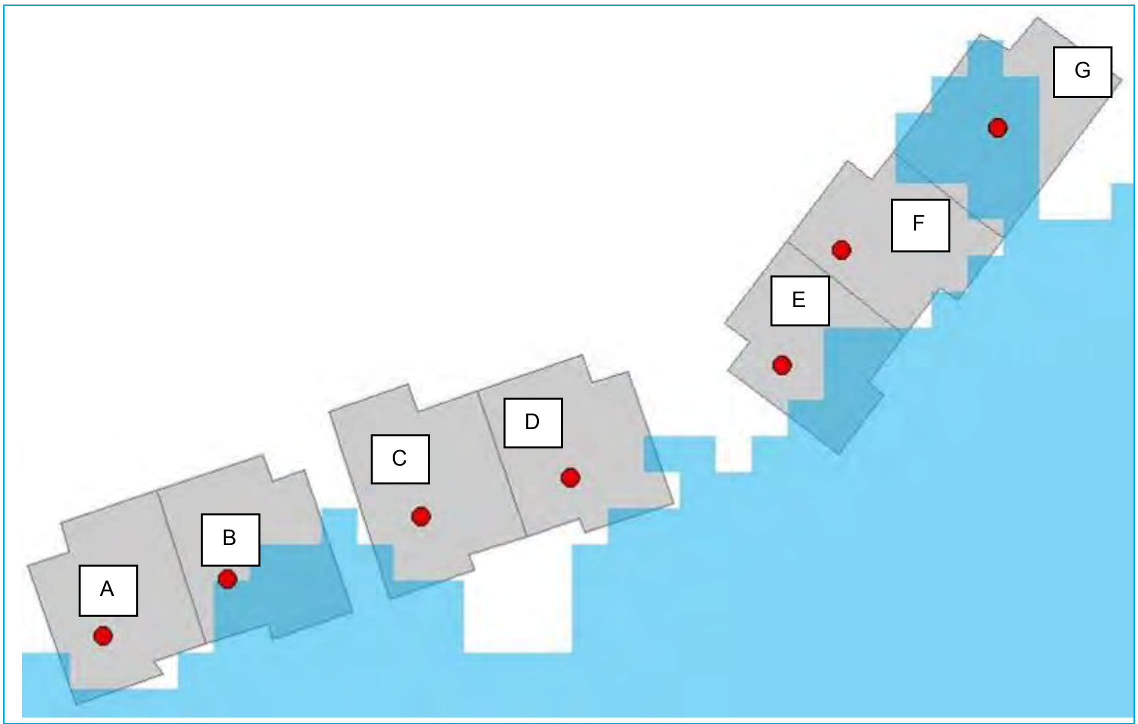
Property count was performed using the Local Land and Property Gazetteer (LLPG) property points dataset and OS Mastermap data provided by WMBC. The LLPG dataset was filtered to remove objects designated as "STREET RECORD" and "BRIDGE", as these objects represent street names and bridges respectively and not a particular type of property. It should be noted that the LLPG dataset contains other types of objects, e.g. farms, electricity substations, which may not be susceptible to flood due to their nature. Nevertheless, these objects were included in total property counts due to uncertainty about the expected extent of filtering required and to minimize any discrepancies between the property counts executed in other parts of this project.

4.4.1 Assumptions and limitations

Calculations undertaken by GIS spatial analysis methods assume the LLPG property points dataset is representative of the current situation in the study area. The dataset is a snapshot of a particular moment in time. New developments or changes to a property type (i.e. house to flat) or property use (i.e. residential to non-residential) may not be represented.

Property counts were undertaken to identify all properties at risk of flooding from the blockage of a particular culvert. This method involves selecting and counting all the properties at risk of flooding. Figure 4-3 illustrates how property footprint data can be used to intersect flood risk datasets to highlight properties at risk.

Figure 4-3: Difference between point count and detailed count



Detailed count based on property outlines: 7 properties (A-G) would be counted
Point count based on property points: 2 properties (B and G) would be counted

4.5 Property counts

The modelling results were processed to produce depth grids and flood outlines for each blockage scenario for each of the two chosen return periods for each location. Flood outlines were then used to execute the property count.

Table 4-4 shows the results of the property count for each location.

Table 4-4: Property counts

Ref. no.	Return period and level of blockage							
	1 in 30-year flood				1 in 100-year flood			
	0%	50%	75%	90%	0%	50%	75%	90%
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	2
11	17	19	19	19	19	20	21	21
12	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
18	0	5	8	13	4	14	18	27
19	7	7	7	7	9	9	9	9
20	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0
22	0	0	1	2	0	0	2	2
23	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
25	11	33	36	37	33	38	38	38
Total	35	64	71	78	65	81	88	99

A set of maps showing each blockage scenario flood outline vs. flood outline for a culvert at full capacity at each of the two return periods was produced for each location. The maps are attached to this report as an Appendix C.

When checking flood outlines and depth grids it should be taken into account that when no wet pixels are present next to the modelled culvert, it means that the culvert capacity is sufficient to accommodate the flow at the corresponding level of blockage.

5 Conclusions

The study has improved the prediction schemes used to estimate flood risk from culvert blockage in many parts of Walsall. In total 25 culverts have been hydrologically and hydraulically modelled using the latest data and methods in broad scale flood modelling. The project has successfully delivered all the specified deliverables, including flood extents, depth grids for the 30 and 100-year return periods as well as property counts.

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Appendices

A Fluvial flood outline maps

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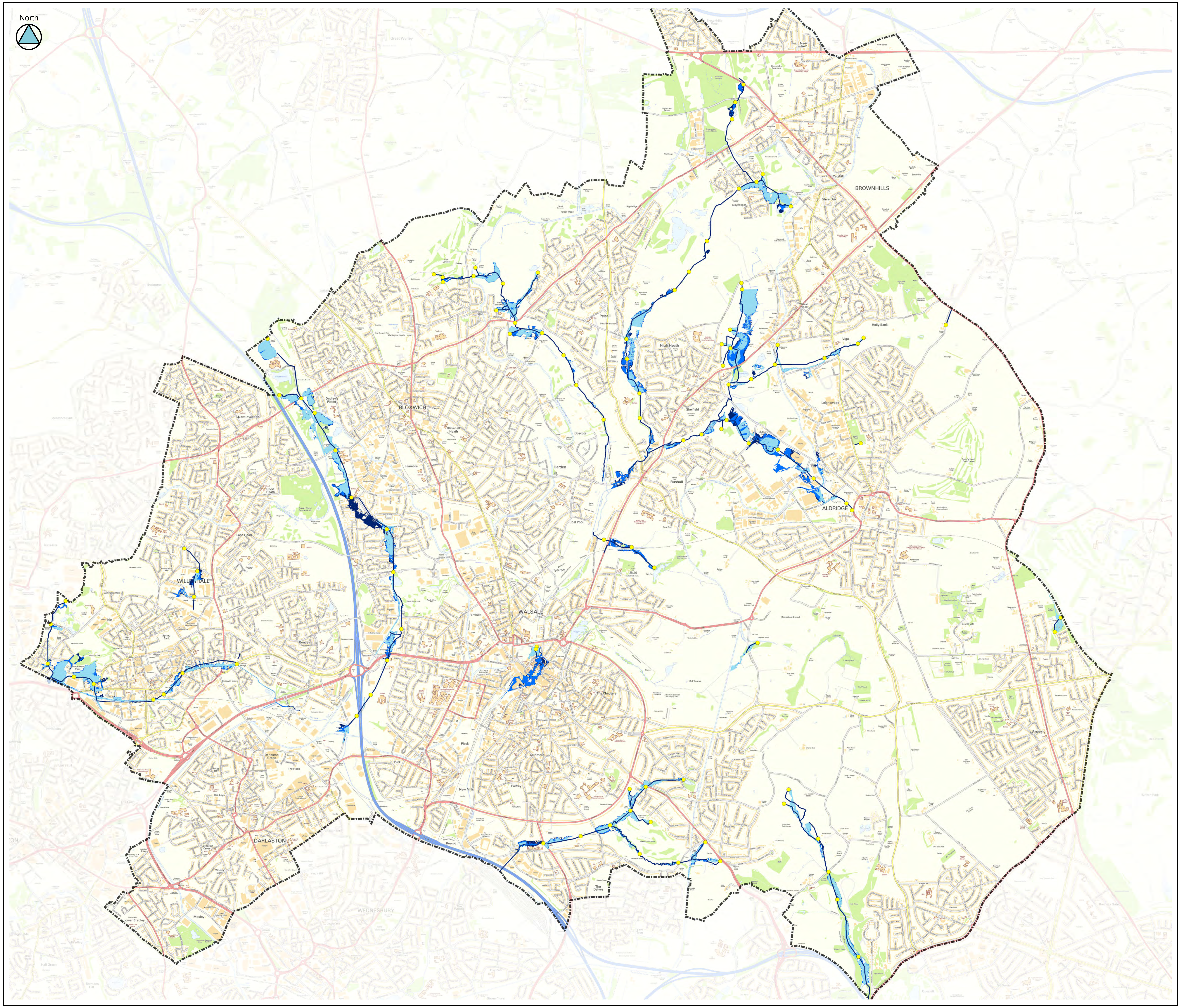

LEGEND

- Inflow Locations
- Modelled Watercourses
- Walsall Boundary
- 20-year Flood Extent
- 100-year Flood Extent
- 100-year plus Climate Change Flood Extent

0 0.25 0.5 1 1.5 2 Km

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for

WALSALL METROPOLITIAN BOROUGH COUNCIL

PREPARATORY WORK FOR WALSALL LOCAL FLOOD RISK MANAGEMENT STRATEGY

FLOOD OUTLINES

Scale:	Drawn	A Waite	March 2013
1:22,000 @ A1	Checked	P Reyes-Firpo	March 2013
	Approved	D Kearney	March 2013

Digital File Name: 2013s6894 Flood Risk A1.MXD

Drawing Number:	Sheet No.:	Status:	Rev.:
2013s6894-002	1 of 1	DRAFT	-

Original @ A1

B Canal breach flood outline maps

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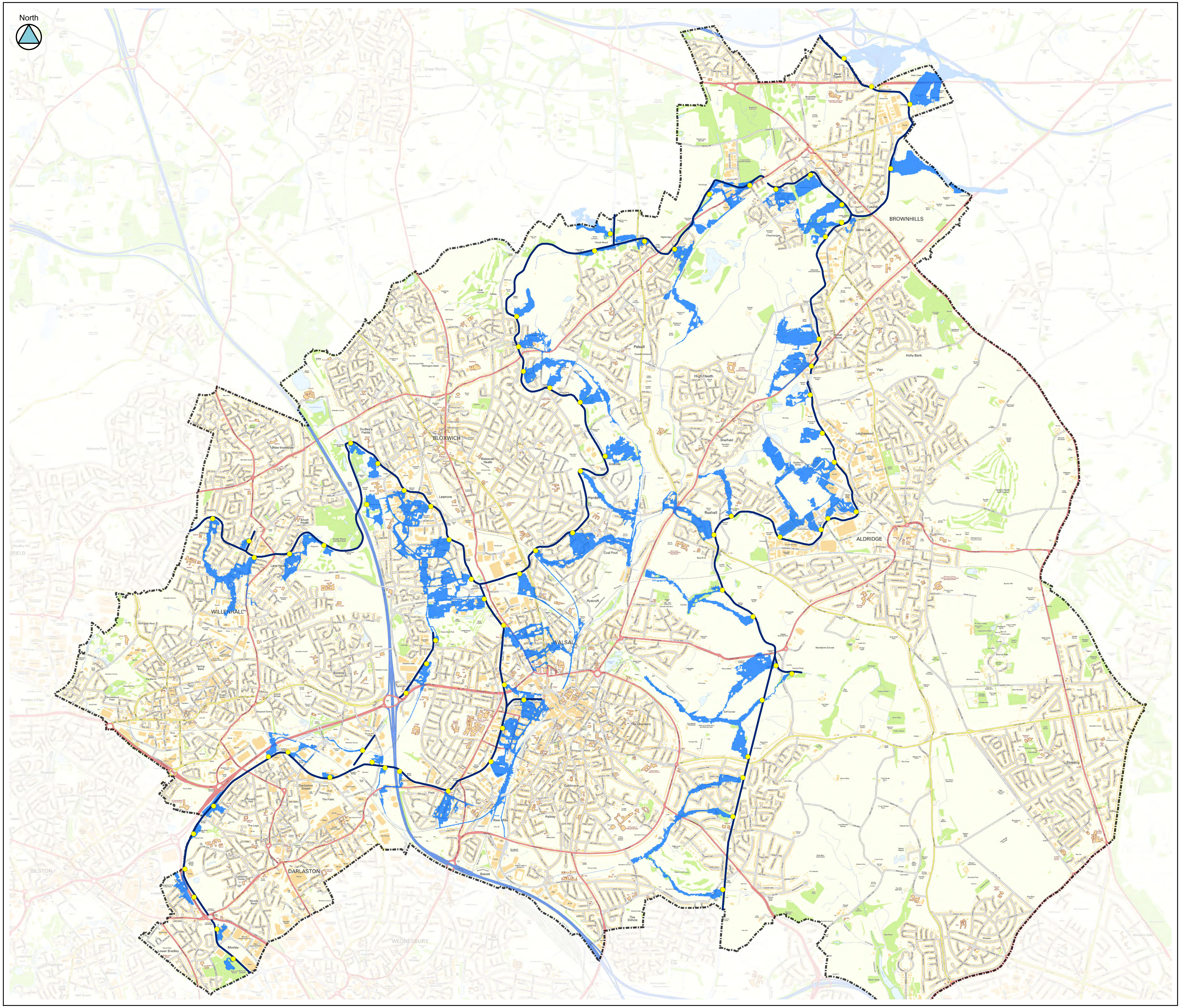

LEGEND

Walsall Boundary

Canal

Canal Breach Locations

Canal Breach Flood Extents

0 0.25 0.5 1 1.5 2 Km

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for

WALSALL METROPOLITIAN BOROUGH COUNCIL

PREPARATORY WORK FOR WALSALL LOCAL FLOOD RISK MANAGEMENT STRATEGY

CANAL BREACH FLOOD OUTLINES

Scale:			
1:22,000 @ A1	Drawn	A Waite	March 2013
	Checked	P Reyes-Firpo	March 2013
	Approved	D Kearney	March 2013

Digital File Name: 2013s6894 Canal Breach A1.MXD

Drawing Number:	Sheet No.:	Status:	Rev.:
2013s6894-001	1 of 1	DRAFT	-

Original @ A1

C Culvert blockage flood outline maps

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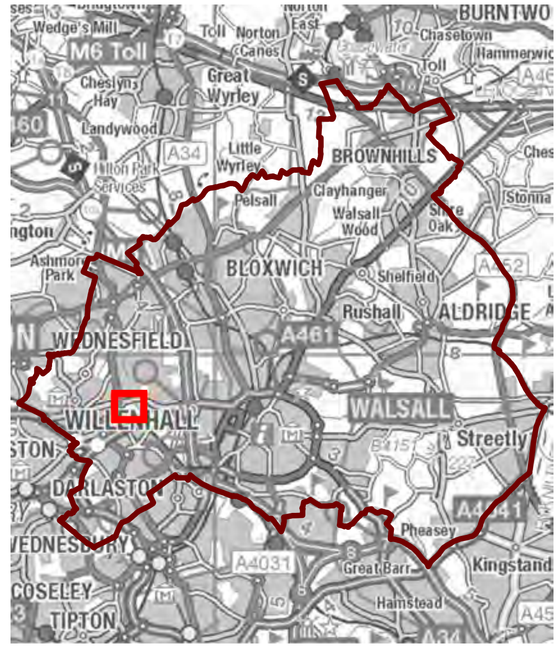

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 90% blockage
- 100yr RP 0% blockage

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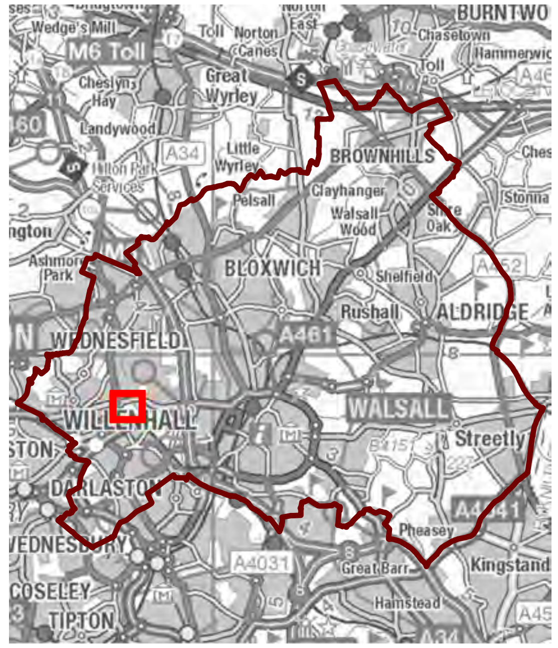
WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C25-100-90
CULVERT 25 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

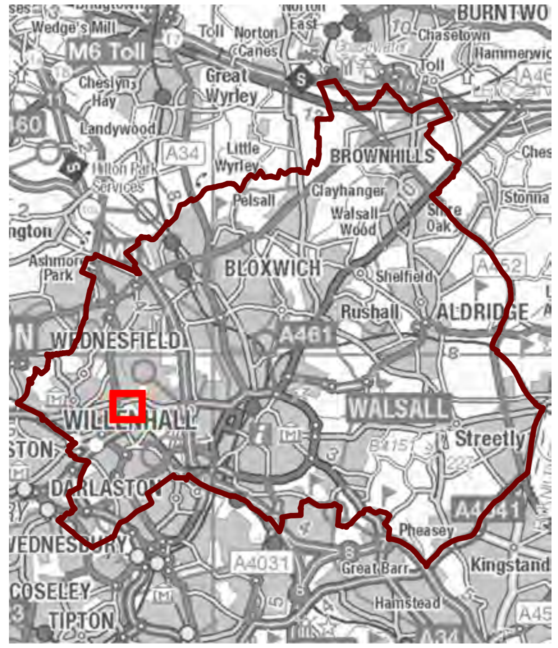
- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 75% blockage
- 100yr RP 0% blockage

JBA consulting

WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C25-100-75
CULVERT 25 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 50% blockage
- 100yr RP 0% blockage

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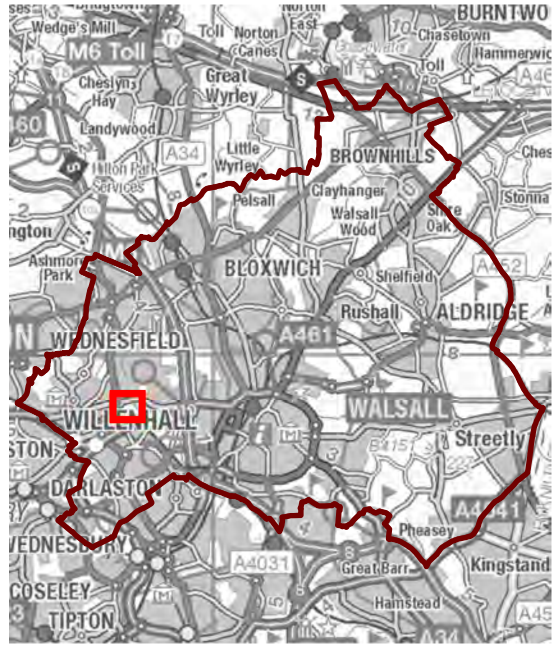
WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C25-100-50
CULVERT 25 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 90% blockage
- 30yr RP 0% blockage

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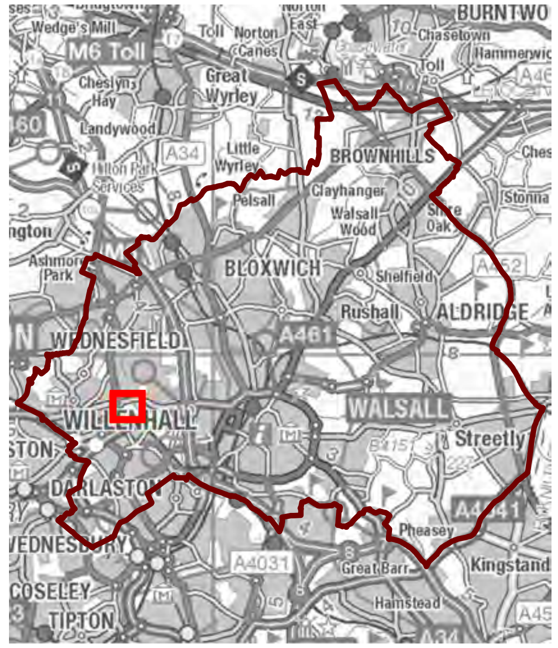
WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C25-30-90
CULVERT 25 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

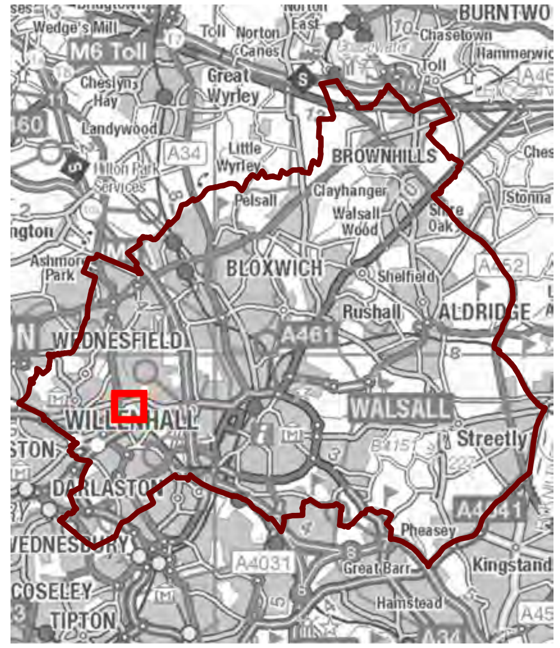
Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 75% blockage
- 30yr RP 0% blockage

WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C25-30-75
CULVERT 25 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

Surveyed culvert capacity

Culvert capacity as channel QMED

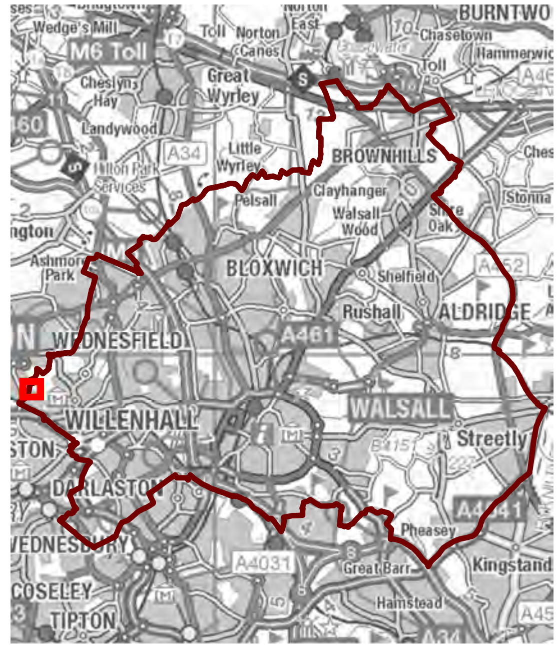
30yr RP 50% blockage

30yr RP 0% blockage

WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C25-30-50
CULVERT 25 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 90% blockage
- 100yr RP 0% blockage

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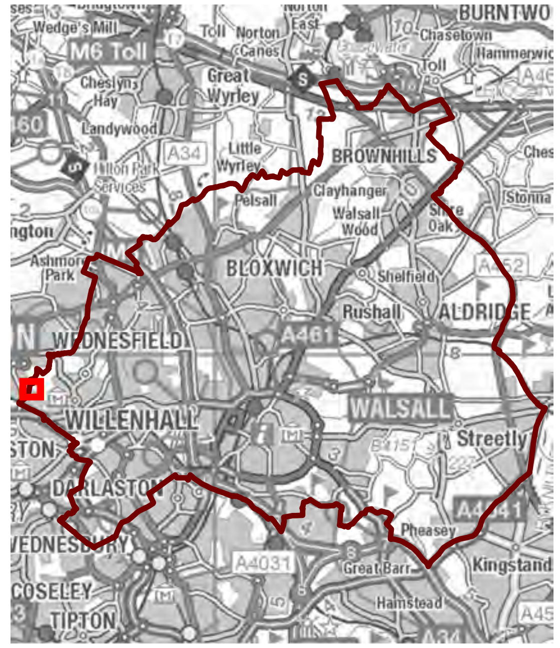
FIGURE C24-100-90
CULVERT 24 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 90% blockage
- 30yr RP 0% blockage

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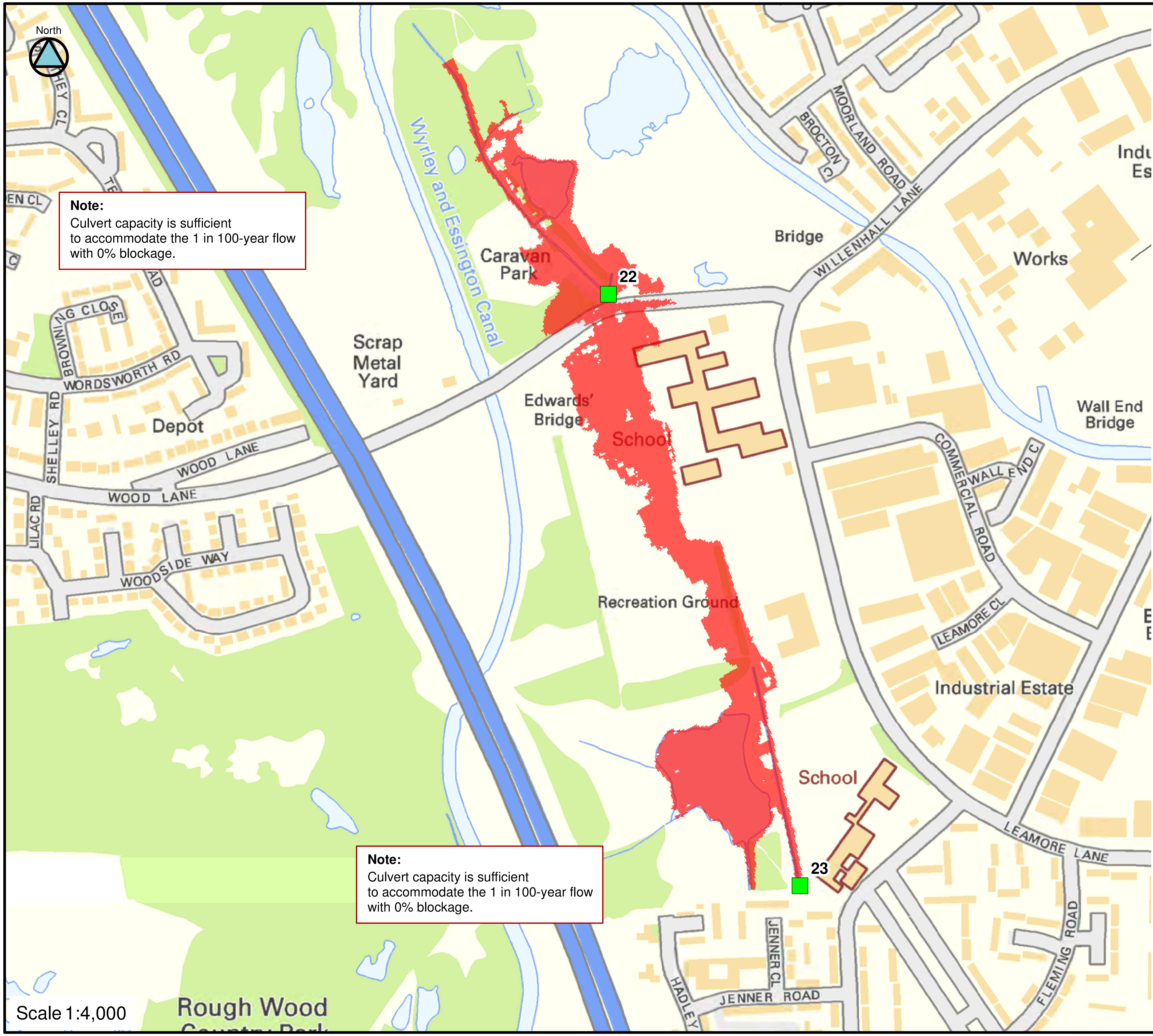
FIGURE C24-30-90
CULVERT 24 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS



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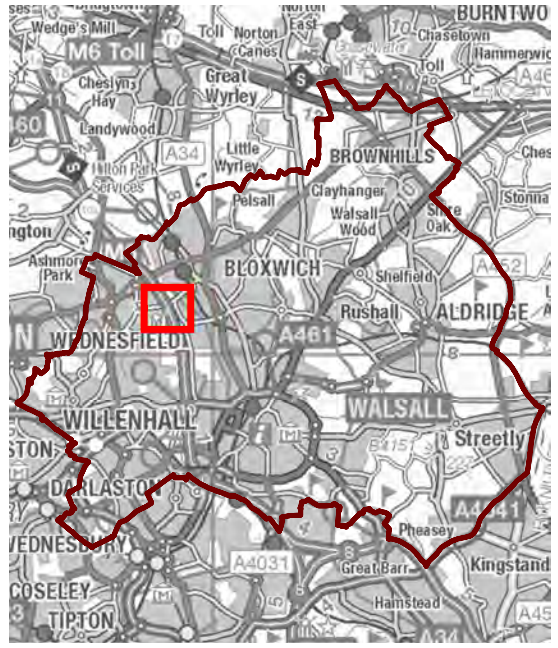


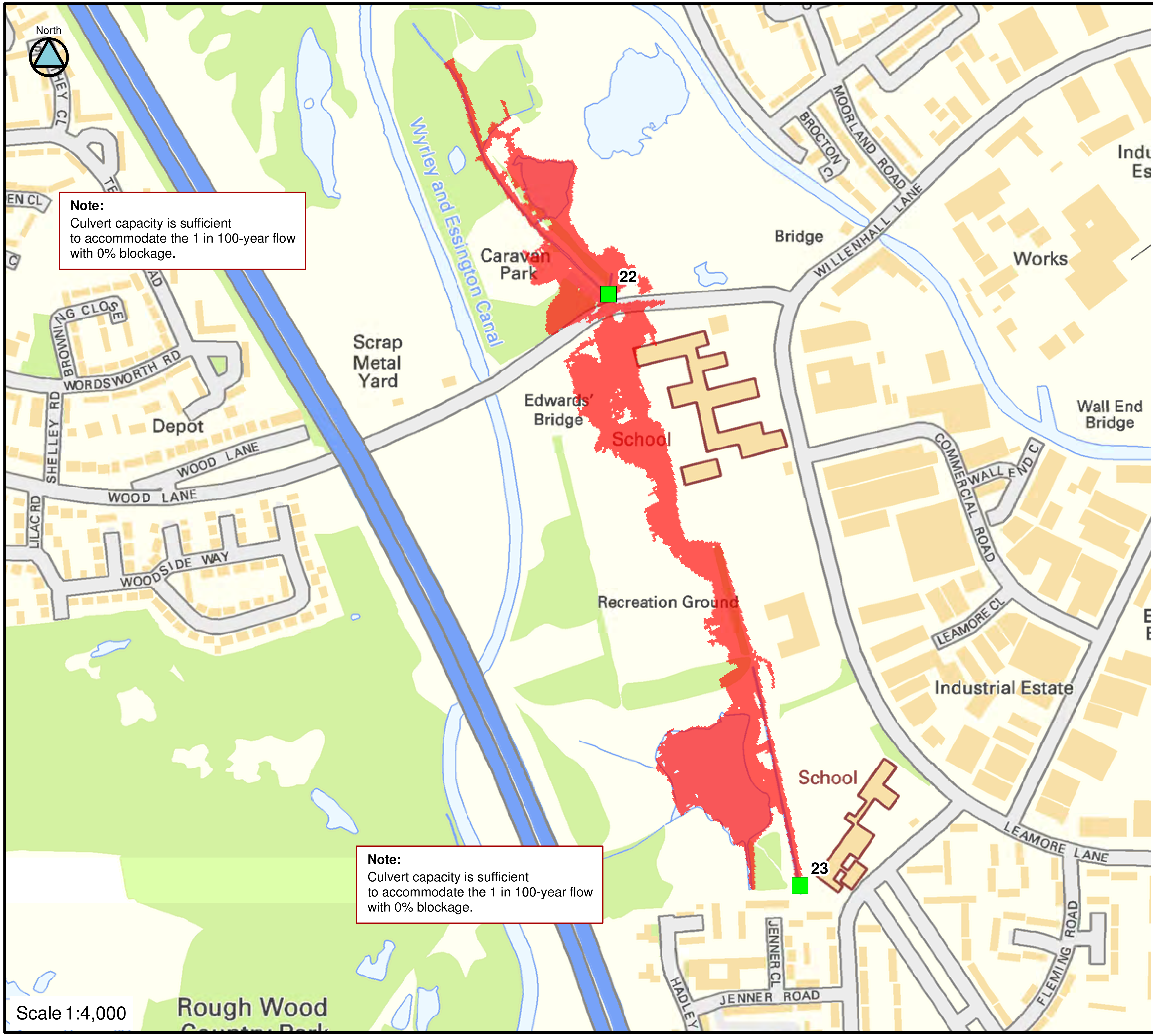
LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 90% blockage
- 100yr RP 0% blockage

WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C22-100-90
CULVERT 22&23 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



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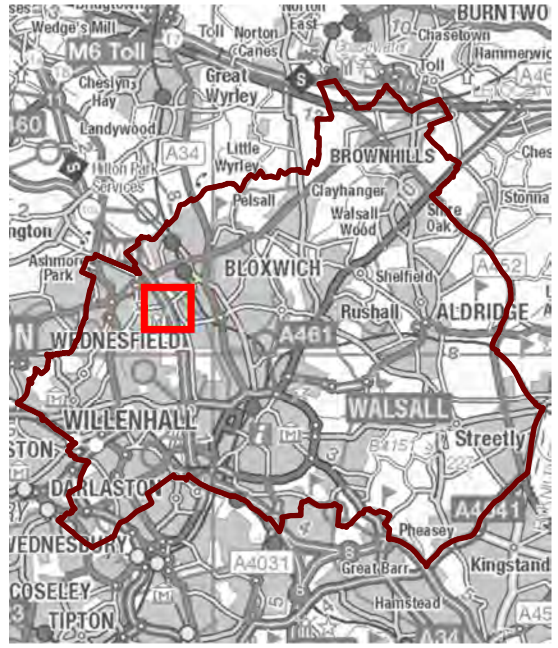

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 75% blockage
- 100yr RP 0% blockage

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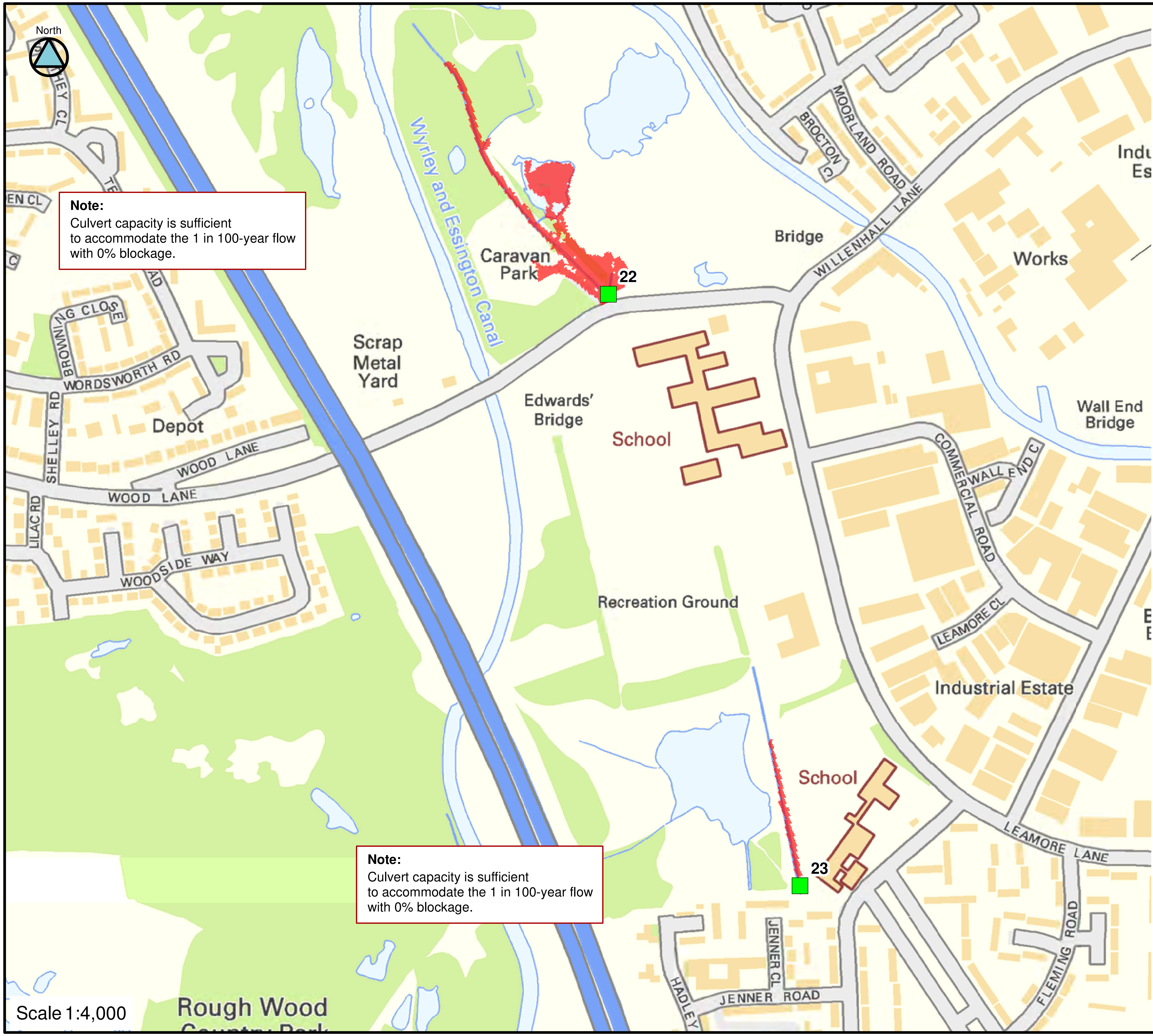
FIGURE C22-100-75
CULVERT 22&23 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



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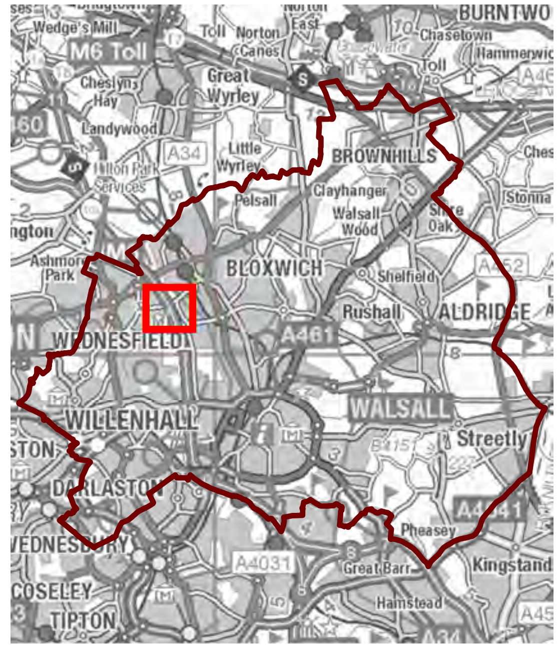

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 50% blockage
- 100yr RP 0% blockage

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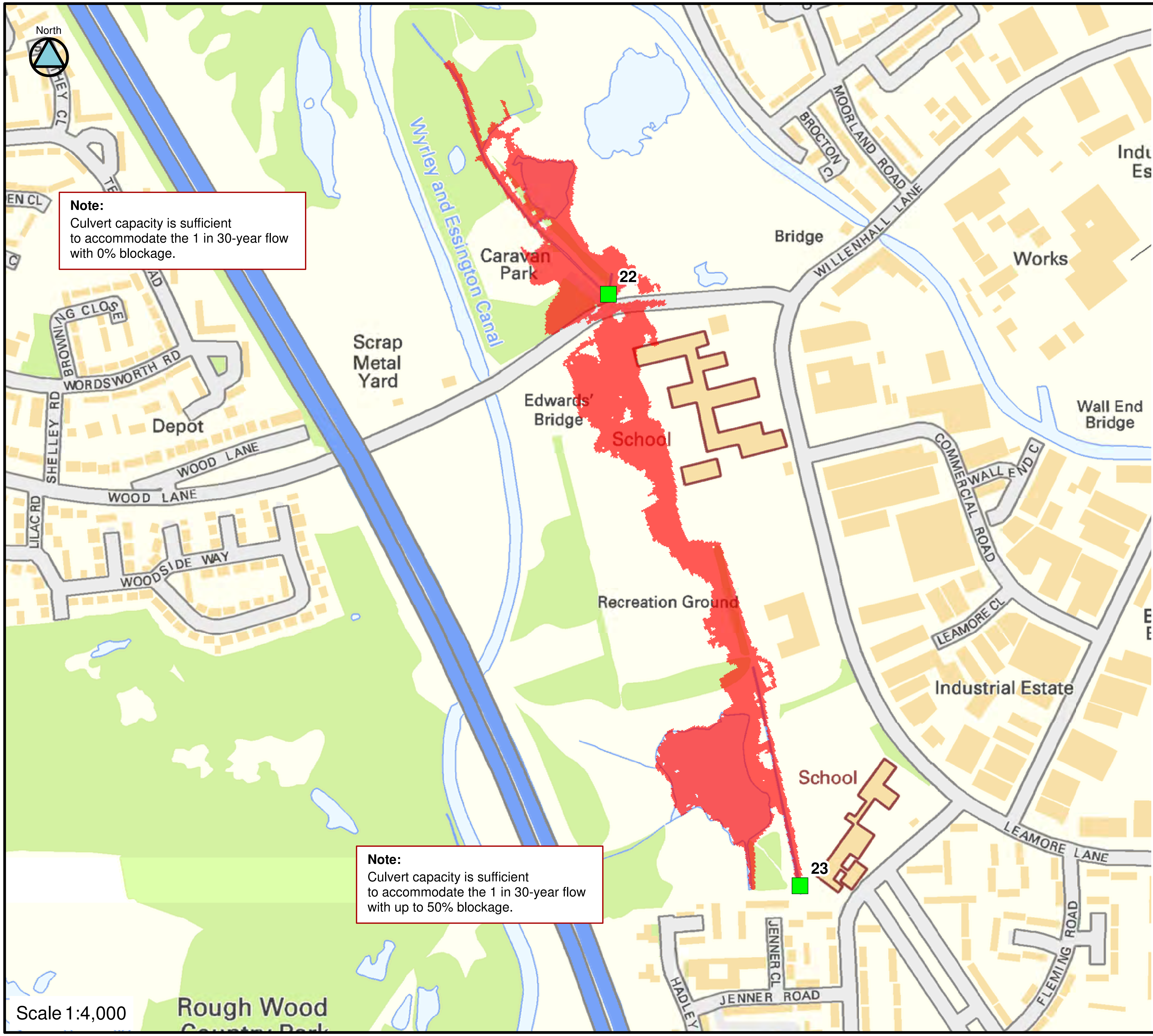
FIGURE C22-100-50
CULVERT 22&23 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



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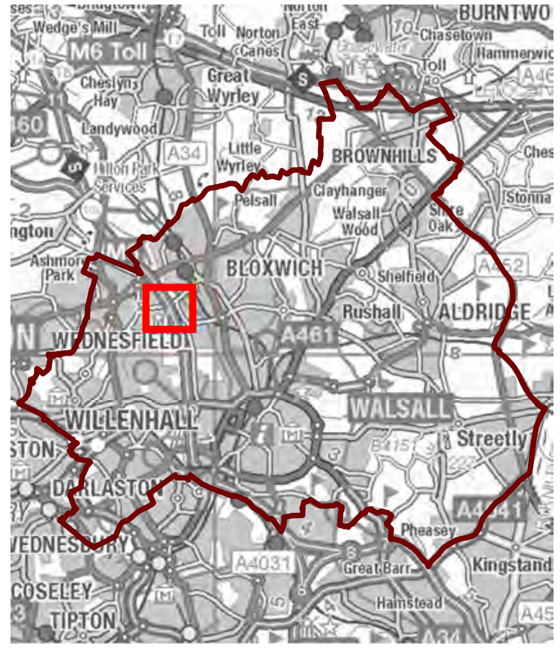

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 90% blockage
- 30yr RP 0% blockage

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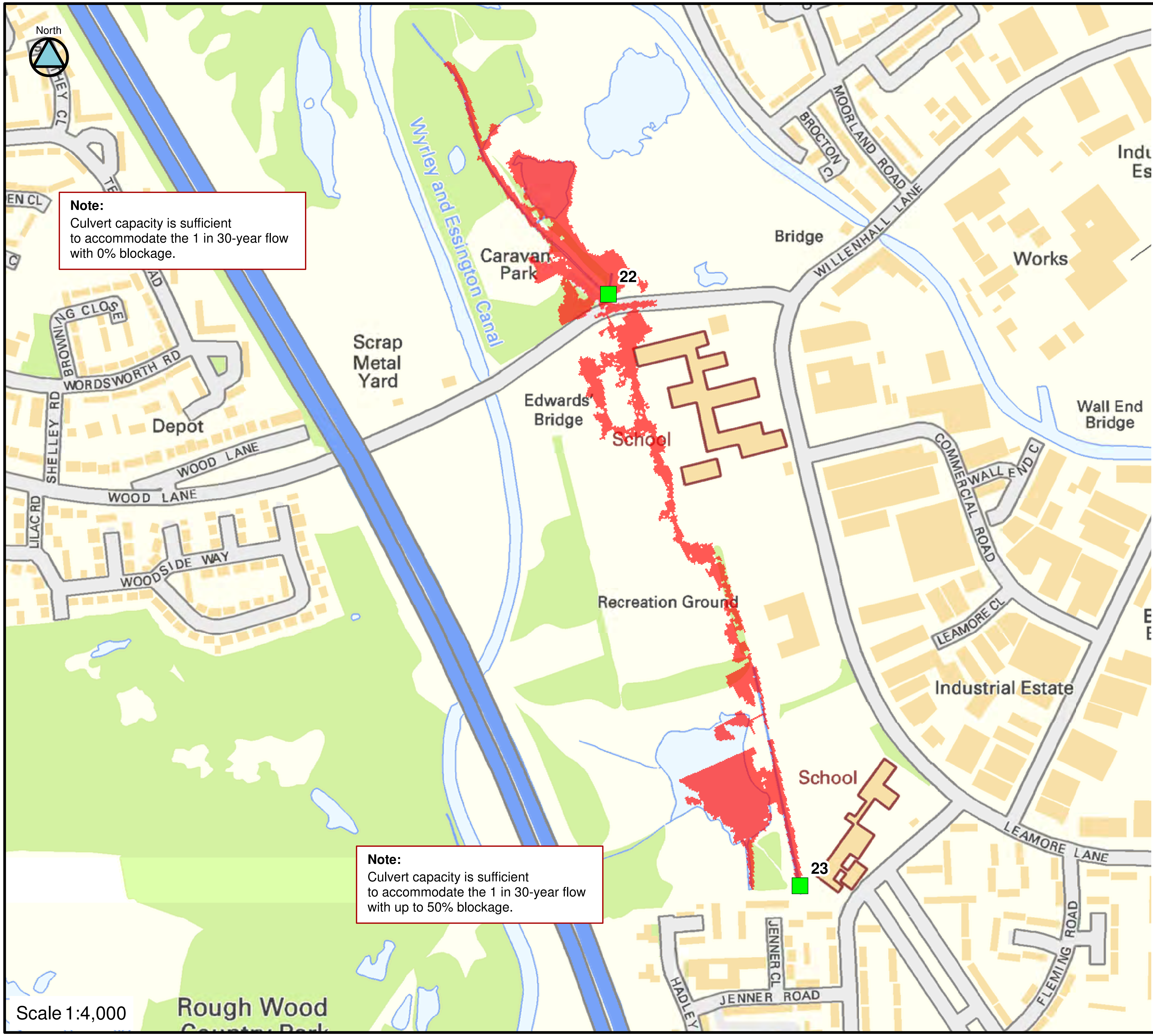
WALSALL METROPOLITAN
BOROUGH COUNCIL

FIGURE C22-30-90
CULVERT 22&23 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS



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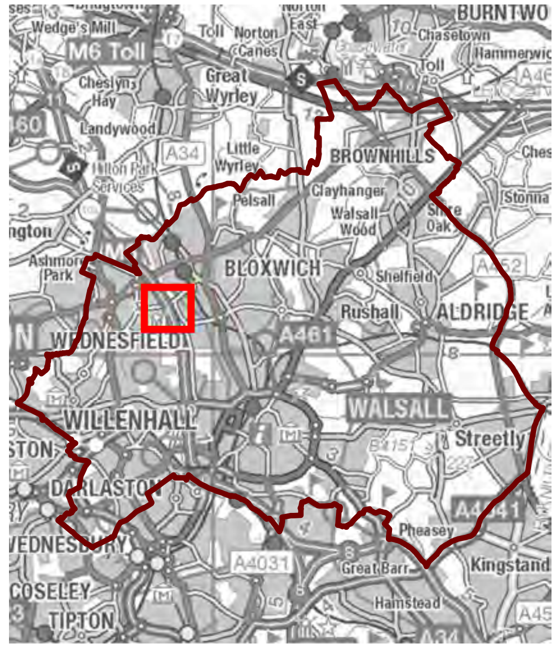

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 75% blockage
- 30yr RP 0% blockage

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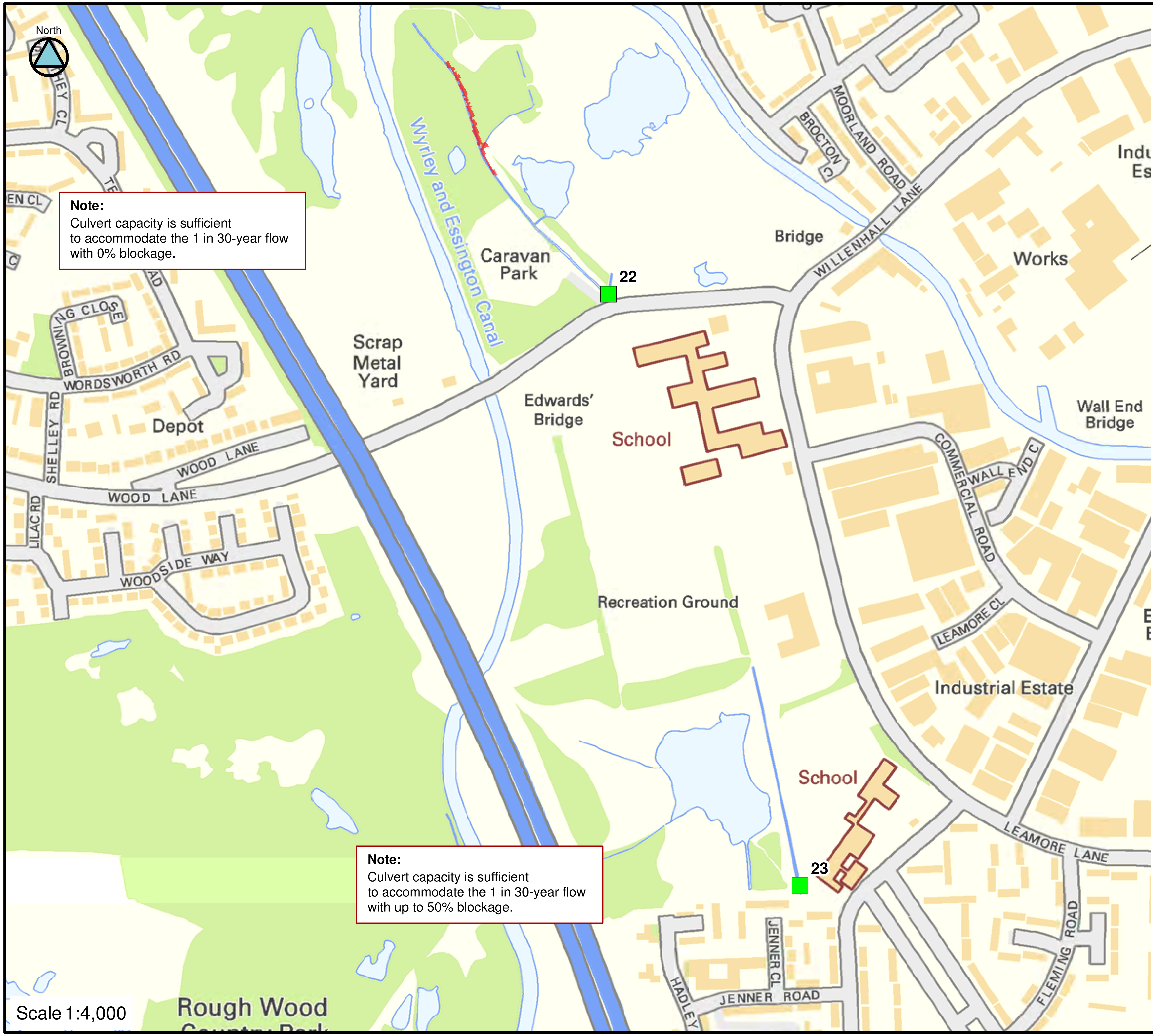
WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C22-30-75
CULVERT 22&23 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS



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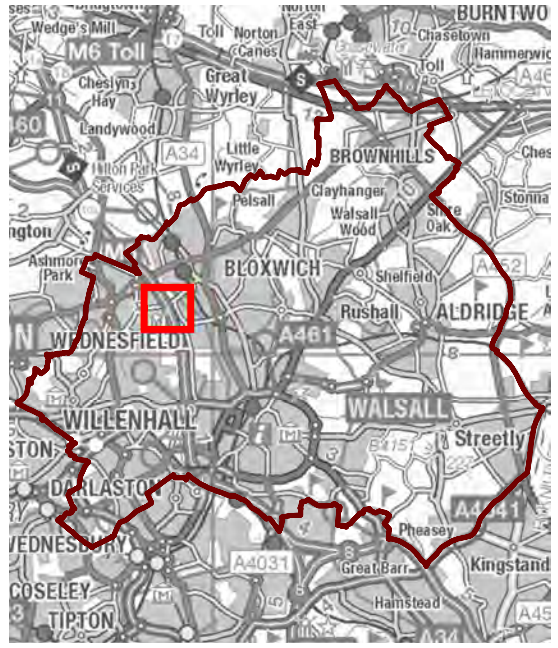

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 50% blockage
- 30yr RP 0% blockage

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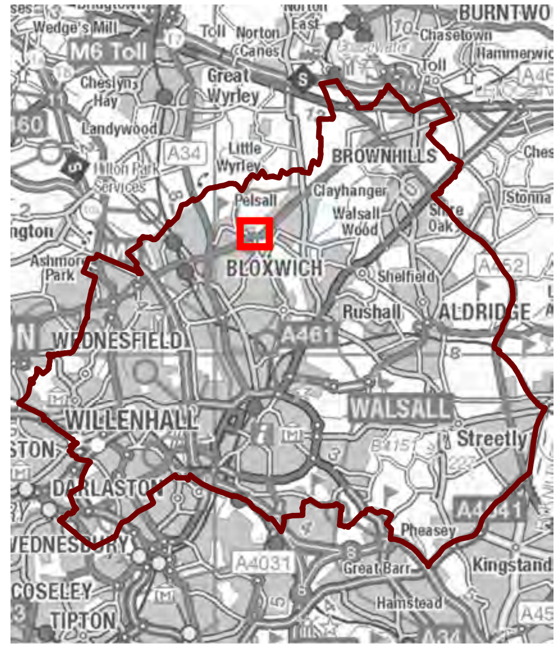
WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C22-30-50
CULVERT 22&23 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

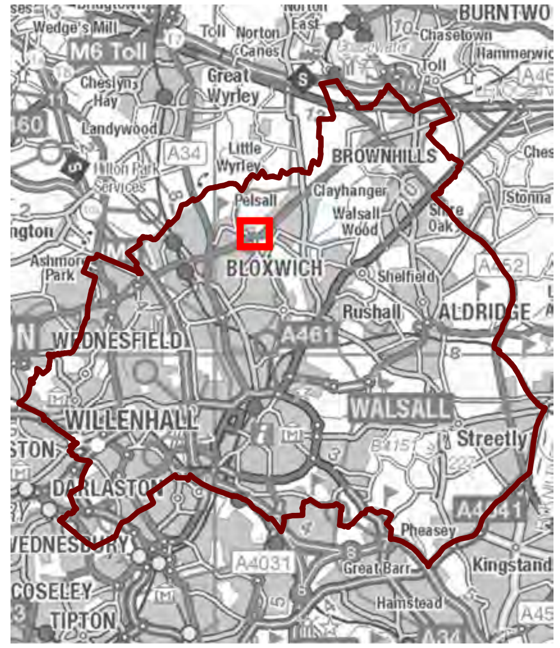
Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 90% blockage
- 100yr RP 0% blockage

WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C20-100-90
CULVERT 20 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 75% blockage
- 100yr RP 0% blockage

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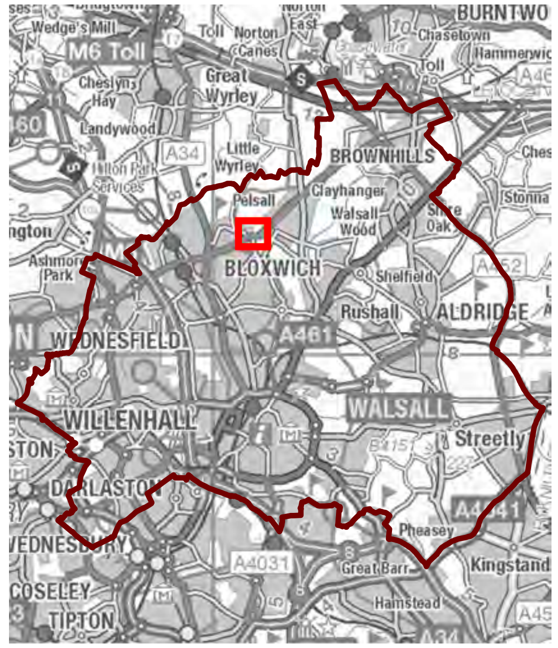
WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C20-100-75
CULVERT 20 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

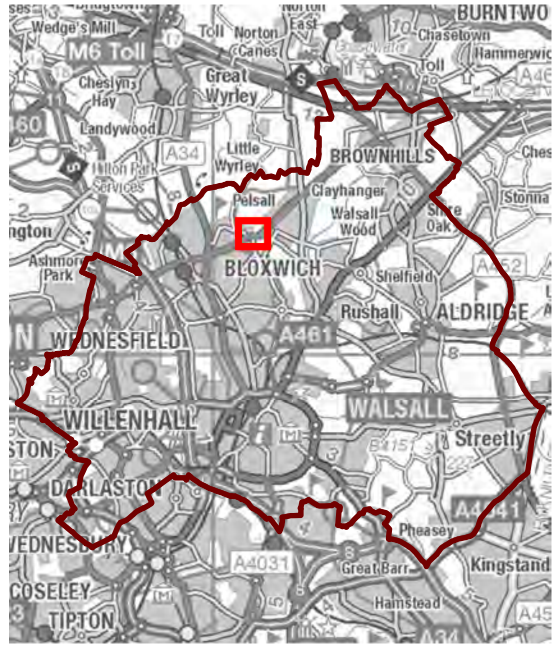
Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 50% blockage
- 100yr RP 0% blockage

WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C20-100-50
CULVERT 20 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

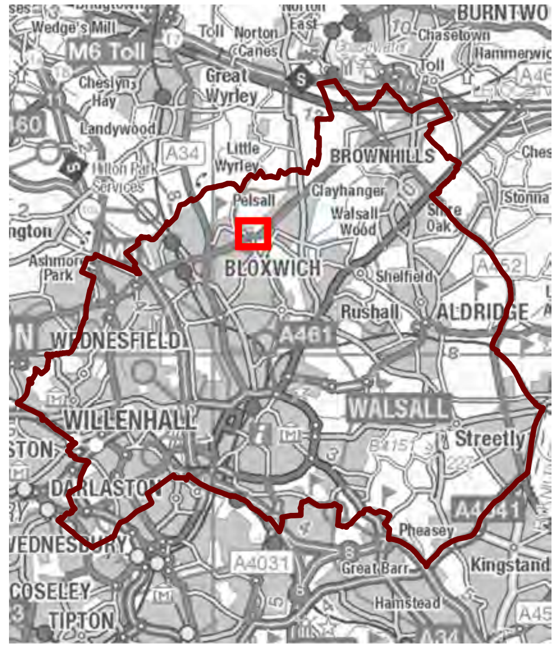
Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 90% blockage
- 30yr RP 0% blockage

WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C20-30-90
CULVERT 20 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 75% blockage
- 30yr RP 0% blockage

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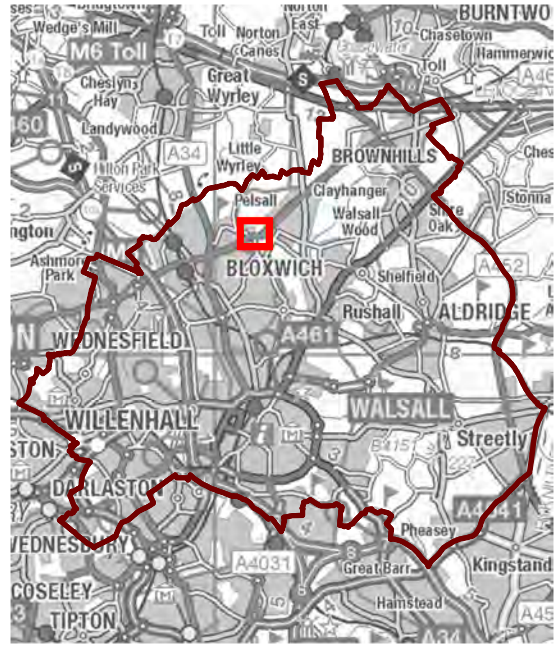
WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C20-30-75
CULVERT 20 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 50% blockage
- 30yr RP 0% blockage

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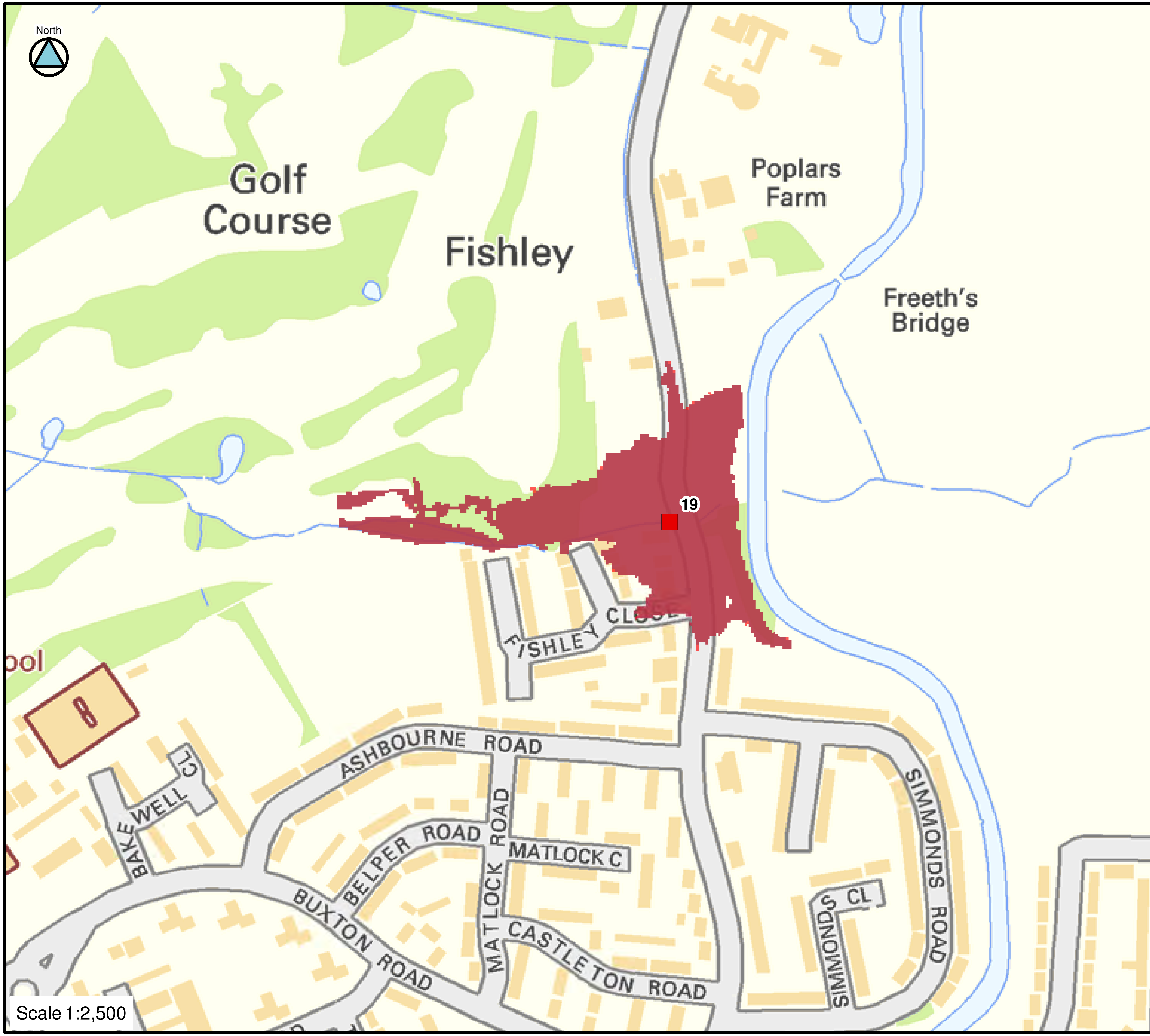
WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C20-30-50
CULVERT 20 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS



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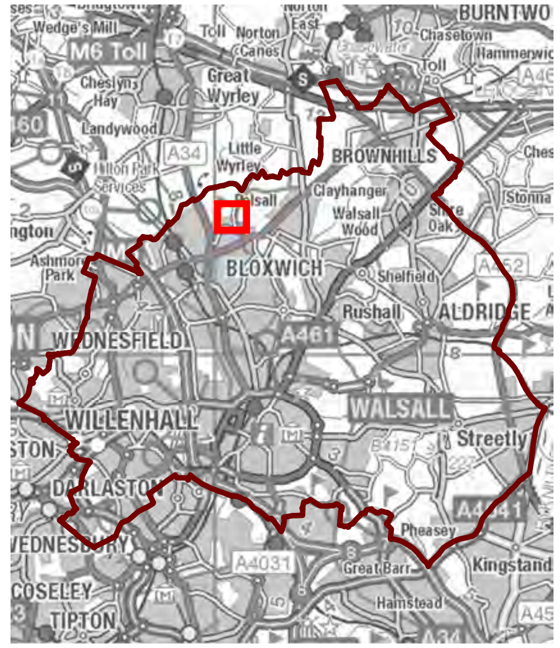

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 90% blockage
- 100yr RP 0% blockage

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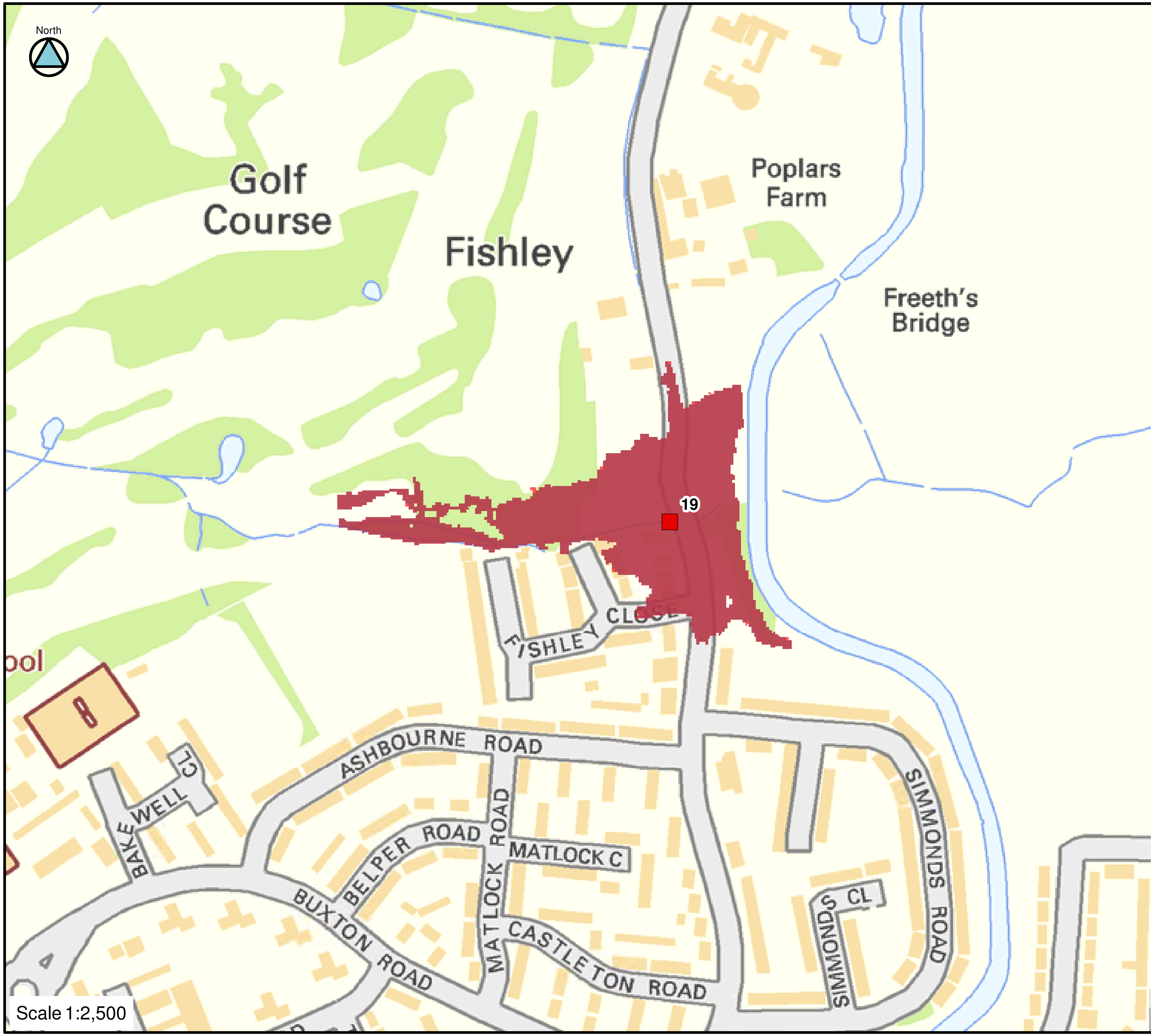
WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C19-100-90
CULVERT 19 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



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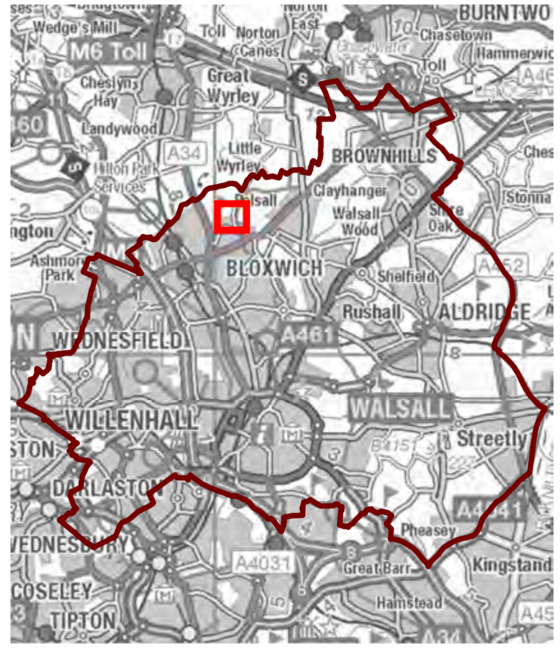

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 75% blockage
- 100yr RP 0% blockage

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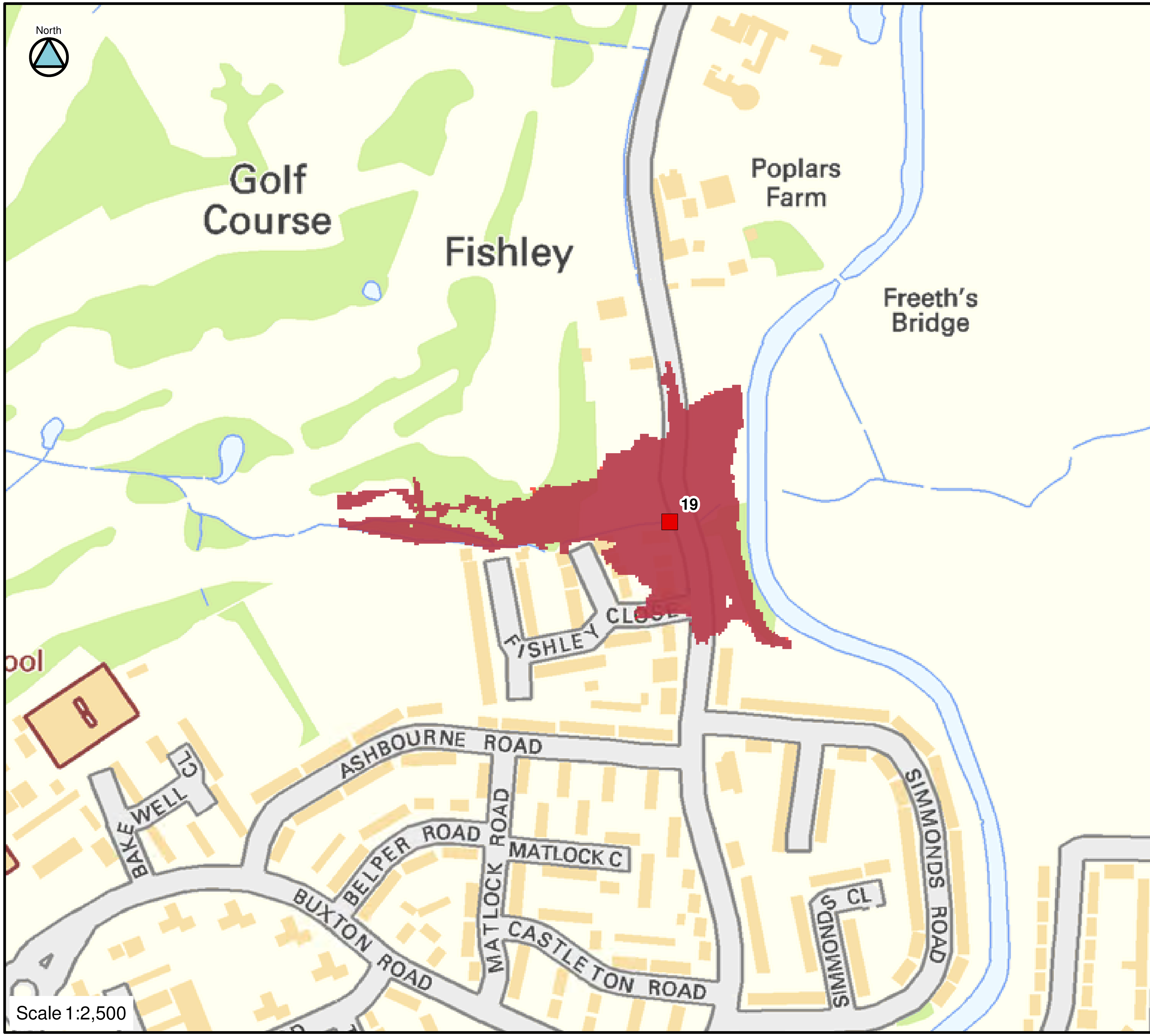
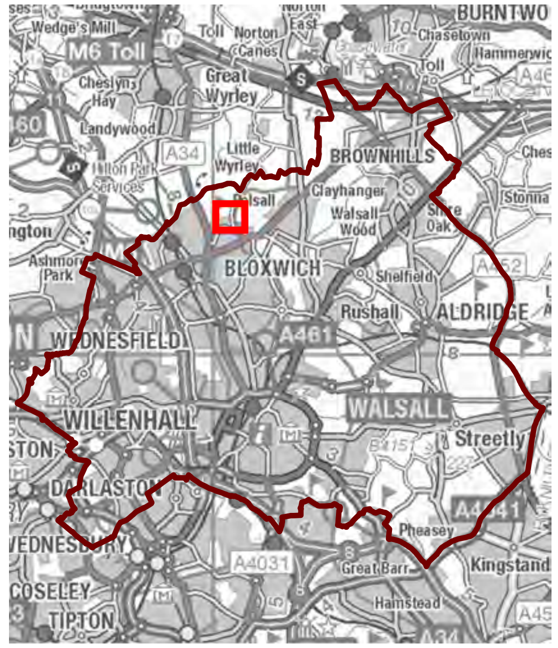
WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C19-100-75
CULVERT 19 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 50% blockage
- 100yr RP 0% blockage

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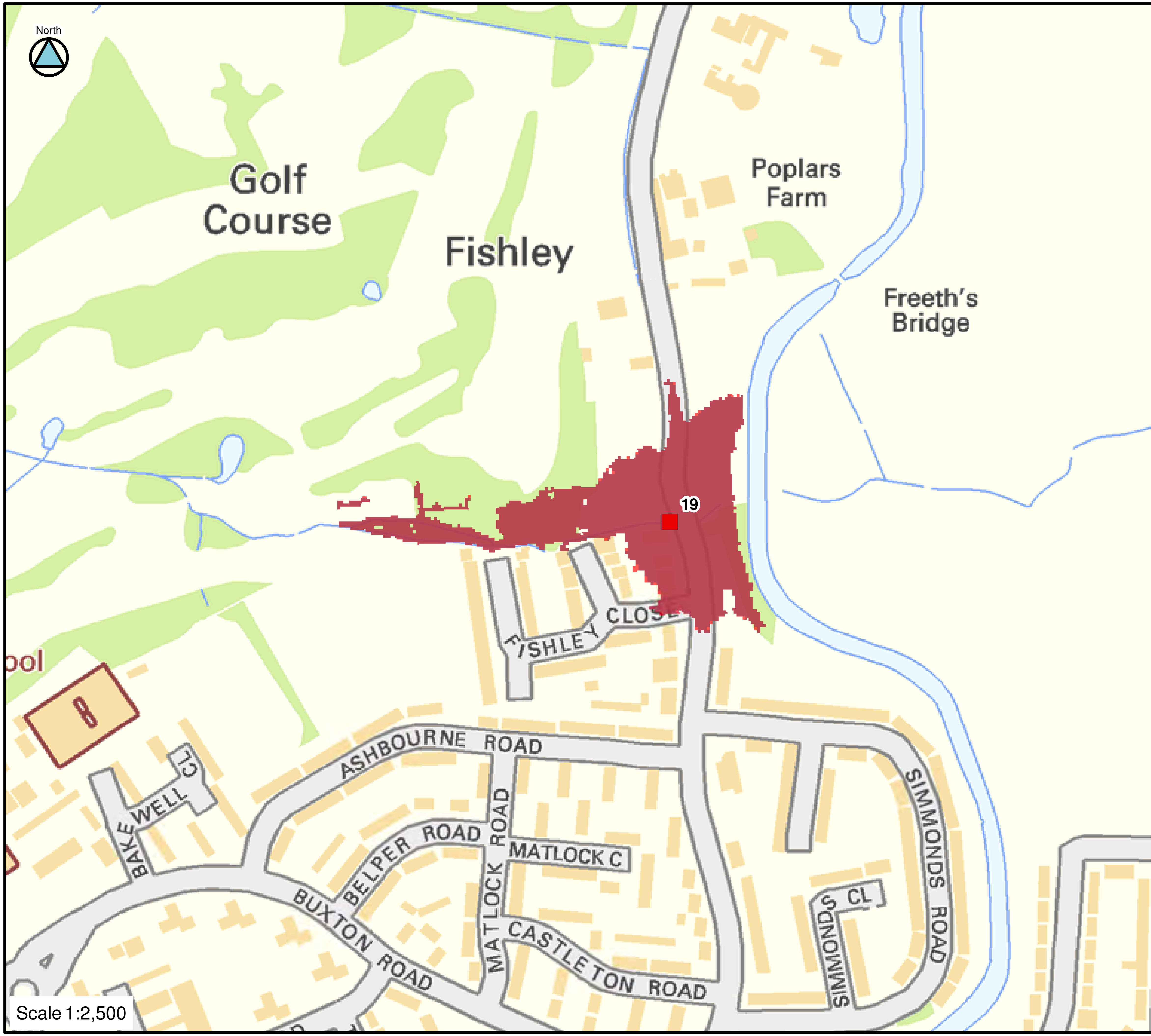
WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C19-100-50
CULVERT 19 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



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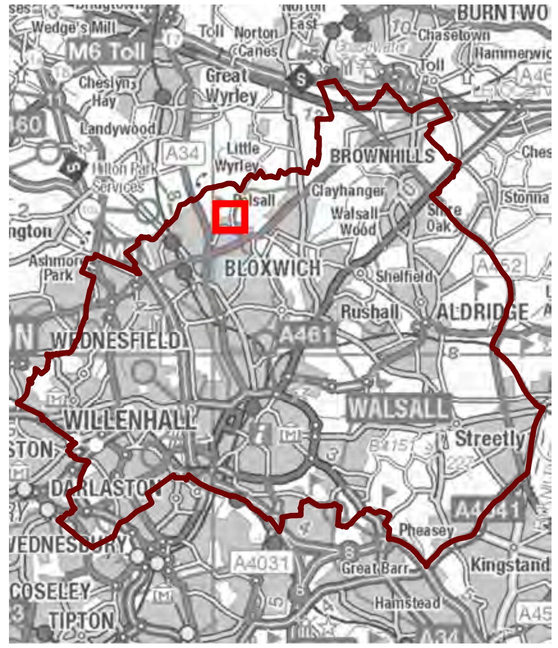

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 90% blockage
- 30yr RP 0% blockage

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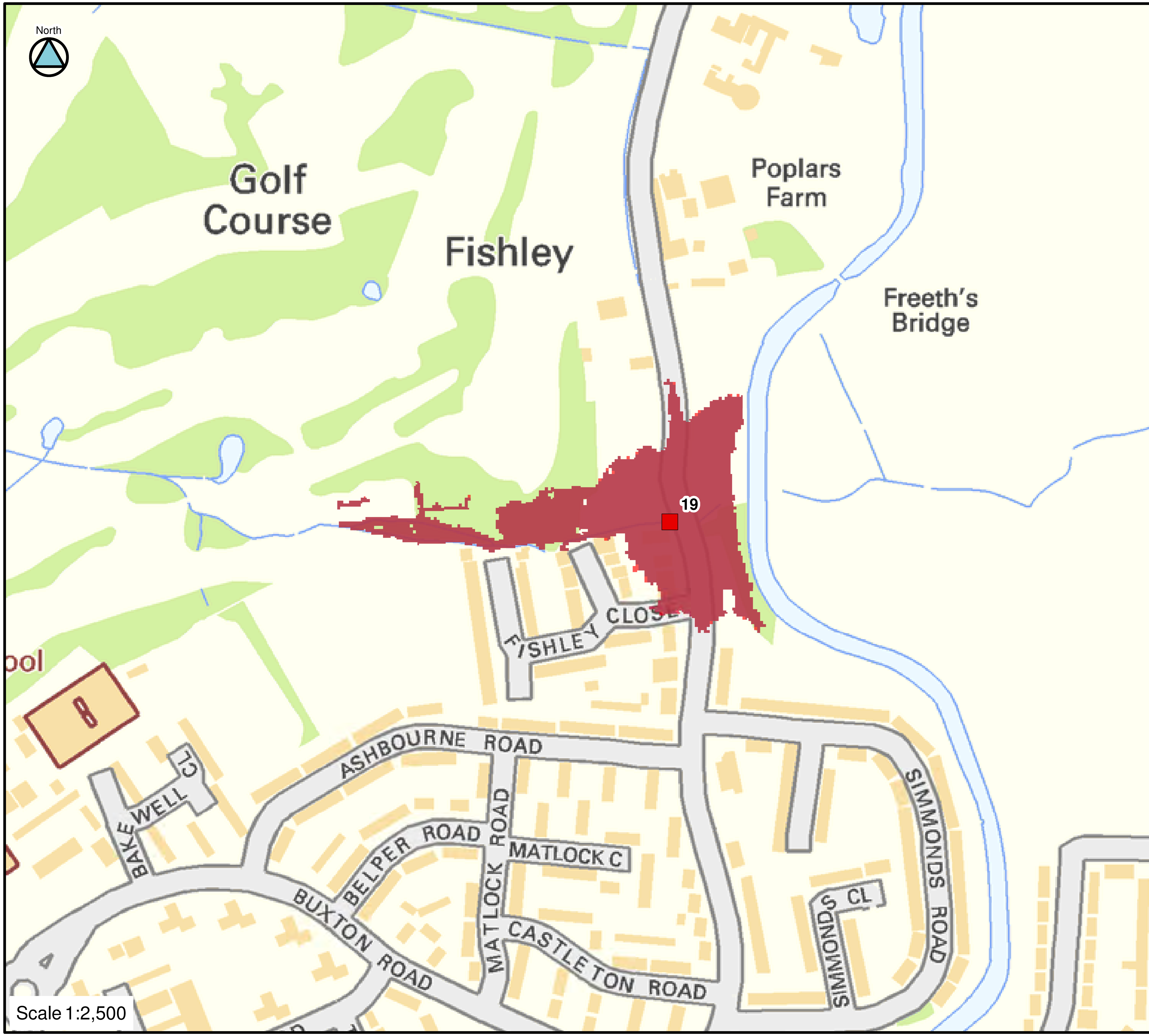
FIGURE C19-30-90
CULVERT 19 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS



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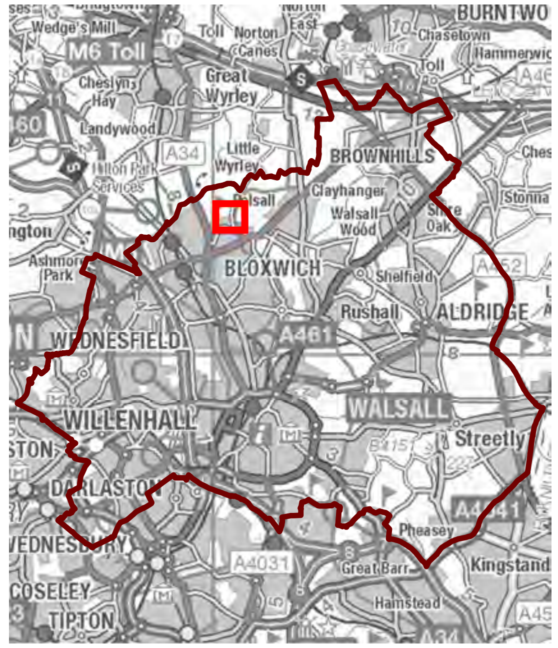

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 75% blockage
- 30yr RP 0% blockage

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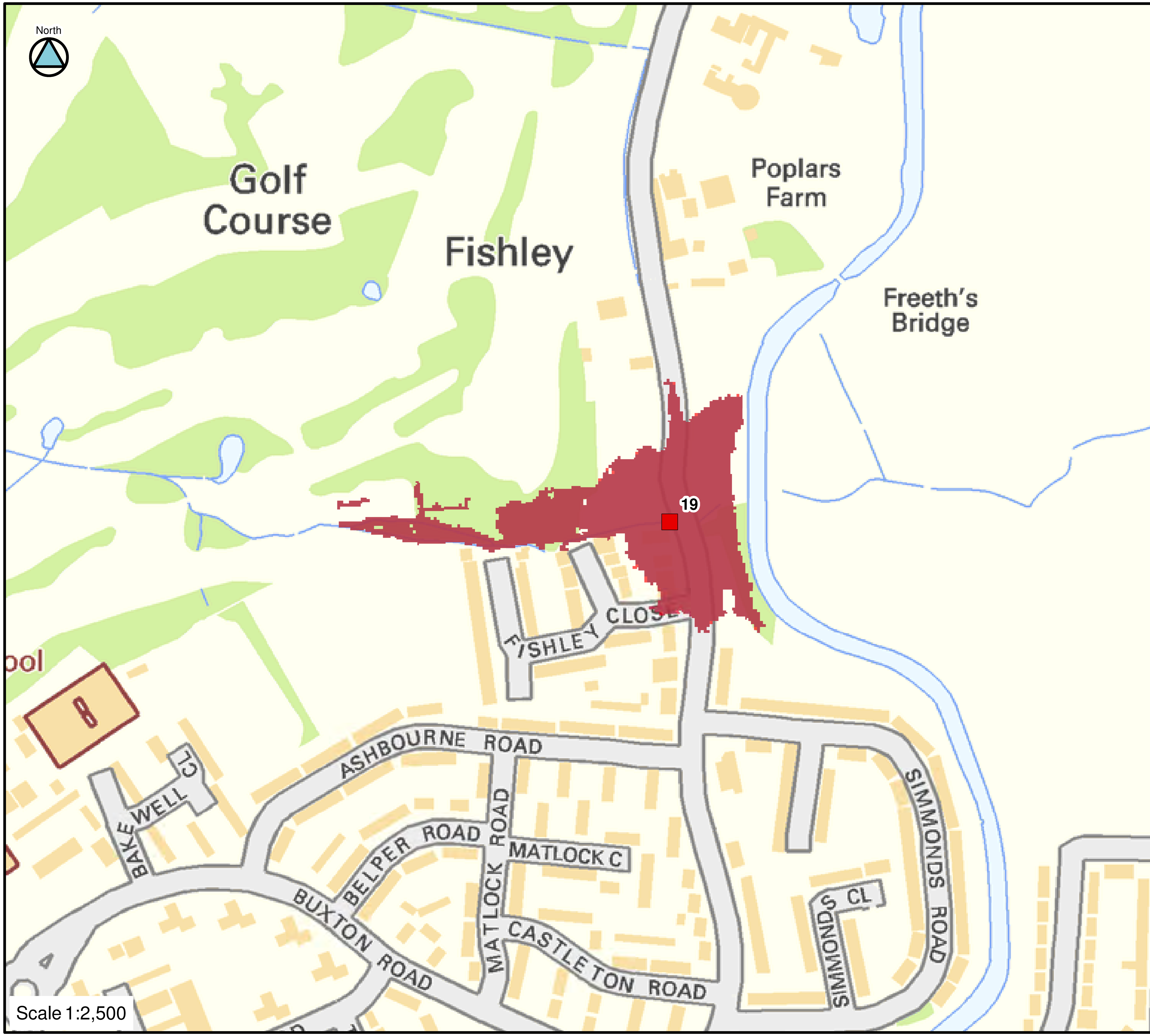
FIGURE C19-30-75
CULVERT 19 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS



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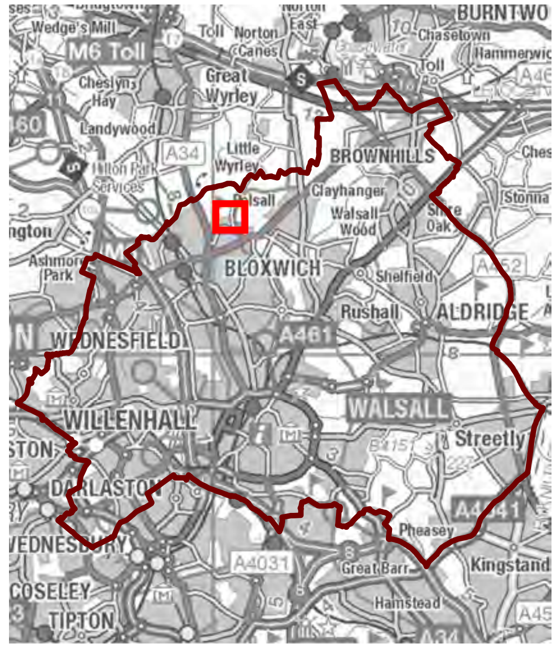

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 50% blockage
- 30yr RP 0% blockage

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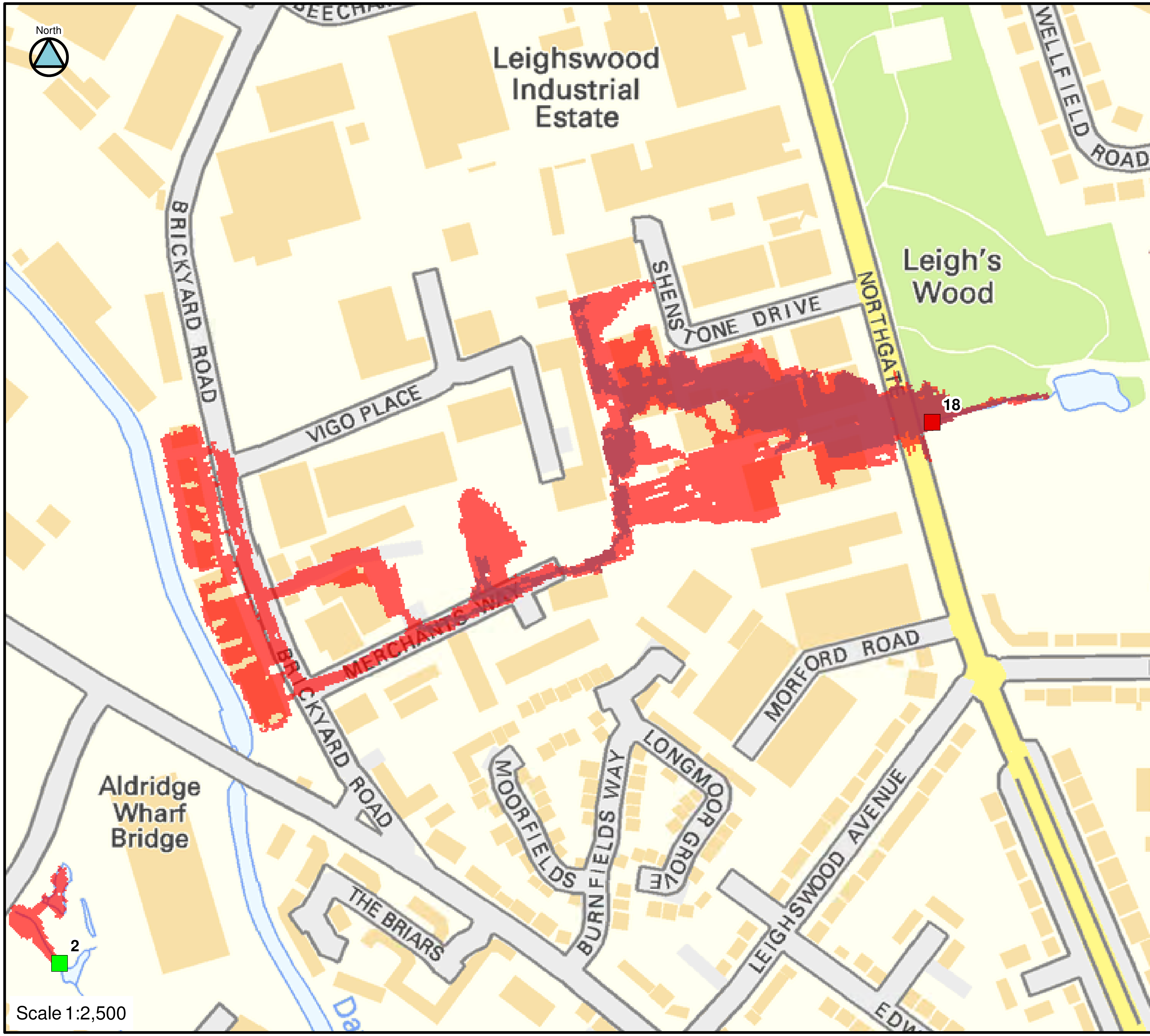
FIGURE C19-30-50
CULVERT 19 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS



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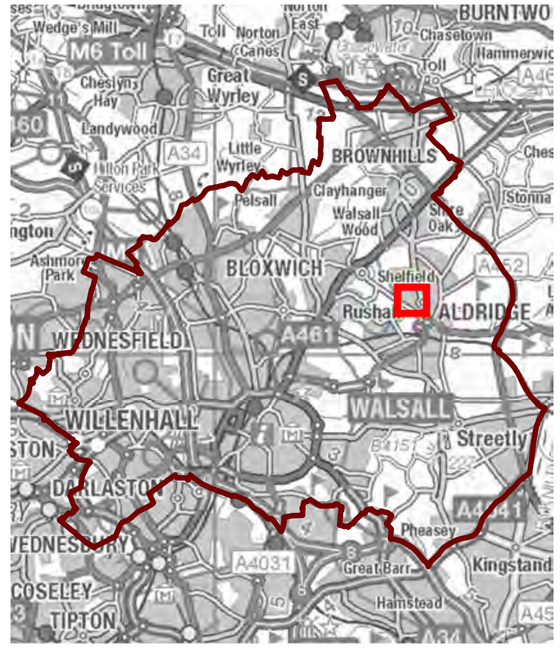

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 90% blockage
- 100yr RP 0% blockage

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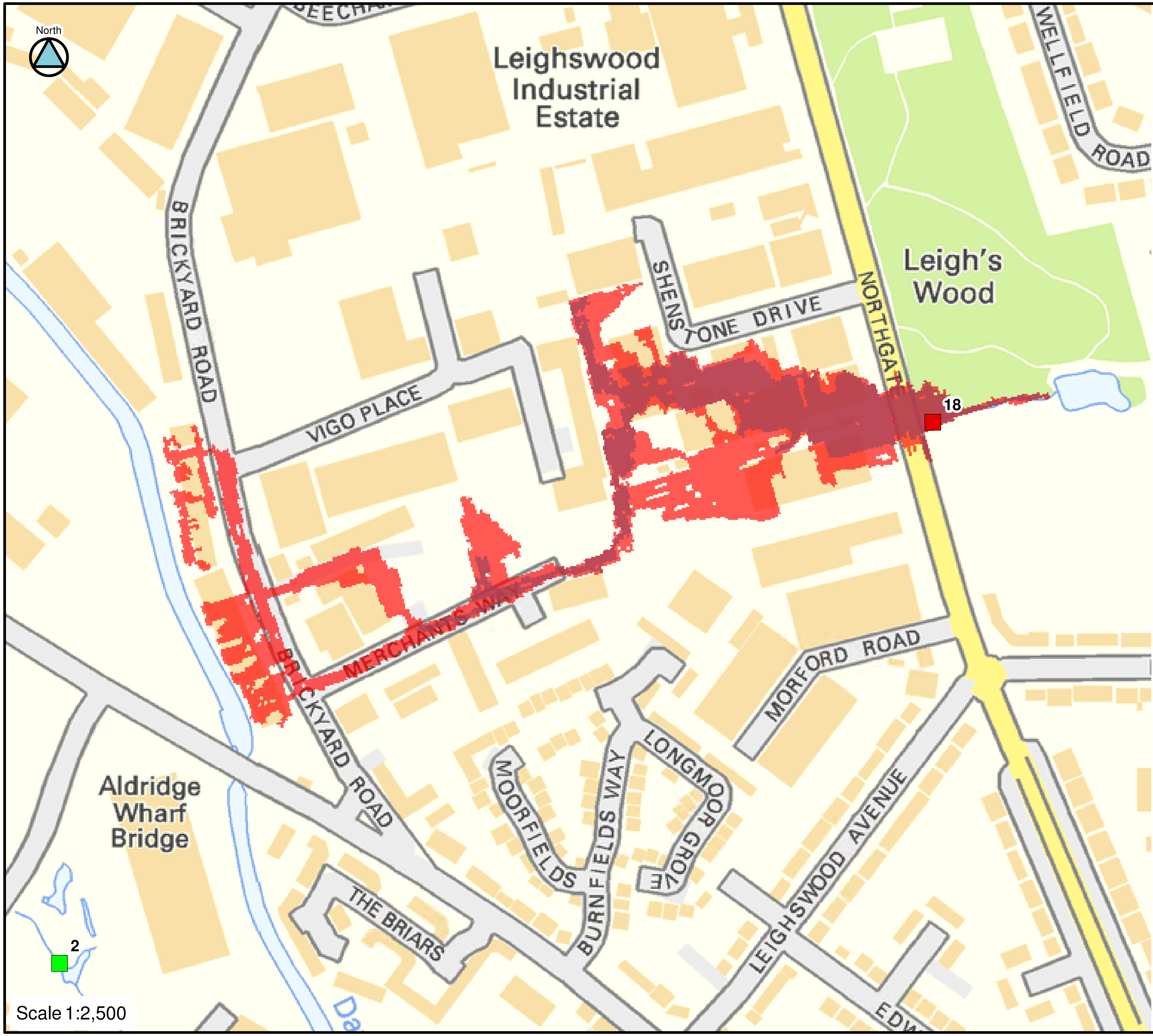
FIGURE C18-100-90
CULVERT 18 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



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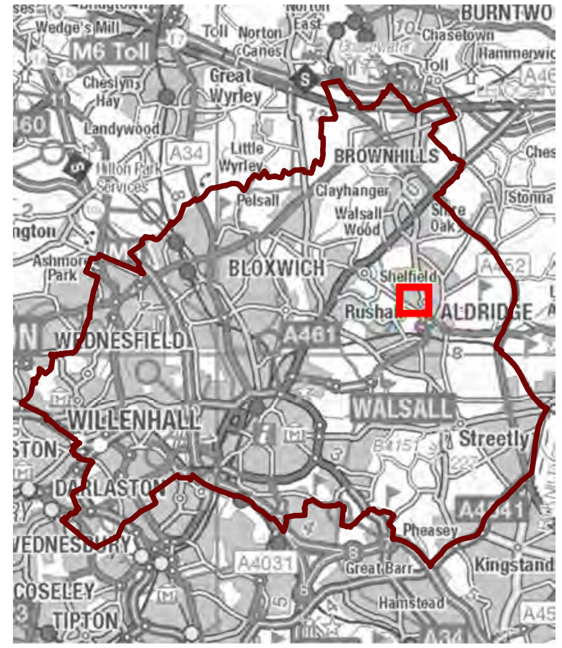

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 75% blockage
- 100yr RP 0% blockage

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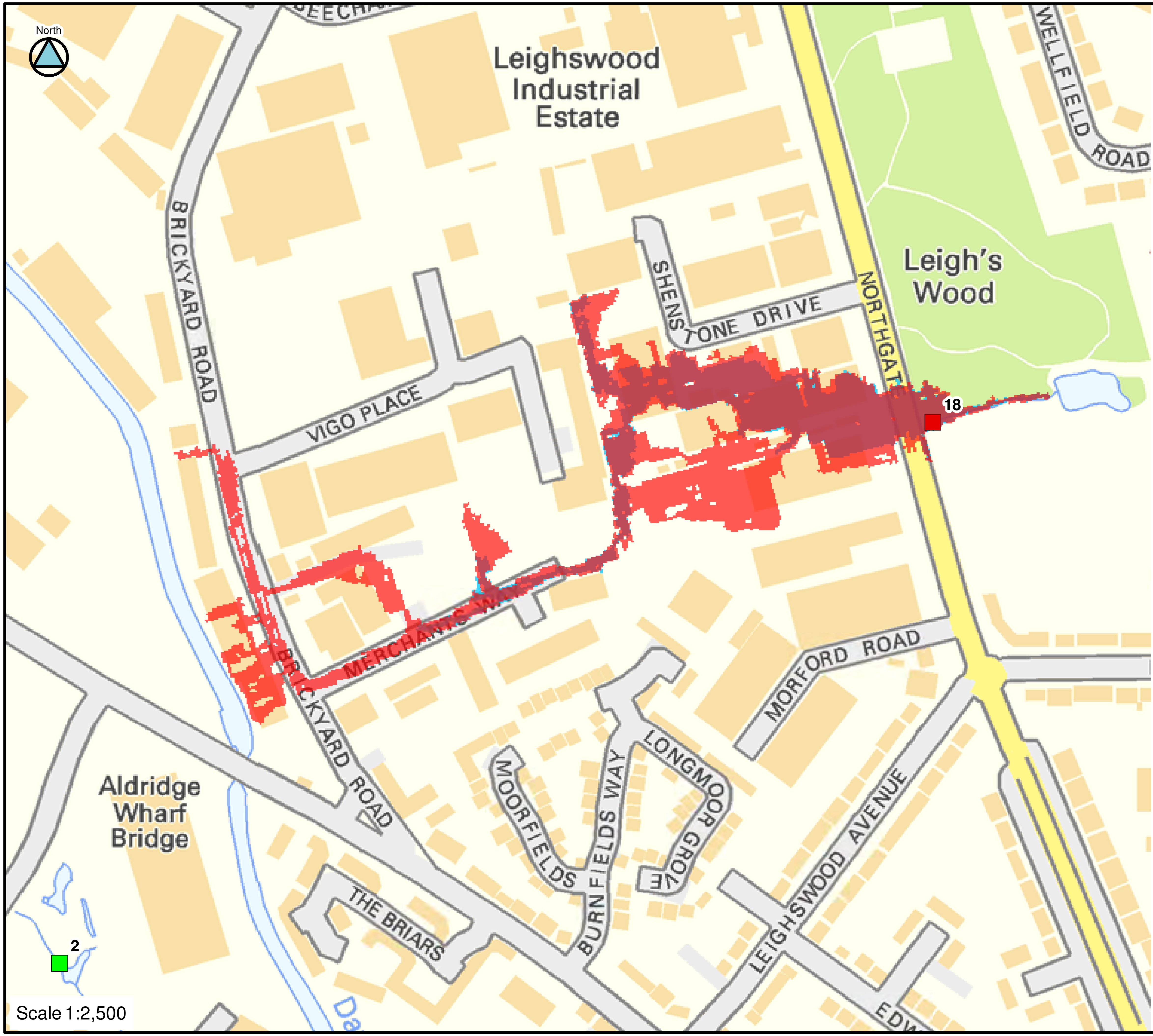
FIGURE C18-100-75
CULVERT 18 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



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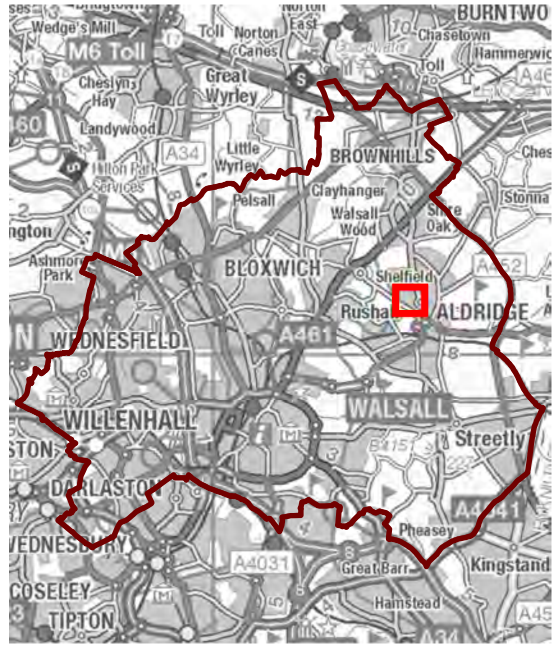

LEGEND

Modelled culverts

Surveyed culvert capacity

Culvert capacity as channel QMED

100yr RP 50% blockage

100yr RP 0% blockage

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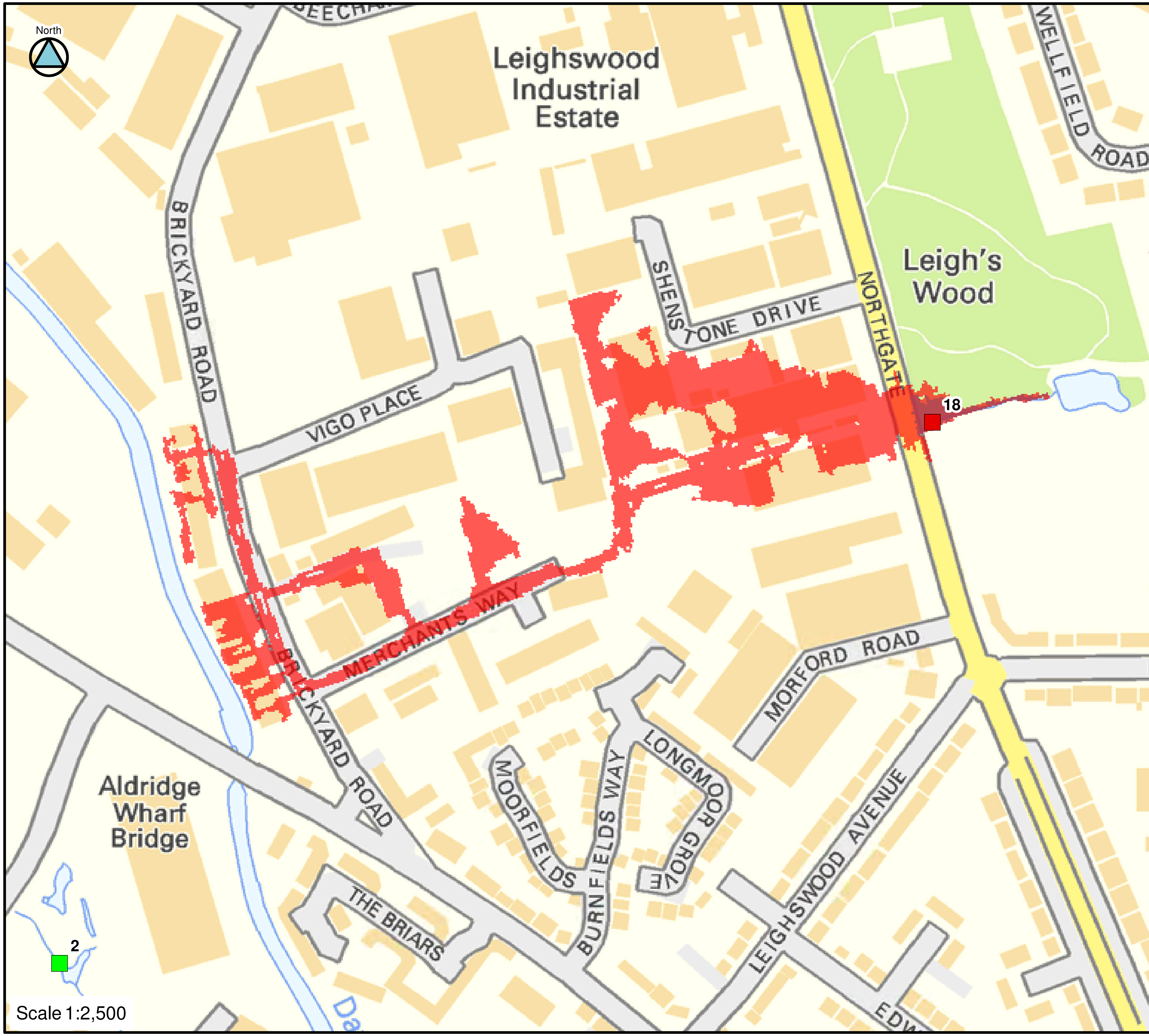
FIGURE C18-100-50
CULVERT 18 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



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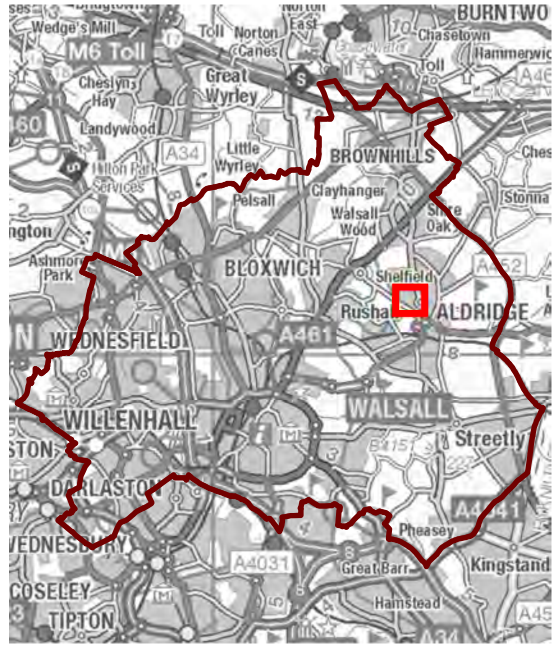

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 90% blockage
- 30yr RP 0% blockage

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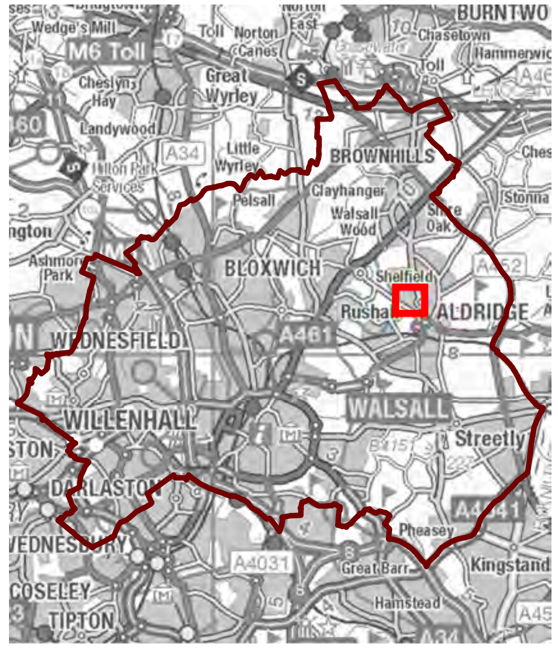
FIGURE C18-30-90
CULVERT 18 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 75% blockage
- 30yr RP 0% blockage

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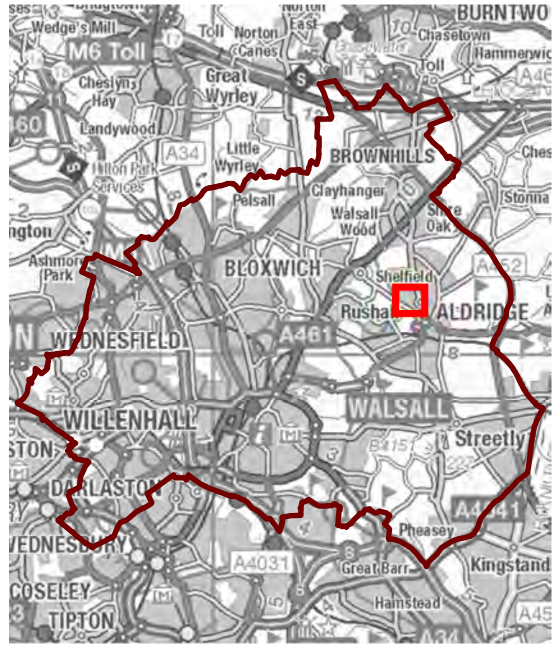
FIGURE C18-30-75
CULVERT 18 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 50% blockage
- 30yr RP 0% blockage

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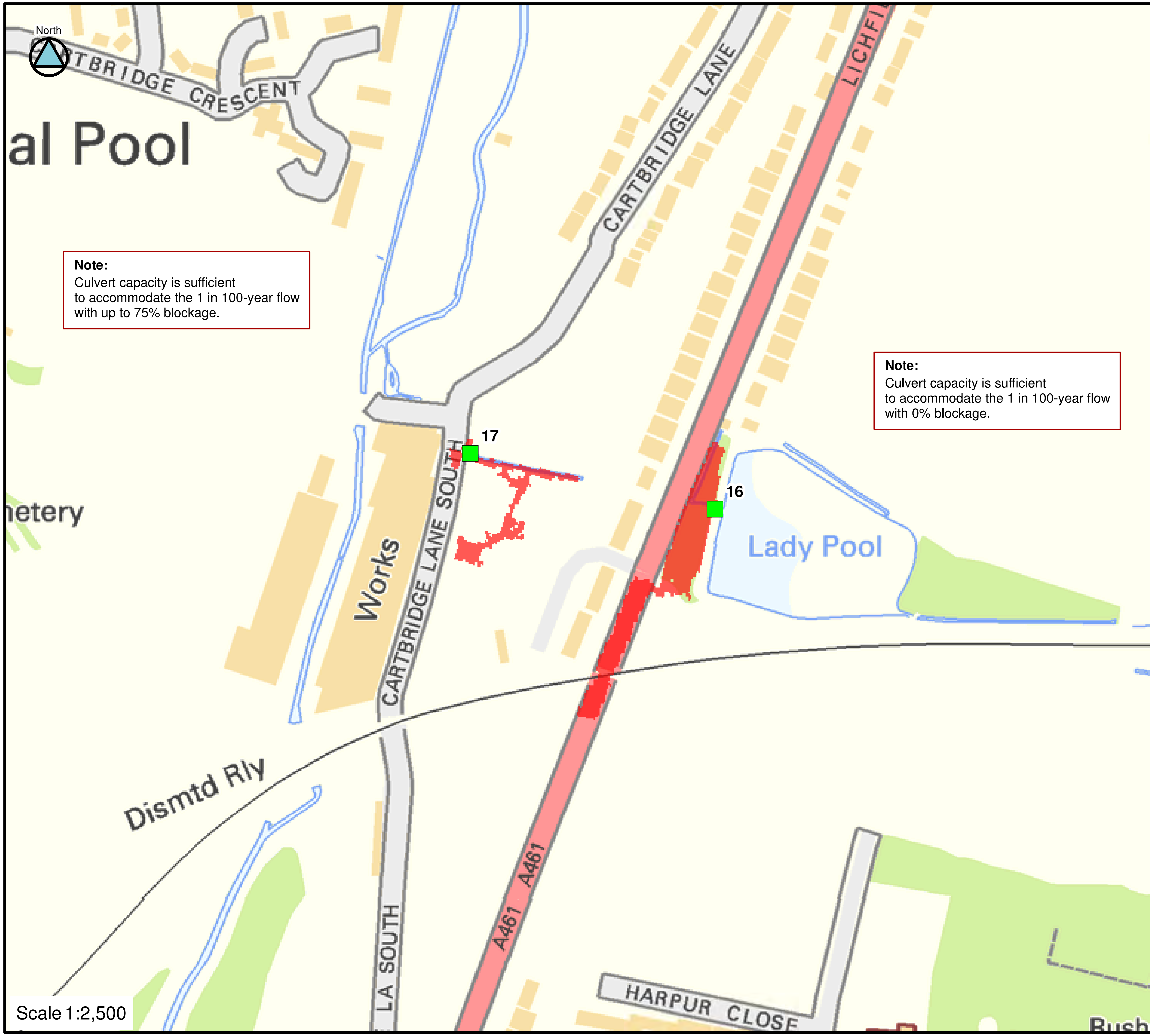
FIGURE C18-30-50
CULVERT 18 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS



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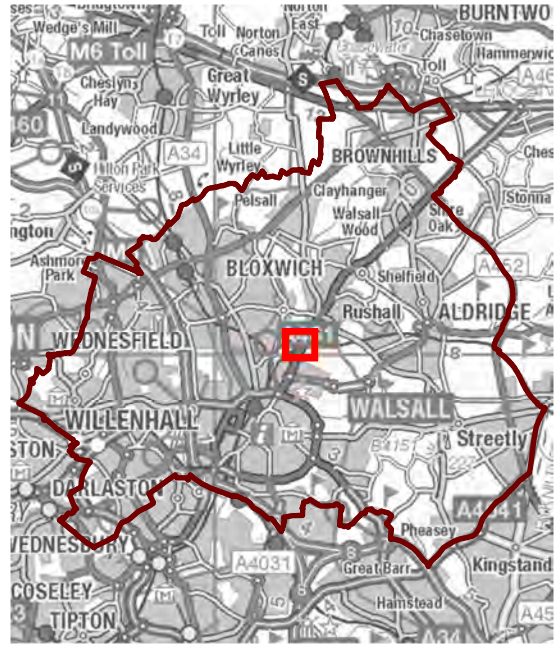

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 90% blockage
- 100yr RP 0% blockage

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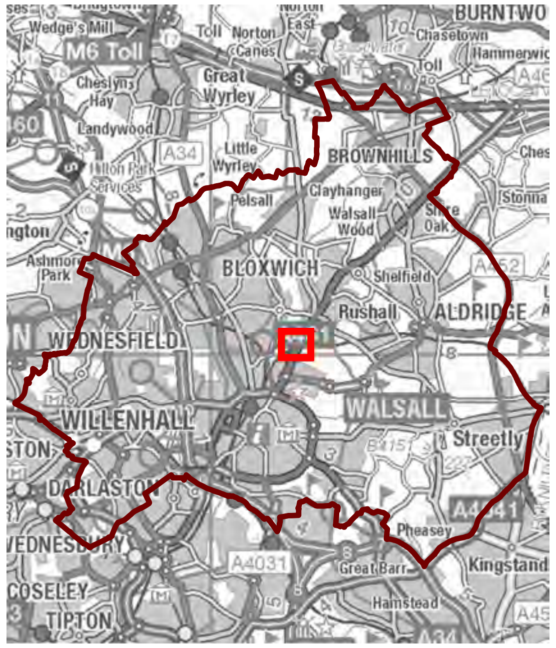
FIGURE C16-100-90
CULVERT 16&17 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS

Note:
Culvert capacity is sufficient to accommodate the 1 in 100-year flow with up to 75% blockage.

Note:
Culvert capacity is sufficient to accommodate the 1 in 100-year flow with 0% blockage.

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 75% blockage
- 100yr RP 0% blockage

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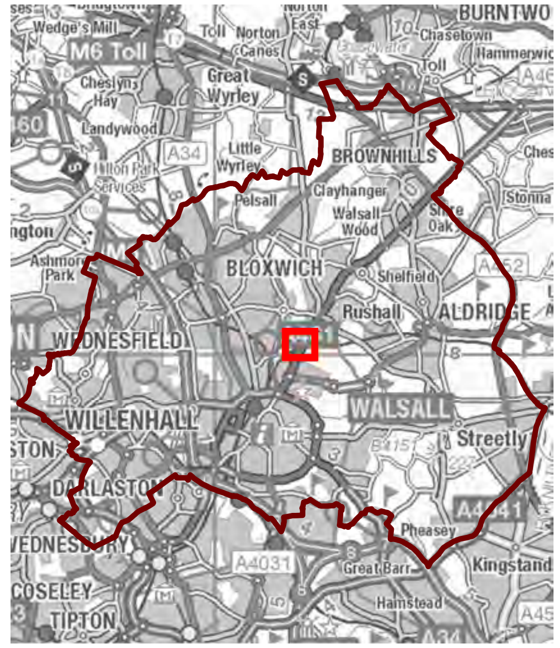
FIGURE C16-100-75
CULVERT 16&17 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 50% blockage
- 100yr RP 0% blockage

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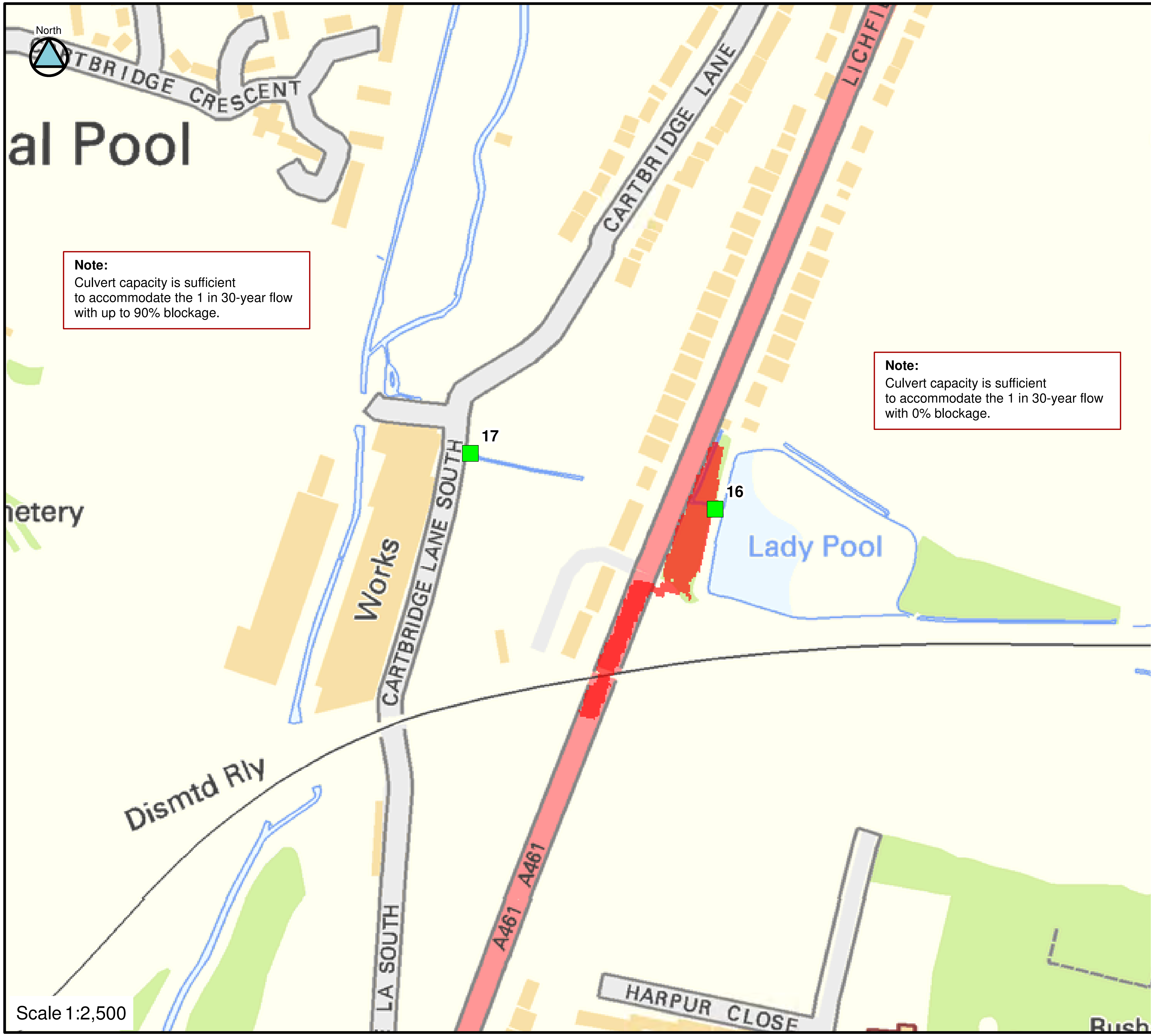
FIGURE C16-100-50
CULVERT 16&17 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



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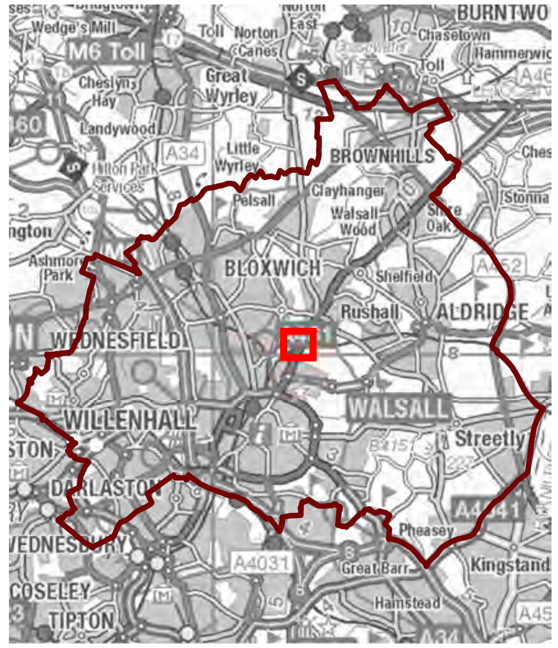

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 90% blockage
- 30yr RP 0% blockage

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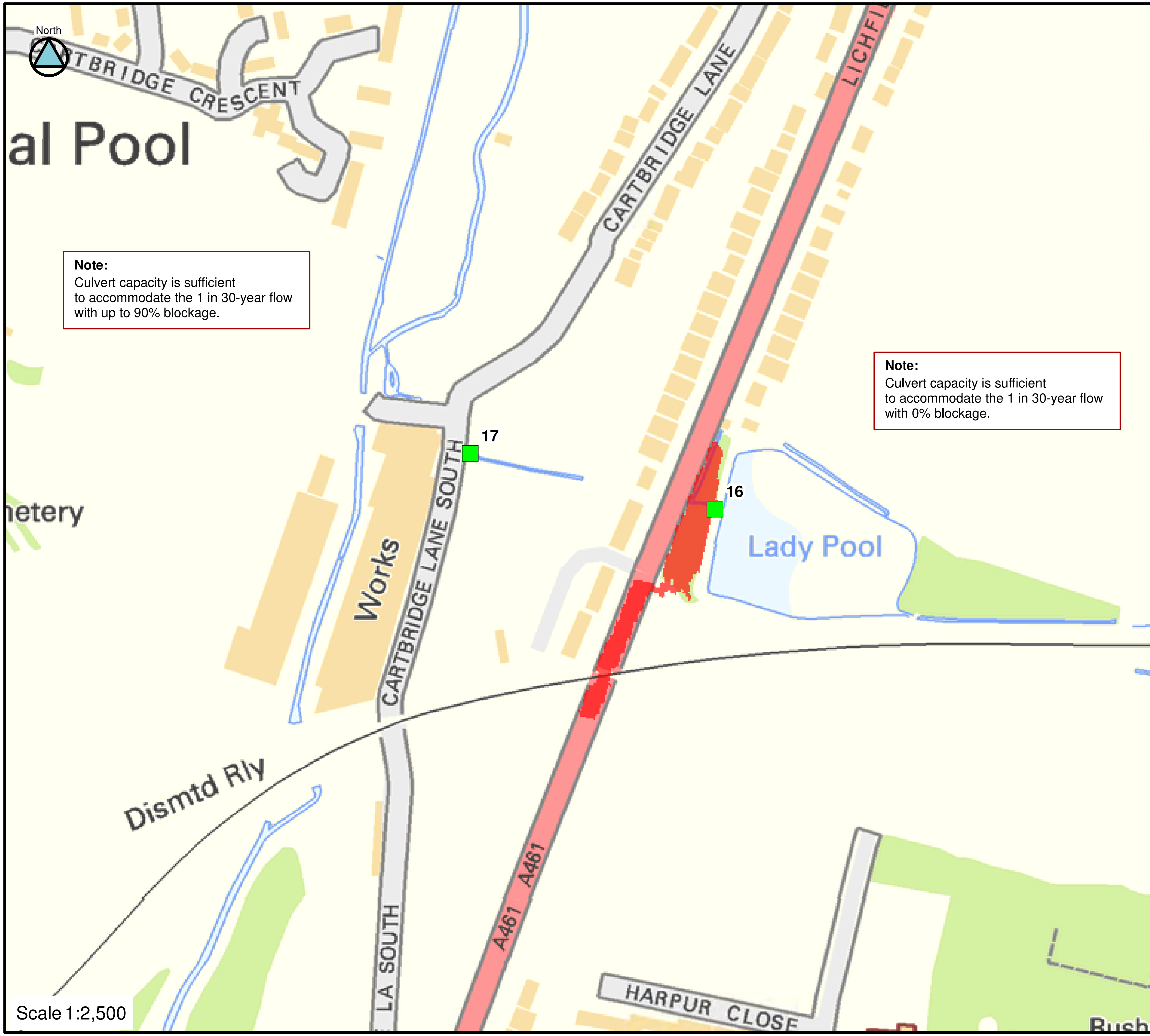
FIGURE C16-30-90
CULVERT 16&17 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS



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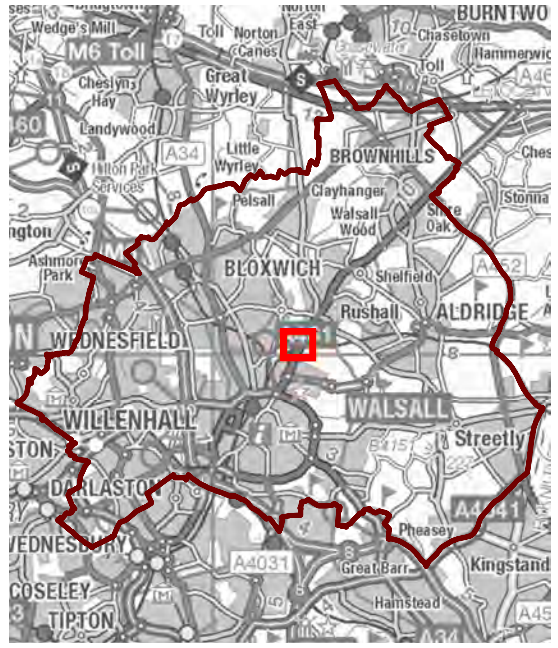

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 75% blockage
- 30yr RP 0% blockage

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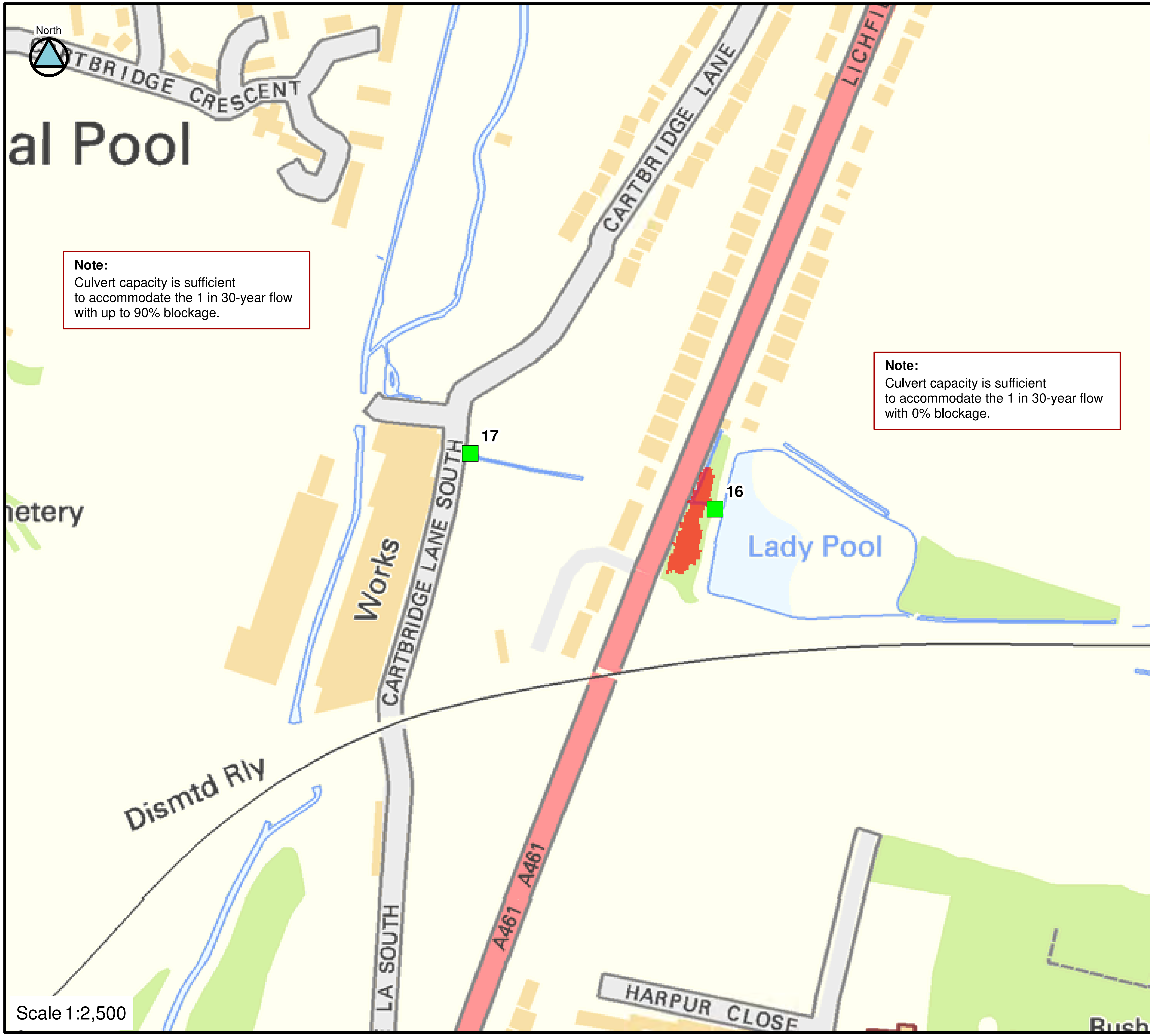
FIGURE C16-30-75
CULVERT 16&17 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS



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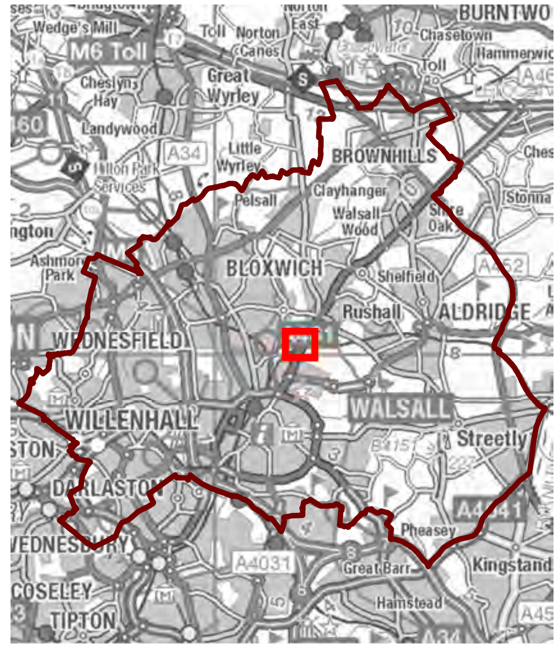

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 50% blockage
- 30yr RP 0% blockage

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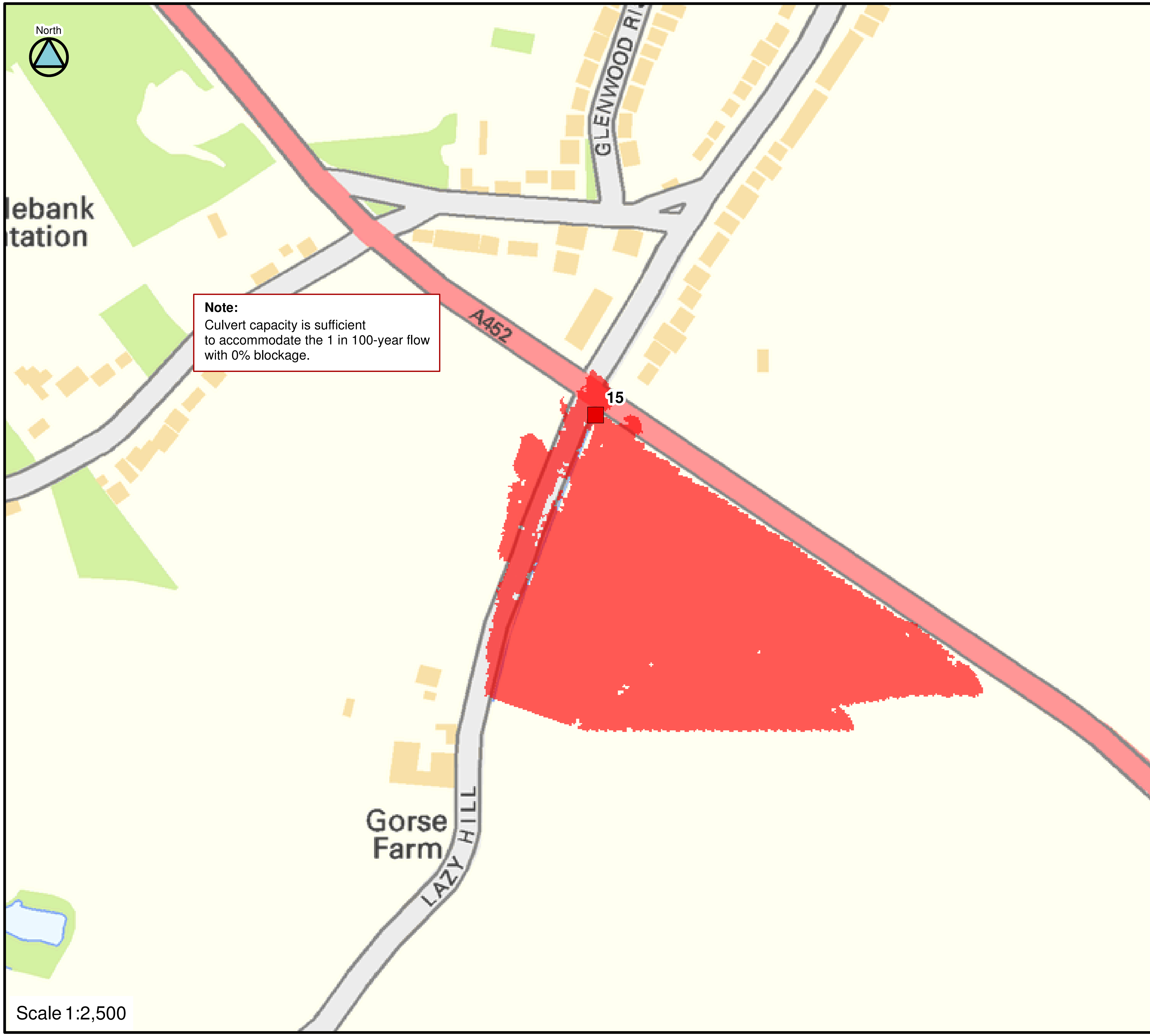
FIGURE C16-30-50
CULVERT 16&17 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS



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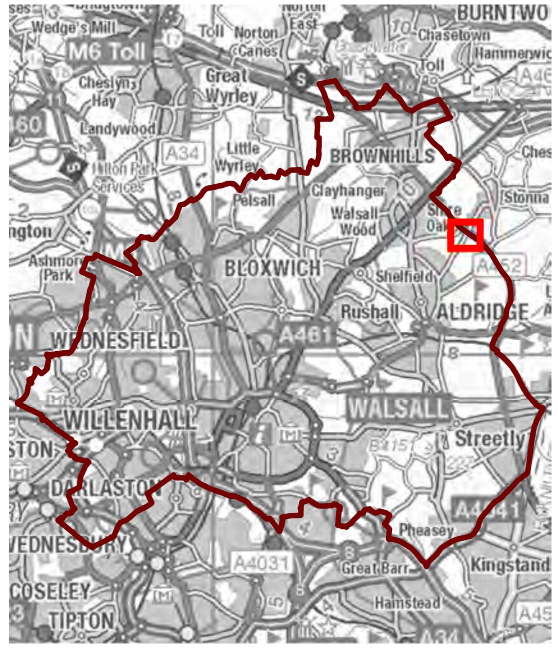

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 90% blockage
- 100yr RP 0% blockage

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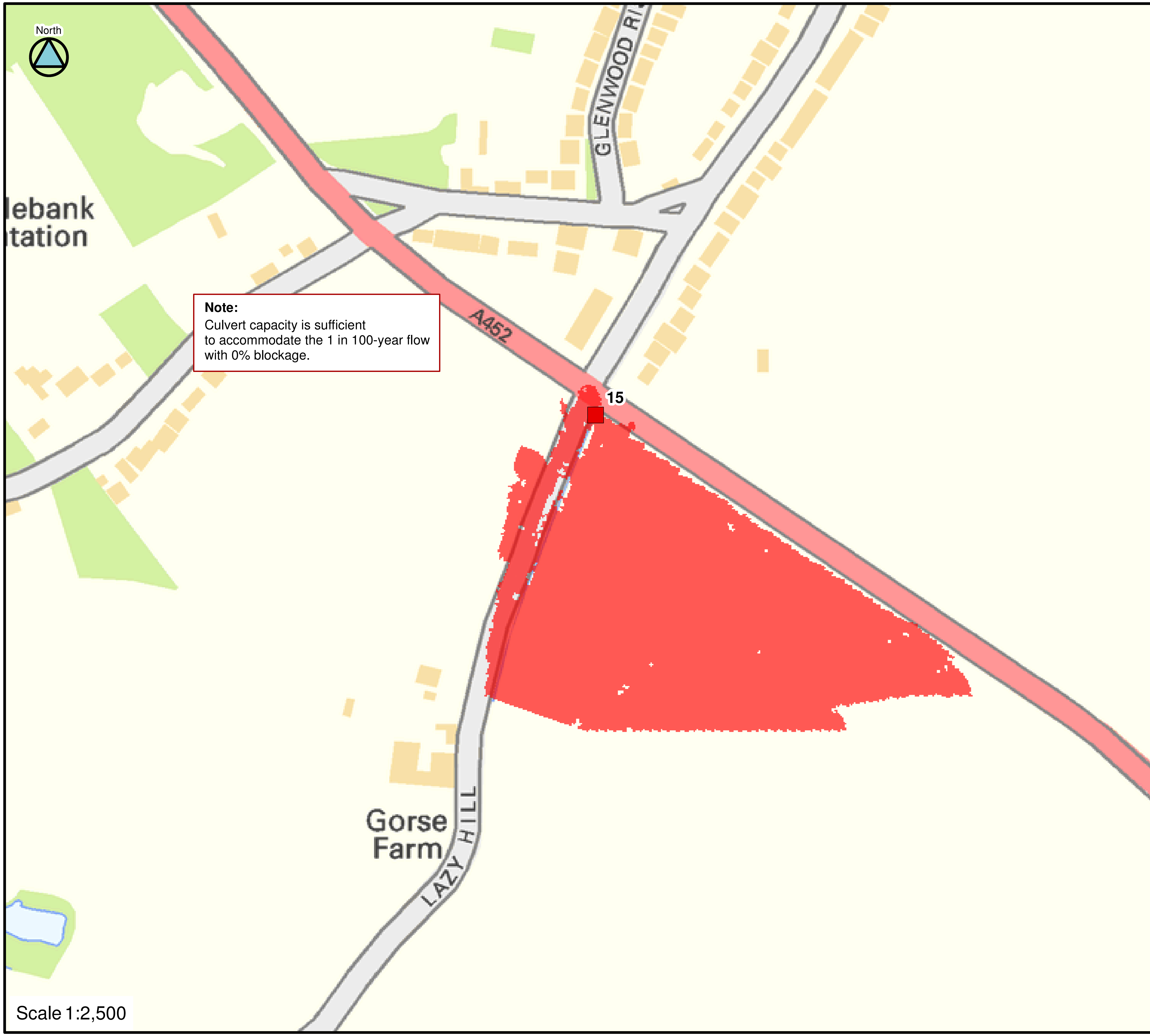
FIGURE C15-100-90
CULVERT 15 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



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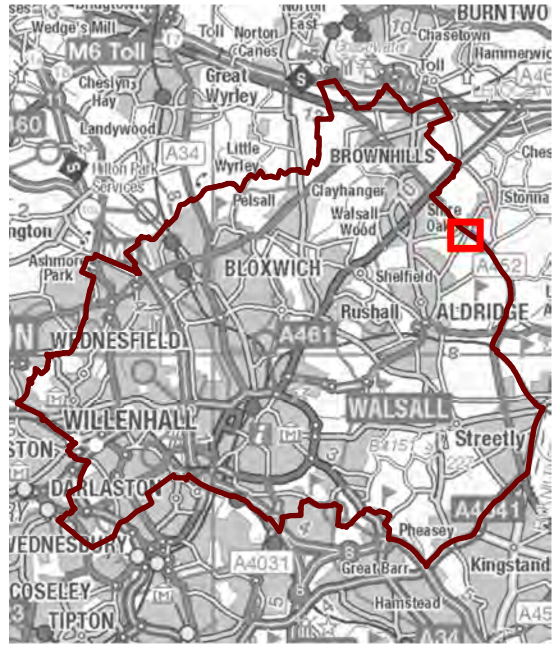

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 75% blockage
- 100yr RP 0% blockage

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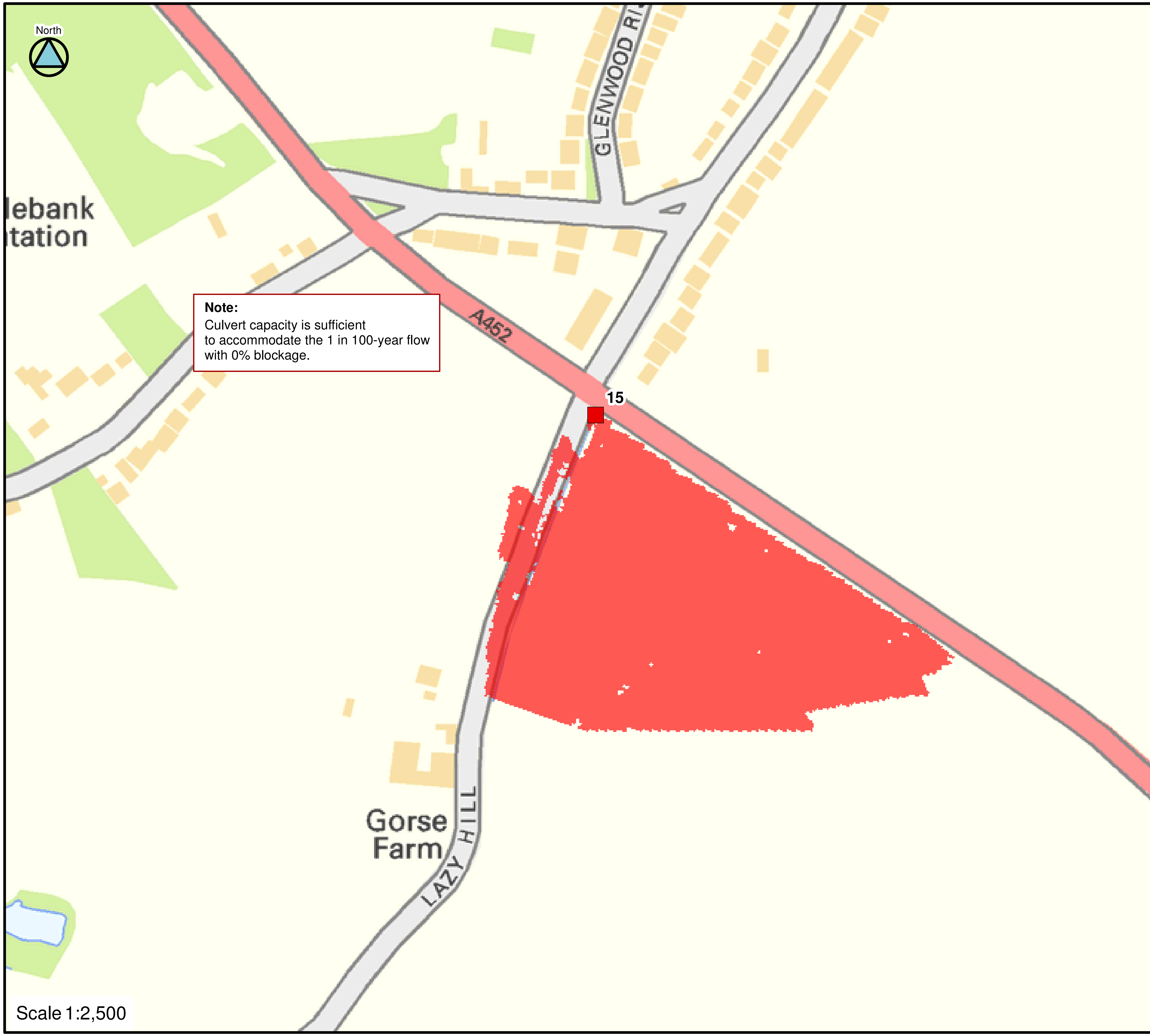
FIGURE C15-100-75
CULVERT 15 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



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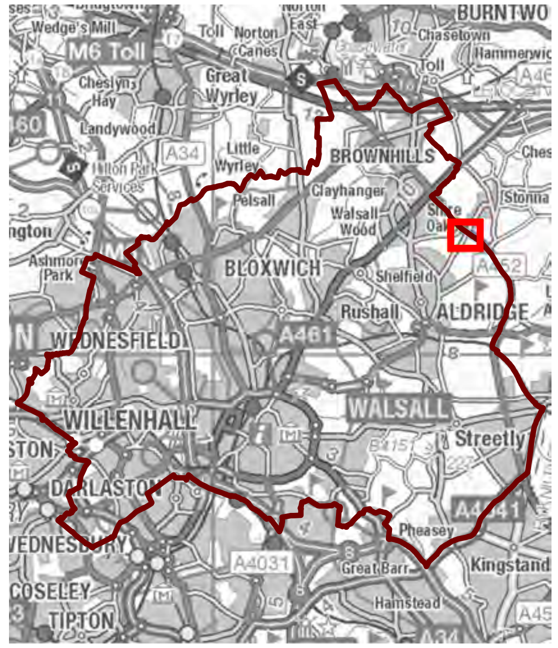

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 50% blockage
- 100yr RP 0% blockage

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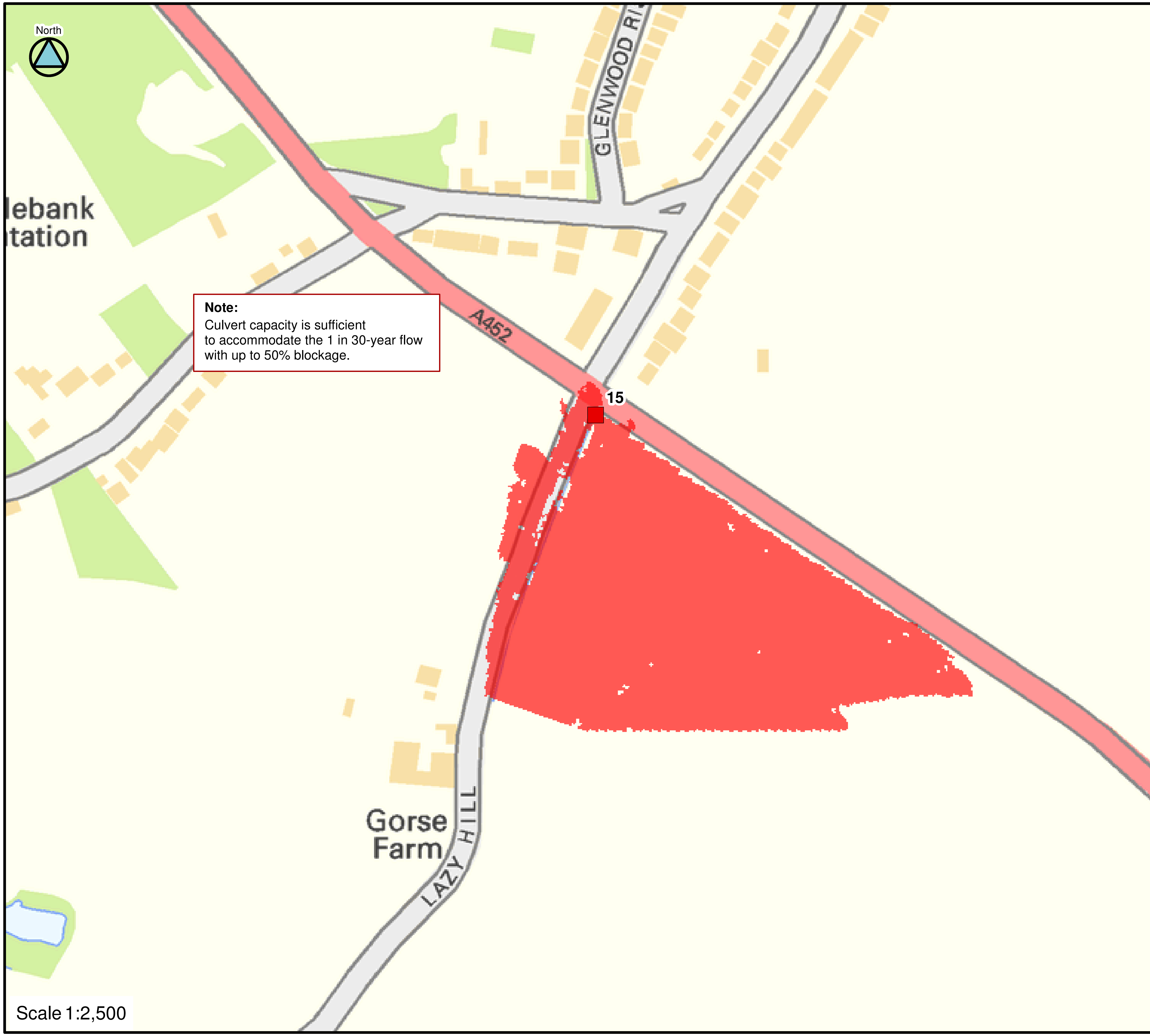
FIGURE C15-100-50
CULVERT 15 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



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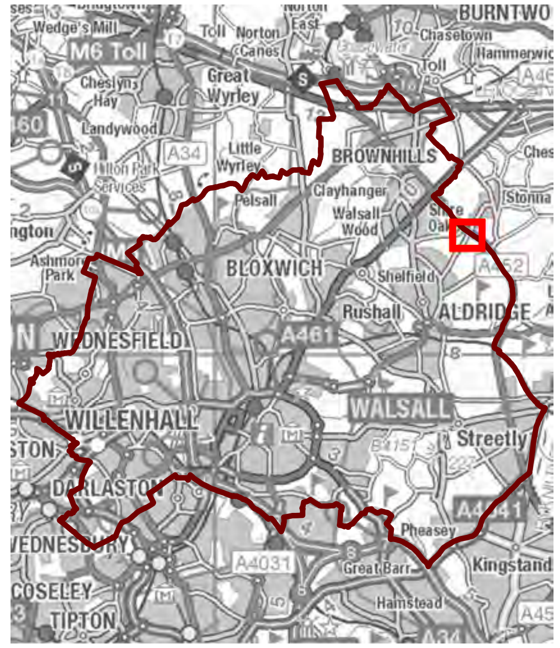

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 90% blockage
- 30yr RP 0% blockage

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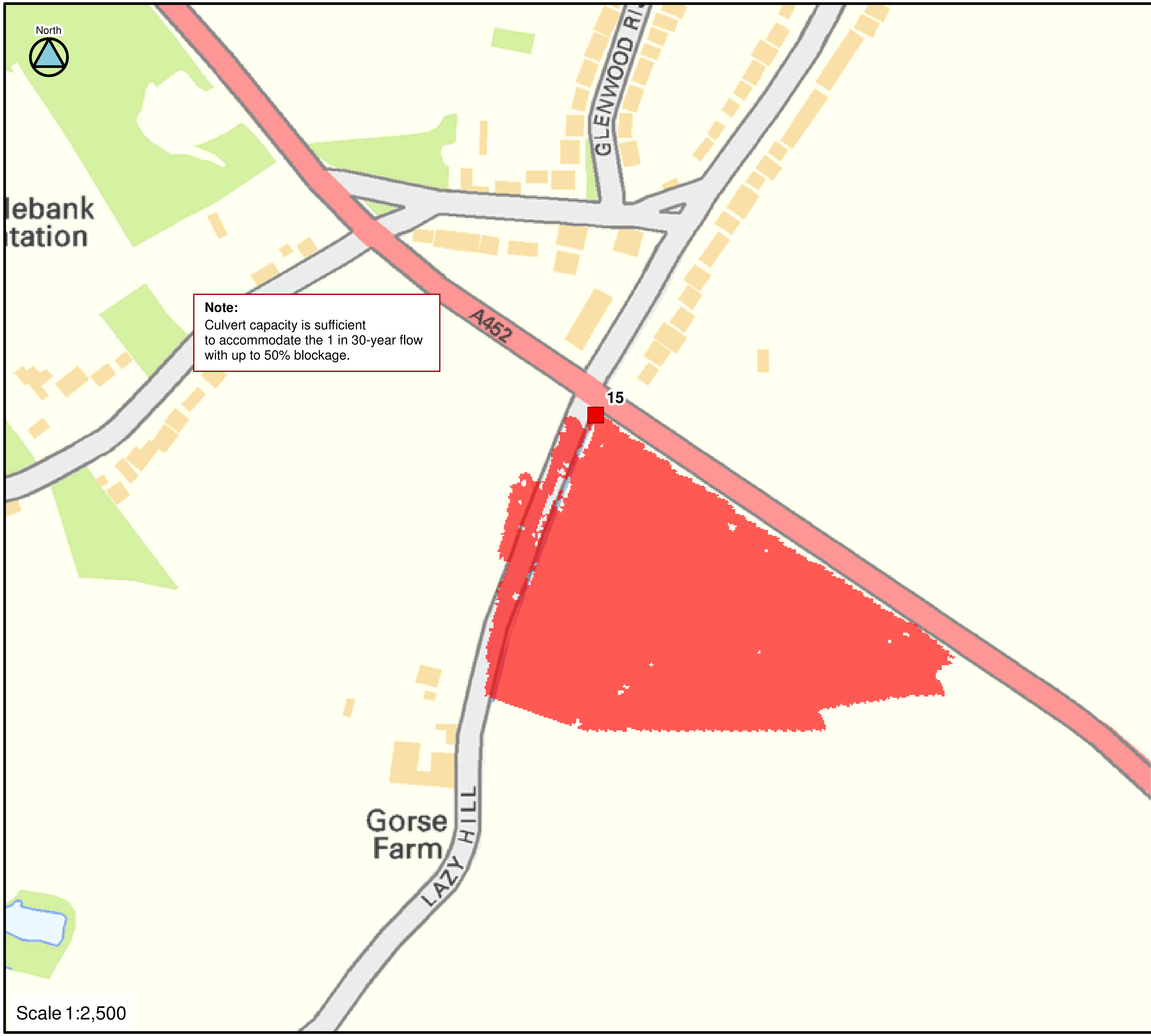
FIGURE C15-30-90
CULVERT 15 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS



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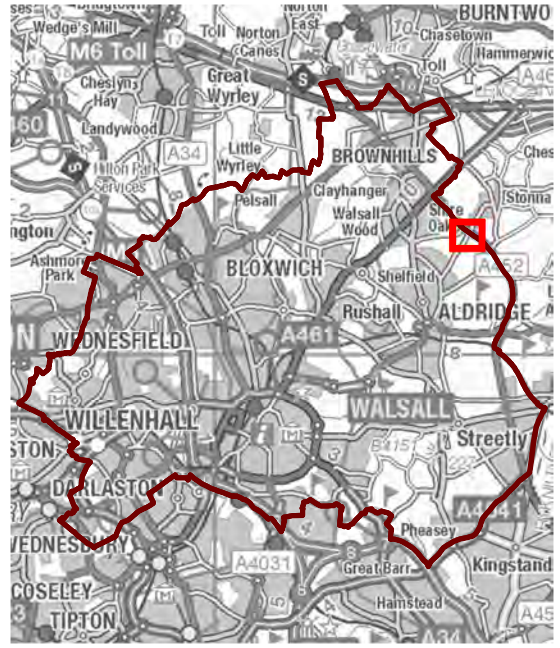

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 75% blockage
- 30yr RP 0% blockage

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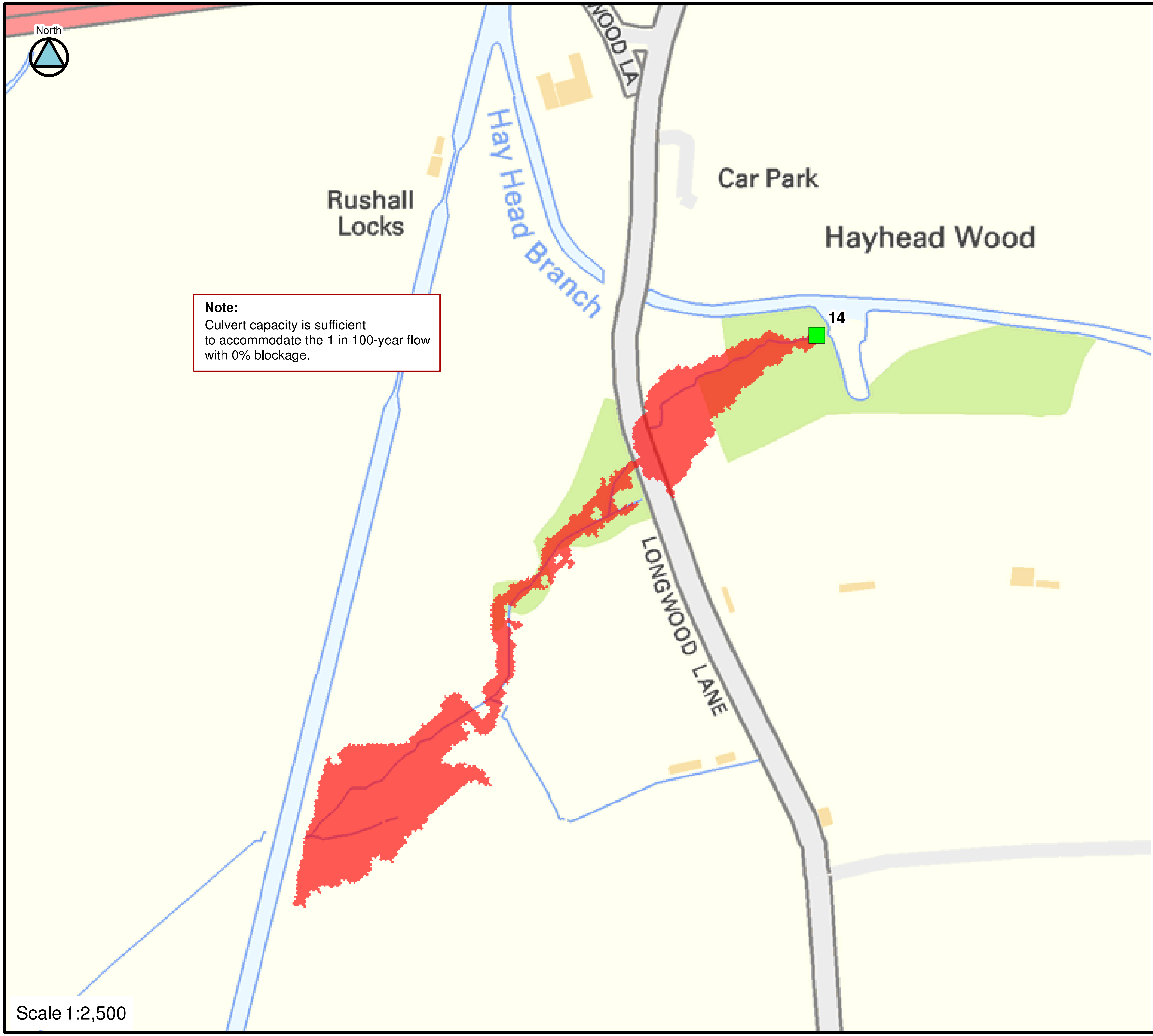
FIGURE C15-30-75
CULVERT 15 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS



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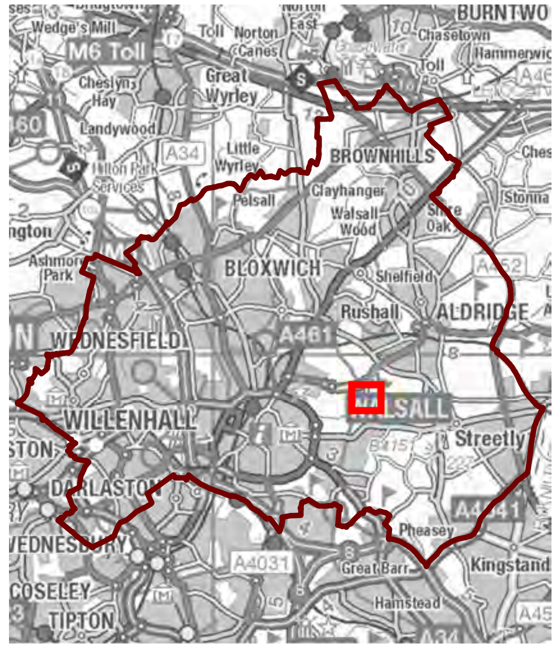

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 90% blockage
- 100yr RP 0% blockage

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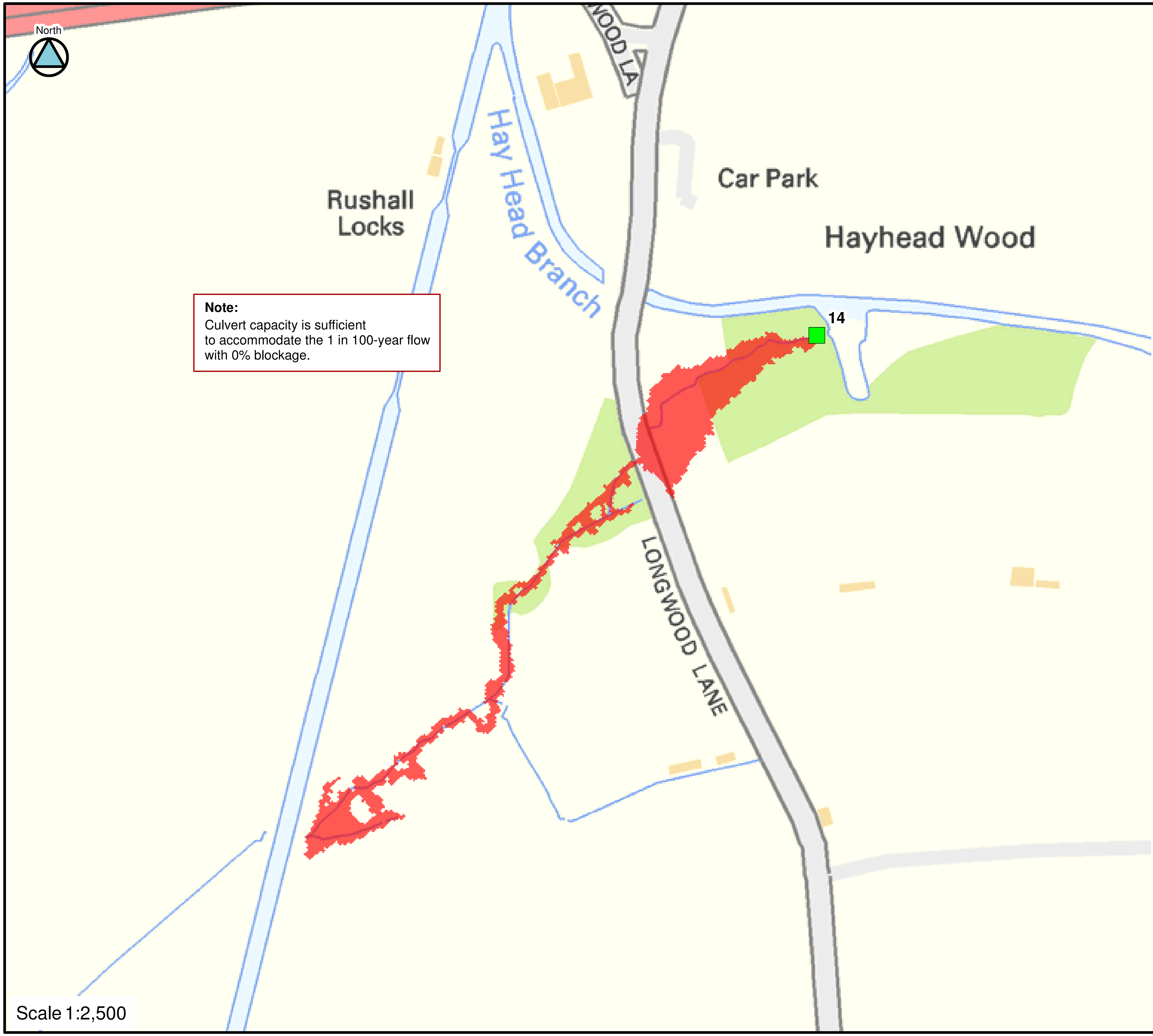
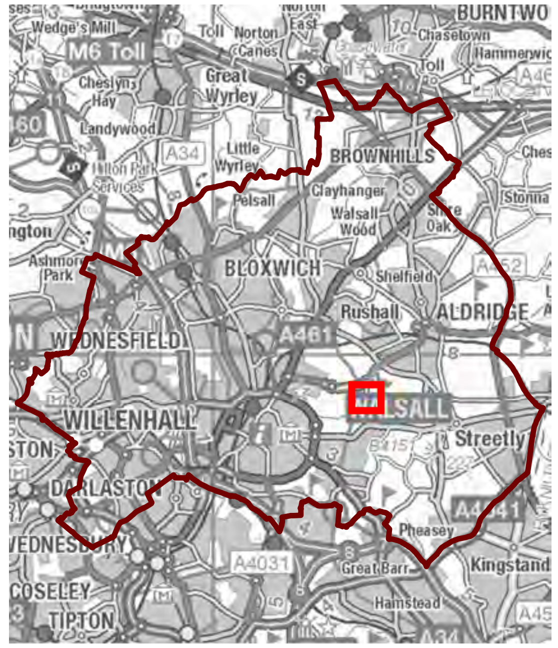
FIGURE C14-100-90
CULVERT 14 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 75% blockage
- 100yr RP 0% blockage

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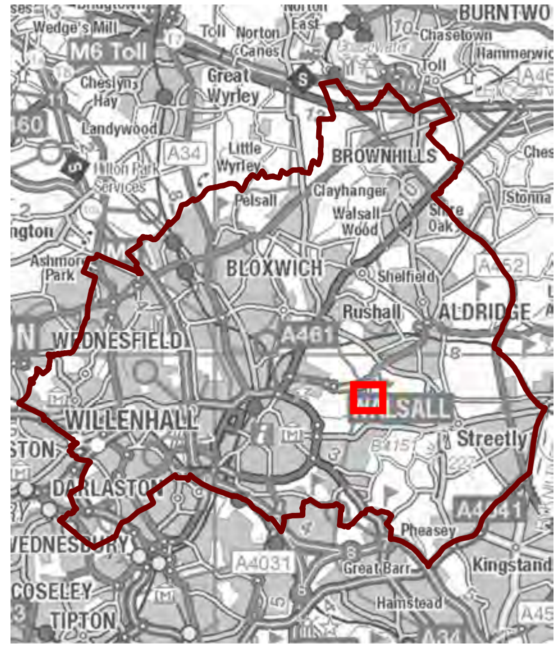
FIGURE C14-100-75
CULVERT 14 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 50% blockage
- 100yr RP 0% blockage

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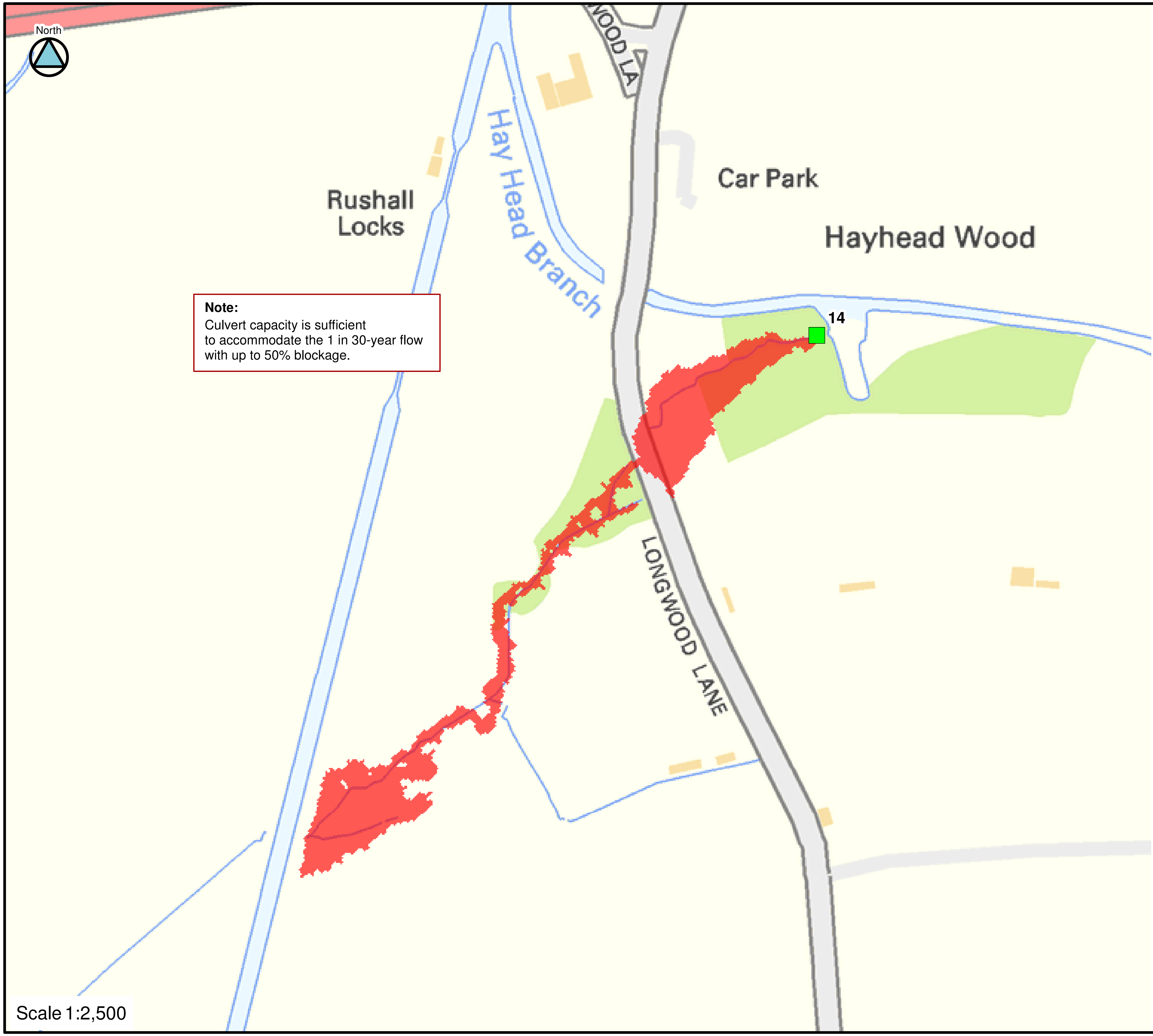
FIGURE C14-100-50
CULVERT 14 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



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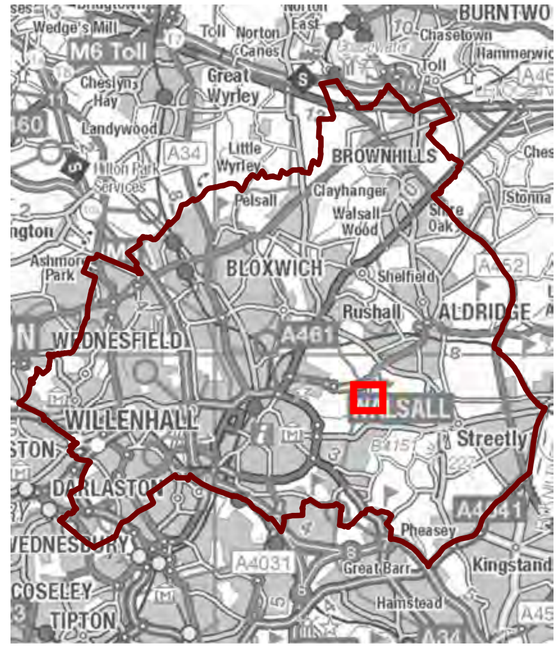

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 90% blockage
- 30yr RP 0% blockage

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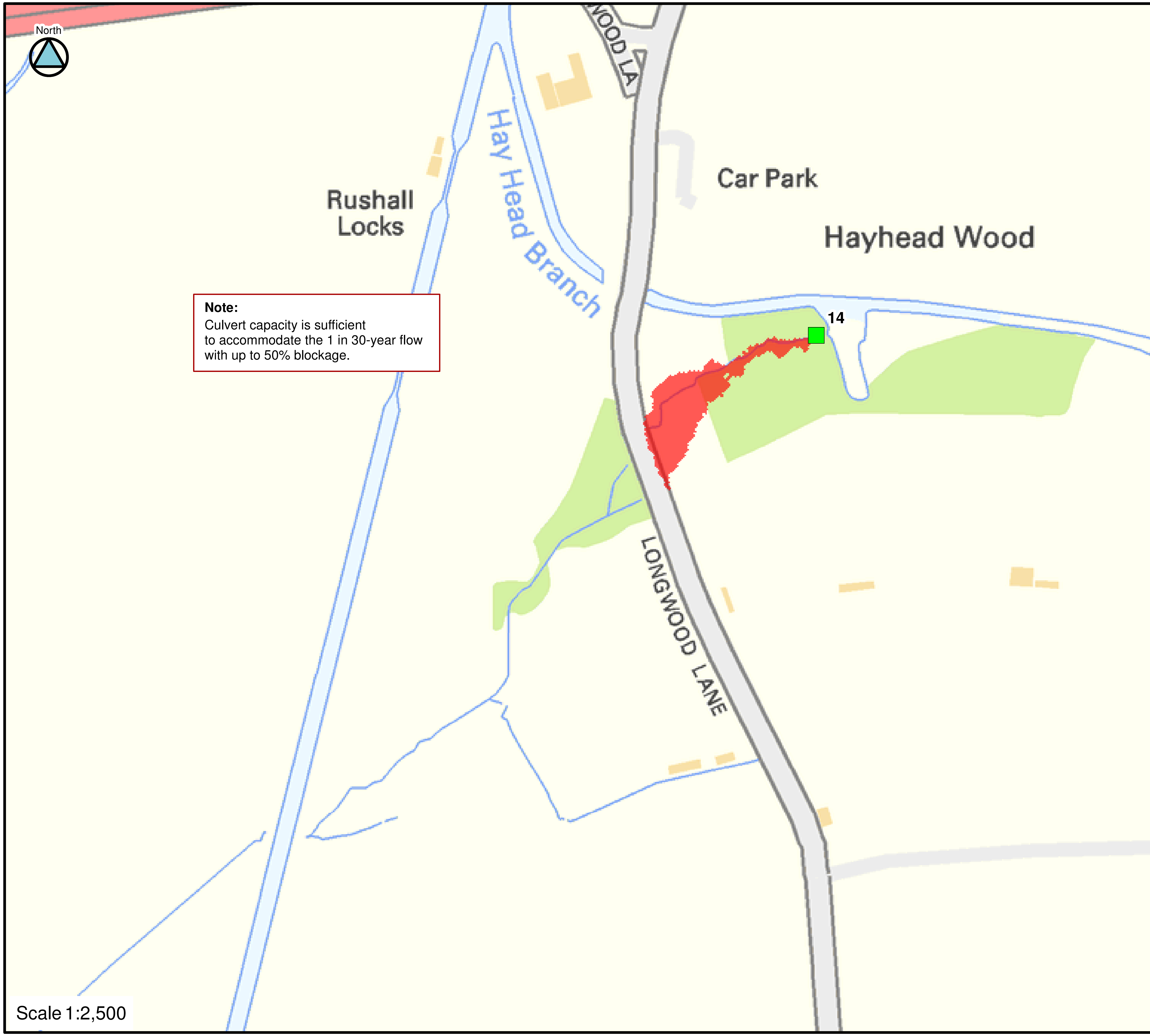
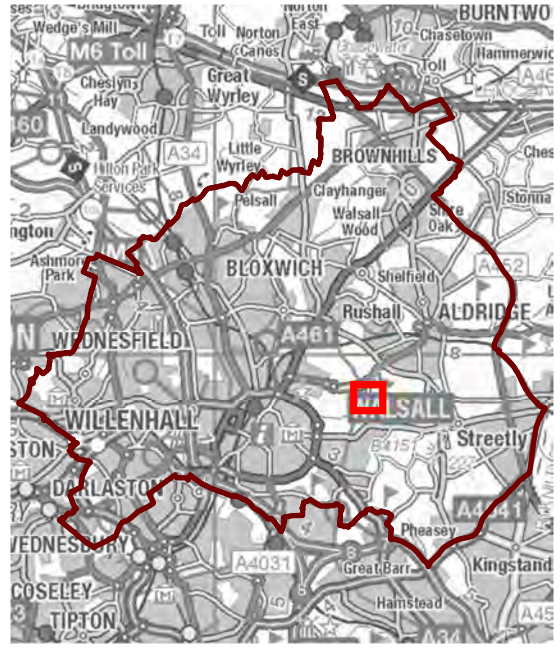
FIGURE C14-30-90
CULVERT 14 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS



Note:
Culvert capacity is sufficient to accommodate the 1 in 30-year flow with up to 50% blockage.

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 75% blockage
- 30yr RP 0% blockage

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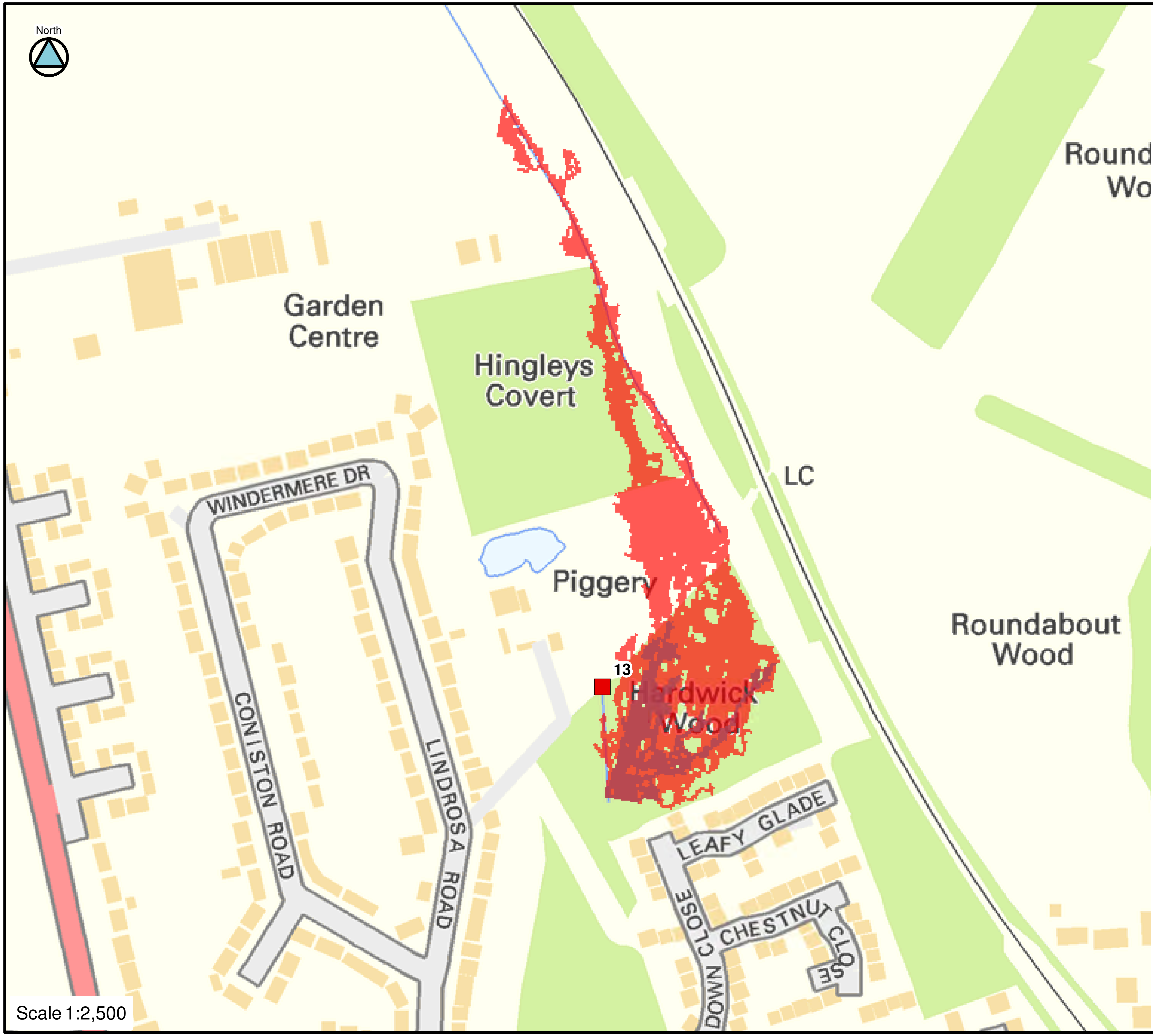
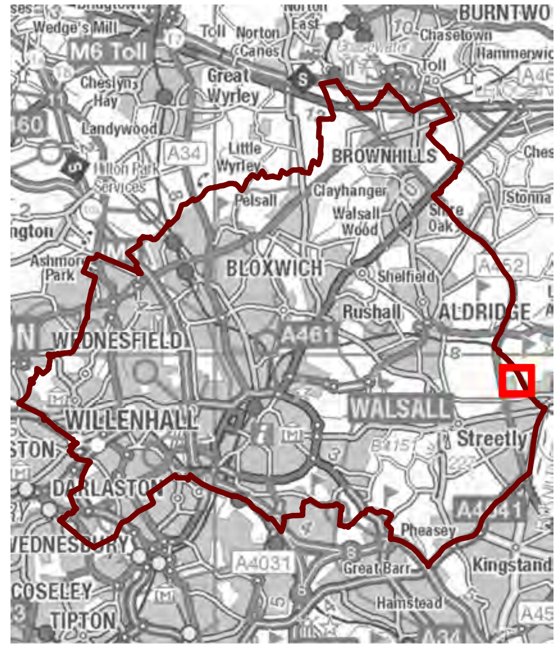
FIGURE C14-30-75
CULVERT 14 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS



KEYPLAN Scale 1:200,000



LEGEND

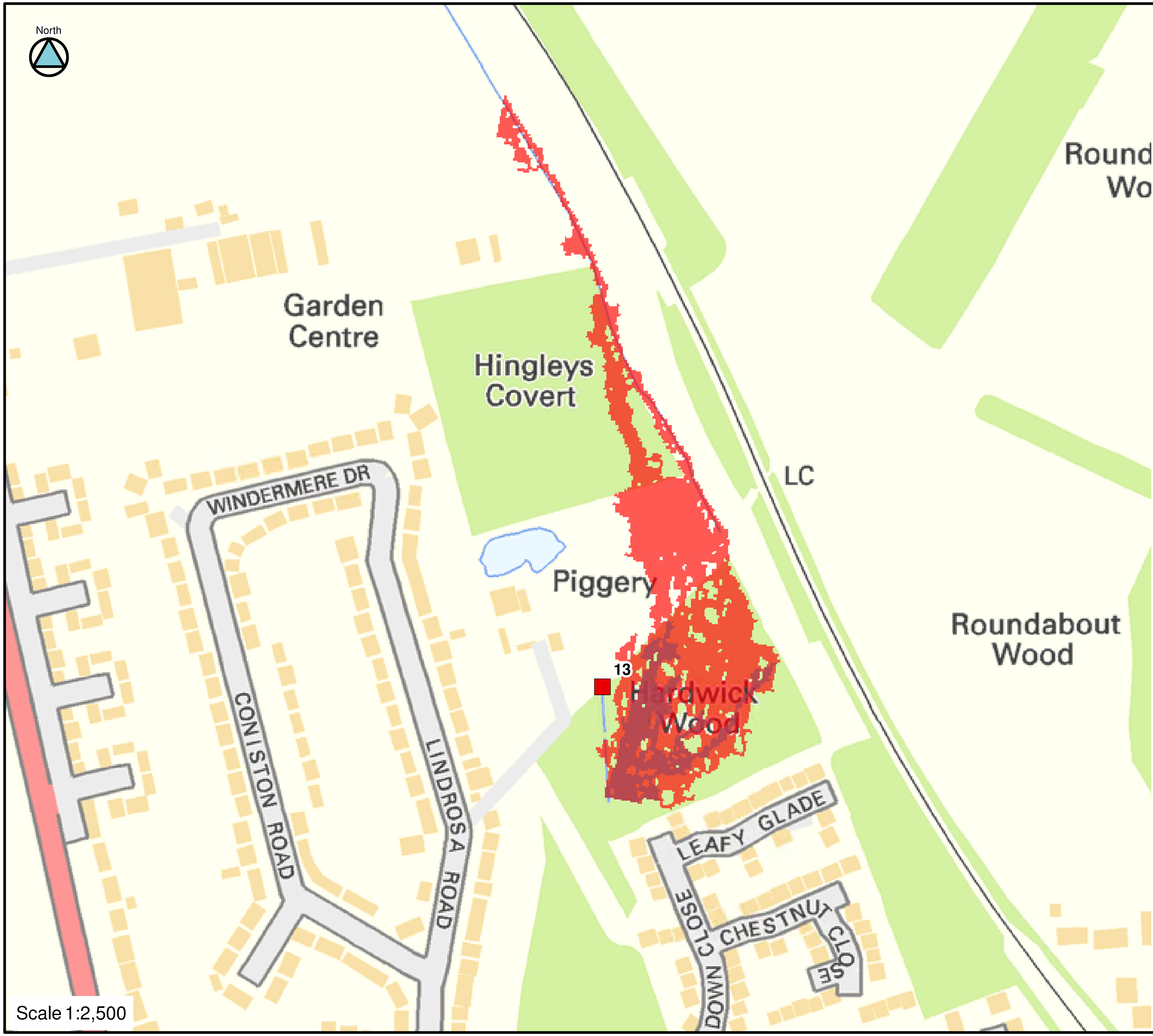
Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 90% blockage
- 100yr RP 0% blockage

JBA consulting

WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C13-100-90
CULVERT 13 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



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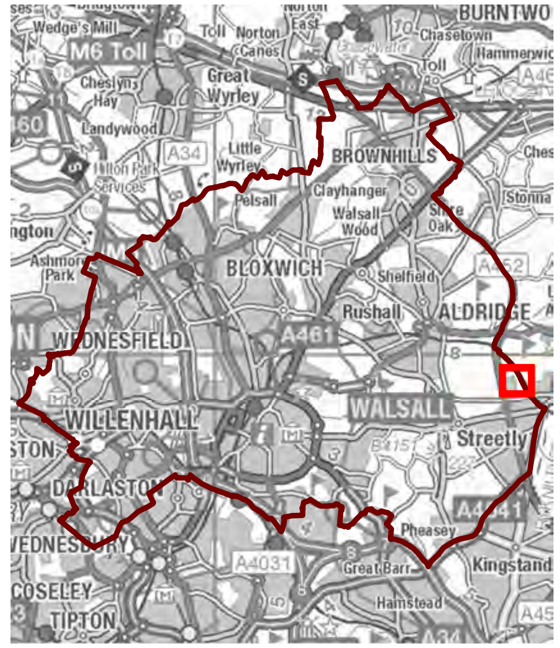

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 75% blockage
- 100yr RP 0% blockage

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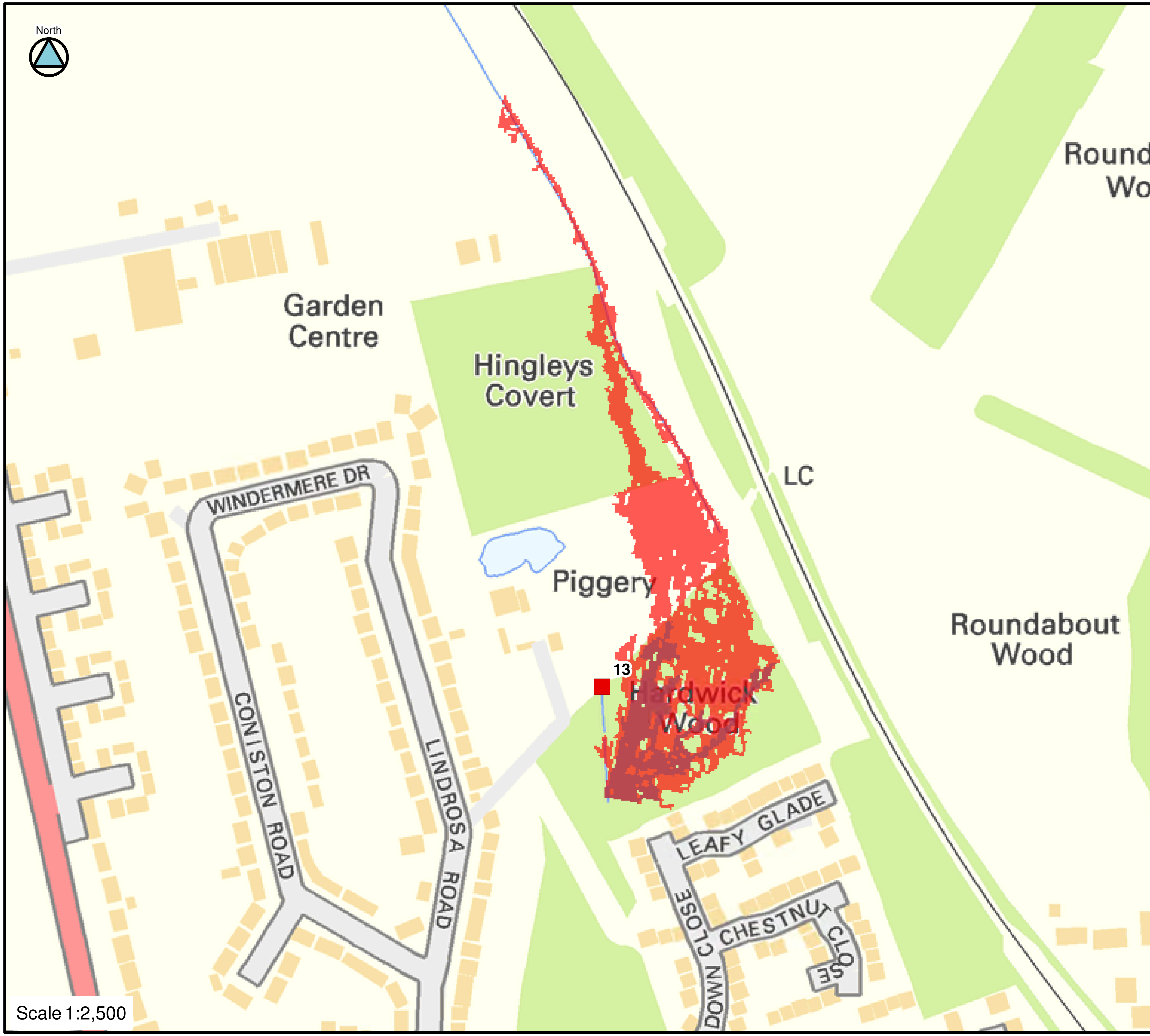
WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C13-100-75
CULVERT 13 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



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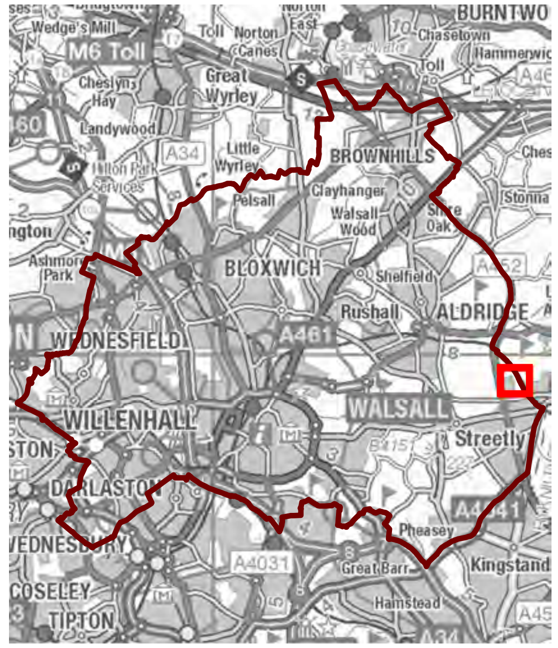

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 50% blockage
- 100yr RP 0% blockage

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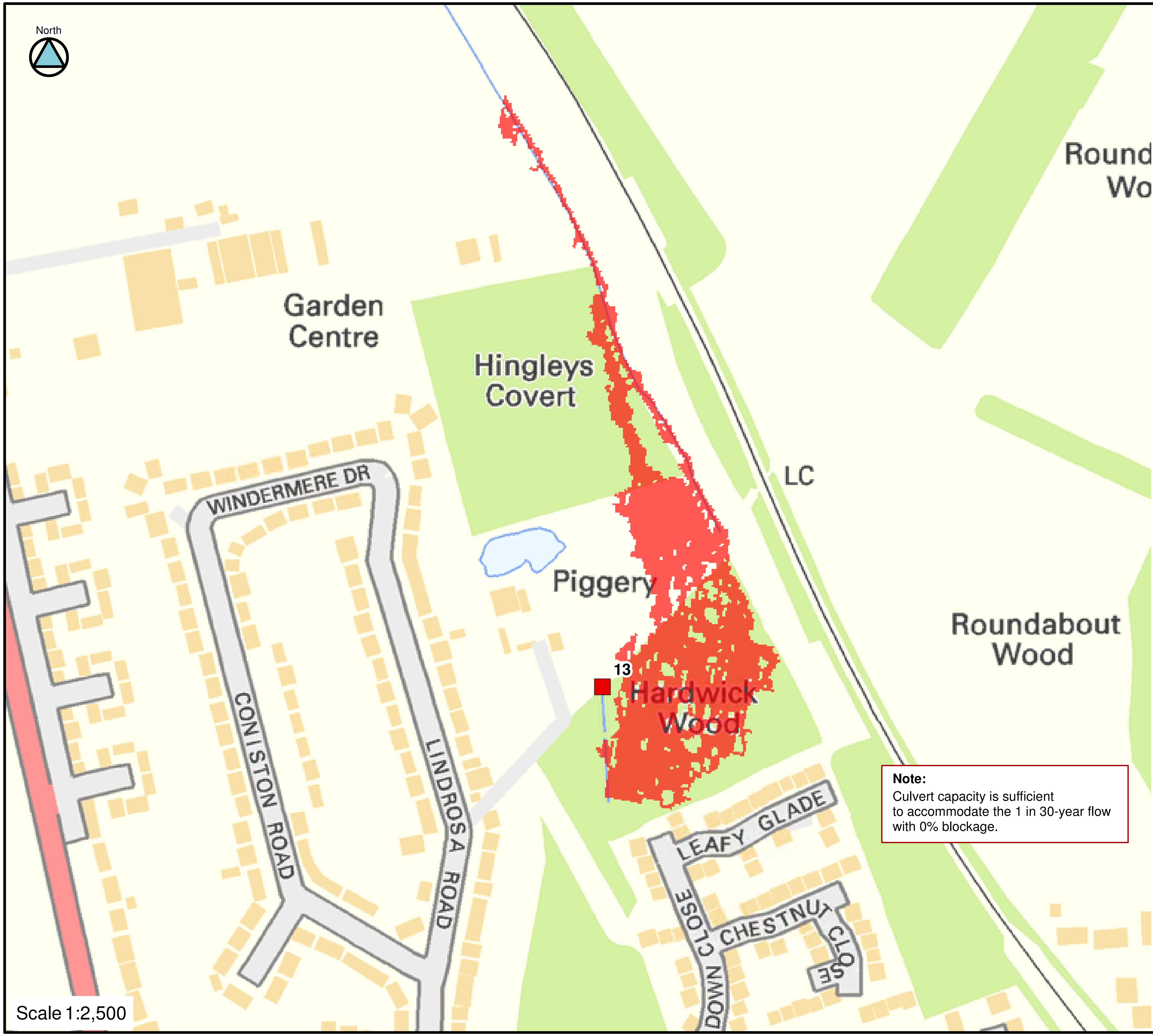
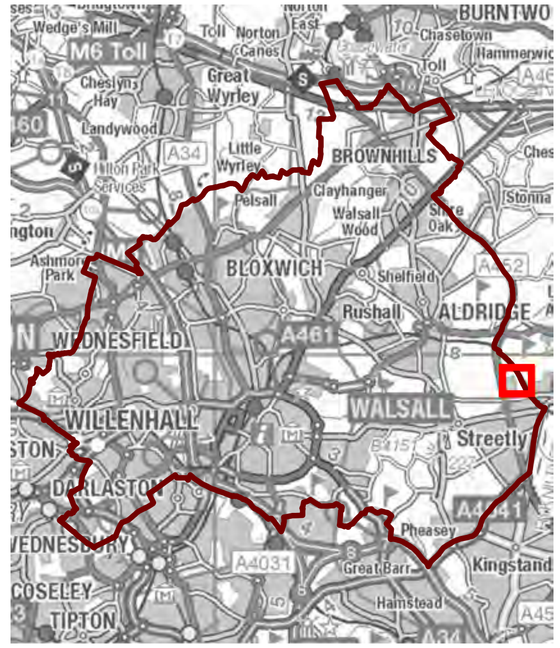
FIGURE C13-100-50
CULVERT 13 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



Note:
Culvert capacity is sufficient to accommodate the 1 in 30-year flow with 0% blockage.

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 90% blockage
- 30yr RP 0% blockage

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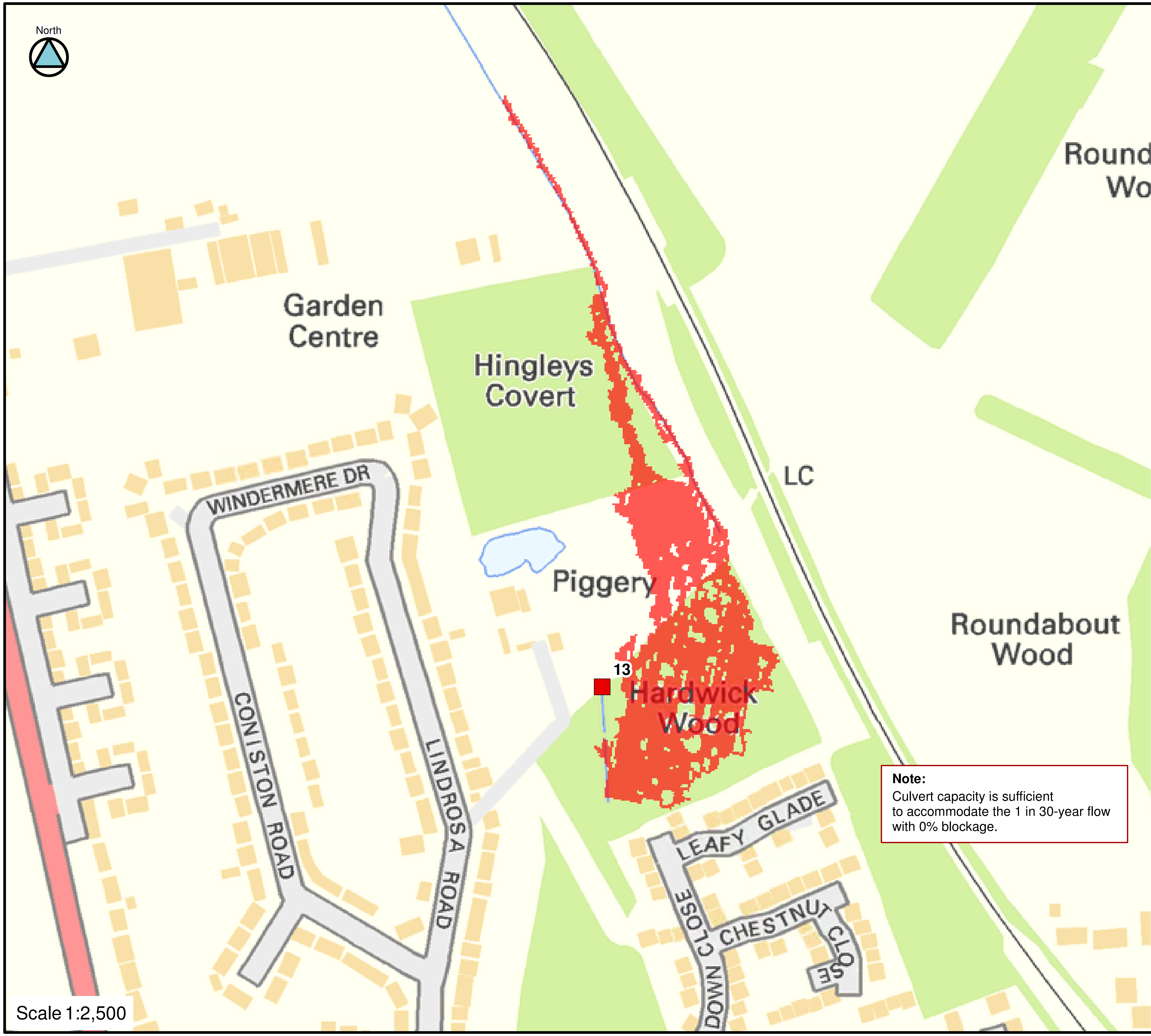
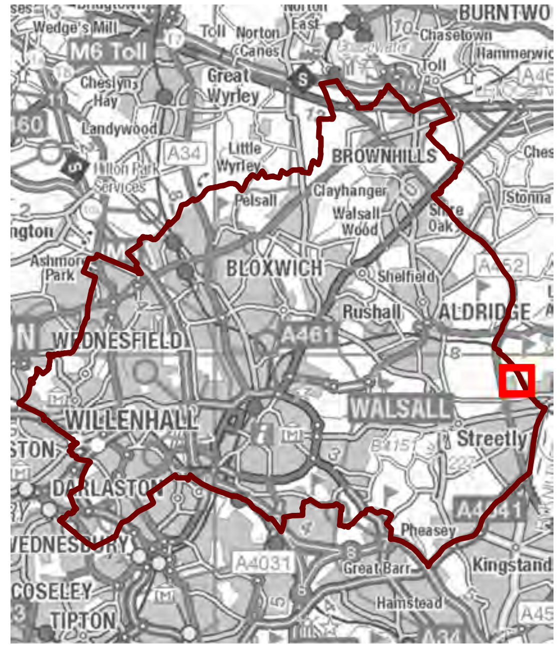
FIGURE C13-30-90
CULVERT 13 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS



Note:
Culvert capacity is sufficient to accommodate the 1 in 30-year flow with 0% blockage.

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 75% blockage
- 30yr RP 0% blockage

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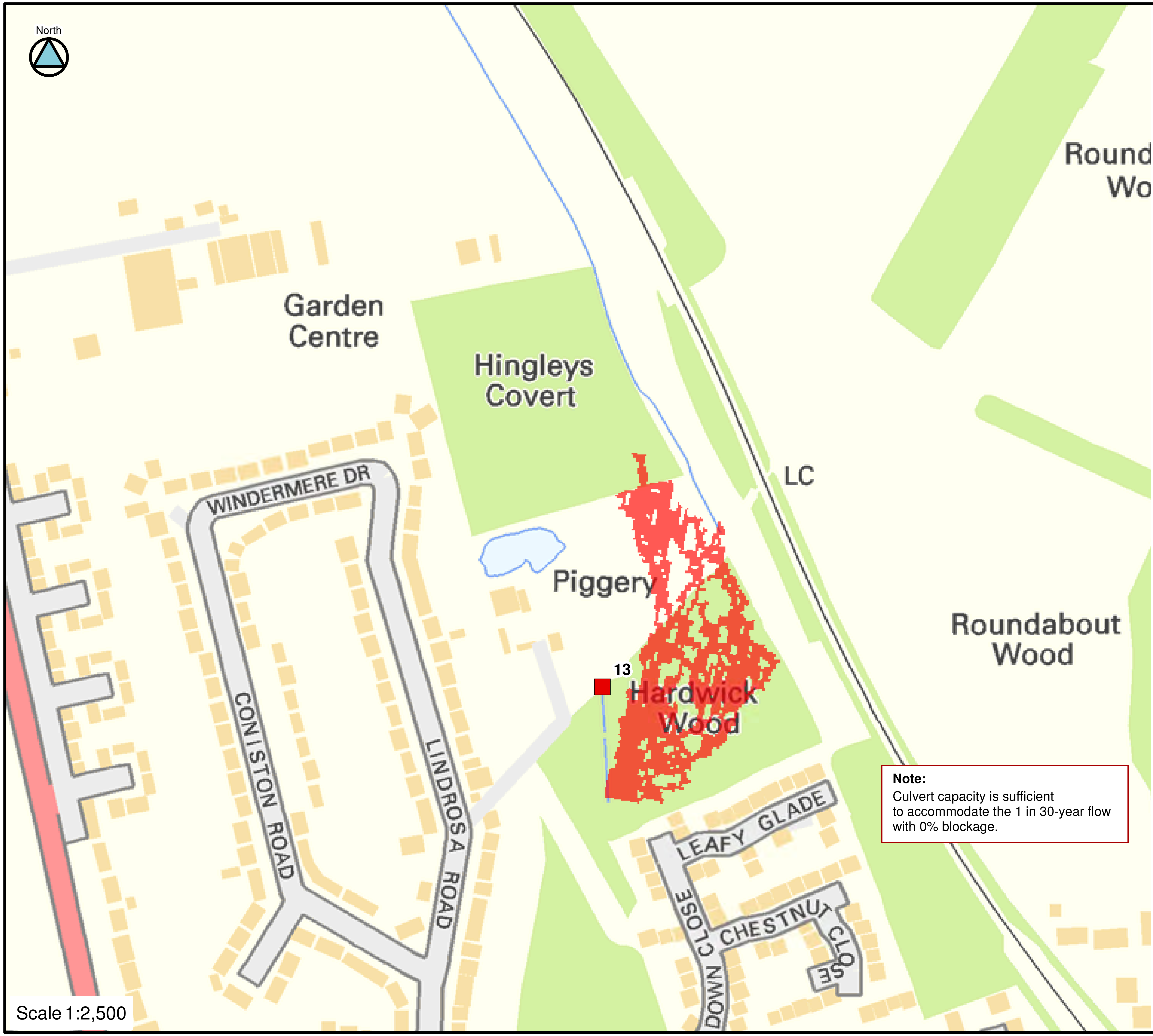
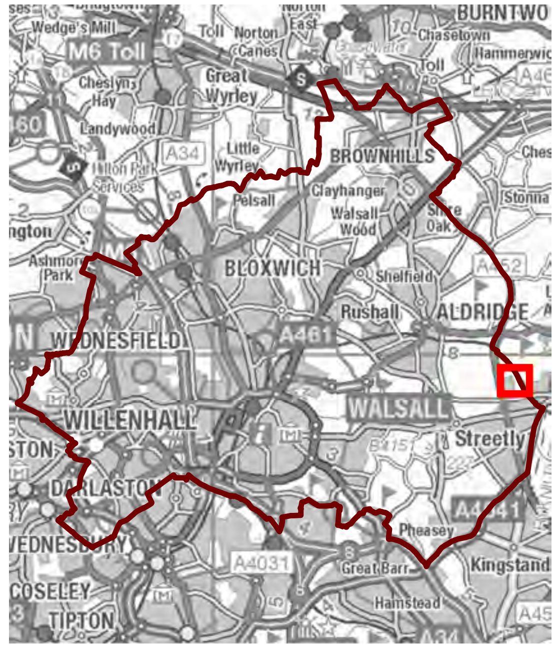
WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C13-30-75
CULVERT 13 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS



Note:
Culvert capacity is sufficient
to accommodate the 1 in 30-year flow
with 0% blockage.

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 50% blockage
- 30yr RP 0% blockage

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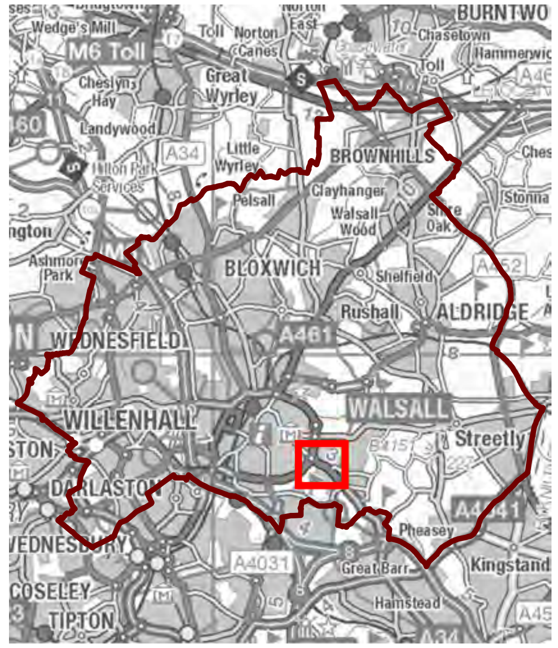
FIGURE C13-30-50
CULVERT 13 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 90% blockage
- 100yr RP 0% blockage

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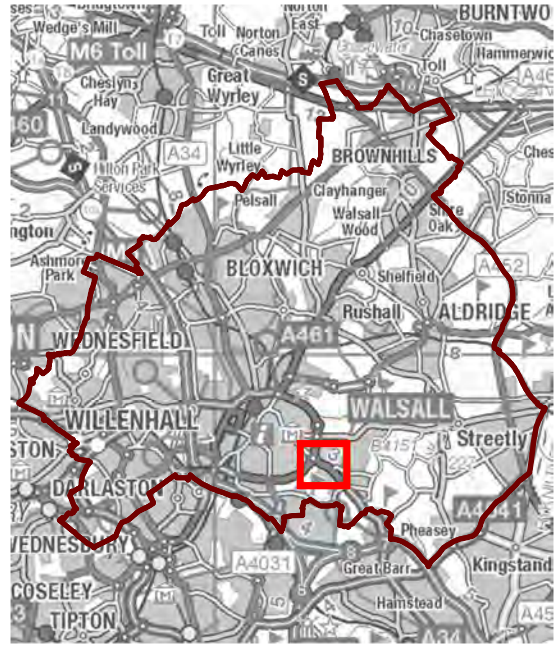
FIGURE C11-100-90
CULVERT 11 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 75% blockage
- 100yr RP 0% blockage

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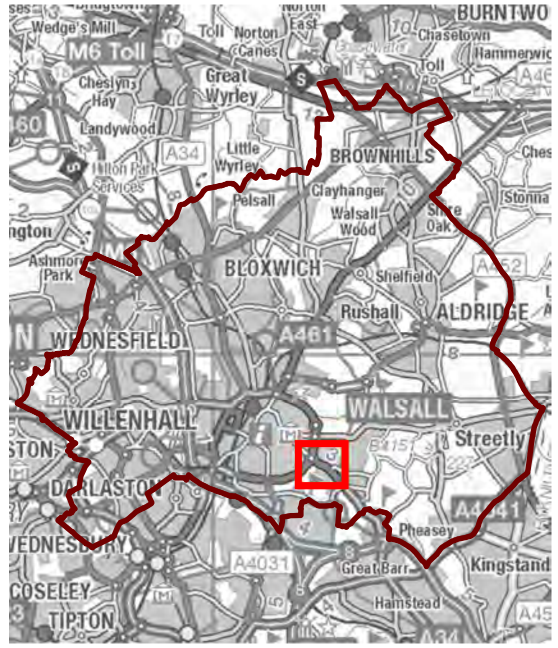
FIGURE C11-100-75
CULVERT 11 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 50% blockage
- 100yr RP 0% blockage

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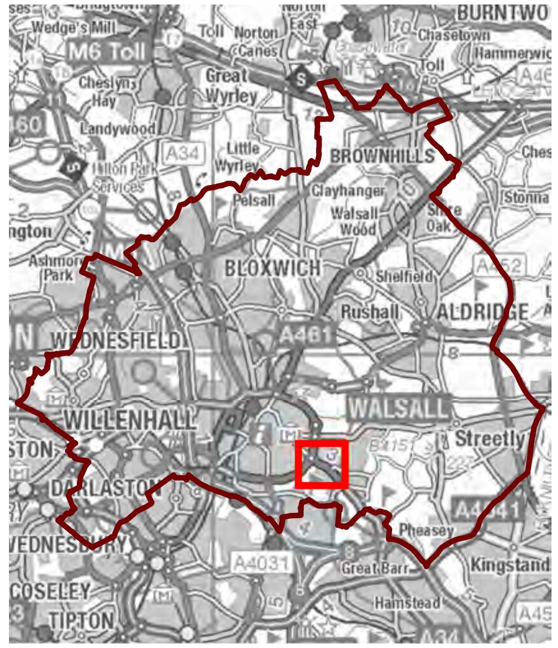
WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C11-100-50
CULVERT 11 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 90% blockage
- 30yr RP 0% blockage

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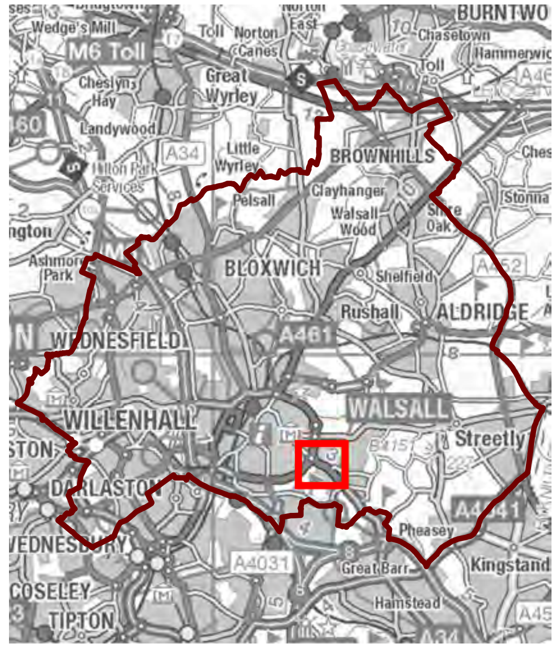
WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C11-30-90
CULVERT 11 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 75% blockage
- 30yr RP 0% blockage

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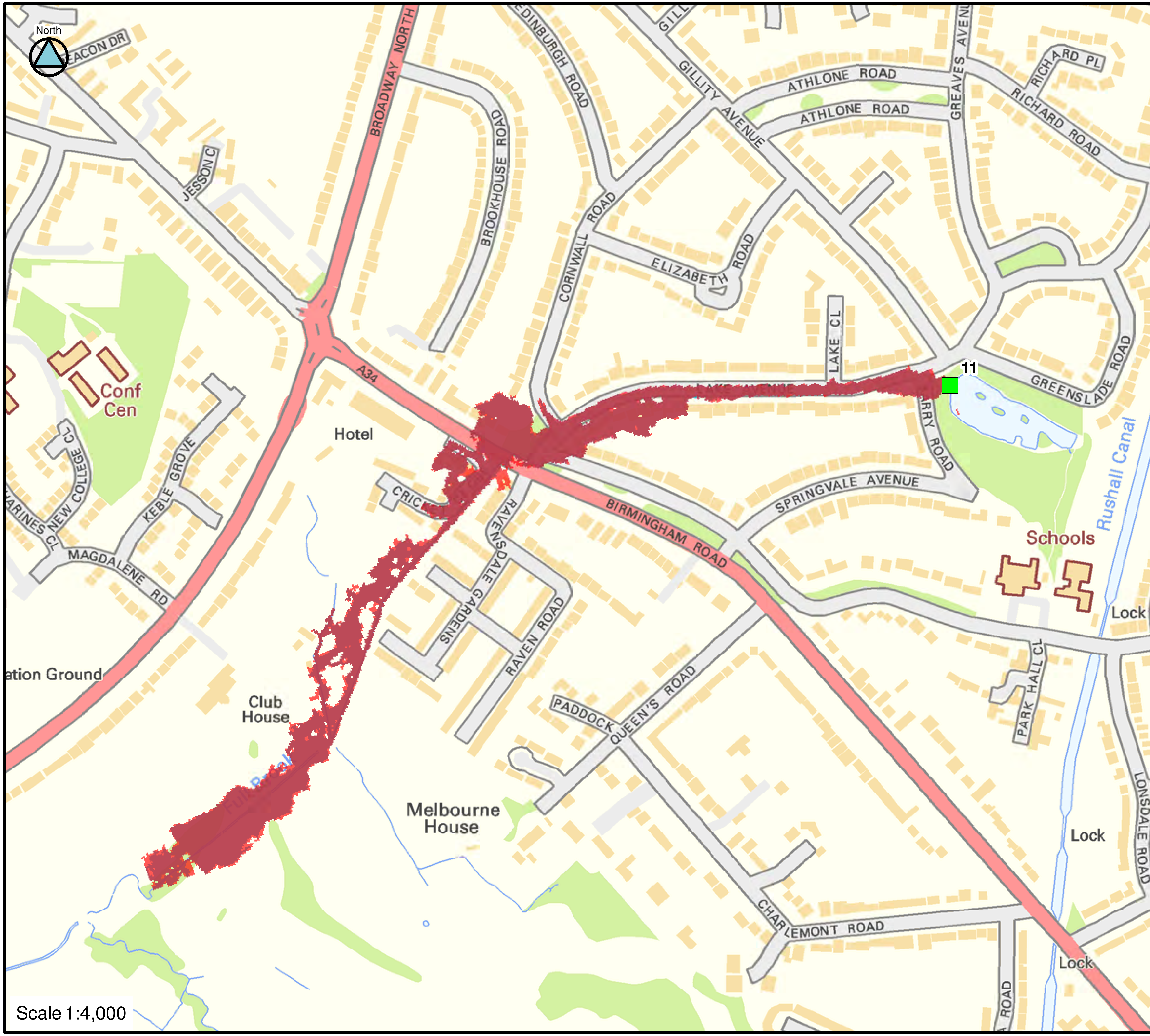
FIGURE C11-30-75
CULVERT 11 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS



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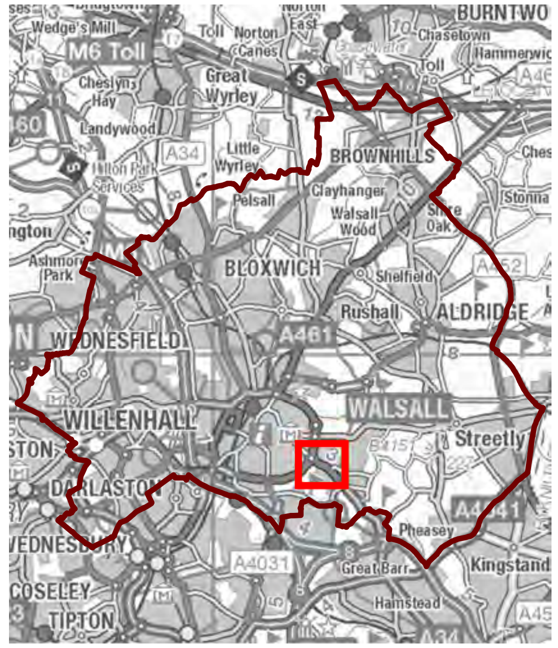


LEGEND

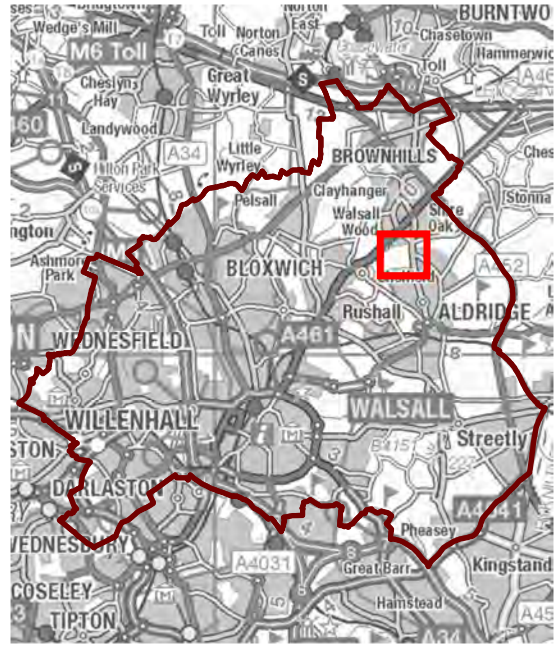
Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 50% blockage
- 30yr RP 0% blockage

WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C11-30-50
CULVERT 11 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 90% blockage
- 100yr RP 0% blockage

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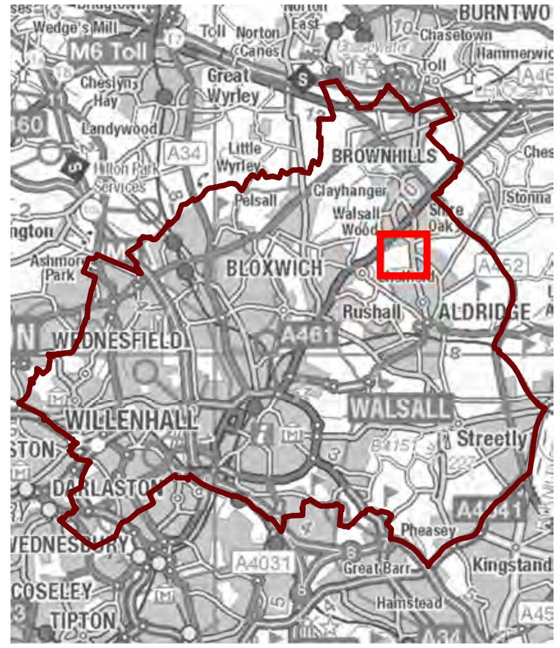
FIGURE C10-100-90
CULVERT 10 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS

Note:
Culvert capacity is sufficient
to accommodate the 1 in 100-year flow
with 0% blockage.

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 75% blockage
- 100yr RP 0% blockage

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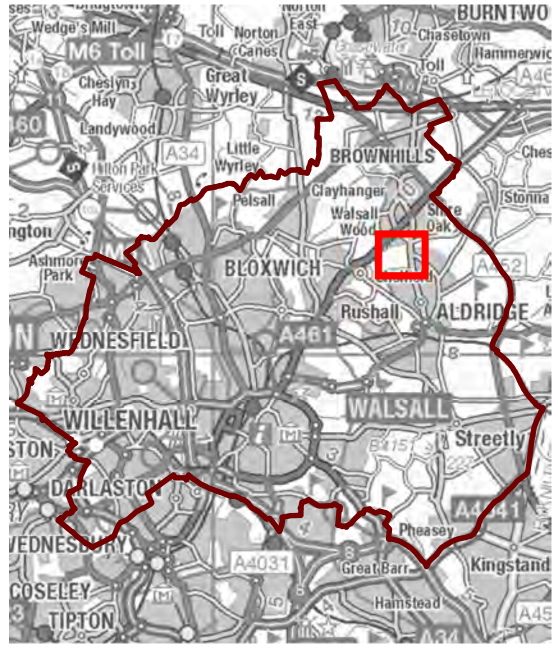
FIGURE C10-100-75
CULVERT 10 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

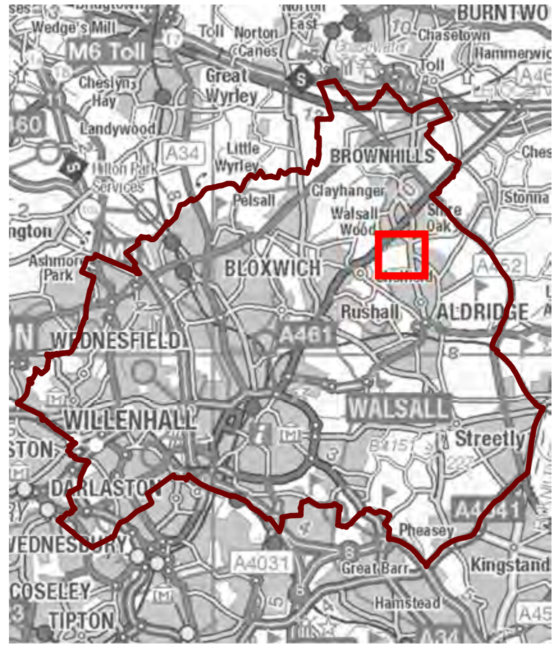
Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 50% blockage
- 100yr RP 0% blockage

WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C10-100-50
CULVERT 10 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

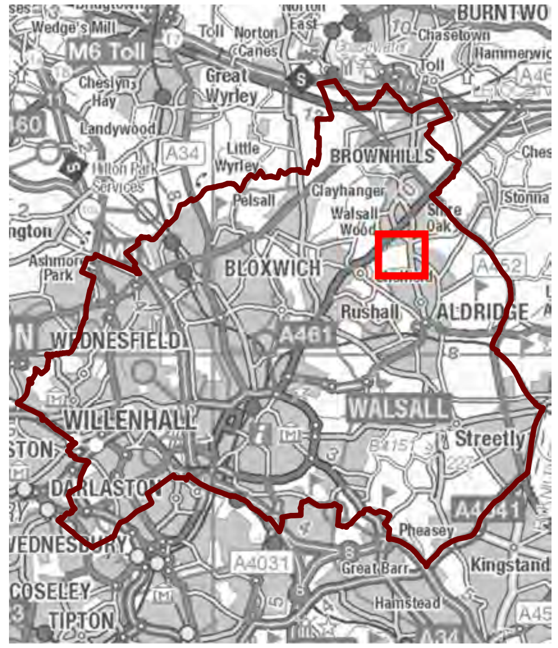
Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 90% blockage
- 30yr RP 0% blockage

WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C10-30-90
CULVERT 10 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 75% blockage
- 30yr RP 0% blockage

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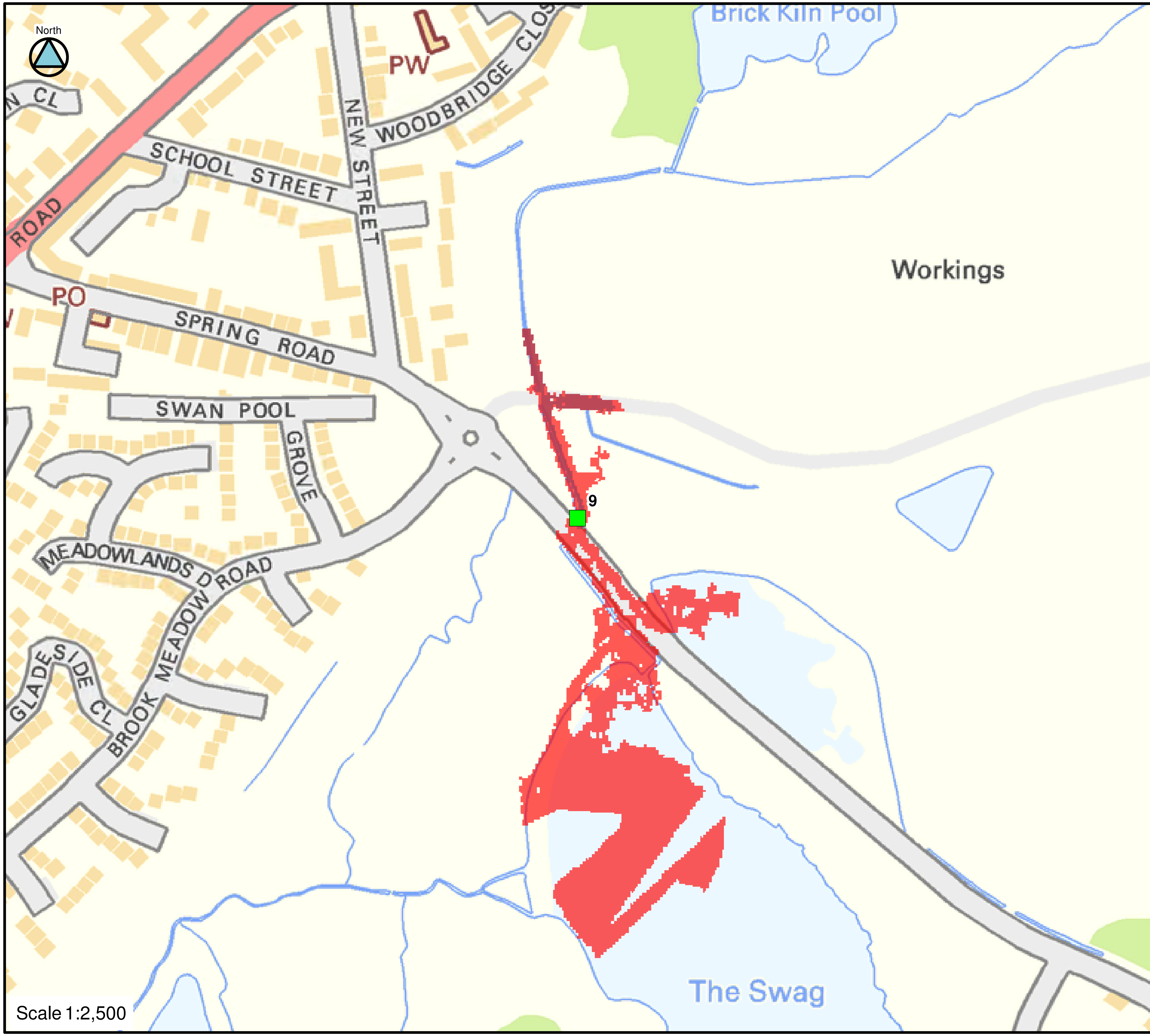
FIGURE C10-30-75
CULVERT 10 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS



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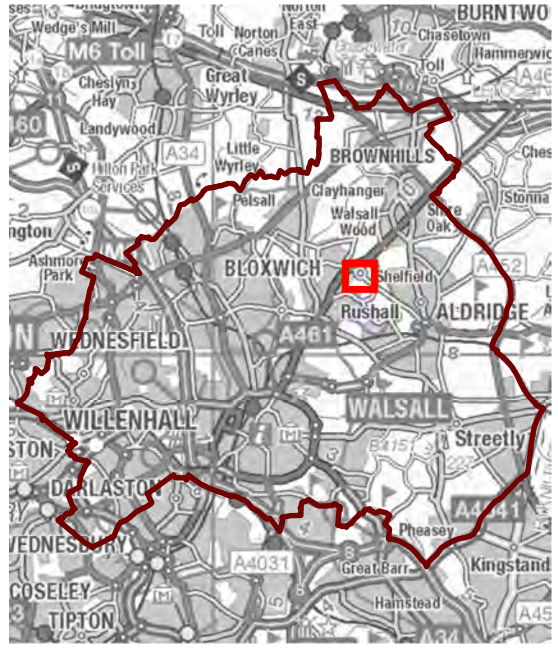


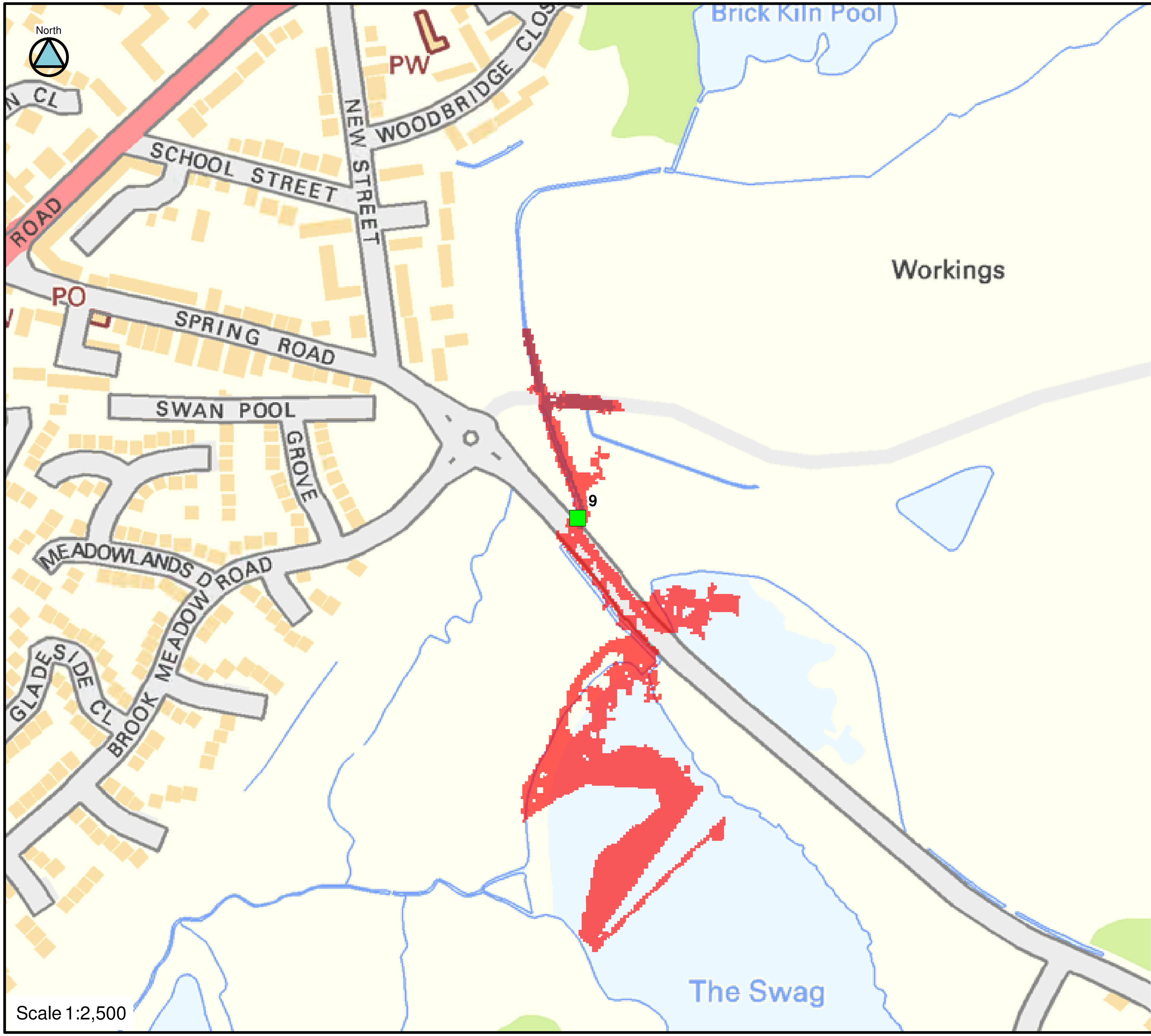
LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 90% blockage
- 100yr RP 0% blockage

WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C09-100-90
CULVERT 9 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



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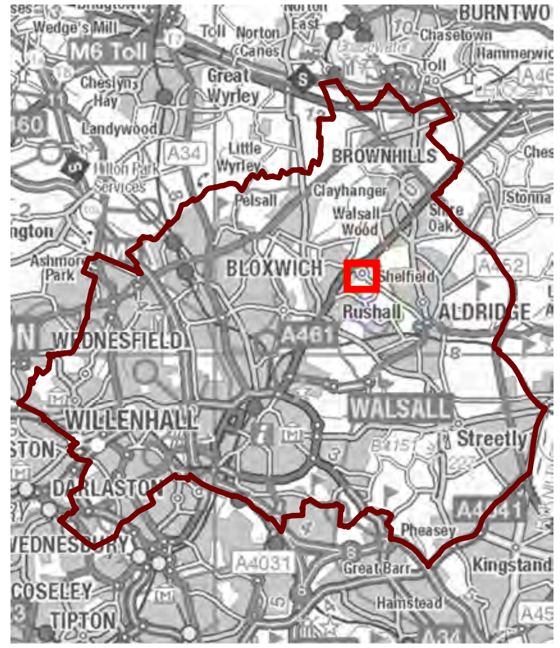


LEGEND

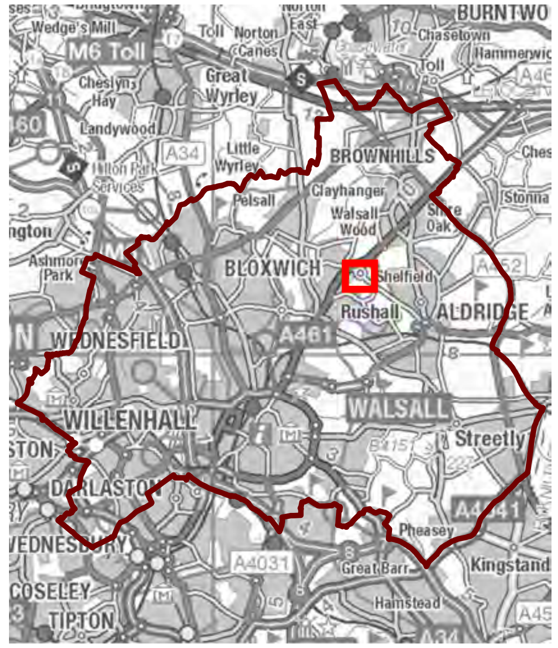
Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 75% blockage
- 100yr RP 0% blockage

WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C09-100-75
CULVERT 9 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

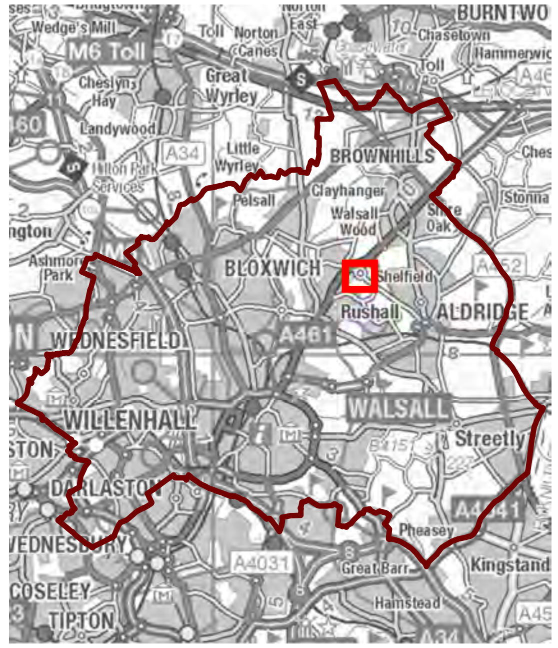
Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 50% blockage
- 100yr RP 0% blockage

WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C09-100-50
CULVERT 9 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 90% blockage
- 30yr RP 0% blockage

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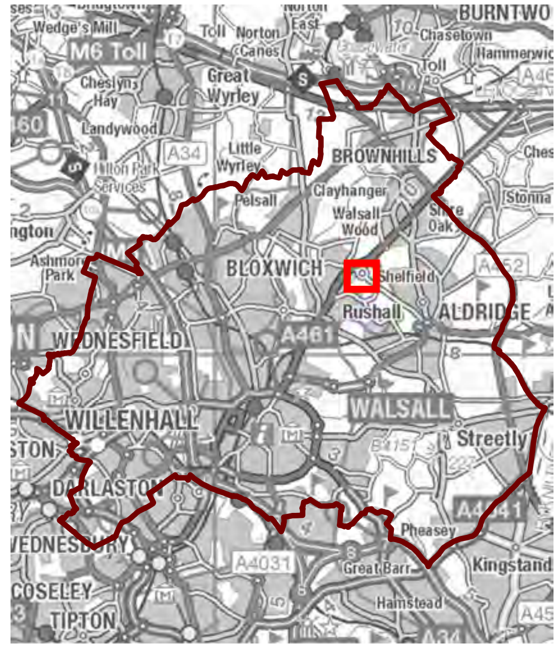
FIGURE C09-30-90
CULVERT 9 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 75% blockage
- 30yr RP 0% blockage

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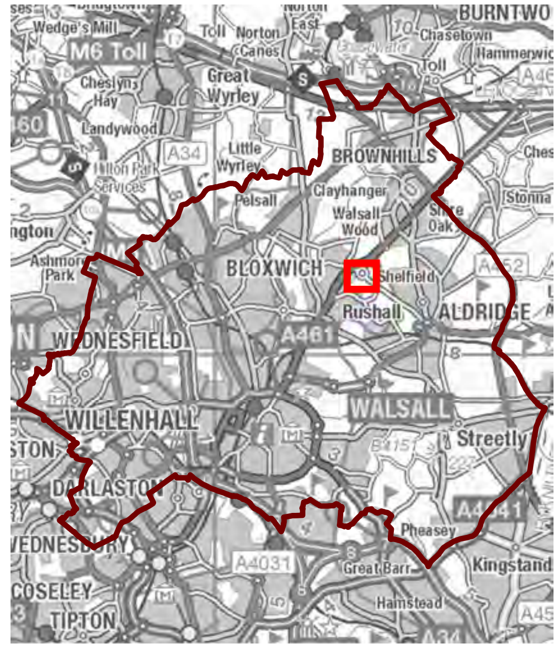
WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C09-30-75
CULVERT 9 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



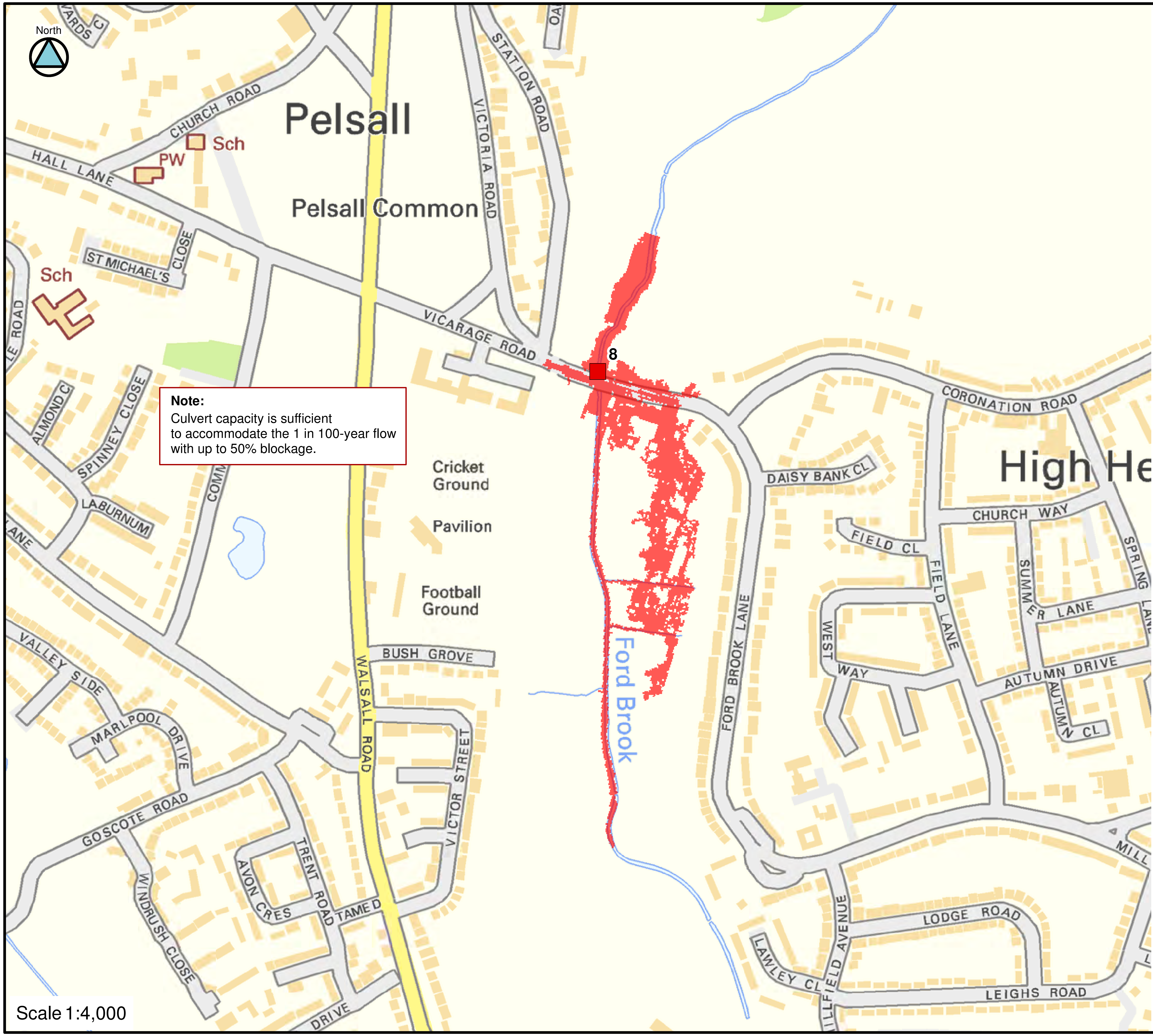
LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 50% blockage
- 30yr RP 0% blockage

WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C09-30-50
CULVERT 9 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS



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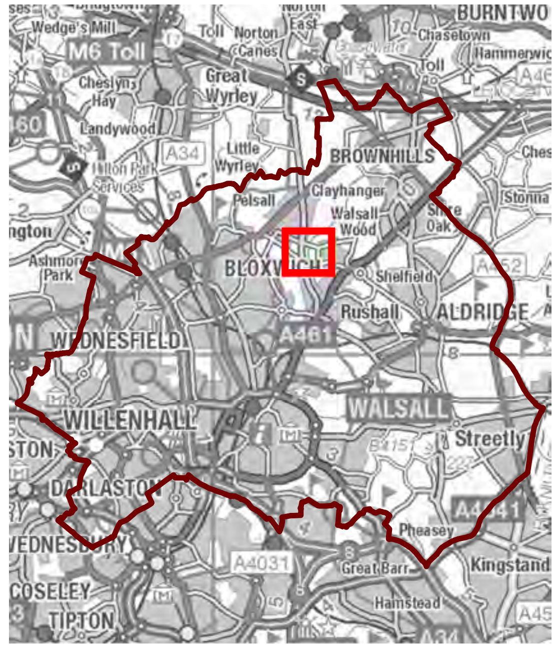

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 90% blockage
- 100yr RP 0% blockage

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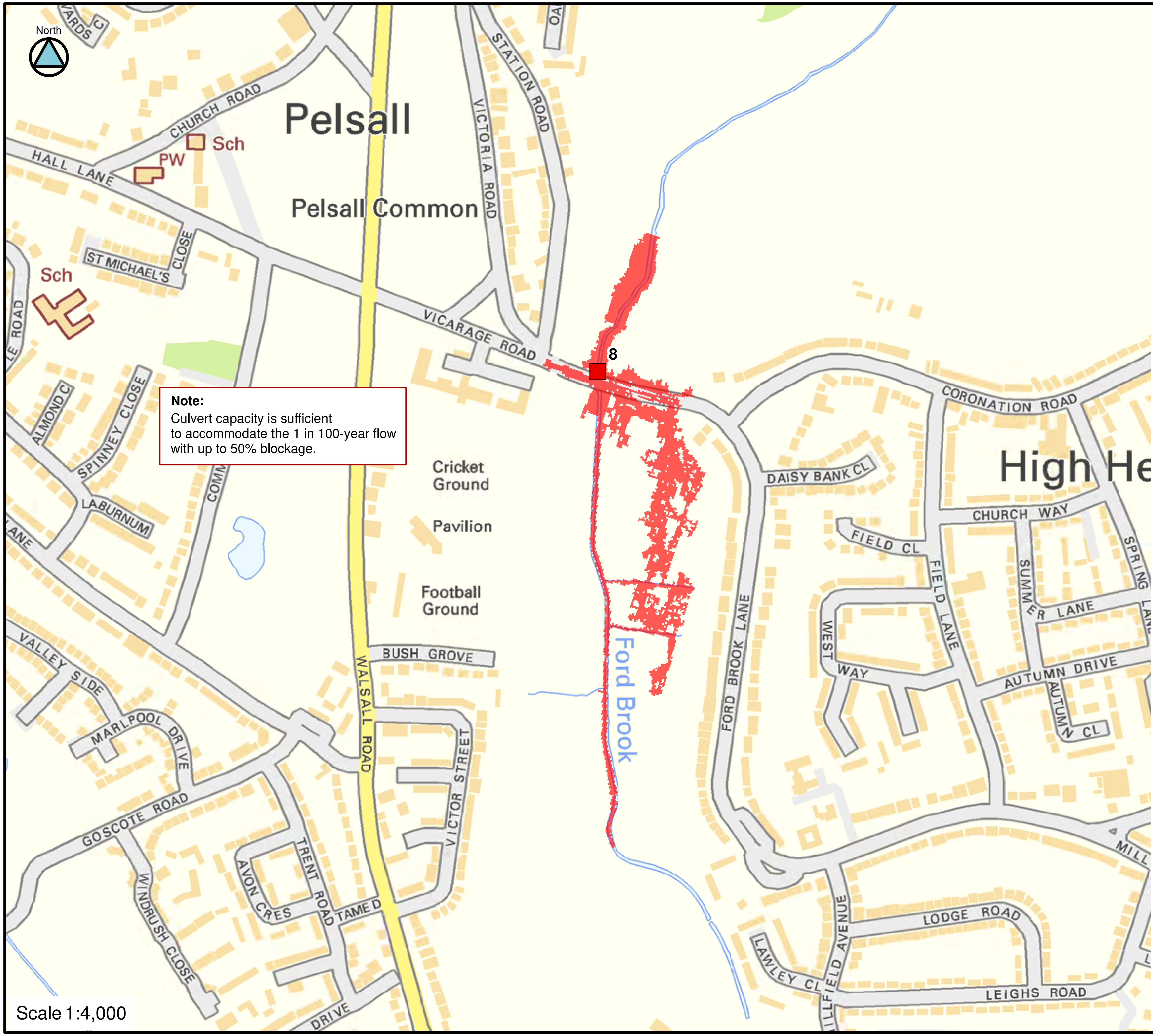
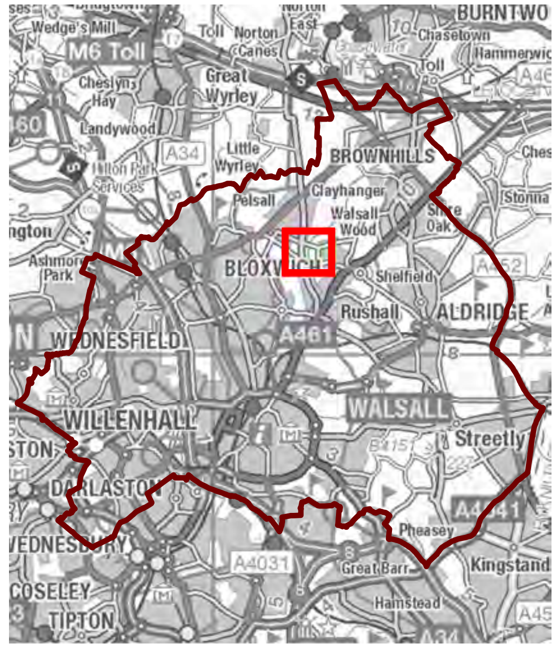
FIGURE C08-100-90
CULVERT 8 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



Note:
Culvert capacity is sufficient
to accommodate the 1 in 100-year flow
with up to 50% blockage.

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 75% blockage
- 100yr RP 0% blockage

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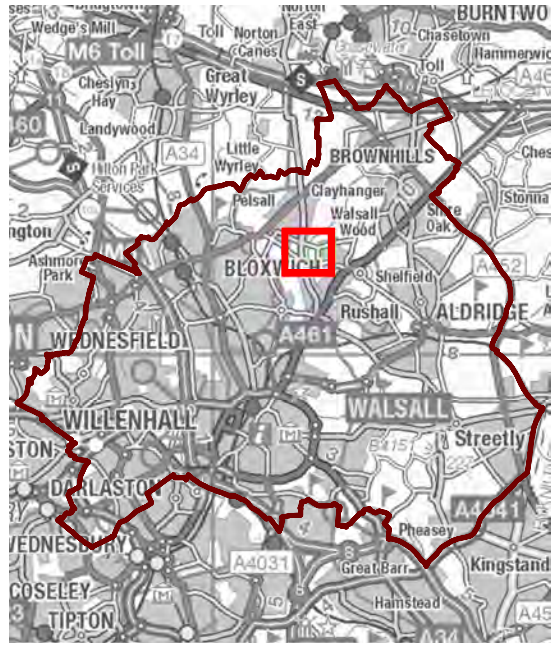
FIGURE C08-100-75
CULVERT 8 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



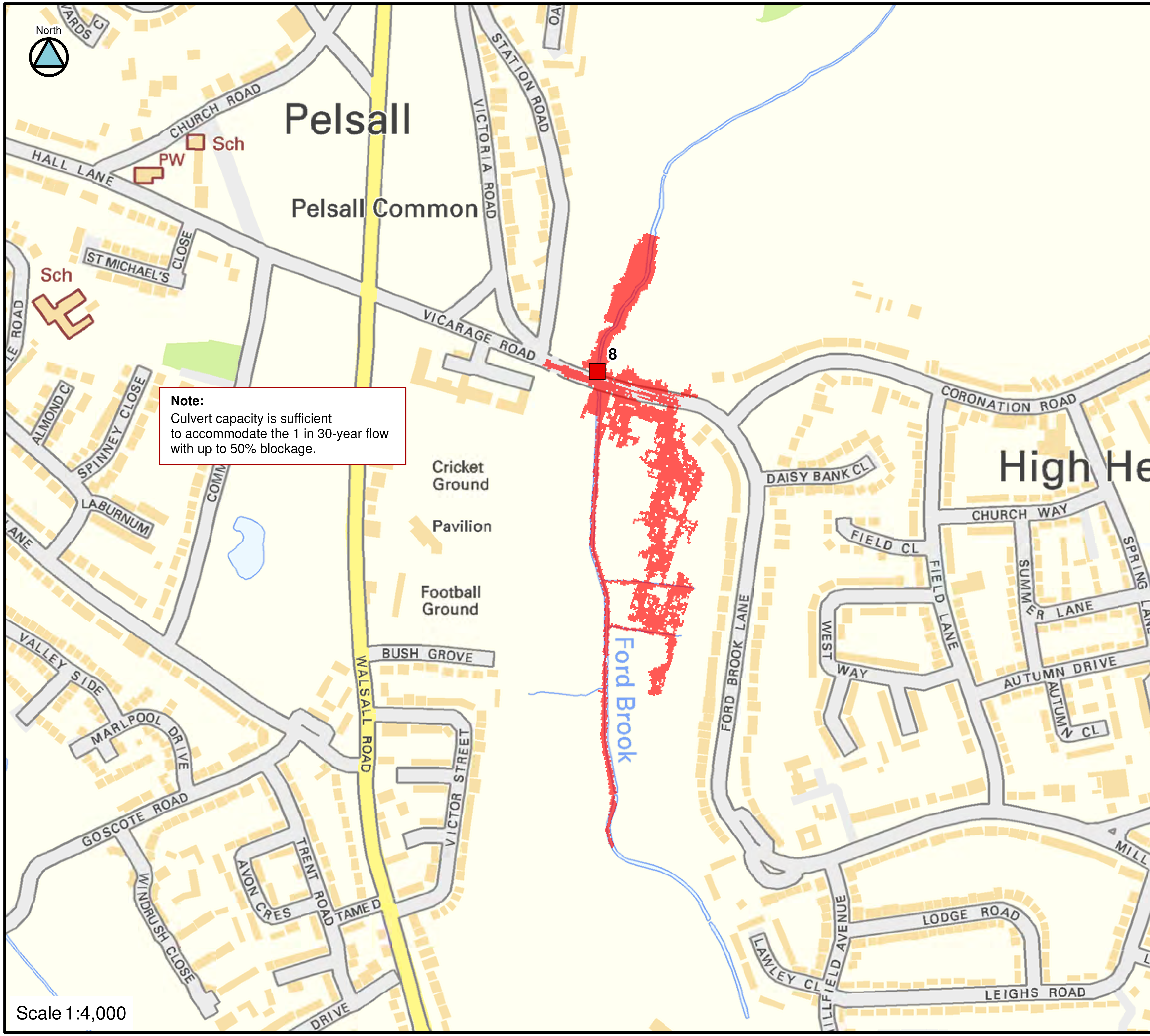
LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 50% blockage
- 100yr RP 0% blockage

WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C08-100-50
CULVERT 8 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



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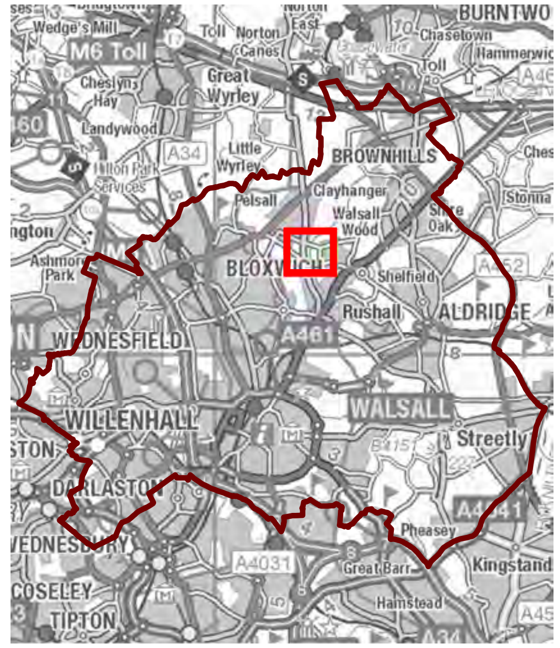


LEGEND

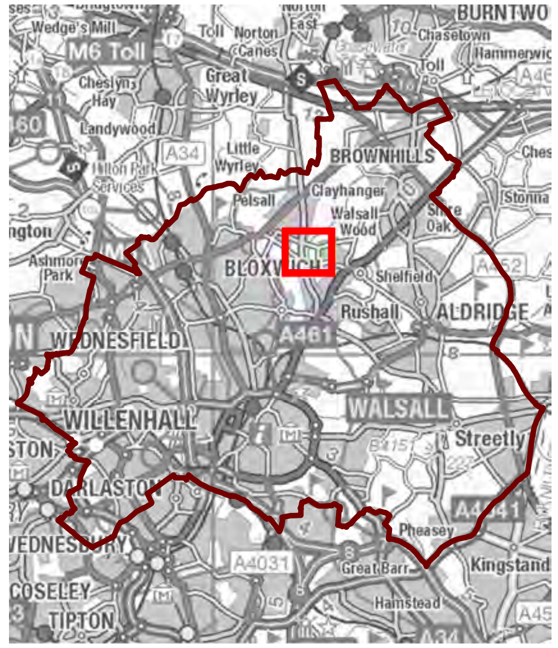
Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 90% blockage
- 30yr RP 0% blockage

WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C08-30-90
CULVERT 8 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 75% blockage
- 30yr RP 0% blockage

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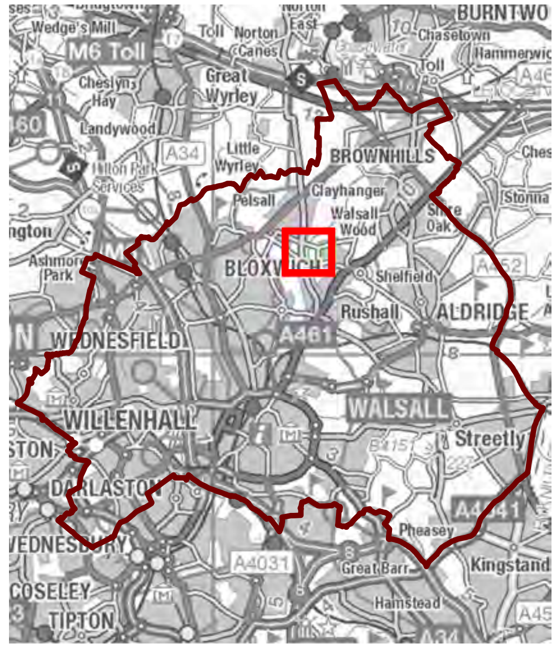
FIGURE C08-30-75
CULVERT 8 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

Surveyed culvert capacity

Culvert capacity as channel QMED

30yr RP 50% blockage

30yr RP 0% blockage

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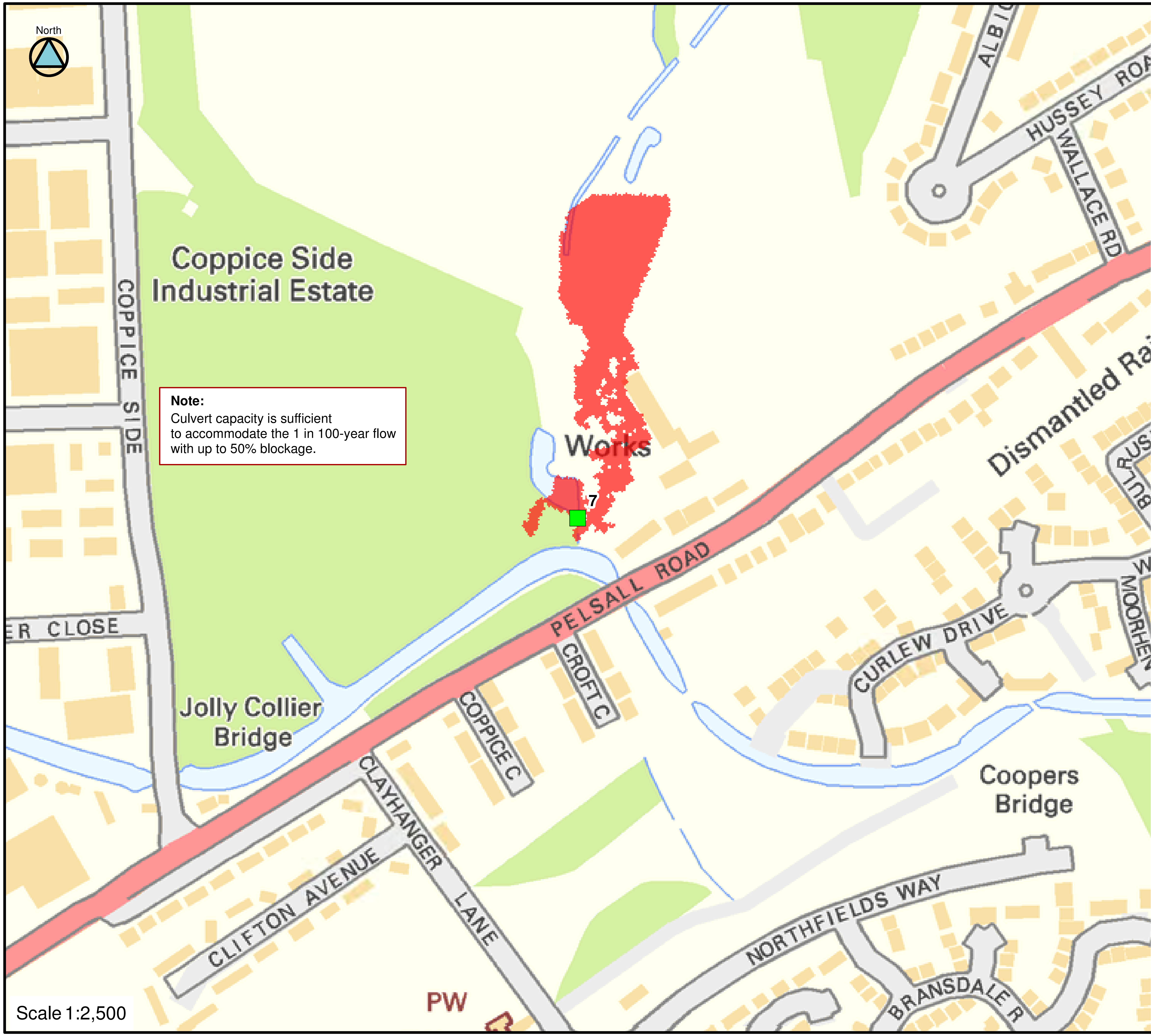
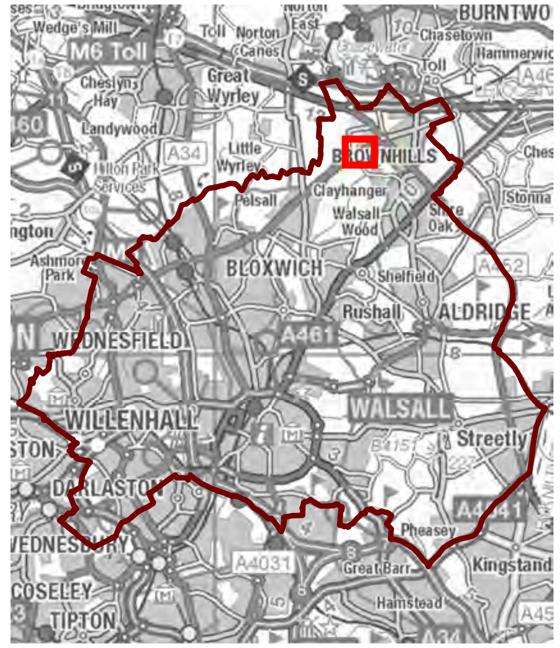
FIGURE C08-30-50
CULVERT 8 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS



Note:
Culvert capacity is sufficient
to accommodate the 1 in 100-year flow
with up to 50% blockage.

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

Surveyed culvert capacity

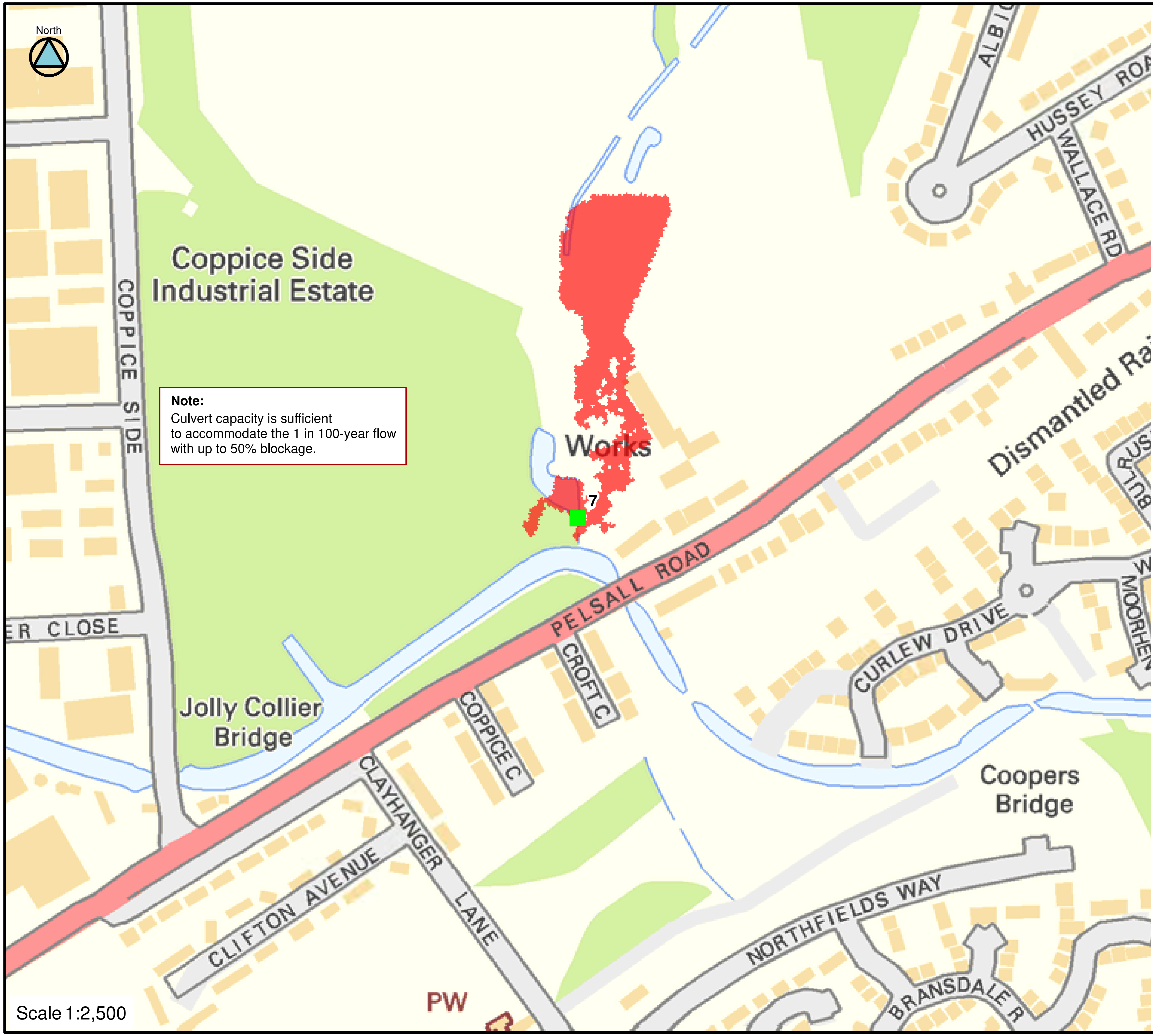
Culvert capacity as channel QMED

100yr RP 90% blockage

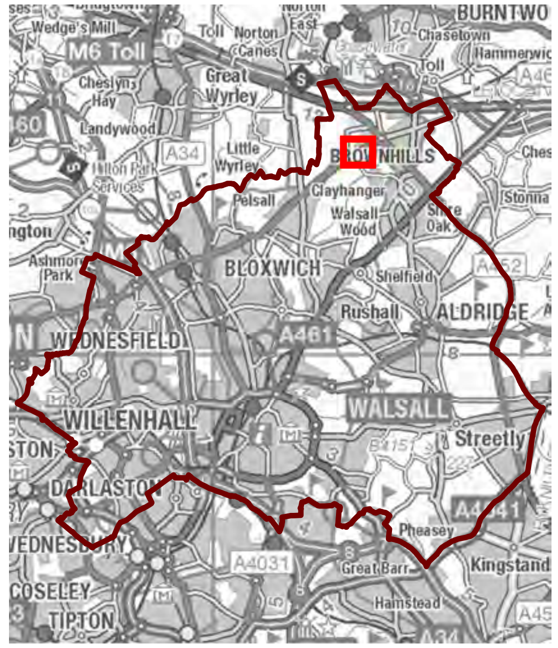
100yr RP 0% blockage

WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C07-100-90
CULVERT 7 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 75% blockage
- 100yr RP 0% blockage

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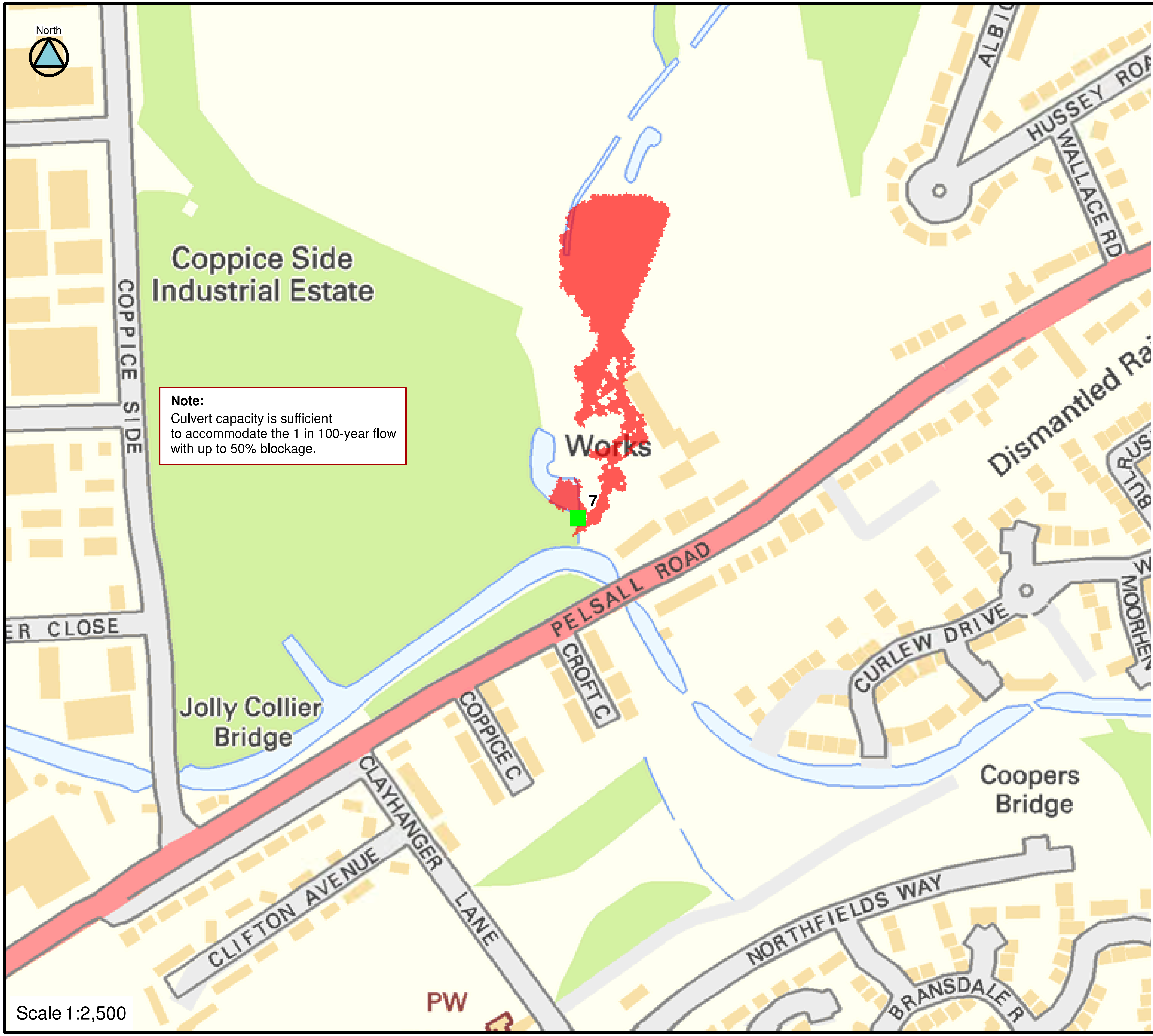
WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C07-100-75
CULVERT 7 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



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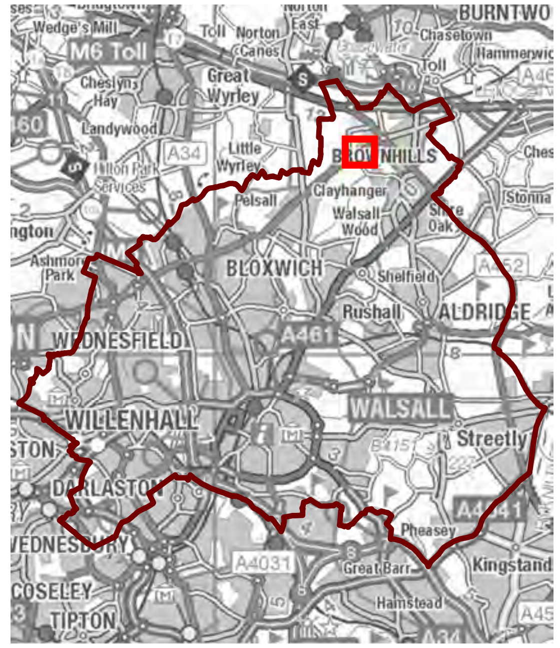


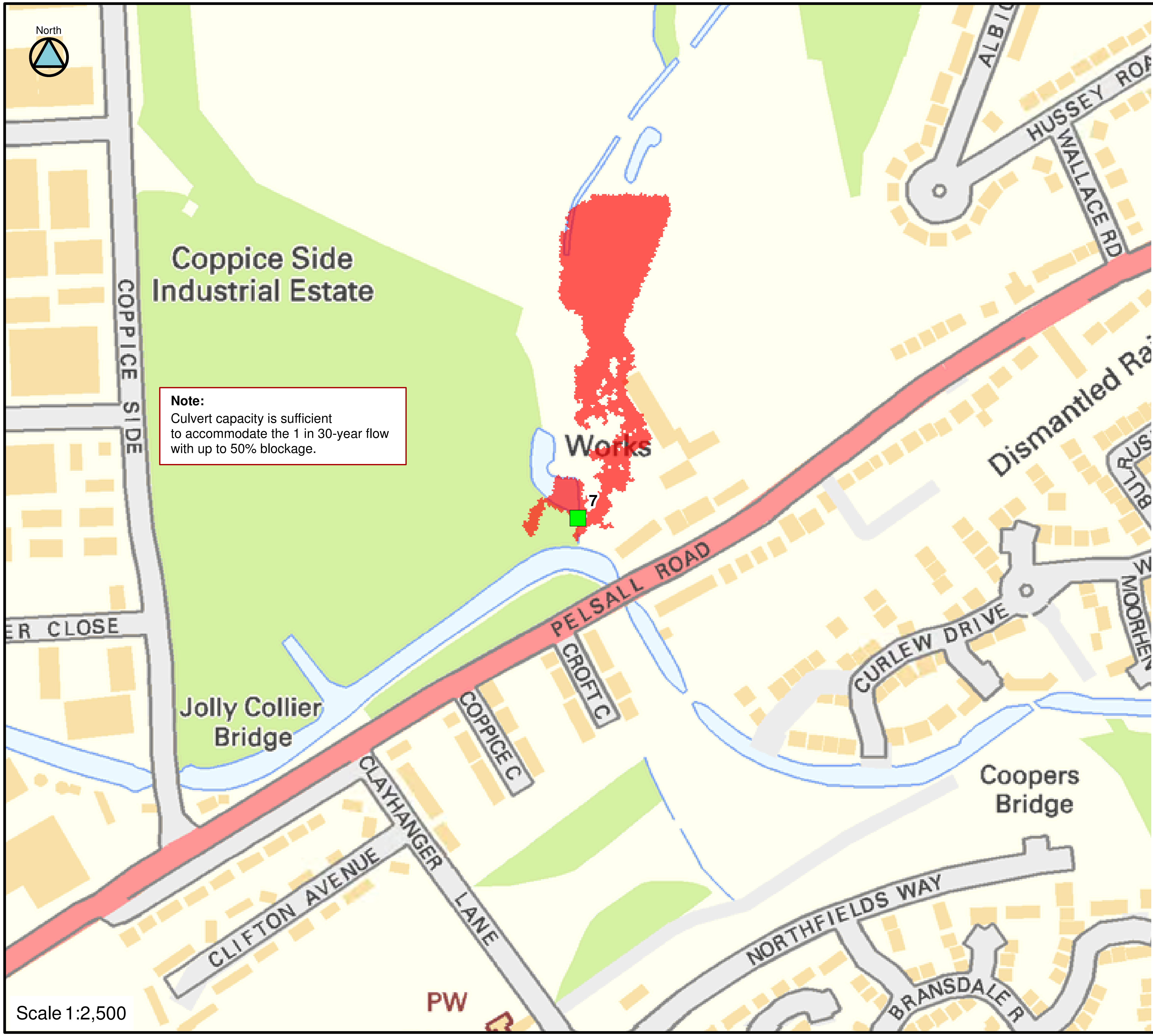
LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 50% blockage
- 100yr RP 0% blockage

WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C07-100-50
CULVERT 7 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



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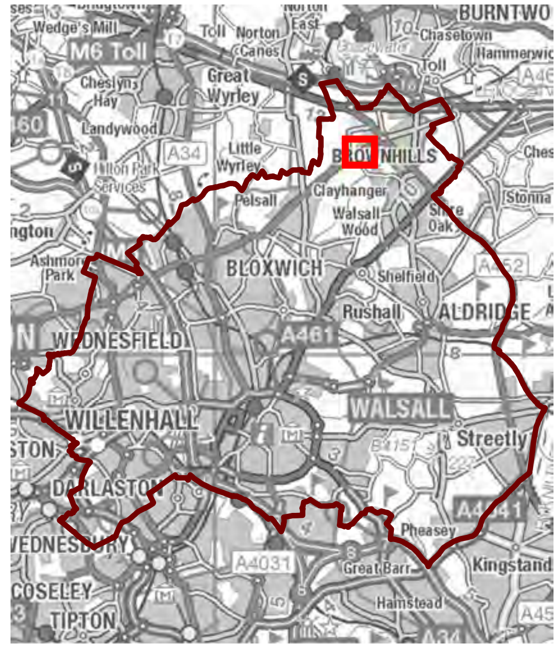

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 90% blockage
- 30yr RP 0% blockage

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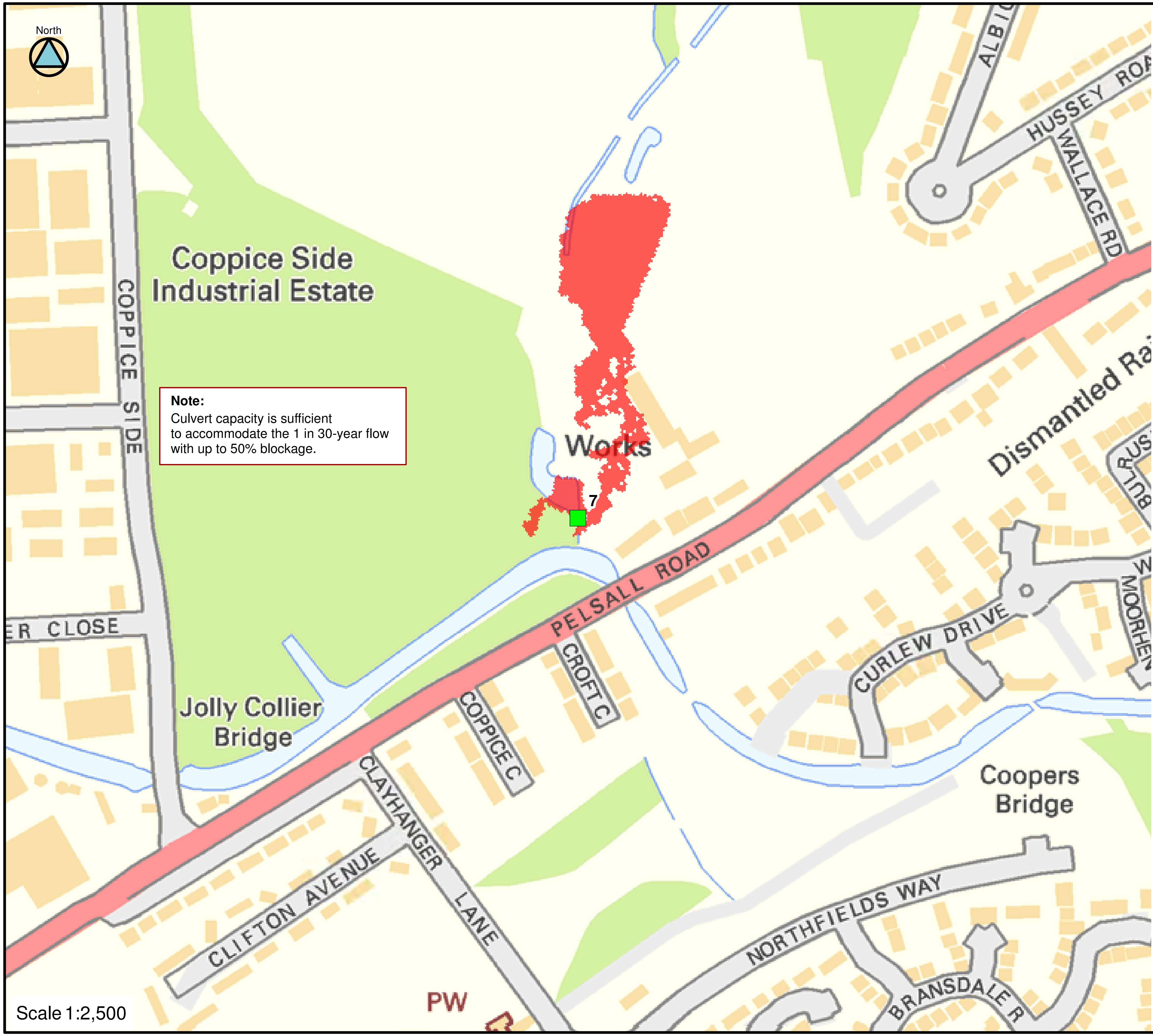
FIGURE C07-30-90
CULVERT 7 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS



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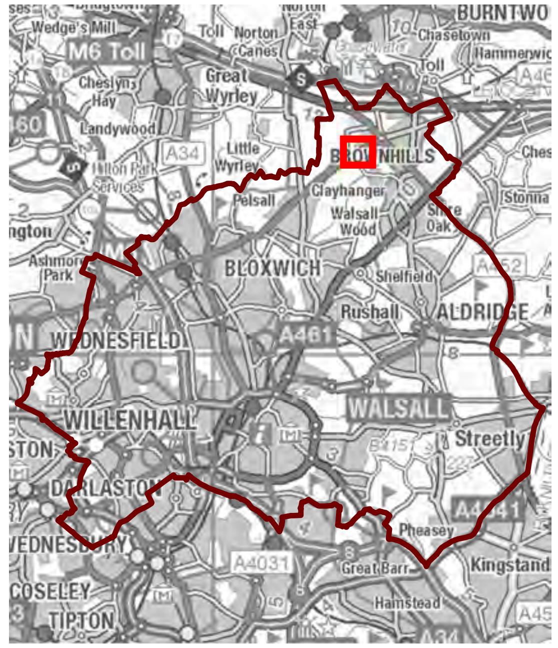

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 75% blockage
- 30yr RP 0% blockage

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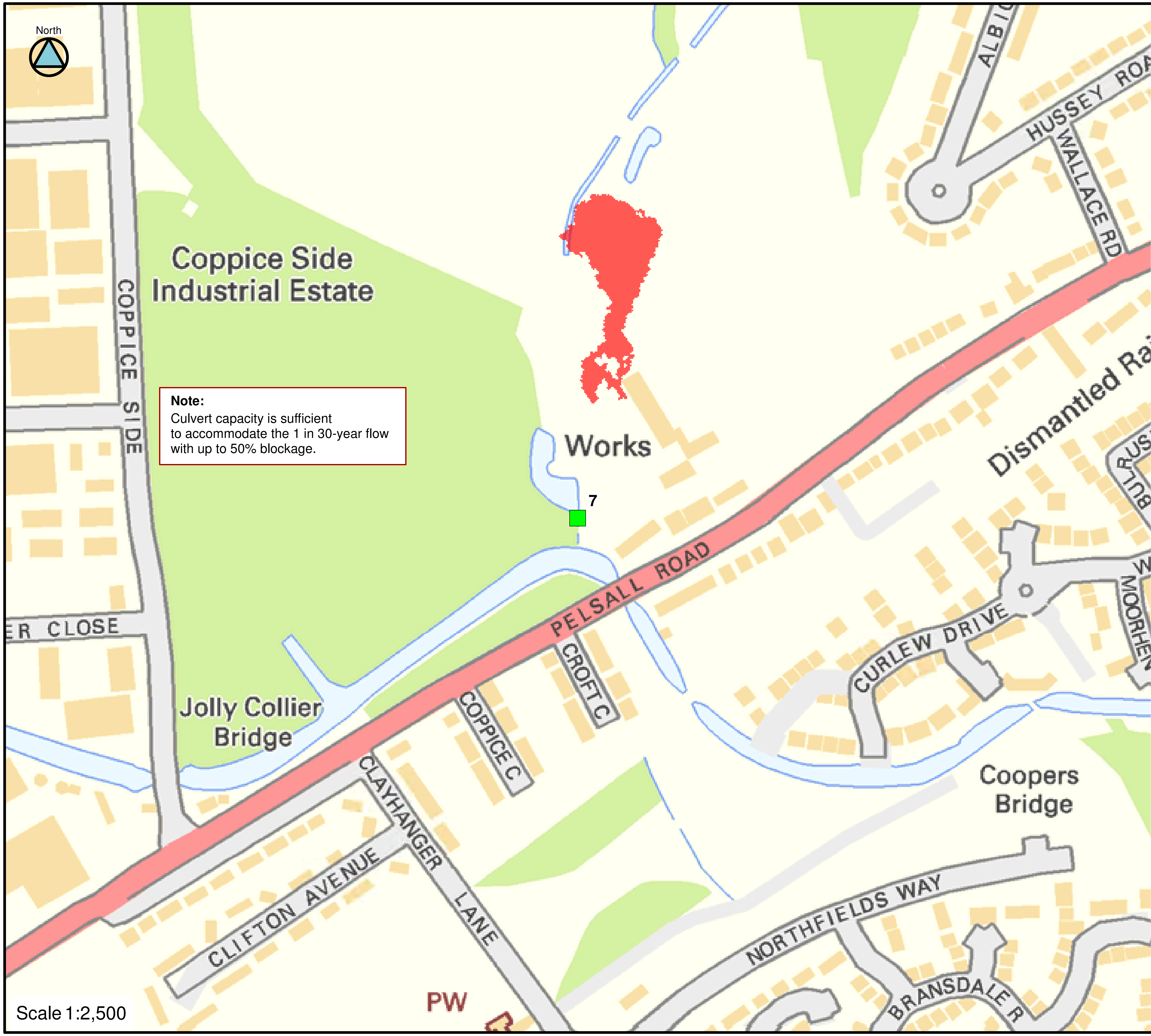
FIGURE C07-30-75
CULVERT 7 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS



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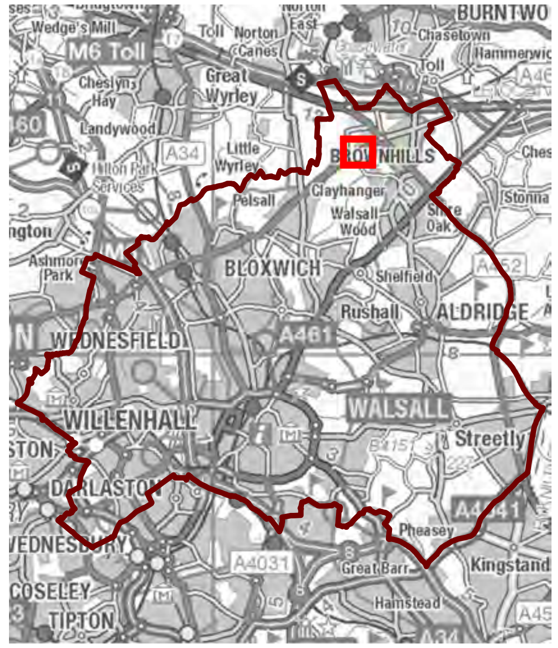


LEGEND

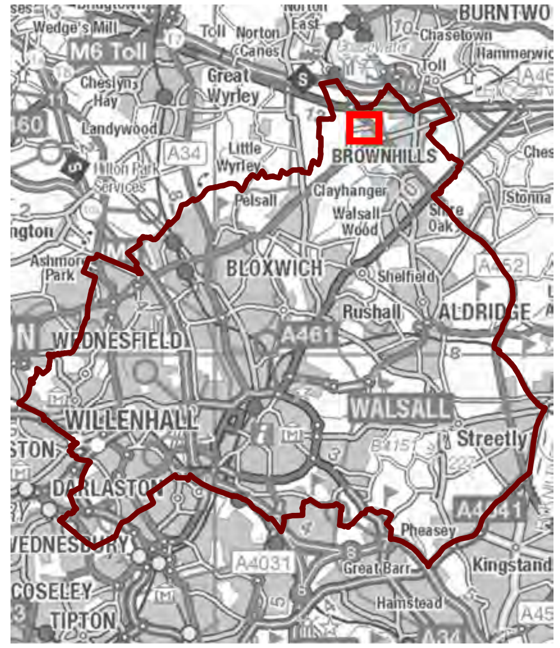
Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 50% blockage
- 30yr RP 0% blockage

WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C07-30-50
CULVERT 7 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 90% blockage
- 100yr RP 0% blockage

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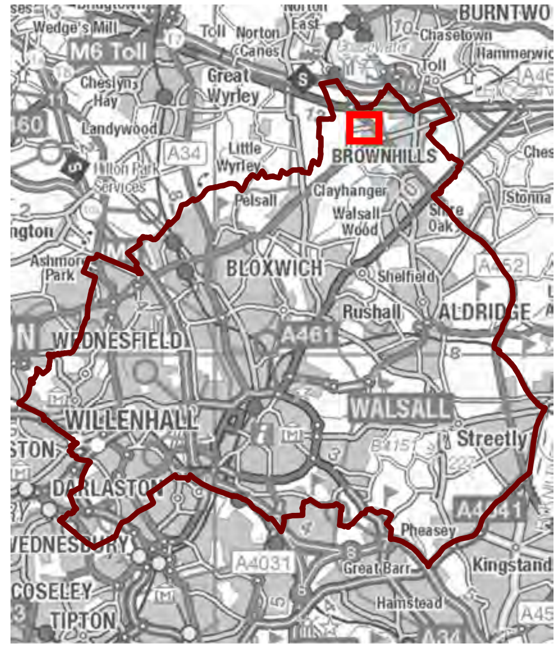
FIGURE C06-100-90
CULVERT 6 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 75% blockage
- 100yr RP 0% blockage

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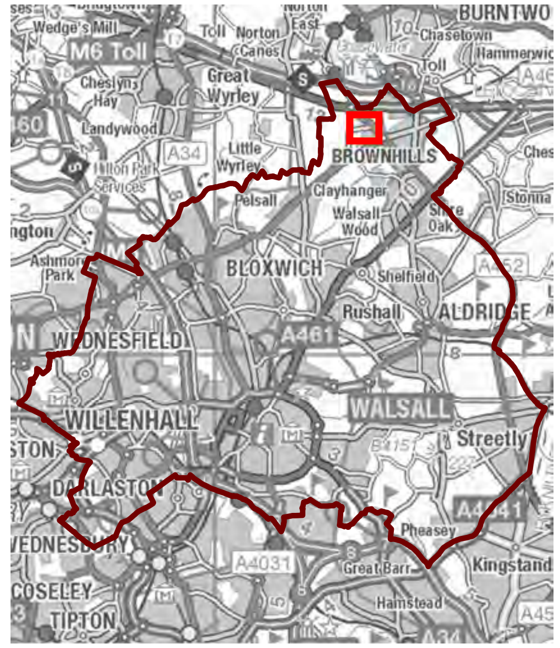
FIGURE C06-100-75
CULVERT 6 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 50% blockage
- 100yr RP 0% blockage

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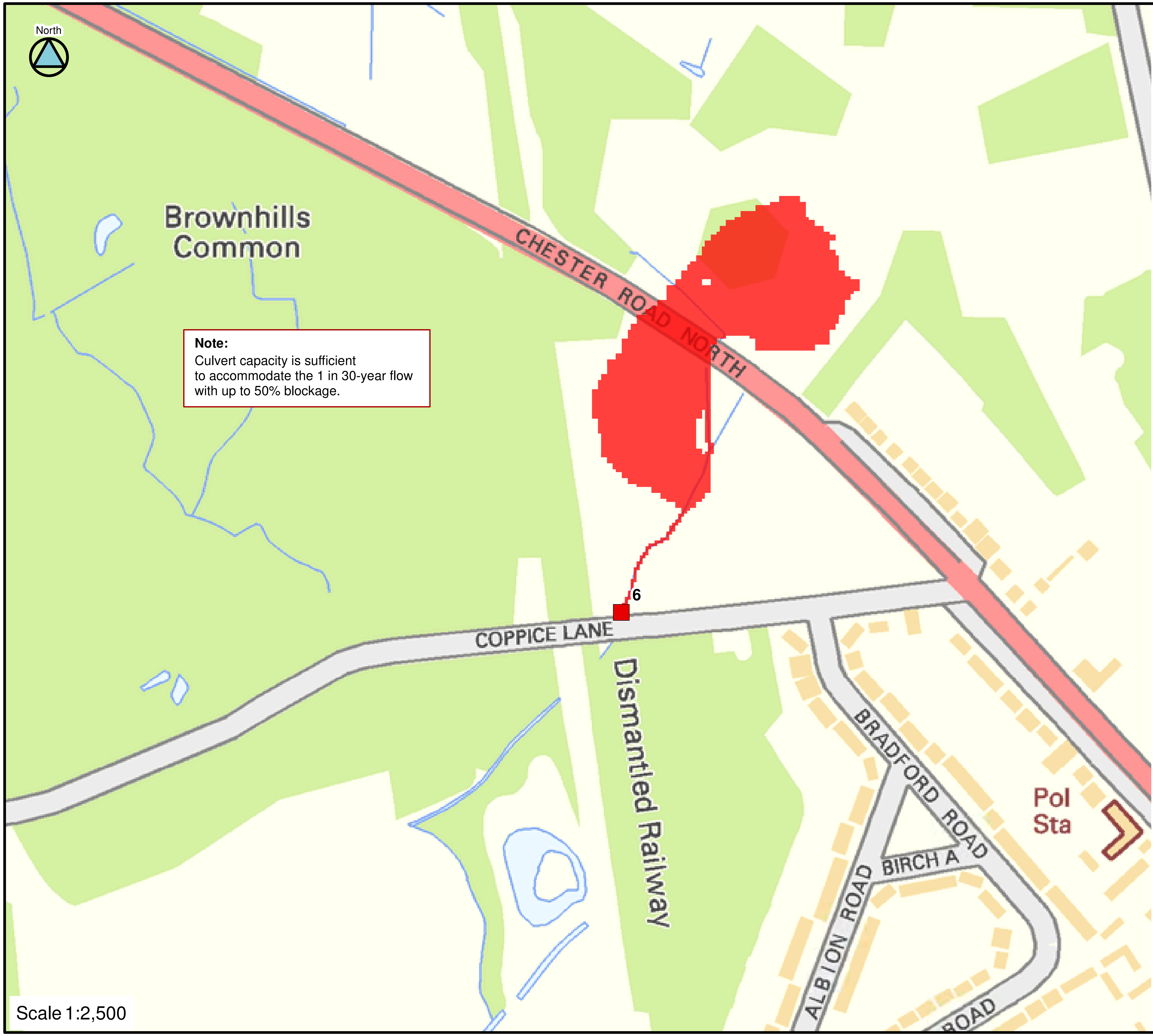
FIGURE C06-100-50
CULVERT 6 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



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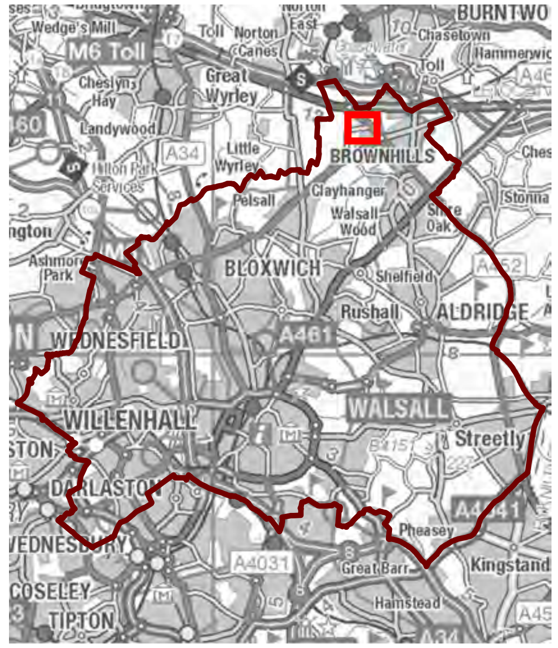

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 90% blockage
- 30yr RP 0% blockage

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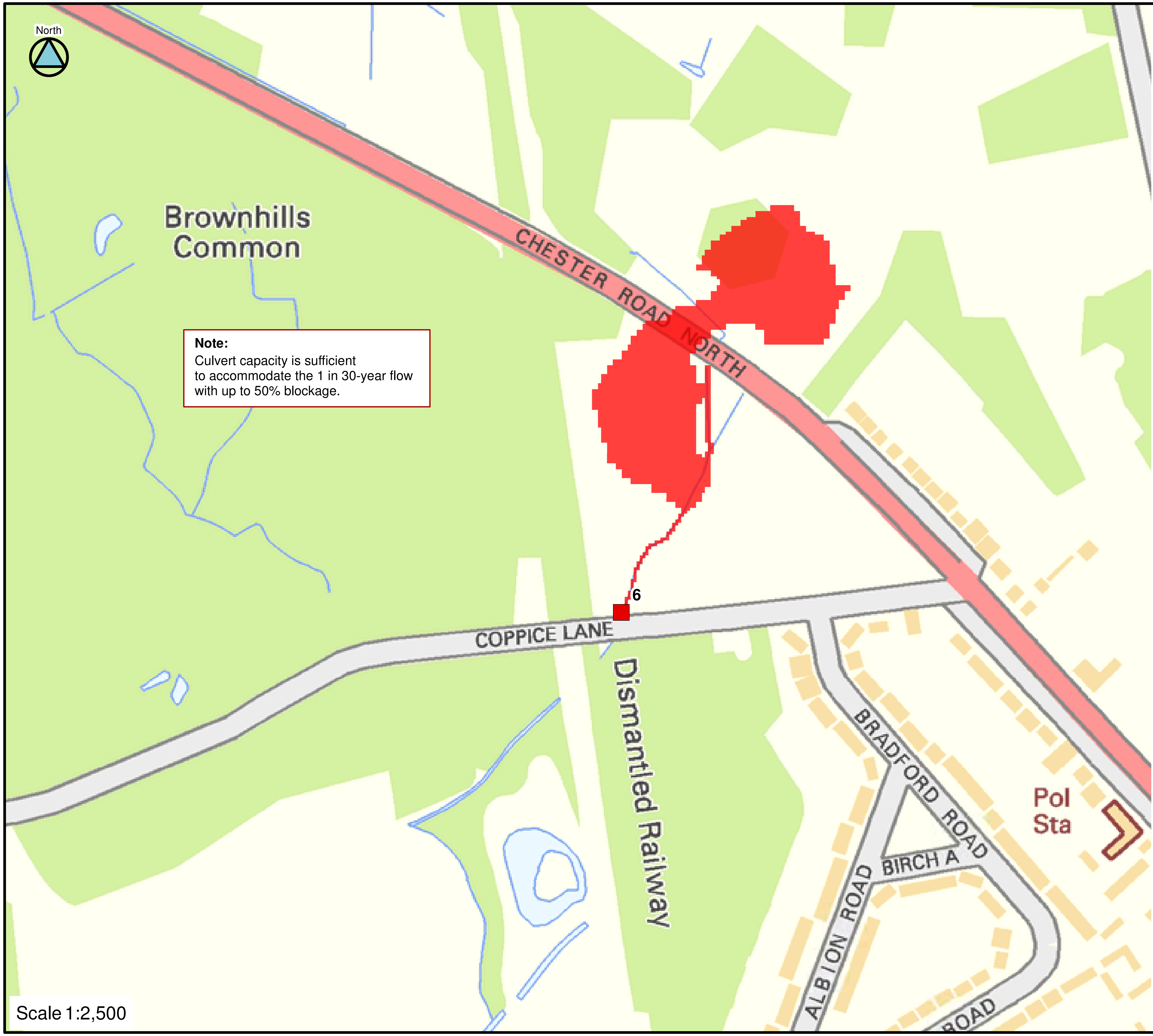
FIGURE C06-30-90
CULVERT 6 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS



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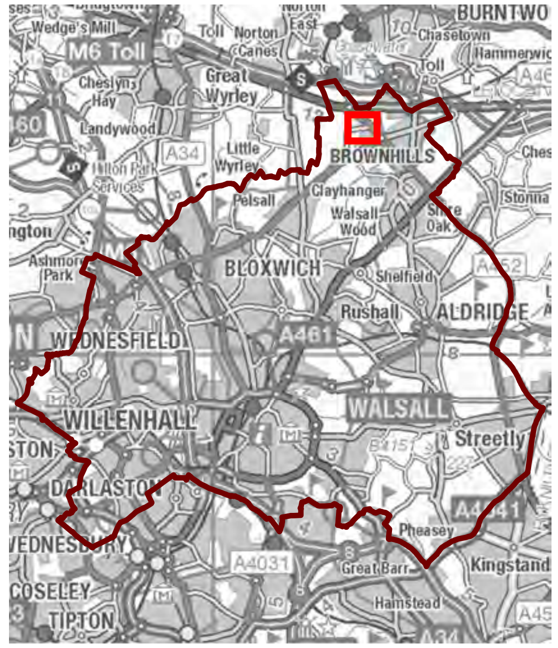


LEGEND

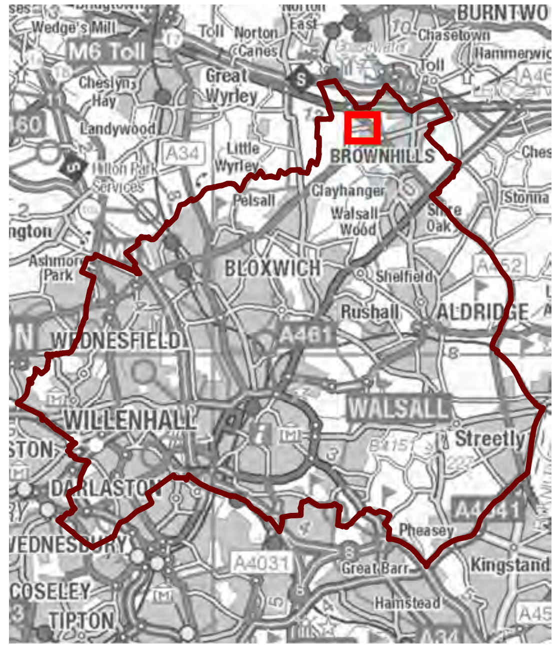
Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 75% blockage
- 30yr RP 0% blockage

WALSALL METROPOLITAN BOROUGH COUNCIL

FIGURE C06-30-75
CULVERT 6 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 50% blockage
- 30yr RP 0% blockage

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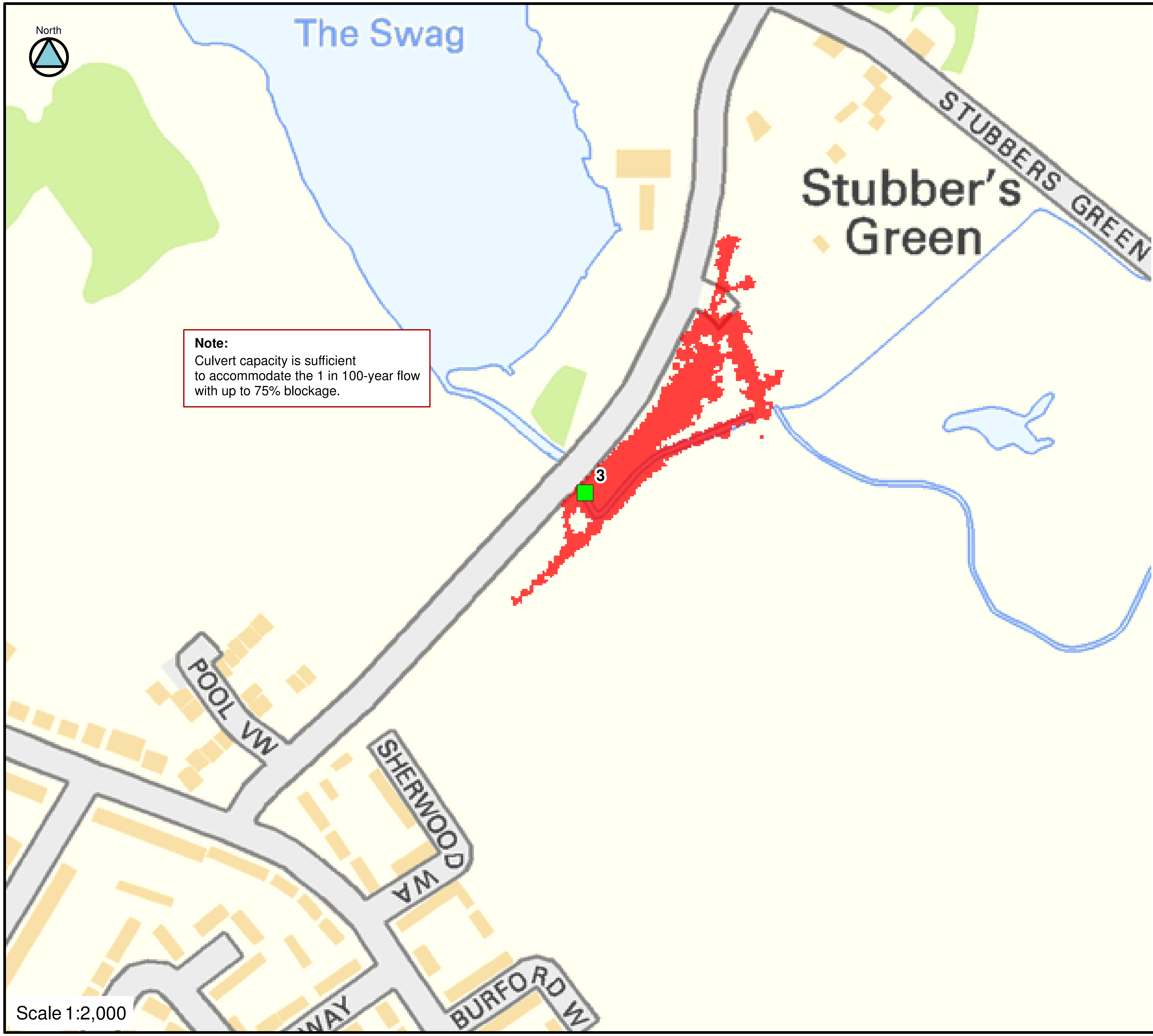
FIGURE C06-30-50
CULVERT 6 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS



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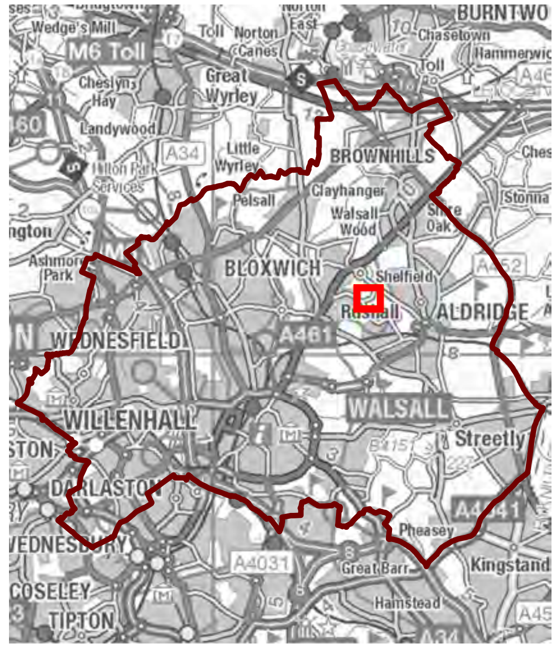

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 90% blockage
- 100yr RP 0% blockage

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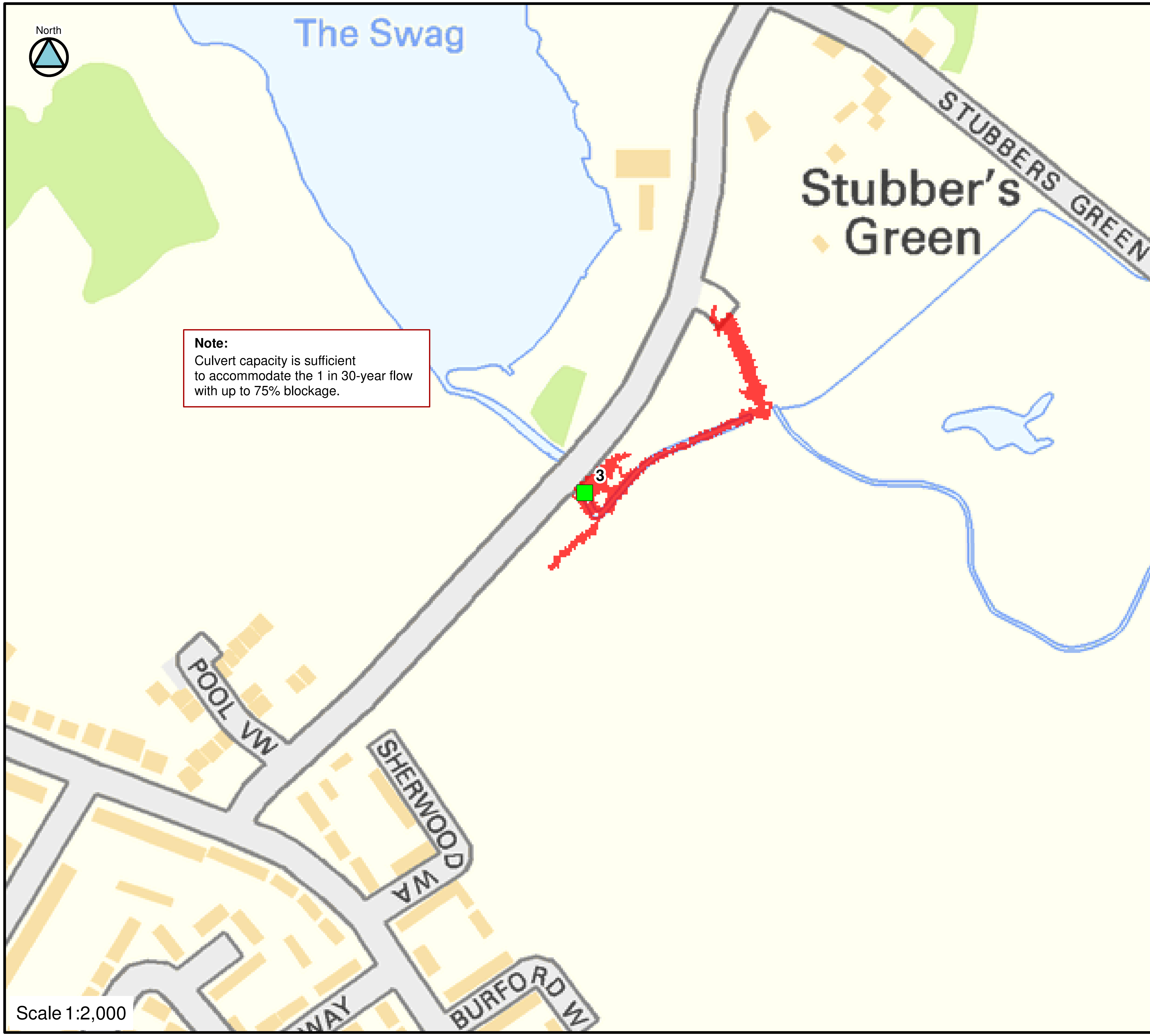
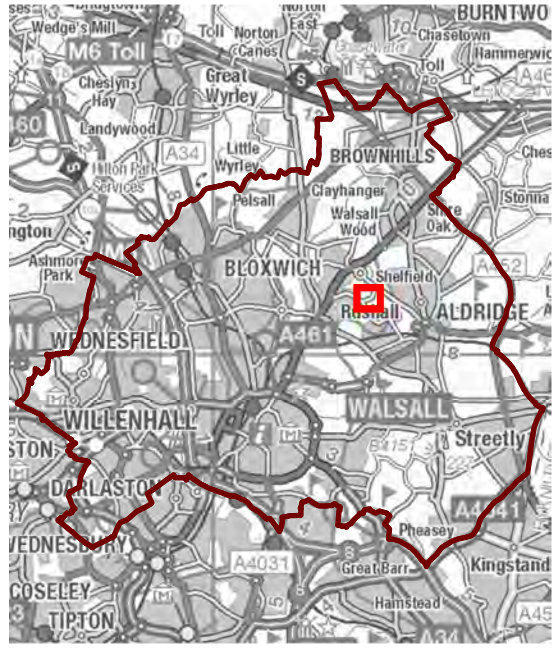
FIGURE C03-100-90
CULVERT 3 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 90% blockage
- 30yr RP 0% blockage

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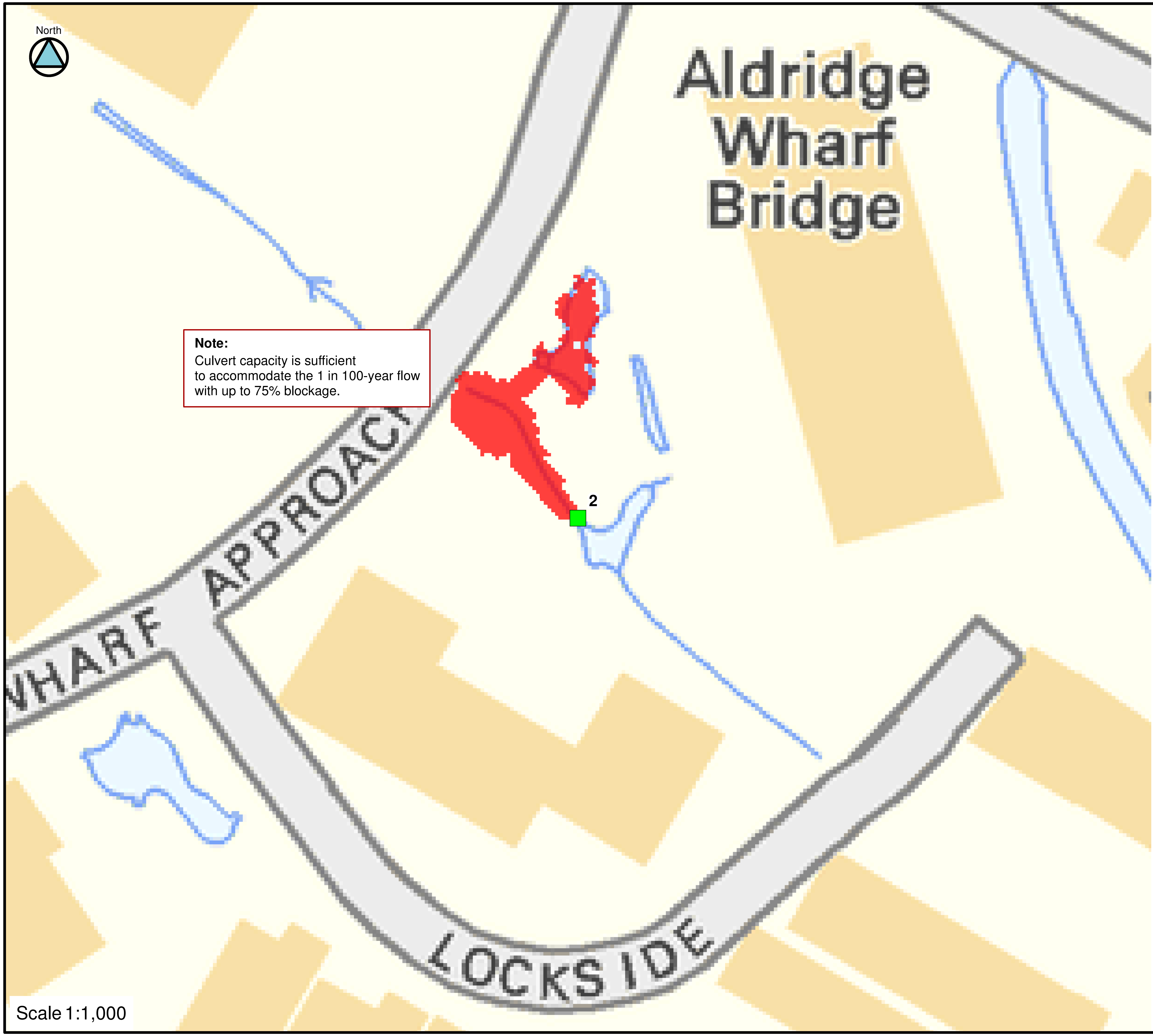
FIGURE C03-30-90
CULVERT 3 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS



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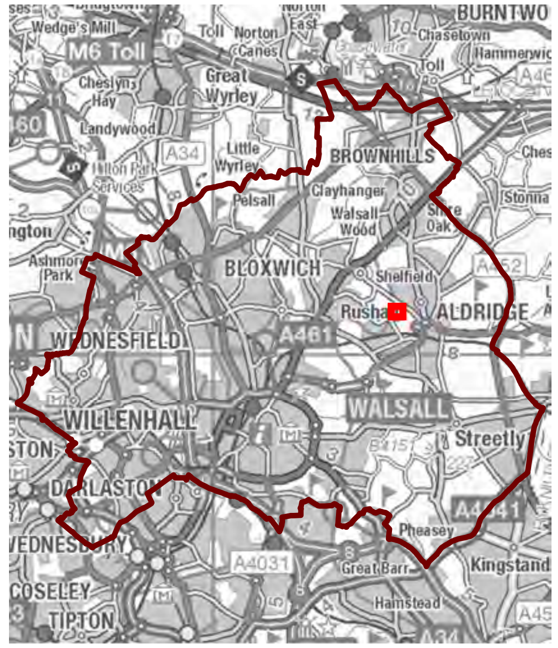

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 90% blockage
- 100yr RP 0% blockage

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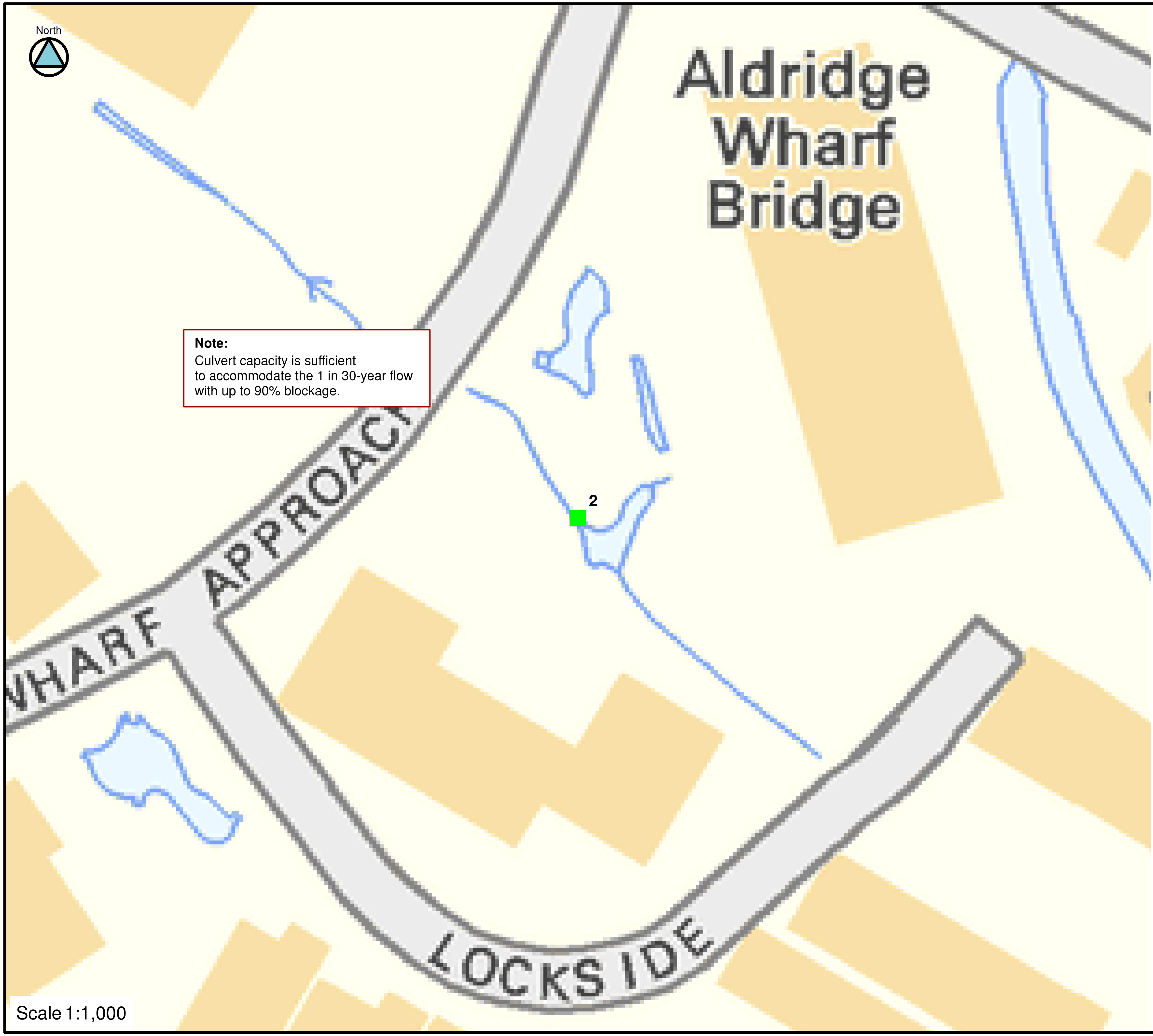
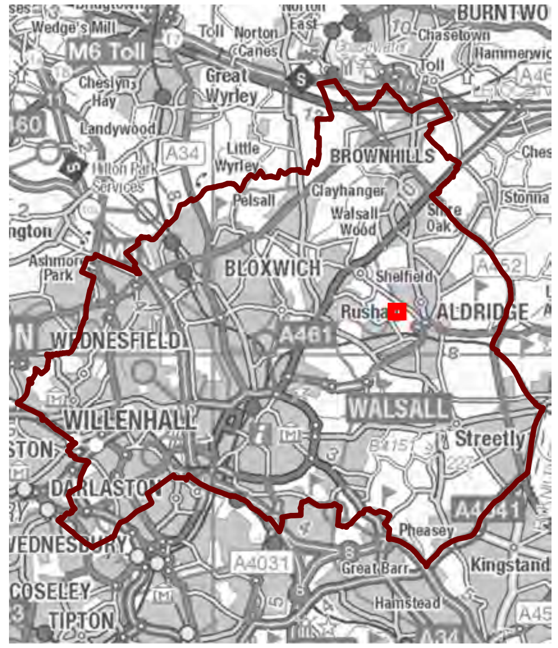
FIGURE C02-100-90
CULVERT 2 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 90% blockage
- 30yr RP 0% blockage

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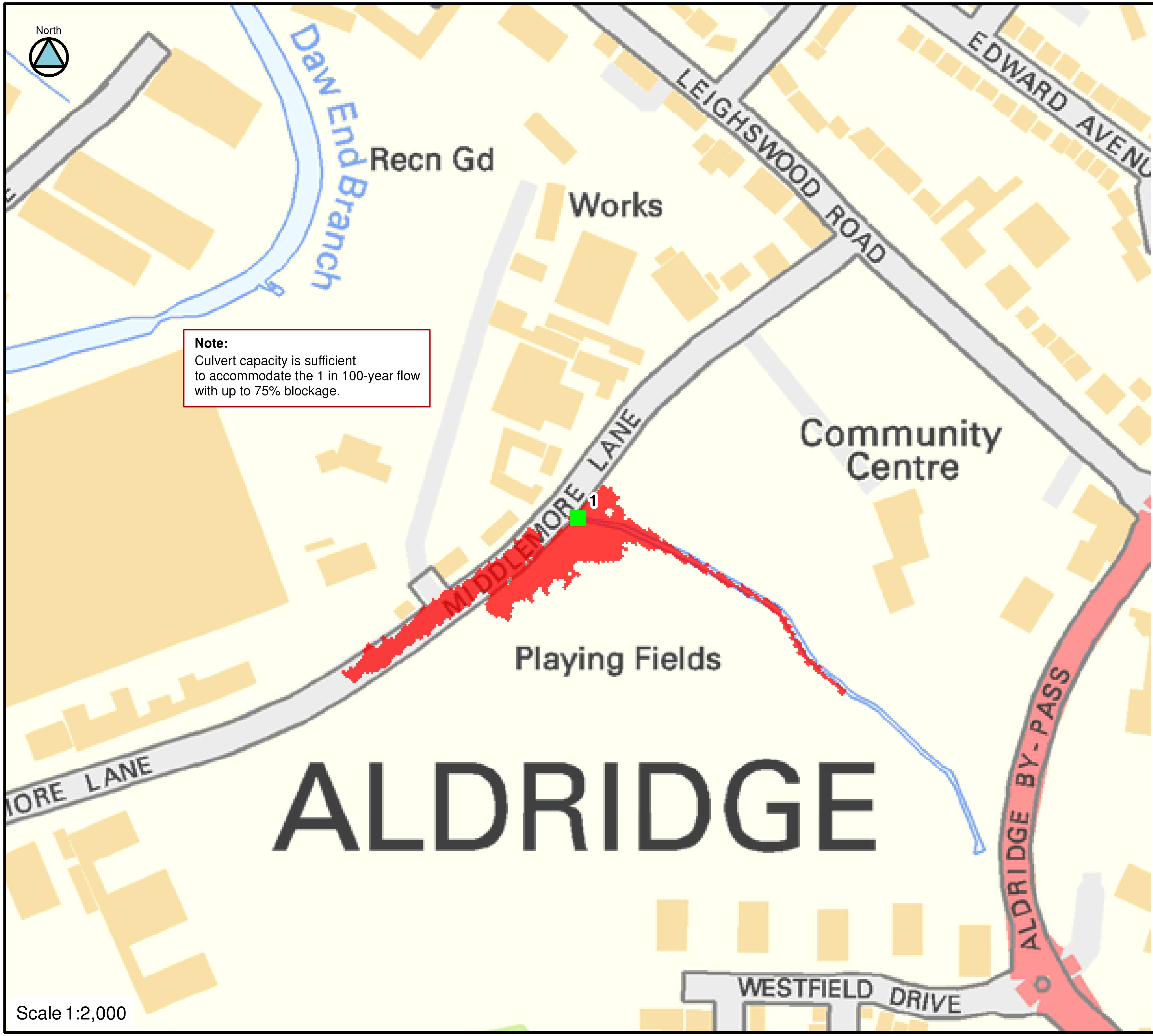
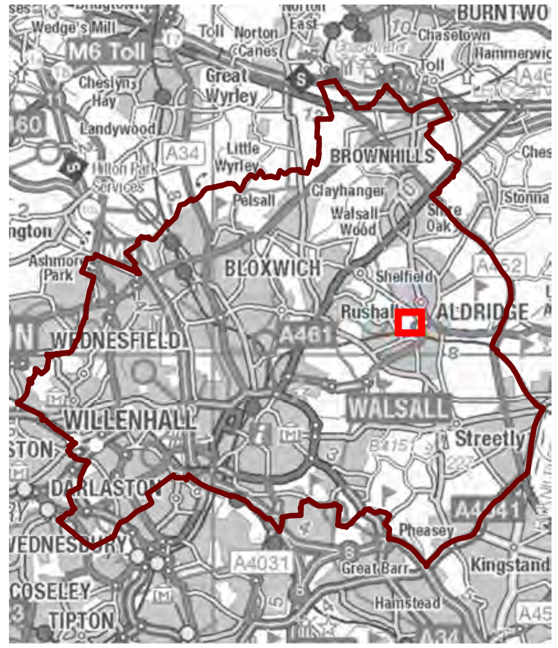
FIGURE C02-30-90
CULVERT 2 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS



Note:
Culvert capacity is sufficient
to accommodate the 1 in 100-year flow
with up to 75% blockage.

KEYPLAN Scale 1:200,000



LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 100yr RP 90% blockage
- 100yr RP 0% blockage

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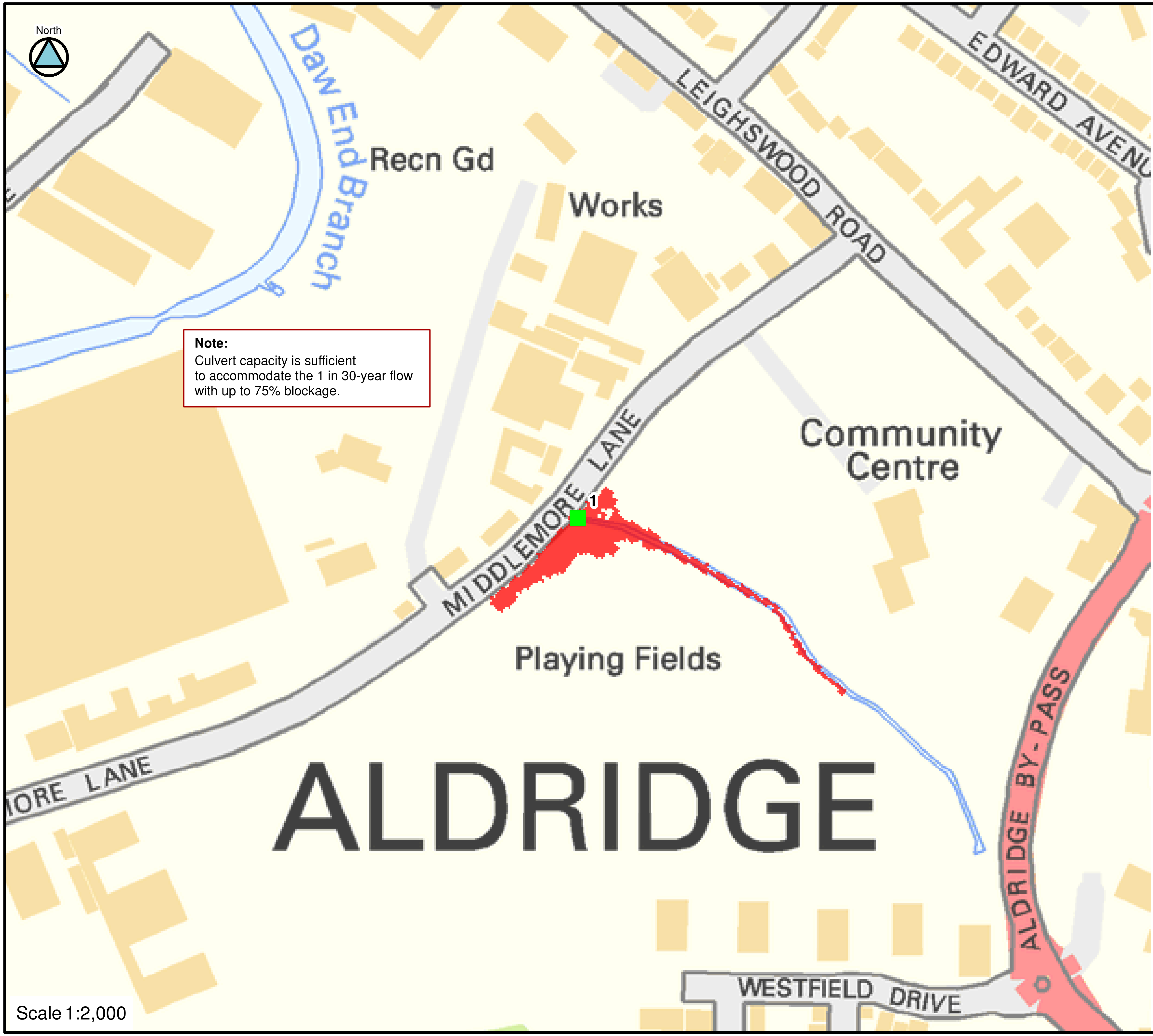
BOROUGH COUNCIL

FIGURE C01-100-90
CULVERT 1 BLOCKAGE
1 IN 100-YEAR
FLOOD EXTENTS



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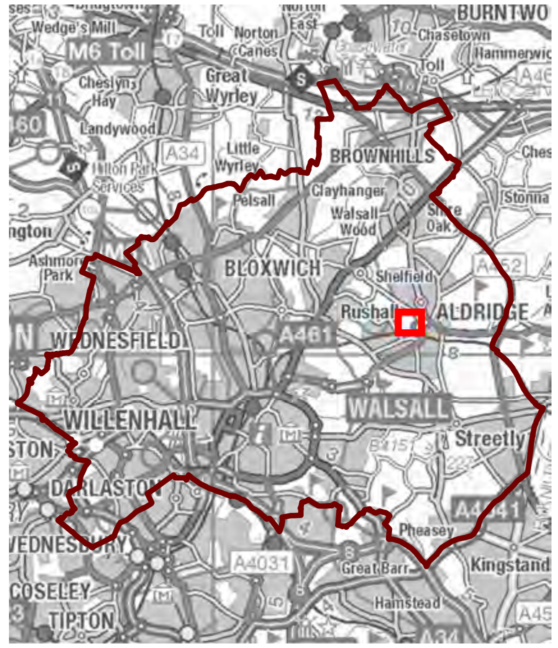

LEGEND

Modelled culverts

- Surveyed culvert capacity
- Culvert capacity as channel QMED
- 30yr RP 90% blockage
- 30yr RP 0% blockage

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FIGURE C01-30-90
CULVERT 1 BLOCKAGE
1 IN 30-YEAR
FLOOD EXTENTS

D Catchment descriptors

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Help!

Change catchment descriptors in this sheet

Hydraulic model boundary	FEH CD versio	Catchment	Watercourse	Place	EASTING	NORTHING	centoid x	centroid y	AREA	FARL	PROPWET	ALTBAR	ASPBAR	ASPVAR	BFIHOST	DPLBAR	DPSBAR	LDP
Tames 01	3	Tames01	Tames	Walsall	396950	298650	394148	298643	0.32	0.976	0.31	146	100	0.33	0.379	5.13	18.9	8.57
Tames 02	3	Tames02	Tames	Walsall	396950	298650	394148	298643	0.48	0.976	0.31	146	100	0.33	0.379	5.13	18.9	8.57
Tames 03	3	Tames03	Tames	Walsall	396950	298650	394148	298643	6.56	0.976	0.31	146	100	0.33	0.379	5.13	18.9	8.57
Tames 04	3	Tames04	Tames	Walsall	396950	298650	394148	298643	0.75	0.976	0.31	146	100	0.33	0.379	5.13	18.9	8.57
Tames 05	3	Tames05	Tames	Walsall	396950	298650	394148	298643	0.17	0.976	0.31	146	100	0.33	0.379	5.13	18.9	8.57
Tames 06	3	Tames06	Tames	Walsall	396950	298650	394148	298643	0.37	0.976	0.31	146	100	0.33	0.379	5.13	18.9	8.57
Tames 07	3	Tames07	Tames	Walsall	396950	298650	394148	298643	1.28	0.976	0.31	146	100	0.33	0.379	5.13	18.9	8.57
Tames 08	3	Tames08	Tames	Walsall	396950	298650	394148	298643	0.65	0.976	0.31	146	100	0.33	0.379	5.13	18.9	8.57
Tames 09	3	Tames09	Tames	Walsall	396950	298650	394148	298643	0.14	0.976	0.31	146	100	0.33	0.379	5.13	18.9	8.57
Sneyd 01	3	Sneyd	Sneyd Brook	Walsall	399050	297950	398744	301336	1.47	0.91	0.31	149	163	0.31	0.353	4.58	21.8	9.23
Sneyd 02	3	Sneyd	Sneyd Brook	Walsall	399050	297950	398744	301336	1.1	0.91	0.31	149	163	0.31	0.353	4.58	21.8	9.23
Sneyd 03	3	Sneyd	Sneyd Brook	Walsall	399050	297950	398744	301336	1.79	0.91	0.31	149	163	0.31	0.353	4.58	21.8	9.23
Sneyd 04	3	Sneyd	Sneyd Brook	Walsall	399050	297950	398744	301336	0.81	0.91	0.31	149	163	0.31	0.353	4.58	21.8	9.23
Sneyd 05	3	Sneyd	Sneyd Brook	Walsall	399050	297950	398744	301336	0.73	0.91	0.31	149	163	0.31	0.353	4.58	21.8	9.23
Sneyd 06	3	Sneyd	Sneyd Brook	Walsall	399050	297950	398744	301336	0.46	0.91	0.31	149	163	0.31	0.353	4.58	21.8	9.23
Sneyd 07	3	Sneyd	Sneyd Brook	Walsall	399050	297950	398744	301336	0.98	0.91	0.31	149	163	0.31	0.353	4.58	21.8	9.23
Sneyd_08	3	Sneyd	Sneyd Brook	Walsall	399050	297950	398744	301336	0.36	0.91	0.31	149	163	0.31	0.353	4.58	21.8	9.23
Sneyd 09	3	Sneyd	Sneyd Brook	Walsall	399050	297950	398744	301336	0.64	0.91	0.31	149	163	0.31	0.353	4.58	21.8	9.23
Sneyd 10	3	Sneyd	Sneyd Brook	Walsall	399050	297950	398744	301336	0.33	0.91	0.31	149	163	0.31	0.353	4.58	21.8	9.23
Sneyd 11	3	Sneyd	Sneyd Brook	Walsall	399050	297950	398744	301336	2.13	0.91	0.31	149	163	0.31	0.353	4.58	21.8	9.23
Sneyd 00	3	Sneyd	Sneyd Brook	Walsall	399050	297950	398744	301336	0.01	0.91	0.31	149	163	0.31	0.353	4.58	21.8	9.23
Sneyd 000	3	Sneyd	Sneyd Brook	Walsall	399050	297950	398744	301336	0.27	0.91	0.31	149	163	0.31	0.353	4.58	21.8	9.23
Rough Brook 1	3	Rough Brook	Rough Brook	Walsall	402300	301450	400896	302792	0.05	1	0.31	148	77	0.28	0.375	3.03	20.9	5.54
Rough Brook 2	3	Rough Brook	Rough Brook	Walsall	402300	301450	400896	302792	0.2	1	0.31	148	77	0.28	0.375	3.03	20.9	5.54
Rough Brook 3	3	Rough Brook	Rough Brook	Walsall	402300	301450	400896	302792	0.63	1	0.31	148	77	0.28	0.375	3.03	20.9	5.54
Rough Brook 4	3	Rough Brook	Rough Brook	Walsall	402300	301450	400896	302792	0.48	1	0.31	148	77	0.28	0.375	3.03	20.9	5.54
Rough Brook 5	3	Rough Brook	Rough Brook	Walsall	402300	301450	400896	302792	0.36	1	0.31	148	77	0.28	0.375	3.03	20.9	5.54
Rough Brook 6	3	Rough Brook	Rough Brook	Walsall	402300	301450	400896	302792	1.67	1	0.31	148	77	0.28	0.375	3.03	20.9	5.54
Rough Brook 7	3	Rough Brook	Rough Brook	Walsall	402300	301450	400896	302792	0.3	1	0.31	148	77	0.28	0.375	3.03	20.9	5.54
Rough Brook 8	3	Rough Brook	Rough Brook	Walsall	402300	301450	400896	302792	0.38	1	0.31	148	77	0.28	0.375	3.03	20.9	5.54
Rough Brook 9	3	Rough Brook	Rough Brook	Walsall	402300	301450	400896	302792	0.46	1	0.31	148	77	0.28	0.375	3.03	20.9	5.54
Rough Brook 1	3	Rough Brook	Rough Brook	Walsall	402300	301450	400896	302792	0.32	1	0.31	148	77	0.28	0.375	3.03	20.9	5.54
Rough Brook 1	3	Rough Brook	Rough Brook	Walsall	402300	301450	400896	302792	0.24	1	0.31	148	77	0.28	0.375	3.03	20.9	5.54
Rough Brook 1	3	Rough Brook	Rough Brook	Walsall	402300	301450	400896	302792	0.18	1	0.31	148	77	0.28	0.375	3.03	20.9	5.54
Rough Brook 1	3	Rough Brook	Rough Brook	Walsall	402300	301450	400896	302792	0.02	1	0.31	148	77	0.28	0.375	3.03	20.9	5.54
Rough Brook 1	3	Rough Brook	Rough Brook	Walsall	402300	301450	400896	302792	1.1	1	0.31	148	77	0.28	0.375	3.03	20.9	5.54
Pool Hayes 01	3	Pool Hayes	Pool Hayes	Walsall	397000	299150	396840	301473	2.61	0.943	0.31	153	181	0.64	0.358	2.76	18.8	5.59
Pool Hayes 02	3	Pool Hayes	Pool Hayes	Walsall	397000	299150	396840	301473	0.7	0.943	0.31	153	181	0.64	0.358	2.76	18.8	5.59
Pool Hayes 03	3	Pool Hayes	Pool Hayes	Walsall	397000	299150	396840	301473	0.18	0.943	0.31	153	181	0.64	0.358	2.76	18.8	5.59
Leigh Wood 0	3	Leigh Wood	Unknown	Aldridge	405400	300700	405566	300403	0.04	1	0.31	160	304	0.67	0.449	0.55	21.1	1.36
Additional	3	Leigh Wood	Unknown	Aldridge	405400	300700	405566	300403	0.18	1	0.31	160	304	0.67	0.449	0.55	21.1	1.36
Lazy Hill 01		Lazy Hill	Unknown		406900	303450	406444	303034	0.49	1	0.31	158	59	0.54	0.819	0.82	58	1.77
Lady Pool 01	3	Lady Brook	Lady Pool	Walsall	402500	300200	403307	299986	1.03	0.909	0.31	144	270	0.44	0.32	1.14	29.3	2.34
Lady Pool 02	3	Lady Brook	Lady Pool	Walsall	402500	300200	403307	299986	0.72	0.909	0.31	144	270	0.44	0.32	1.14	29.3	2.34
Lady Pool 03	3	Lady Brook	Lady Pool	Walsall	402500	300200	403307	299986	0.1	0.909	0.31	144	270	0.44	0.32	1.14	29.3	2.34
Hay Head	3	Hay Head	Unknown	Hay Head, Wlsall	405300	299000	405531	298651	0.67	1	0.31	178	296	0.77	0.413	0.60	35.5	1.42
Hardwick Woo	3	Hardwick Wood	Hardwick Wood	Walsall	407100	298400	406584	297854	0.53	1	0.31	190	46	0.8	0.882	0.83	55.7	1.5
Hardwick Woo	3	Hardwick Wood	Hardwick Wood	Walsall	407100	298400	406584	297854	0.08	1	0.31	190	46	0.8	0.882	0.83	55.7	1.5
Full Brook 01	3	Full Brook	Full Brook	Walsall	400950	296050	402792	296885	0.44	1	0.31	133	233	0.35	0.337	2.73	29.9	4.35
Full Brook 02	3	Full Brook	Full Brook	Walsall	400950	296050	402792	296885	0.29	1	0.31	133	233	0.35	0.337	2.73	29.9	4.35
Full Brook 03	3	Full Brook	Full Brook	Walsall	400950	296050	402792	296885	0.28	1	0.31	133	233	0.35	0.337	2.73	29.9	4.35
Full Brook 04	3	Full Brook	Full Brook	Walsall	400950	296050	402792	296885	0.49	1	0.31	133	233	0.35	0.337	2.73	29.9	4.35
Full Brook 05	3	Full Brook	Full Brook	Walsall	400950	296050	402792	296885	0.77	1	0.31	133	233	0.35	0.337	2.73	29.9	4.35
Full Brook 06	3	Full Brook	Full Brook	Walsall	400950	296050	402792	296885	0.49	1	0.31	133	233	0.35	0.337	2.73	29.9	4.35
Full Brook 07	3	Full Brook	Full Brook	Walsall	400950	296050	402792	296885	0.4	1	0.31	133	233	0.35	0.337	2.73	29.9	4.35
Full Brook 08	3	Full Brook	Full Brook	Walsall	400950	296050	402792	296885	0.52	1	0.31	133	233	0.35	0.337	2.73	29.9	4.35
Full Brook 09	3	Full Brook	Full Brook	Walsall	400950	296050	402792	296885	0.41	1	0.31	133	233	0.35	0.337	2.73	29.9	4.35
Full Brook 10	3	Full Brook	Full Brook	Walsall	400950	296050	402792	296885	0.67	1	0.31	133	233	0.35	0.337	2.73	29.9	4.35
Full Brook 11	3	Full Brook	Full Brook	Walsall	400950	296050	402792	296885	0.73	1	0.31	133	233	0.35	0.337	2.73	29.9	4.35
Full Brook 12	3	Full Brook	Full Brook	Walsall	400950	296050	402792	296885	0.02	1	0.31	133	233	0.35	0.337	2.73	29.9	4.35
Duck 01	3	Duckery	The Duckery	Walsall	405550	294400	405162	296369	0.77	0.874	0.31	161	208	0.26	0.433	2.64	54	5.01
Duck 02	3	Duckery	The Duckery	Walsall	405550	294400			0.12	0.874	0.31	161	208	0.26	0.433	2.64	54	5.01
Duck 03	3	Duckery	The Duckery	Walsall	405550	294400			0.79	0.874	0.31	161	208	0.26	0.433	2.64	54	5.01
Duck 04	3	Duckery	The Duckery	Walsall	405550	294400			1.08	0.874	0.31	161	208	0.26	0.433	2.64	54	5.01
Duck 05	3	Duckery	The Duckery	Walsall	405550	294400			0.94	0.874	0.31	161	208	0.26	0.433	2.64	54	5.01
Duck 06	3	Duckery	The Duckery	Walsall	405550	294400			0.79	0.874	0.31	161	208	0.26	0.433	2.64	54	5.01
Ford Brook 01	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	0.53	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Ford Brook 02	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	0.28	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Ford Brook 03	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	0.09	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Ford Brook 04	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	2.73	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Ford Brook 05	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	0.83	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Ford Brook 06	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	0.15	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Ford Brook 07	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	2.4	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Ford Brook 08	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	0.38	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Ford Brook 09	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	1.46	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Ford Brook 10	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	0.29	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Ford Brook 11	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	0.82	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Ford Brook 12	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	0.39	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Ford Brook 13	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	0.53	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Ford Brook 14	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	0.02	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Ford Brook 15	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	2.77	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Ford Brook 16	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	0.12	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Ford Brook 17	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	0.51	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Ford Brook 18	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	0.1	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Ford Brook 19	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	0.69	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Anchor Brook 0	3	Anchor Brook	Anchor Brook	Walsall	402450	300950	404070	303078	0.19	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Anchor Brook 0	3	Anchor Brook	Anchor Brook	Walsall	402450	300950	404070	303078	0.13	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Anchor Brook 0	3	Anchor Brook	Anchor Brook	Walsall	402450	300950	404070	303078	0.72	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Anchor Brook 0	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	1.5	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Anchor Brook 0	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	0.25	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Anchor Brook 0	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	0.37	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Anchor Brook 0	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	0.28	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Ford Brook 20	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	0.36	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Ford Brook 21	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	0.36	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Ford Brook 22	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	0.46	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Ford Brook 23	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	0.2	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Ford Brook 24	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	0.03	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Ford Brook 25	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	0.1	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Ford Brook 26	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	0.15	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Ford Brook 27	3	Ford Brook	Ford Brook	Walsall	402450	300950	404070	303078	0.14	0.942	0.31	147	245	0.27	0.453	4.26	19.1	7.81
Arb Brook 01	3	Arb Brook 01	Arb Brook		401400	299400	400788	299861	0.74	1	0.31	138	126	0.69	0.374	1.03	21.8	2.09
Arb Brook 02	3	Arb Brook 02	Arb Brook		401400	299400	400788	299861	0.11	1	0.31	138	126	0.69	0.374	1.03	21.8	2.09

Hydraulic model boundary	RMED-1H	RMED-1D	RMED-2D	SAAR	SAAR4170	SPRHOST	URBCONC1990	URBEXT1990	URBLOC1990	URBCONC2000	URBEXT2000	URBLOC2000	C	D1	D2	D3	E	F	C(1km)	D1(1km)	D2(1km)	D3(1km)	E(1km)	F(1km)
Tames 01	11	32.7	39.5	703	708	39.64	0.877	0.452	0.978	0.963	0.719	0.984	-0.033	0.366	0.323	0.315	0.32	2.413	-0.032	0.369	0.316	0.317	0.321	2.409
Tames 02	11	32.7	39.5	703	708	39.64	0.877	0.452	0.978	0.963	0.719	0.984	-0.033	0.366	0.323	0.315	0.32	2.413	-0.032	0.369	0.316	0.317	0.321	2.409
Tames 03	11	32.7	39.5	703	708	39.64	0.877	0.452	0.978	0.963	0.719	0.984	-0.033	0.366	0.323	0.315	0.32	2.413	-0.032	0.369	0.316	0.317	0.321	2.409
Tames 04	11	32.7	39.5	703	708	39.64	0.877	0.452	0.978	0.963	0.719	0.984	-0.033	0.366	0.323	0.315	0.32	2.413	-0.032	0.369	0.316	0.317	0.321	2.409
Tames 05	11	32.7	39.5	703	708	39.64	0.877	0.452	0.978	0.963	0.719	0.984	-0.033	0.366	0.323	0.315	0.32	2.413	-0.032	0.369	0.316	0.317	0.321	2.409
Tames 06	11	32.7	39.5	703	708	39.64	0.877	0.452	0.978	0.963	0.719	0.984	-0.033	0.366	0.323	0.315	0.32	2.413	-0.032	0.369	0.316	0.317	0.321	2.409
Tames 07	11	32.7	39.5	703	708	39.64	0.877	0.452	0.978	0.963	0.719	0.984	-0.033	0.366	0.323	0.315	0.32	2.413	-0.032	0.369	0.316	0.317	0.321	2.409
Tames 08	11	32.7	39.5	703	708	39.64	0.877	0.452	0.978	0.963	0.719	0.984	-0.033	0.366	0.323	0.315	0.32	2.413	-0.032	0.369	0.316	0.317	0.321	2.409
Tames 09	11	32.7	39.5	703	708	39.64	0.877	0.452	0.978	0.963	0.719	0.984	-0.033	0.366	0.323	0.315	0.32	2.413	-0.032	0.369	0.316	0.317	0.321	2.409
Sneyd 01	11.2	32.9	39	698	704	39.69	0.849	0.301	0.837	0.951	0.619	0.818	-0.032	0.367	0.302	0.322	0.321	2.41	-0.032	0.37	0.298	0.323	0.323	2.398
Sneyd 02	11.2	32.9	39	698	704	39.69	0.849	0.301	0.837	0.951	0.619	0.818	-0.032	0.367	0.302	0.322	0.321	2.41	-0.032	0.37	0.298	0.323	0.323	2.398
Sneyd 03	11.2	32.9	39	698	704	39.69	0.849	0.301	0.837	0.951	0.619	0.818	-0.032	0.367	0.302	0.322	0.321	2.41	-0.032	0.37	0.298	0.323	0.323	2.398
Sneyd 04	11.2	32.9	39	698	704	39.69	0.849	0.301	0.837	0.951	0.619	0.818	-0.032	0.367	0.302	0.322	0.321	2.41	-0.032	0.37	0.298	0.323	0.323	2.398
Sneyd 05	11.2	32.9	39	698	704	39.69	0.849	0.301	0.837	0.951	0.619	0.818	-0.032	0.367	0.302	0.322	0.321	2.41	-0.032	0.37	0.298	0.323	0.323	2.398
Sneyd 06	11.2	32.9	39	698	704	39.69	0.849	0.301	0.837	0.951	0.619	0.818	-0.032	0.367	0.302	0.322	0.321	2.41	-0.032	0.37	0.298	0.323	0.323	2.398
Sneyd 07	11.2	32.9	39	698	704	39.69	0.849	0.301	0.837	0.951	0.619	0.818	-0.032	0.367	0.302	0.322	0.321	2.41	-0.032	0.37	0.298	0.323	0.323	2.398
Sneyd_08	11.2	32.9	39	698	704	39.69	0.849	0.301	0.837	0.951	0.619	0.818	-0.032	0.367	0.302	0.322	0.321	2.41	-0.032	0.37	0.298	0.323	0.323	2.398
Sneyd 09	11.2	32.9	39	698	704	39.69	0.849	0.301	0.837	0.951	0.619	0.818	-0.032	0.367	0.302	0.322	0.321	2.41	-0.032	0.37	0.298	0.323	0.323	2.398
Sneyd 10	11.2	32.9	39	698	704	39.69	0.849	0.301	0.837	0.951	0.619	0.818	-0.032	0.367	0.302	0.322	0.321	2.41	-0.032	0.37	0.298	0.323	0.323	2.398
Sneyd 11	11.2	32.9	39	698	704	39.69	0.849	0.301	0.837	0.951	0.619	0.818	-0.032	0.367	0.302	0.322	0.321	2.41	-0.032	0.37	0.298	0.323	0.323	2.398
Sneyd 00	11.2	32.9	39	698	704	39.69	0.849	0.301	0.837	0.951	0.619	0.818	-0.032	0.367	0.302	0.322	0.321	2.41	-0.032	0.37	0.298	0.323	0.323	2.398
Sneyd 000	11.2	32.9	39	698	704	39.69	0.849	0.301	0.837	0.951	0.619	0.818	-0.032	0.367	0.302	0.322	0.321	2.41	-0.032	0.37	0.298	0.323	0.323	2.398
Rough Brook 1	11	32.9	40.1	697	706	38.61	0.873	0.286	1.036	0.954	0.488	0.975	-0.033	0.368	0.317	0.315	0.321	2.41	-0.032	0.362	0.321	0.311	0.32	2.409
Rough Brook 2	11	32.9	40.1	697	706	38.61	0.873	0.286	1.036	0.954	0.488	0.975	-0.033	0.368	0.317	0.315	0.321	2.41	-0.032	0.362	0.321	0.311	0.32	2.409
Rough Brook 3	11	32.9	40.1	697	706	38.61	0.873	0.286	1.036	0.954	0.488	0.975	-0.033	0.368	0.317	0.315	0.321	2.41	-0.032	0.362	0.321	0.311	0.32	2.409
Rough Brook 4	11	32.9	40.1	697	706	38.61	0.873	0.286	1.036	0.954	0.488	0.975	-0.033	0.368	0.317	0.315	0.321	2.41	-0.032	0.362	0.321	0.311	0.32	2.409
Rough Brook 5	11	32.9	40.1	697	706	38.61	0.873	0.286	1.036	0.954	0.488	0.975	-0.033	0.368	0.317	0.315	0.321	2.41	-0.032	0.362	0.321	0.311	0.32	2.409
Rough Brook 6	11	32.9	40.1	697	706	38.61	0.873	0.286	1.036	0.954	0.488	0.975	-0.033	0.368	0.317	0.315	0.321	2.41	-0.032	0.362	0.321	0.311	0.32	2.409
Rough Brook 7	11	32.9	40.1	697	706	38.61	0.873	0.286	1.036	0.954	0.488	0.975	-0.033	0.368	0.317	0.315	0.321	2.41	-0.032	0.362	0.321	0.311	0.32	2.409
Rough Brook 8	11	32.9	40.1	697	706	38.61	0.873	0.286	1.036	0.954	0.488	0.975	-0.033	0.368	0.317	0.315	0.321	2.41	-0.032	0.362	0.321	0.311	0.32	2.409
Rough Brook 9	11	32.9	40.1	697	706	38.61	0.873	0.286	1.036	0.954	0.488	0.975	-0.033	0.368	0.317	0.315	0.321	2.41	-0.032	0.362	0.321	0.311	0.32	2.409
Rough Brook 1	11	32.9	40.1	697	706	38.61	0.873	0.286	1.036	0.954	0.488	0.975	-0.033	0.368	0.317	0.315	0.321	2.41	-0.032	0.362	0.321	0.311	0.32	2.409
Rough Brook 1	11	32.9	40.1	697	706	38.61	0.873	0.286	1.036	0.954	0.488	0.975	-0.033	0.368	0.317	0.315	0.321	2.41	-0.032	0.362	0.321	0.311	0.32	2.409
Rough Brook 1	11	32.9	40.1	697	706	38.61	0.873	0.286	1.036	0.954	0.488	0.975	-0.033	0.368	0.317	0.315	0.321	2.41	-0.032	0.362	0.321	0.311	0.32	2.409
Rough Brook 1	11	32.9	40.1	697	706	38.61	0.873	0.286	1.036	0.954	0.488	0.975	-0.033	0.368	0.317	0.315	0.321	2.41	-0.032	0.362	0.321	0.311	0.32	2.409
Rough Brook 1	11	32.9	40.1	697	706	38.61	0.873	0.286	1.036	0.954	0.488	0.975	-0.033	0.368	0.317	0.315	0.321	2.41	-0.032	0.362	0.321	0.311	0.32	2.409
Pool Hayes 01	11.1	32.7	38.8	698	706	39.7	0.895	0.377	0.84	0.973	0.763	0.855	-0.032	0.369	0.305	0.318	0.321	2.406	-0.032	0.369	0.316	0.317	0.321	2.409
Pool Hayes 02	11.1	32.7	38.8	698	706	39.7	0.895	0.377	0.84	0.973	0.763	0.855	-0.032	0.369	0.305	0.318	0.321	2.406	-0.032	0.369	0.316	0.317	0.321	2.409
Pool Hayes 03	11.1	32.7	38.8	698	706	39.7	0.895	0.377	0.84	0.973	0.763	0.855	-0.032	0.369	0.305	0.318	0.321	2.406	-0.032	0.369	0.316	0.317	0.321	2.409
Leigh Wood 0	11.1	31.2	40.2	710	702	35.92	0.854	0.436	0.911	0.922	0.485	0.913	-0.032	0.353	0.33	0.3	0.321	2.394	-0.032	0.352	0.327	0.302	0.32	2.401
Additional	11.1	31.2	40.2	710	702	35.92	0.854	0.436	0.911	0.922	0.485	0.913	-0.032	0.353	0.33	0.3	0.321	2.394	-0.032	0.352	0.327	0.302	0.32	2.401
Lazy Hill 01	11.1	30.8	39.9	716	712	21.76	0.451	0.071	0.706	0.65	0.098	0.538	-0.033	0.355	0.33	0.299	0.321	2.385	-0.033	0.353	0.333	0.3	0.321	2.383
Lady Pool 01	11.1	31.8	40	703	702	39.78	0.681	0.067	1.008	0.839	0.057	0.839	-0.032	0.353	0.316	0.308	0.321	2.407	-0.032	0.362	0.301	0.316	0.321	2.411
Lady Pool 02	11.1	31.8	40	703	702	39.78	0.681	0.067	1.008	0.839	0.057	0.839	-0.032	0.353	0.316	0.308	0.321	2.407	-0.032	0.362	0.301	0.316	0.321	2.411
Lady Pool 03	11.1	31.8	40	703	702	39.78	0.681	0.067	1.008	0.839	0.057	0.839	-0.032	0.353	0.316	0.308	0.321	2.407	-0.032	0.362	0.301	0.316	0.321	2.411
Hay Head	11.2	32.4	41.3	715	700	36.35	0.667	0.011	0.597	1	0.008	0.781	-0.031	0.35	0.319	0.283	0.317	2.429	-0.03	0.35	0.321	0.275	0.315	2.437
Hardwick Woo	11.5	32.4	41.9	724	701	13.93	0.839	0.22	0.617	0.87	0.194	0.559	-0.03	0.35	0.324	0.277	0.315	2.429	-0.031	0.352	0.33	0.283	0.317	2.414
Hardwick Woo	11.5	32.4	41.9	724	701	13.93	0.839	0.22	0.617	0.87	0.194	0.559	-0.03	0.35	0.324	0.277	0.315	2.429	-0.031	0.352	0.33	0.283	0.317	2.414
Full Brook 01	11.1	33.6	41.9	695	700	40.45	0.855	0.334	0.99	0.944	0.58	1.048	-0.031	0.361	0.308	0.286	0.319	2.424	-0.031	0.357	0.31	0.301	0.32	2.412
Full Brook 02	11.1	33.6	41.9	695	700	40.45	0.855	0.334	0.99	0.944	0.58	1.048	-0.031	0.361	0.308	0.286	0.319	2.424	-0.031	0.357	0.31	0.301	0.32	2.412
Full Brook 03	11.1	33.6	41.9	695	700	40.45	0.855	0.334	0.99	0.944	0.58	1.048	-0.031	0.361	0.308	0.286	0.319	2.424	-0.031	0.357	0.31	0.301	0.32	2.412
Full Brook 04	11.1	33.6	41.9	695	700	40.45	0.855	0.334	0.99	0.944	0.58	1.048	-0.031	0.361	0.308	0.286	0.319	2.424	-0.031	0.357	0.31	0.301	0.32	2.412
Full Brook 05	11.1	33.6	41.9	695	700	40.45	0.855	0.334	0.99	0.944	0.58	1.048	-0.031	0.361	0.308	0.286	0.319	2.424	-0.031	0.357	0.31	0.301	0.32	2.412
Full Brook 06	11.1	33.6	41.9	695	700	40.45	0.855	0.334	0.99	0.944	0.58	1.048	-0.031	0.361	0.308	0.286	0.319	2.424	-0.031	0.357	0.31	0.301	0.32	2.412
Full Brook 07	11.1	33.6	41.9	695	700	40.45	0.855	0.334	0.99	0.944	0.58	1.048	-0.031	0.361	0.308	0.286	0.319	2.424	-0.031	0.357	0.31	0.301	0.32	2.412
Full Brook 08	11.1	33.6	41.9	695	700	40.45	0.855	0.334	0.99	0.944	0.58	1.048	-0.031	0.361	0.308	0.286	0.319	2.424	-0.031	0.357	0.31	0.301	0.32	2.412
Full Brook 09	11.1	33.6	41.9	695	700	40.45	0.855	0.334	0.99	0.944	0.58	1.048	-0.031	0.361	0.308	0.286	0.319	2.424	-0.031	0.357	0.31	0.301	0.32	2.412
Full Brook 10	11.1	33.6	41.9	695	700	40.45	0.855	0.334	0.99	0.944	0.58	1.048	-0.031	0.361	0.308	0.286	0.319	2.424	-0.031	0.357	0.31	0.301	0.32	2.412
Full Brook 11	11.1	33.6	41.9	695	700	40.45	0.855	0.334	0.99	0.944	0.58	1.048	-0.031	0.361	0.308	0.286	0.319	2.424	-0.031	0.357	0.31	0.301	0.32	2.412
Full Brook 12	11.1	33.6	41.9	695	700	40.45	0.855	0.334	0.99	0.944	0.58	1.048	-0.031	0.361	0.308	0.286	0.319	2.424	-0.031	0.357	0.31	0.301	0.32	2.412
Duck 01	11.3	33.2	42.3	711	702	36.59	0.772	0.054	0.512	0.873	0.132	0.653	-0.03	0.358	0.311	0.274	0.315	2.432	-0.029	0.364	0.298	0.269	0.312	2.43
Duck 02	11.3	33.2	42.3	711	702	36.59	0.772	0.054	0.512	0.873	0.132	0.653	-0.03	0.358	0.311	0.274	0.315	2.432	-0.029	0.364	0.298	0.269	0.312	2.43
Duck 03	11.3	33.2	42.3	711	702	36.59	0.772	0.054	0.512	0.873	0.132	0.653	-0.03	0.358	0.311	0.274	0.315	2.432	-0.029	0.364	0.298	0.269	0.312	2.43
Duck 04	11.3	33.2	42.3	711	702	36.59	0.772	0.054	0.512	0.873	0.132	0.653	-0.03	0.358	0.311	0.274	0.315	2.432	-0.029	0.364	0.298	0.269	0.312	2.43
Duck 05	11.3	33.2	42.3	711	702	36.59	0.772	0.054	0.512	0.873	0.132	0.653	-0.03	0.358	0.311	0.274	0.315	2.432	-0.029	0.364	0.298	0.269	0.312	2.43
Duck 06	11.3	33.2	42.3	711	702	36.59	0.772	0.054	0.512	0.873	0.132	0.653	-0.03	0.358	0.311	0.274	0.315	2.432	-0.029	0.364	0.298	0.269	0.312	2.43
Ford Brook 01	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Ford Brook 02	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Ford Brook 03	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Ford Brook 04	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Ford Brook 05	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Ford Brook 06	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Ford Brook 07	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Ford Brook 08	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Ford Brook 09	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Ford Brook 10	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Ford Brook 11	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Ford Brook 12	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Ford Brook 13	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Ford Brook 14	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Ford Brook 15	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Ford Brook 16	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Ford Brook 17	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Ford Brook 18	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Ford Brook 19	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Anchor Brook 0	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Anchor Brook 0	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Anchor Brook 0	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Anchor Brook 0	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Anchor Brook 0	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Anchor Brook 0	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Anchor Brook 0	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Ford Brook 20	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Ford Brook 21	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Ford Brook 22	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Ford Brook 23	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Ford Brook 24	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Ford Brook 25	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Ford Brook 26	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Ford Brook 27	11	31.9	40.7	705	710	34.97	0.857	0.279	0.933	0.912	0.362	0.88	-0.033	0.359	0.332	0.305	0.321	2.402	-0.032	0.363	0.3	0.321	0.322	2.413
Arb Brook 01	11.1	33	39.8	697	702	39.82	0.923	0.672	1.01	1	0.95	1.002	-0.032	0.363	0.302	0.317	0.321	2.412	-0.031	0.362	0.291	0.32	0.321	2.414
Arb Brook 02	11.1	33	39.8	697	702	39.82	0.923	0.672	1.01	1	0.95	1.002	-0.032	0.363	0.302	0.317	0.321	2.412	-0.031	0.362	0.291	0.32	0.321	2.414

Hydraulic model boundary	1. Urban In						2. Urban Natural												4. Urban Excess					
	Area	DPLBAR	DPSBAR	URBEXT 1990	Season	Extend by (hrs)	Area	DPLBAR	DPSBAR	URBEXT 1990	Season	Extend by (hrs)	Area	DPLBAR	DPSBAR	URBEXT 1990	Season	Extend by (hrs)	Area	DPLBAR	DPSBAR	URBEXT 1990	Season	Extend by (hrs)
Tames 01		0	18.9	1.0	Summer	0	0.07	0.2329	18.9	1.0	Summer	0.25	0.25	0.46781	18.9	0.0	Summer	0		0	18.9	1.0	Summer	0
Tames 02		0	18.9	1.0	Summer	0	0.08	0.2505	18.9	1.0	Summer	0.25	0.4	0.60524	18.9	0.0	Summer	0		0	18.9	1.0	Summer	0
Tames 03		0	18.9	1.0	Summer	0	1.66	1.3201	18.9	1.0	Summer	0.25	4.9	2.38906	18.9	0.0	Summer	0		0	18.9	1.0	Summer	0
Tames 04		0	18.9	1.0	Summer	0	0.19	0.4025	18.9	1.0	Summer	0.25	0.56	0.72779	18.9	0.0	Summer	0		0	18.9	1.0	Summer	0
Tames 05		0	18.9	1.0	Summer	0	0.06	0.214	18.9	1.0	Summer	0.25	0.11	0.29832	18.9	0.0	Summer	0		0	18.9	1.0	Summer	0
Tames 06		0	18.9	1.0	Summer	0	0.1	0.2831	18.9	1.0	Summer	0.25	0.27	0.48796	18.9	0.0	Summer	0		0	18.9	1.0	Summer	0
Tames 07		0	18.9	1.0	Summer	0	0.38	0.5885	18.9	1.0	Summer	0.25	0.9	0.9439	18.9	0.0	Summer	0		0	18.9	1.0	Summer	0
Tames 08		0	18.9	1.0	Summer	0	0.19	0.4025	18.9	1.0	Summer	0.25	0.46	0.65342	18.9	0.0	Summer	0		0	18.9	1.0	Summer	0
Tames 09		0	18.9	1.0	Summer	0	0.01	0.0802	18.9	1.0	Summer	0.25	0.13	0.32692	18.9	0.0	Summer	0		0	18.9	1.0	Summer	0
Sneyd 01	0	0	21.8	1.0	Summer	0	0	0	21.8	1.0	Summer	0	1.47	1.23507	21.8	0.0	Summer	0	0	0	21.8	1.0	Summer	0
Sneyd 02	0	0	21.8	1.0	Summer	0	0.07	0.2329	21.8	1.0	Summer	0	1.03	1.01633	21.8	0.0	Summer	0	0	0	21.8	1.0	Summer	0
Sneyd 03	0	0	21.8	1.0	Summer	0	0.25	0.4678	21.8	1.0	Summer	0	1.54	1.26696	21.8	0.0	Summer	0	0	0	21.8	1.0	Summer	0
Sneyd 04	0	0	21.8	1	Summer	0	0.18	0.3907	21.8	1	Summer	0	0.63	0.77632	21.8	0	Summer	0	0	0	21.8	1	Summer	0
Sneyd 05	0	0	21.8	1	Summer	0	0.21	0.4252	21.8	1	Summer	0	0.52	0.69883	21.8	0	Summer	0	0	0	21.8	1	Summer	0
Sneyd 06	0	0	21.8	1	Summer	0	0.14	0.3405	21.8	1	Summer	0	0.32	0.53558	21.8	0	Summer	0	0	0	21.8	1	Summer	0
Sneyd 07	0	0	21.8	1	Summer	0	0.12	0.3129	21.8	1	Summer	0	0.86	0.92067	21.8	0	Summer	0	0	0	21.8	1	Summer	0
Sneyd_08	0	0	21.8	1	Summer	0	0.06	0.214	21.8	1	Summer	0	0.3	0.51697	21.8	0	Summer	0	0	0	21.8	1	Summer	0
Sneyd 09	0	0	21.8	1	Summer	0	0.16	0.3663	21.8	1	Summer	0	0.48	0.66884	21.8	0	Summer	0	0	0	21.8	1	Summer	0
Sneyd 10	0	0	21.8	1	Summer	0	0.05	0.1937	21.8	1	Summer	0	0.28	0.49779	21.8	0	Summer	0	0	0	21.8	1	Summer	0
Sneyd 11	0	0	21.8	1	Summer	0	0.17	0.3787	21.8	1	Summer	0	1.85	1.40091	21.8	0	Summer	0	0.11	0.2983	21.8	1	Summer	0
Sneyd 00	0	0	21.8	1	Summer	0	0	0	21.8	1	Summer	0	0.01	0.08017	21.8	0	Summer	0	0	0	21.8	1	Summer	0
Sneyd 000	0	0	21.8	1	Summer	0	0.07	0.2329	21.8	1	Summer	0	0.2	0.41397	21.8	0	Summer	0		0	21.8	1	Summer	0
Rough Brook 1	0	0	20.9	1	Summer	0	0	0	20.9	1	Summer	0	0.05	0.19366	20.9	0	Summer	0	0	0	20.9	1	Summer	0
Rough Brook 2	0	0	20.9	1	Summer	0	0.18	0.3907	20.9	1	Summer	0	0.02	0.11721	20.9	0	Summer	0	0	0	20.9	1	Summer	0
Rough Brook 3	0	0	20.9	1	Summer	0	0.02	0.1172	20.9	1	Summer	0	0.61	0.76271	20.9	0	Summer	0	0	0	20.9	1	Summer	0
Rough Brook 4	0	0	20.9	1	Summer	0	0.1	0.2831	20.9	1	Summer	0	0.38	0.58847	20.9	0	Summer	0	0	0	20.9	1	Summer	0
Rough Brook 5	0	0	20.9	1	Summer	0	0.02	0.1172	20.9	1	Summer	0	0.34	0.55367	20.9	0	Summer	0	0	0	20.9	1	Summer	0
Rough Brook 6	0	0	20.9	1	Summer	0	0.39	0.5969	20.9	1	Summer	0	1.28	1.14486	20.9	0	Summer	0	0	0	20.9	1	Summer	0
Rough Brook 7	0	0	20.9	1	Summer	0	0.02	0.1172	20.9	1	Summer	0	0.28	0.49779	20.9	0	Summer	0	0	0	20.9	1	Summer	0
Rough Brook 8	0	0	20.9	1	Summer	0	0.06	0.214	20.9	1	Summer	0	0.32	0.53558	20.9	0	Summer	0	0	0	20.9	1	Summer	0
Rough Brook 9	0	0	20.9	1	Summer	0	0.06	0.214	20.9	1	Summer	0	0.4	0.60524	20.9	0	Summer	0	0	0	20.9	1	Summer	0
Rough Brook 1	0	0	20.9	1	Summer	0	0.05	0.1937	20.9	1	Summer	0	0.27	0.48796	20.9	0	Summer	0	0	0	20.9	1	Summer	0
Rough Brook 1	0	0	20.9	1	Summer	0	0	0	20.9	1	Summer	0	0.21	0.42518	20.9	0	Summer	0	0.03	0.1464	20.9	1	Summer	0
Rough Brook 1	0	0	20.9	1	Summer	0	0.05	0.1937	20.9	1	Summer	0	0.13	0.32692	20.9	0	Summer	0	0	0	20.9	1	Summer	0
Rough Brook 1	0	0	20.9	1	Summer	0	0	0	20.9	1	Summer	0	0.02	0.11721	20.9	0	Summer	0	0	0	20.9	1	Summer	0
Rough Brook 1	0	0	20.9	1	Summer	0	0.26	0.478	20.9	1	Summer	0	0.84	0.90888	20.9	0	Summer	0	0	0	20.9	1	Summer	0
Pool Hayes 01	0	0	18.8	1.0	Summer	0	0.06	0.214	18.8	1.0	Summer	0	1.81	1.38423	18.8	0.0	Summer	0	0.74	0.8479	18.8	1.0	Summer	0
Pool Hayes 02	0	0	18.8	1.0	Summer	0	0.09	0.2673	18.8	1.0	Summer	0	0.49	0.67644	18.8	0.0	Summer	0	0.12	0.3129	18.8	1.0	Summer	0
Pool Hayes 03	0	0	18.8	1.0	Summer	0	0.05	0.1937	18.8	1.0	Summer	0	0.13	0.32692	18.8	0.0	Summer	0	0	0	18.8	1.0	Summer	0
Leigh Wood 0	0	0	21.1	1.0	Summer	0	0	0	21.1	1.0	Summer	0	0.04	0.17137	21.1	0.0	Summer	0	0	0	21.1	1.0	Summer	0
Additional	0	0	21.1	1.0	Summer	0	0.05	0.1937	21.1	1.0	Summer	0	0.13	0.32692	21.1	0.0	Summer	0	0	0	21.1	1.0	Summer	0
Lazy Hill 01	0	0	58	1.0	Summer	0	0	0	58	1.0	Summer	0	0.49	0.67644	58	0.0	Summer	0	0	0	58	1.0	Summer	0
Lady Pool 01	0	0	29.3	1.0	Summer	0	0	0	29.3	1.0	Summer	0	1.01	1.00547	29.3	0.0	Summer	0	0.02	0.1172	29.3	1.0	Summer	0
Lady Pool 02	0	0	29.3	1.0	Summer	0	0	0	29.3	1.0	Summer	0	0.62	0.76954	29.3	0.0	Summer	0	0.1	0.2831	29.3	1.0	Summer	0
Lady Pool 03	0	0	29.3	1.0	Summer	0	0	0	29.3	1.0	Summer	0	0.09	0.26725	29.3	0.0	Summer	0	0.01	0.0802	29.3	1.0	Summer	0
Hay Head	0	0	35.5	1.0	Summer	0	0.03	0.1464	35.5	1.0	Summer	0	0.64	0.78304	35.5	0.0	Winter	0	0	0	35.5	1.0	Summer	0
Hardwick Woo	0	0	55.7	1.0	Summer	0	0.15	0.3536	55.7	1.0	Summer	0	0.38	0.58847	55.7	0.0	Summer	0	0	0	55.7	1.0	Summer	0
Hardwick Woo	0	0	55.7	1.0	Summer	0	0.02	0.1172	55.7	1.0	Summer	0	0.06	0.21401	55.7	0.0	Summer	0	0	0	55.7	1.0	Summer	0
Full Brook 01	0	0	29.9	1.0	Summer	0	0.13	0.3269	29.9	1.0	Summer	0	0.31	0.52634	29.9	0.0	Summer	0		0	29.9	1.0	Summer	0
Full Brook 02	0	0	29.9	1.0	Summer	0	0.05	0.1937	29.9	1.0	Summer	0	0.24	0.45746	29.9	0.0	Summer	0		0	29.9	1.0	Summer	0
Full Brook 03	0	0	29.9	1.0	Summer	0	0.05	0.1937	29.9	1.0	Summer	0	0.23	0.44692	29.9	0.0	Summer	0		0	29.9	1.0	Summer	0
Full Brook 04	0	0	29.9	1.0	Summer	0	0.08	0.2505	29.9	1.0	Summer	0	0.41	0.61349	29.9	0.0	Summer	0		0	29.9	1.0	Summer	0
Full Brook 05	0	0	29.9	1.0	Summer	0	0.19	0.4025	29.9	1.0	Summer	0	0.58	0.74192	29.9	0.0	Summer	0		0	29.9	1.0	Summer	0
Full Brook 06	0	0	29.9	1.0	Summer	0	0.14	0.3405	29.9	1.0	Summer	0	0.35	0.56253	29.9	0.0	Summer	0		0	29.9	1.0	Summer	0
Full Brook 07	0	0	29.9	1.0	Summer	0	0.1	0.2831	29.9	1.0	Summer	0	0.3	0.51697	29.9	0.0	Summer	0		0	29.9	1.0	Summer	0
Full Brook 08	0	0	29.9	1.0	Summer	0	0.05	0.1937	29.9	1.0	Summer	0	0.47	0.66116	29.9	0.0	Summer	0		0	29.9	1.0	Summer	0
Full Brook 09	0	0	29.9	1.0	Summer	0	0.08	0.2505	29.9	1.0	Summer	0	0.33	0.54469	29.9	0.0	Summer	0		0	29.9	1.0	Summer	0
Full Brook 10	0	0	29.9	1.0	Summer	0	0.18	0.3907	29.9	1.0	Summer	0	0.49	0.67644	29.9	0.0	Summer	0		0	29.9	1.0	Summer	0
Full Brook 11	0	0	29.9	1.0	Summer	0	0.26	0.478	29.9	1.0	Summer	0	0.47	0.66116	29.9	0.0	Summer	0		0	29.9	1.0	Summer	0
Full Brook 12	0	0	29.9	1.0	Summer	0	0	0	29.9	1.0	Summer	0	0.01	0.08017	29.9	0.0	Summer	0	0.01	0.0802	29.9	1.0	Summer	0
Duck 01	0	0	54	1.0	Summer	0	0	0	54	1.0	Summer	0	0.77	0.86656	54	0.0	Summer	0	0	0	54	1.0	Summer	0
Duck 02	0	0	54	1.0	Summer	0	0	0	54	1.0	Summer	0	0.12	0.31289	54	0.0	Summer	0	0	0	54	1.0	Summer	0
Duck 03	0	0	54	1.0	Summer	0	0	0	54	1.0	Summer	0	0.79	0.87882	54	0.0	Summer	0	0	0	54	1.0	Summer	0
Duck 04	0	0	54	1.0	Summer	0	0	0	54	1.0	Summer	0	1.08	1.04308	54	0.0	Summer	0	0	0	54	1.0	Summer	0
Duck 05	0	0	54	1.0	Summer	0	0.01	0.0802	54	1.0	Summer	0	0.93	0.96101	54	0.0	Summer	0	0	0	54	1.0	Summer	0
Duck 06	0	0	54	1.0	Summer	0	0.02	0.1172	54	1.0	Summer	0	0.76	0.86037	54	0.0	Summer	0	0.01	0.0802	54	1.0	Summer	0
Ford Brook 01	0	0	19.1	1.0	Summer	0	0.01	0.0802	19.1	1.0	Summer	0	0.52	0.69883	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Ford Brook 02	0	0	19.1	1.0	Summer	0	0.02	0.1172	19.1	1.0	Summer	0	0.26	0.47798	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Ford Brook 03	0	0	19.1	1.0	Summer	0	0	0	19.1	1.0	Summer	0	0.09	0.26725	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Ford Brook 04	0	0	19.1	1.0	Summer	0	0.53	0.7062	19.1	1.0	Summer	0	2.2	1.54045	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Ford Brook 05	0	0	19.1	1.0	Summer	0	0.11	0.2983	19.1	1.0	Summer	0	0.72	0.83525	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Ford Brook 06	0	0	19.1	1.0	Summer	0	0.02	0.1172	19.1	1.0	Summer	0	0.13	0.32692	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Ford Brook 07	0	0	19.1	1.0	Summer	0	0.16	0.3663	19.1	1.0	Summer	0	2.24	1.55574	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Ford Brook 08	0	0	19.1	1.0	Summer	0	0	0	19.1	1.0	Summer	0	0.38	0.58847	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Ford Brook 09	0	0	19.1	1.0	Summer	0	0.25	0.4678	19.1	1.0	Summer	0	1.21	1.11011	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Ford Brook 10	0	0	19.1	1.0	Summer	0	0.05	0.1937	19.1	1.0	Summer	0	0.24	0.45746	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Ford Brook 11	0	0	19.1	1.0	Summer	0	0.11	0.2983	19.1	1.0	Summer	0	0.71	0.82888	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Ford Brook 12	0	0	19.1	1.0	Summer	0	0.02	0.1172	19.1	1.0	Summer	0	0.37	0.57993	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Ford Brook 13	0	0	19.1	1.0	Summer	0	0.12	0.3129	19.1	1.0	Summer	0	0.41	0.61349	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Ford Brook 14	0	0	19.1	1.0	Summer	0	0	0	19.1	1.0	Summer	0	0.02	0.11721	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Ford Brook 15	0	0	19.1	1.0	Summer	0	0.53	0.7062	19.1	1.0	Summer	0	2.24	1.55574	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Ford Brook 16	0	0	19.1	1.0	Summer	0	0	0	19.1	1.0	Summer	0	0.12	0.31289	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Ford Brook 17	0	0	19.1	1.0	Summer	0	0.02	0.1172	19.1	1.0	Summer	0	0.49	0.67644	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Ford Brook 18	0	0	19.1	1.0	Summer	0	0.01	0.0802	19.1	1.0	Summer	0	0.09	0.26725	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Ford Brook 19	0	0	19.1	1.0	Summer	0	0.07	0.2329	19.1	1.0	Summer	0	0.62	0.76954	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Anchor Brook 0	0	0	19.1	1.0	Summer	0	0.04	0.1714	19.1	1.0	Summer	0	0.15	0.35359	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Anchor Brook 0	0	0	19.1	1.0	Summer	0	0.01	0.0802	19.1	1.0	Summer	0	0.12	0.31289	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Anchor Brook 0	0	0	19.1	1.0	Summer	0	0.08	0.2505	19.1	1.0	Summer	0	0.55	0.72064	19.1	0.0	Summer	0	0.09	0.2673	19.1	1.0	Summer	0
Anchor Brook 0	0	0	19.1	1.0	Summer	0	0.36	0.5713	19.1	1.0	Summer	0	1.14	1.07444	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Anchor Brook 0	0	0	19.1	1.0	Summer	0	0	0	19.1	1.0	Summer	0	0.25	0.46781	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Anchor Brook 0	0	0	19.1	1.0	Summer	0	0.04	0.1714	19.1	1.0	Summer	0	0.33	0.54469	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Anchor Brook 0	0	0	19.1	1.0	Summer	0	0.06	0.214	19.1	1.0	Summer	0	0.22	0.43616	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Ford Brook 20	0	0	19.1	1.0	Summer	0	0.07	0.2329	19.1	1.0	Summer	0	0.29	0.50745	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Ford Brook 21	0	0	19.1	1.0	Summer	0	0.05	0.1937	19.1	1.0	Summer	0	0.31	0.52634	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Ford Brook 22	0	0	19.1	1.0	Summer	0	0.06	0.214	19.1	1.0	Summer	0	0.4	0.60524	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Ford Brook 23	0	0	19.1	1.0	Summer	0	0	0	19.1	1.0	Summer	0	0.2	0.41397	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Ford Brook 24	0	0	19.1	1.0	Summer	0	0	0	19.1	1.0	Summer	0	0.03	0.14637	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Ford Brook 25	0	0	19.1	1.0	Summer	0	0	0	19.1	1.0	Summer	0	0.1	0.28314	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Ford Brook 26	0	0	19.1	1.0	Summer	0	0.02	0.1172	19.1	1.0	Summer	0	0.13	0.32692	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Ford Brook 27	0	0	19.1	1.0	Summer	0	0.01	0.0802	19.1	1.0	Summer	0	0.13	0.32692	19.1	0.0	Summer	0		0	19.1	1.0	Summer	0
Arb Brook 01		0	21.8	1.0	Summer	0	0.22	0.4362	21.8	1.0	Summer	0	0.52	0.69883	21.8	0.0	Summer	0		0	21.8	1.0	Summer	0
Arb Brook 02		0	21.8	1.0	Summer	0	0.03	0.1464	21.8	1.0	Summer	0	0.08	0.25055	21.8	0.0	Summer	0		0	21.8	1.0	Summer	0

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