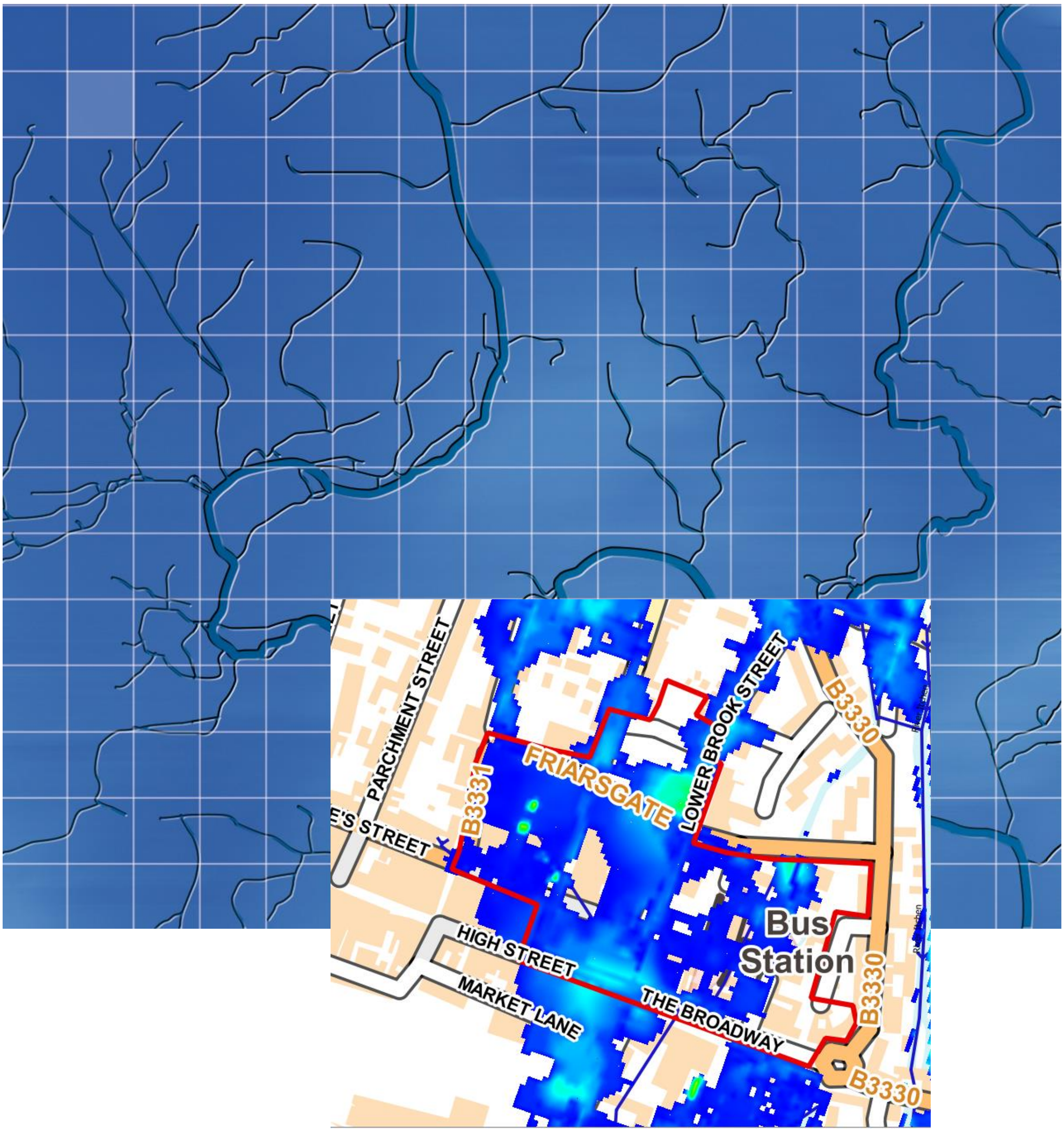
Winchester City Council

March 2017

Central Winchester Regeneration Area FRA



Wallingford HydroSolutions Limited
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Winchester City Council

Central Winchester Regeneration Area FRA

Document issue details

WHS1483

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Contents

1 Introduction

1.1 Background

Wallingford Hydrosolutions Ltd (WHS) have been commissioned by Winchester City Council (WCC) to undertake a review of the key flood risk issues for the Silver Hill area in central Winchester. WCC are proposing to regenerate this area, which covers approximately 2.3 hectares of urban area, and includes King's Walk, Friarsgate Carpark and the central bus station of Winchester (NGR: 448425, 129440). This assessment has been completed with reference to the requirements of the National Planning Policy Framework (NPPF)[1] and its associated technical guidance[2].

1.2 Scope

This assessment will be used to inform the Supplementary Planning Document (SPD) which is to be carried out by the Central Winchester Informal policy Group (IPG).

The task of the Central Winchester Regeneration Informal Policy Group is to produce a Supplementary Planning Document (SPD) that Cabinet can subsequently recommend for adoption by the Council. The SPD will set out the detailed aims and objectives for regeneration of central Winchester (within a defined area) and the consequential changes required to the surrounding area (including the Broadway and Lower High Street), as guided by the adopted planning policies in the Local Plan. The Group will aim to produce the draft SPD to Cabinet by June 2017, so that it can be adopted before the end of 2017.

This flood risk review document will inform the SPD and summarise the key flood risk issues pertaining to the future redevelopment of the Central Winchester Area. It will gather together all of the existing data to identify key considerations, and will also refer to the requirements set out in the current Strategic Flood Risk Assessment (SFRA) document.

The SFRA states that:

'No development will be allowed unless it is demonstrated that a) dry access and egress is provided, b) the receiving watercourse has sufficient capacity and c) flood risk will not be increased in nearby localised flooding areas and/or flood incident locations'.

All available information will be reviewed with specific focus on the following key points:

- Determination of the broad extents of potential land uses within the study site using the mapped flood zones, in accordance with the requirements set out in the National Planning Policy Framework (NPPF).
- A detailed analysis of flood risk issues (including all sources of flooding). Where significant flood risk issues are identified, an assessment of likely significance of flood risk will be carried out in terms of likely probability of flooding and potential consequences/flood damages.
- Identification of areas within the study area with significant flood risk - high probability of flooding and significant flood damages with deep flooding and high velocities which could result in loss of property and potentially loss of life.

[1] National Planning Policy Framework, Department for Communities and Local Government, March 2012
[2] Technical Guidance to the National Planning Policy Framework, Department for Communities and Local Government, March 2012.

- Assessment of all potential access/egress routes within the study area in accordance with the recommendations set out in the SFRA which states that dry access and egress is recommended above the 1% probability flood level plus climate change.
- Review of the model outputs and identification of where any mitigation measures could be incorporated into future development to ensure that it remains compliant with the NPPF. This will focus on raised floor levels, basements and dry access (with freeboard). As stated in the SFRA, the raising of floor levels above the 1% probability peak flood level will ensure that the damage to property is minimised.

This FRA is to be used as a scoping study, which will identify if any further assessment of flood risk is required using a semi-quantitative approach. It will not undertake any new and/or updated hydraulic modelling. In summary, this report will:

- Collate and review publicly available data e.g. EA flood maps.
- Document liaison with statutory bodies.
- Collate and review surface water sewer data.
- Review and interpret model outputs for the River Itchen.
- Summarise the flood risk to the site.
- Outline recommendations for the site and further assessment (if required).

1.3 Data sources

Flood risk through Winchester is currently determined by the EA Flood Map. The EA are responsible for both the fluvial flood map for planning and the surface water flood maps. They hold the latest model data for the River Itchen, as well as any historic flood outlines and recorded instances of fluvial flooding. The EA were contacted in order to obtain the latest model outputs for the River Itchen and relevant tributaries, and a data request was submitted for all historical flood records.

Hampshire county council, who are the Lead Local Flood Authority (LLFA) for the area, provided their Preliminary Flood Risk Assessment (PFRA) which was reviewed to inform this FRA.

In addition, Winchester City Council provided their SFRA for review, as well as the red line plan for the regeneration area. In summary, all data sources are referred to below, with references available in the associated footnotes:

- Hampshire PFRA
- Winchester SFRA[3]
- Environment Agency Flood Maps[4]
- Hampshire Local Flood Risk Management Strategy[5]
- Southern Water Sewer Maps[6]
- OS Mapping
- Aerial Imagery
- Hydraulic Model for the River Itchen[7]

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[3] Strategic Flood Risk Assessment for Local Development Framework, Winchester City Council, September 2007
[4] Environment Agency Flood Map for Planning (Rivers and Sea), Available at: http://maps.environment-agency.gov.uk/wiyby/wiybyController?x=357683.0&y=355134.0&scale=1&layerGroups=default&ep=map&textonly=off&lang=_e&topic=floodmap
[5] Hampshire Local Flood Risk Management Strategy, Hampshire County Council, July 2013
[6] Public Sewer and/or Water Main Records, Southern Water, January 2017
[7] Winchester Flood Mapping, Halcrow Group Ltd, December 2008

- LiDAR data
- Halcrow groundwater flooding reports[8]
- Southern Water Reported Incidents Data[9]
- Environment Agency Winter 2013/2014 Flooding Summary[10]

[8] Winter 2000-2001 Flooding in Winchester, Halcrow, August 2002
[9] Southern Water Reported Incidents, Southern Water, February 2017
[10] Winter 2013/2014 Flooding in Winchester City Centre Internal Brief, Environment Agency

2 The Site

2.1 Location

The Silver Hill regeneration area red line plan was provided by WCC for use within this study. The area extends from Eastgate Street to the East, westward toward Upper Brook Street. The southern extent is bound by the High Street and The Broadway, with the north extending just beyond Friarsgate. Figure 1 displays the location of the site. The site, which comprises Kings Walk, the Friarsgate Carpark and medical centre and the central bus station is currently of mixed development use.

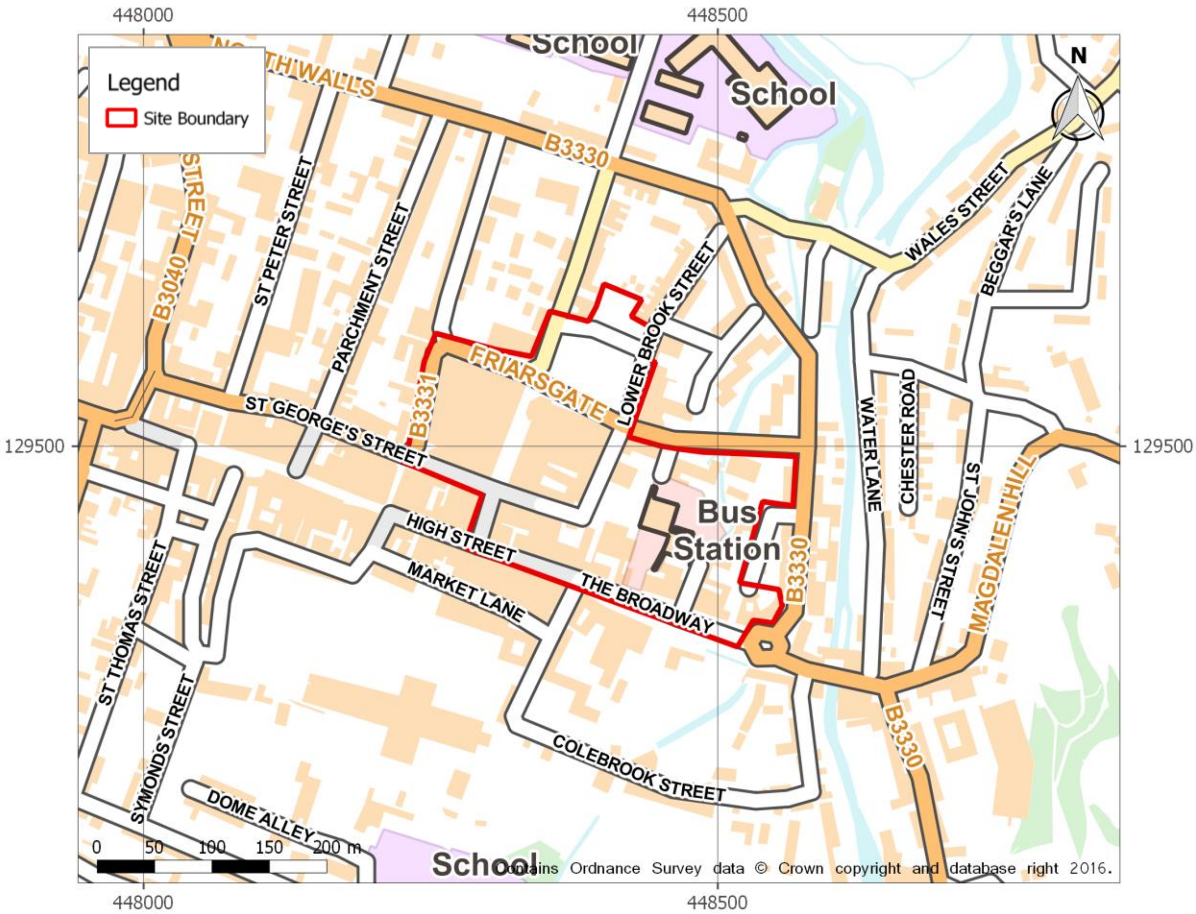


Figure 1 - Site location

2.2 Topography

In order to gain an understanding of the site's topography, 2m resolution LiDAR data was obtained to identify any key flow routes or topographical features. A review of the LiDAR levels across the site, shown as Figure 2, indicates that the ground levels slope toward the south, ranging from around 35.65 – 37.64mAOD. The Digital Terrain Model (DTM) identifies a small drainage ditch to the north east of the central bus station which conveys flow in a north to south direction. This feature is also evident on the EA flood maps, which are reviewed in Section 3.

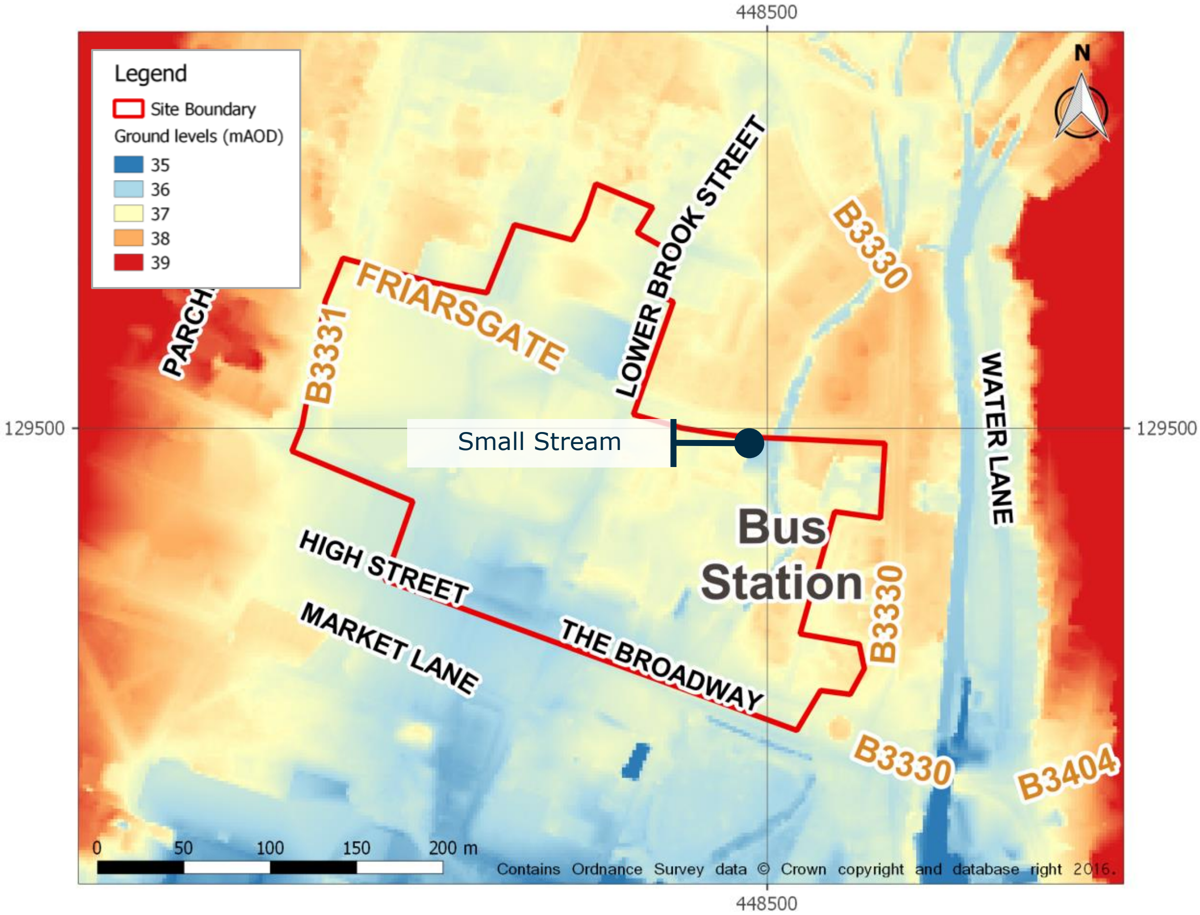


Figure 2 - Lidar Levels across the site

2.3 Planning History

Interest in the regeneration of the Silver Hill area first arose in 2009, when a planning application was submitted to Winchester City Council and approved. The proposed works included residential and commercial development, as well as a new bus station. The developers of the 2009 scheme later lost financial backing, which resulted in the scheme not becoming active again until 2011.

Due to inquiries relating to the Compulsory Purchasing Order (CPO) undertaken by the council, the scheme was delayed and a new application was submitted in 2014 for review, which was thought to have better demonstrated the requirements of Winchester City. The IPG are now drafting a SPD which outlines the main objectives of the scheme, and any consequent changes to the surrounding area. The IPG meeting on the 8th November 2016 advised on technical studies that were required to produce a robust SPD, which have led to the FRA being commissioned by WCC.

3 Sources of Flooding

3.1 EA Fluvial Flood Map

The flood map indicates that the site lies within a mixture of fluvial flood zones 1, 2 and 3, indicating an annual probability of fluvial flooding ranging from >1% to <0.1%. The main fluvial risk emanates from the River Itchen, which lies approximately 40m to the east of the site boundary. As a result, the highest flood risk is found in central and eastern parts of the site, with parts of the sites west remaining in flood zone 1. The far east of the site also remains flood free. The area of highest flood risk is located in the central and eastern parts of the site and is therefore considered attributable to overland flow from the River Itchen upstream, and from channel conveyance exceedance at the small ditch which lies to the north east of the bus station. The EA flood map is displayed in Figure 3.

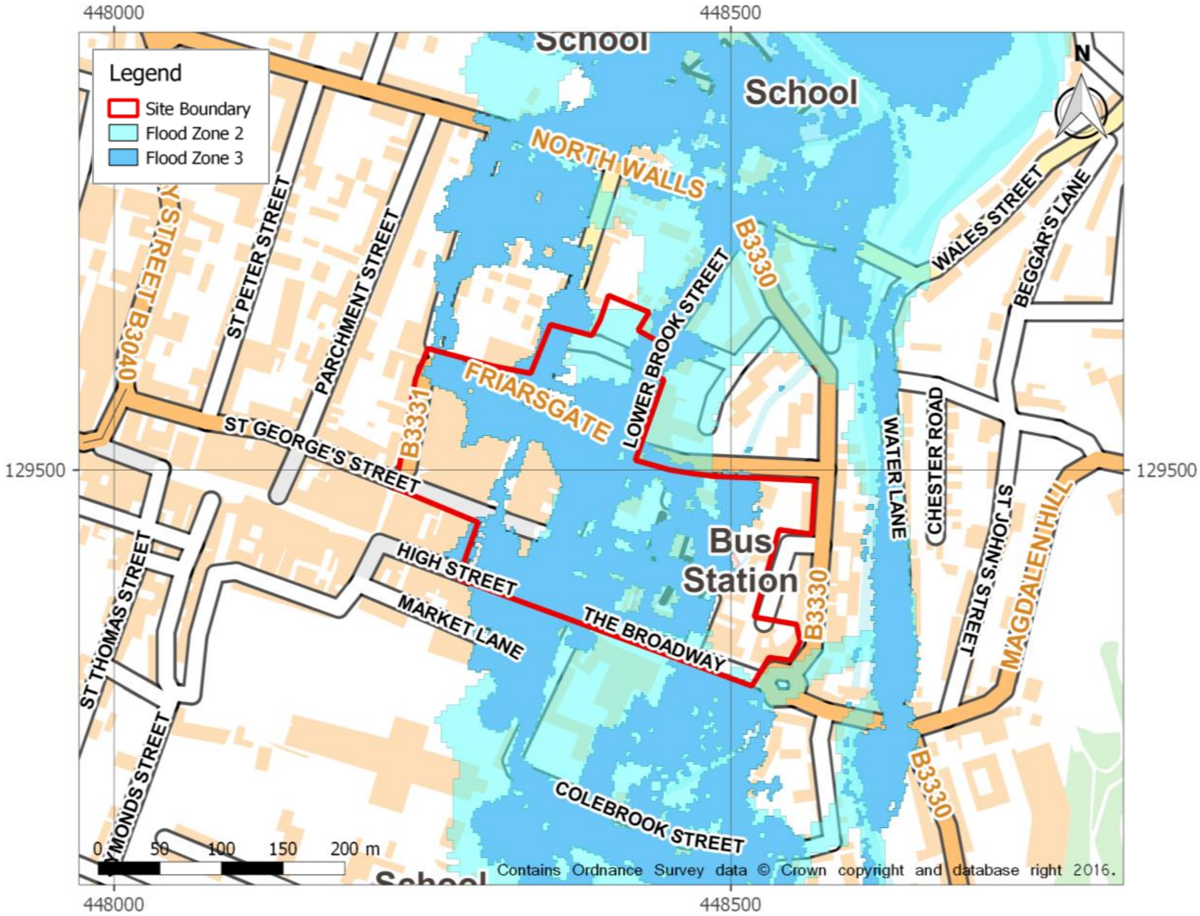


Figure 3 - EA fluvial flood map data

3.2 EA Surface Water Map

According to the EA surface water flood map, the risk of surface water flooding (also known as pluvial flooding) to the site ranges from the >3.3% to <0.1% annual event probability (AEP). The surface water flood pattern is fairly consistent with the topography evident in the LiDAR data, with depressions in the topography being at the highest risk of pluvial flooding. For example, the road networks through the site are more susceptible to flooding, such as Lower Brook Street and the High Street to the south. Figure 4 displays the EA surface water flood data.

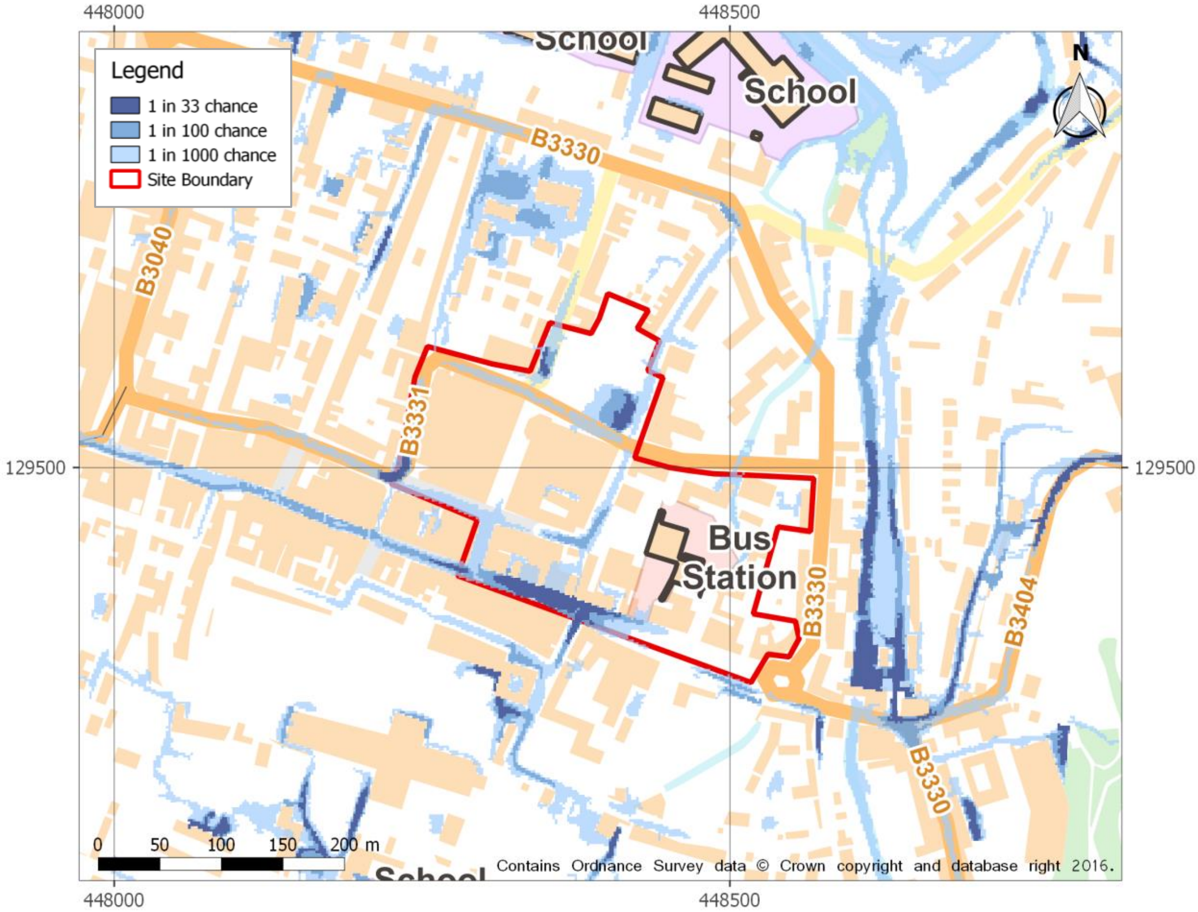


Figure 4 - EA surface water flood risk data

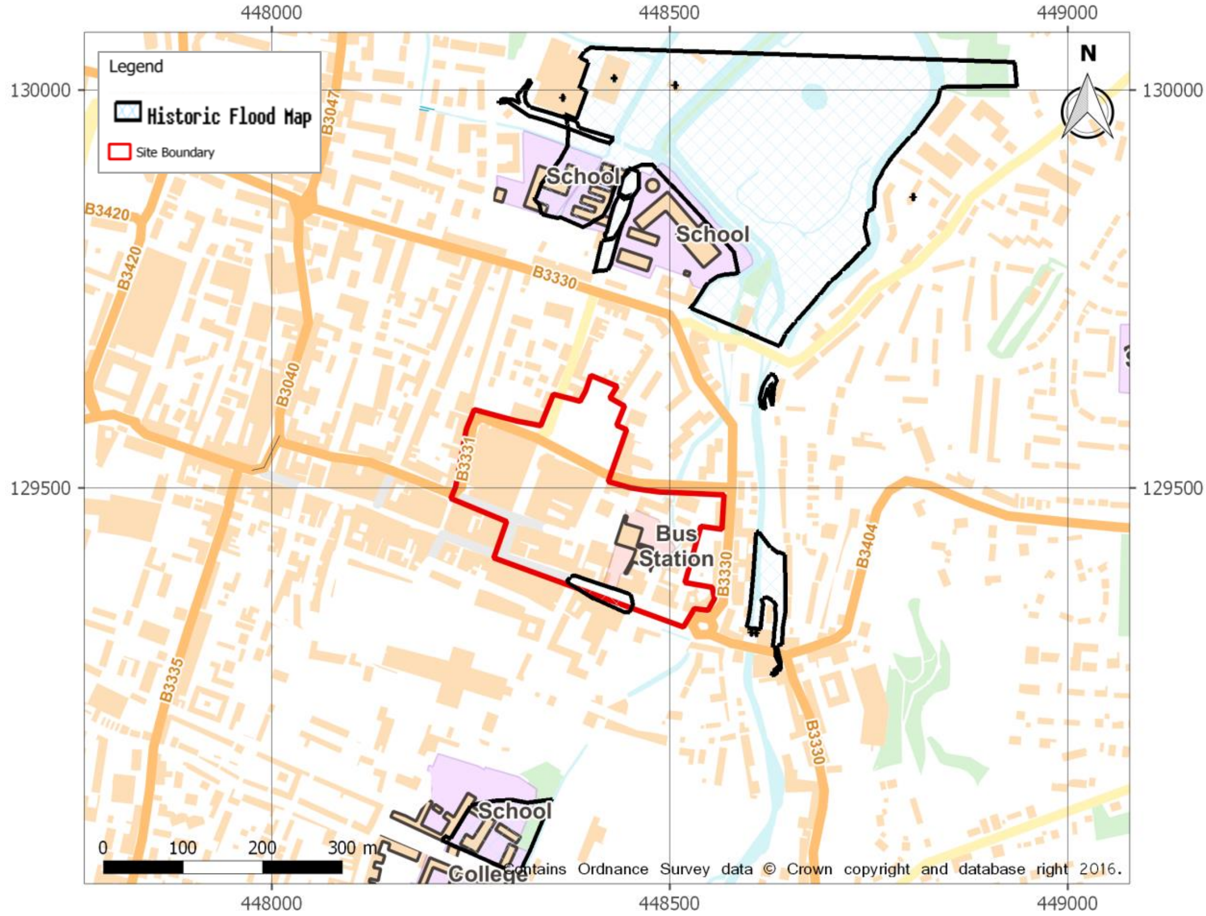
3.3 Historic Flooding

The historic flood map and recorded flood outlines were made available in GIS format by the EA. The Winchester City SFRA and Hampshire PFRA were also reviewed which provided useful historic flood information for the area. The main historic flood extent lies to the north of the site within the fluvial flood plain of the River Itchen. There is also a record of minor flooding to the east of site boundary, and a small section of recorded surface water flooding on the High Street to the south of the site. Both the SFRA and PFRA highlight the significance of the role groundwater has played in historic flood events, most notably in 2000/2001 and 2013/2014. Figure 5 displays the recorded flood outline data from the EA and Table 1 contains information on notable historic flood events.

Table 1 - Historic flooding information

Year of Flooding	Cause of Flooding
1916	Groundwater and fluvial flooding
1935	Groundwater and fluvial flooding
1965	Groundwater and fluvial flooding
Winter 2000-2001	High intensity rainfall leading to groundwater flooding
Winer 2013-2014	High intensity rainfall leading to groundwater flooding + highest flow ever recorded in the river Itchen (12.9m^3/s)

Figure 5 - EA Historic Flood Map



3.4 Groundwater Flooding

As mentioned in Section 3.3, several of the key documents reviewed for this study make reference to the area being susceptible to groundwater flooding. This was the major cause of flooding during the winter period 2000-2001. The flood mapping report[7] for the River Itchen completed by Halcrow, 2008, states that the 2000-2001 winter flood was one of the worst flooding incidents to date. Due to the significance of this flood event and the critical role of groundwater, the EA commissioned a detailed report[8] to detail this key mechanism of flooding. This report was obtained under the relevant licence from the Environment Agency.

It is reported that the flooding occurred due to a combination of overtopping of the River Itchen and exceptionally high groundwater levels. The flows observed in the River Itchen were estimated to be rarer than a 1 in 50-year event. However, when combined with the exceptionally high groundwater levels, the flood event was considered to be closer to a 1 in 200-year probability event, resulting in flooding of major road networks and Winchester Cathedral. It is likely that the unusually high groundwater levels were the result of the wettest year on record between April and March, 2000 to 2001.

Following liaison with the EA, their flooding summary document was obtained for the flooding of 2013/2014 (available as Appendix C). A review of this document indicated that the cause of flooding during the 2013/2014 event was due to the Hampshire area receiving nearly 3 times the average amount of winter rainfall. This led to exceptionally high groundwater levels, similar to the 2000/2001 flooding, resulting in the city centre of Winchester being flooded. In conjunction with this, the highest flow in the River Itchen ever recorded occurred in February 2014 (12.9m^3/s). Several properties reported internal flooding, with St Bede's School and Riverside Park leisure centre reporting drainage problems. In response to this, the EA have implemented mitigation measures to the North of the city in an attempt to hold back the flow and reduce flooding to Winchester City Centre.

3.5 2008 River Itchen Hydraulic Modelling Study

3.5.1 Background

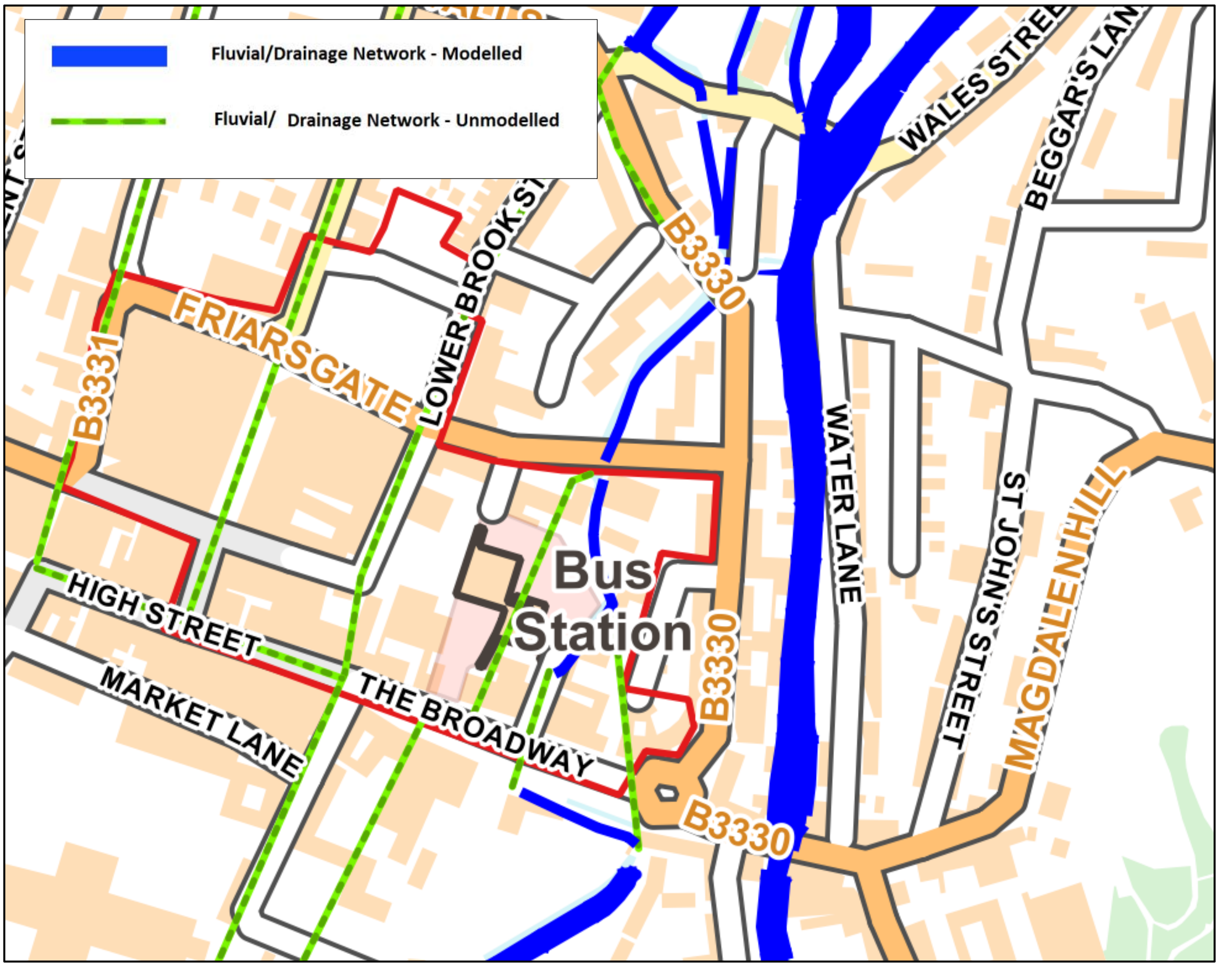
Halcrow Group Ltd were commissioned by the EA Southern Region in 2007 to undertake hydraulic modelling of the River Itchen for a flood mapping study of Winchester City. The model is in the form of a 1D/2D linked ISIS/TuFLOW model, and is the latest model data available for the area. The outputs from this study have informed the EA Flood Map and the current EA Flood Zones 2 and 3 are derived from the modelled flood extents. In order to inform this FRA document, the model and outputs were obtained from the EA under the relevant government licence to provide a more detailed analysis of fluvial flooding at the site.

The 2008 study also includes an updated hydrological assessment of peak flows for the River Itchen catchment. It is recommended that the original flood mapping report is read in addition to this report in order to gain a full understanding of the modelling approach. As part of the modelling exercise, simulations were carried out for the 2, 5, 10 25, 50 and 100-year return periods. The 100 year plus climate change scenario was also assessed by adding 20% to the model inflows. Sensitivity analysis was also carried out on the key model parameters including hydraulic roughness and boundary conditions.

This FRA has sought to summarise the 2008 model outputs below in order to highlight the key flood risk mechanisms and key flow routes.

Figure 6 illustrates the key watercourses and/or drainage networks which were modelled as part of the 2008 study, which are shown in the blue colours. The green line indicates those channels and drainage infrastructure not modelled as part of the same study.

Figure 6 – Mapped watercourses for the 2008 hydraulic modelling study



3.5.2 1 in 50-year event

During the 1 in 50-year fluvial event, flooding occurs around 4 hours into the design model run as a result of the overtopping of the drainage ditch north of the bus station within the site boundary. This overland flow path develops southwards towards The Broadway. The channel capacity of the channel immediately upstream of Busket Lane is exceeded and flood waters are shown to spill out of the channel here and spread along the southern boundary of the site. Flooding also enters the north of the site via Lower Brook Street, progressing southwards through Friarsgate before merging with the floodwaters from the drainage ditch west of the bus station. This flow route emanates from channel capacity exceedance at the culvert conveying the channel beneath the B3330/Durnsgate Place, which is modelled as a rectangular culvert. The main River Itchen channel capacity is also exceeded north of Park Place and the Winchester School of Art buildings, and overland flows subsequently flow southwards towards the site. Flood depths within the site boundary range from 10mm to circa 645mm. This area of deepest flooding is predicted across a small northern section of the study area at Lower Brook Street, which represents a small depression in the existing topography. The model outputs were interrogated using GIS software to obtain the maximum flood levels within the study area. Flood levels at the site range from 35.98 to 37.06mAOD for the 1 in 50 year return period. The flood depths and extents are displayed in Figure 7.

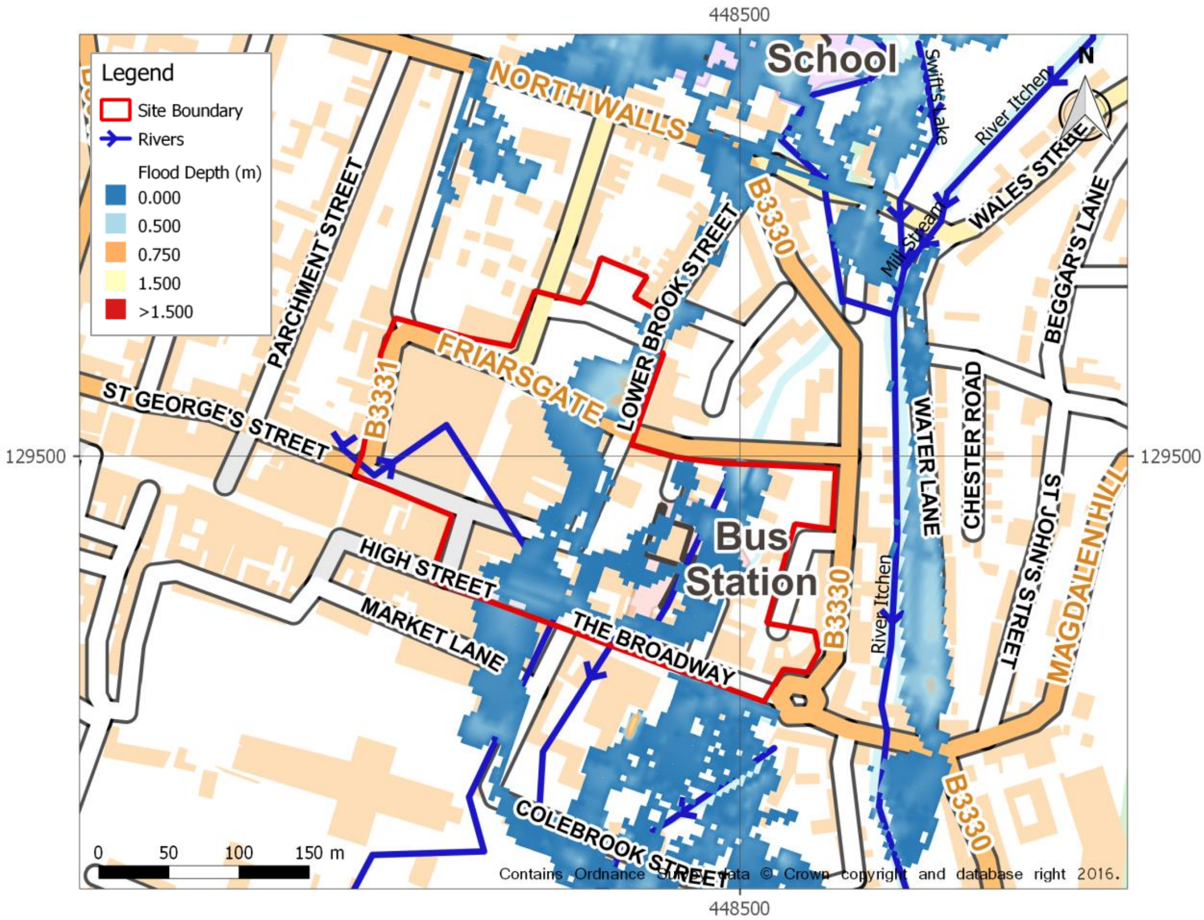


Figure 7 - 1 in 50-year max depth and extent

3.5.3 1 in 100-year event

The evolution of flooding within the study area is similar to that of the 1 in 50 year event. Key flow routes include the ditch to the north of the central bus station and Lower Brook Street to the North. Notably, more flooding occurs in the 100-year event around Friarsgate as well as the High Street in the south of the study area. Maximum flood depths around Lower Brook Street reach circa 795mm. The flood level grids were also interrogated, indicating that the maximum flood level predicted within the study area is 37.11mAOD. The peak flood depths and extents are displayed in Figure 8, and it can be seen that large areas of the study area are inundated by flood waters.

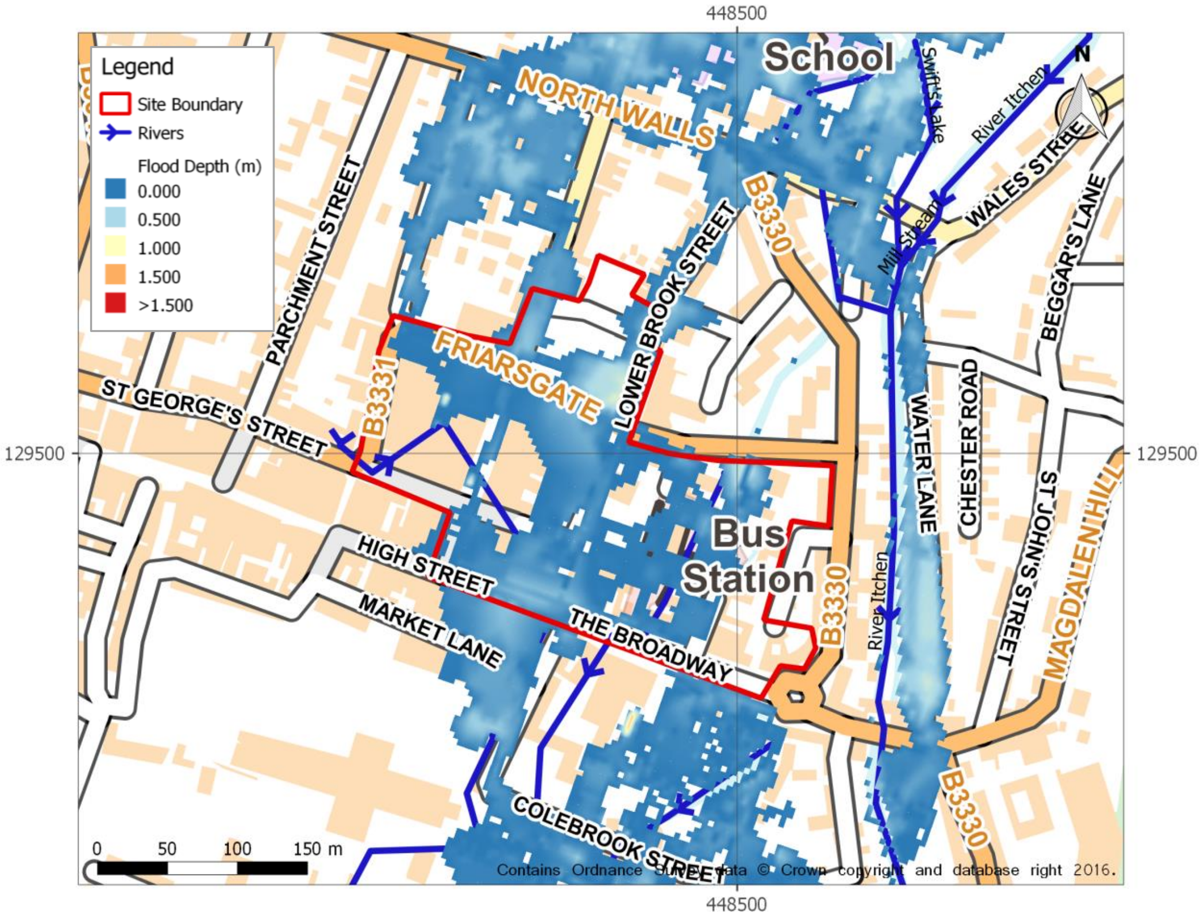


Figure 8 - 1 in 100-year max depth and extent

3.5.4 1 in 100-year plus 20% climate change

The 2008 modelling study applies a 20% increase to peak flows to account for climate change. This was in accordance with the climate change allowances at the time of the study. The evolution of flooding remains similar to the 1 in 100-year event. Notably, additional flood waters enter the site from the northwest, with a significant overland flow path developing in a southerly direction from North Walls to Friarsgate. The deepest flooding occurs around Lower Brook Street, as well as several deep spots south of Friarsgate. Peak flood levels have also been provided by the EA for the 100-year plus climate change scenario. These have been interrogated, and have provided a maximum flood level at the site of 37.15mAOD. The flood depths and extents are displayed in Figure 9. A flood map for this event has been produced, available in Appendix A.

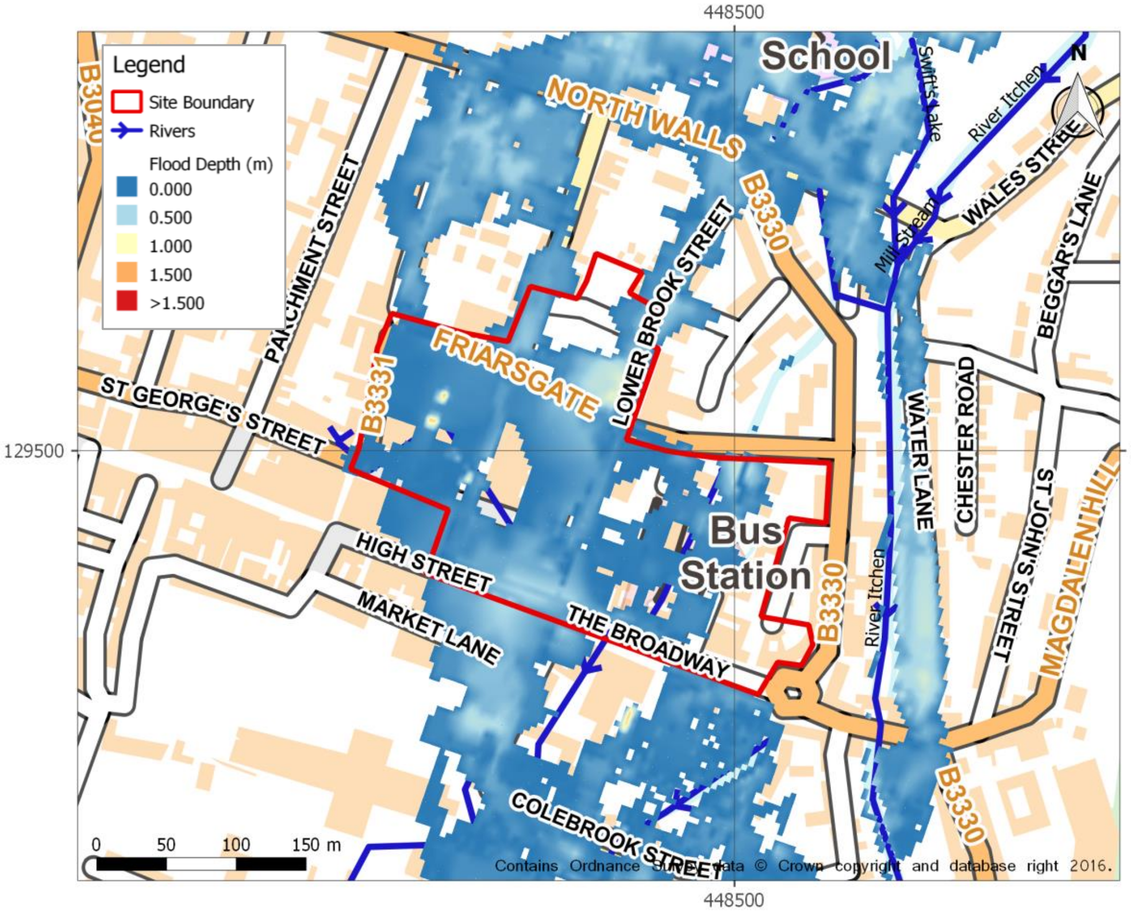


Figure 9 - 1 in 100yrCC max depth and extent

3.5.5 Key considerations for flood risk

The model outputs have identified that the flood mechanisms from the existing River Itchen network and associated drainage channels and infrastructure are complex, with interaction between a number of channels. Model outputs confirm that the study area is affected by floodwaters emanating from further upstream as a result of the river channel capacity being exceeded. This is combined with floodwaters spilling out of smaller tributaries as a result of insufficient capacity of culvert structures both off site and within the site boundary. The study area does not appear to serve as a significant storage area for floodwaters, and peak flood depths are generally shallow at 200-300mm during the 1 in 1000 year event.

It is clear that future development of the study area will need to account for the key flow paths, as highlighted in Figure 9 below, and perhaps consider the vulnerability of existing structures with regard to conveyance capacity and potential for blockages. A review of the maximum flood hazard ratings across the site has been calculated for the 1 in 100 year plus climate change event. The resultant output is shown in drawing WHS1483_T01_005, included in Appendix A. This illustrates the areas of 'Low' hazard (i.e hazard rating below 0.75) as set out in the DEFRA flood hazard guidance. The hazard rating is calculated using the model outputs for depth and velocity. It can be seen that the majority of the site remains as a 'Low' hazard during this scenario. It is recommended that no development is proposed where the hazard rating is show to exceed 0.75.

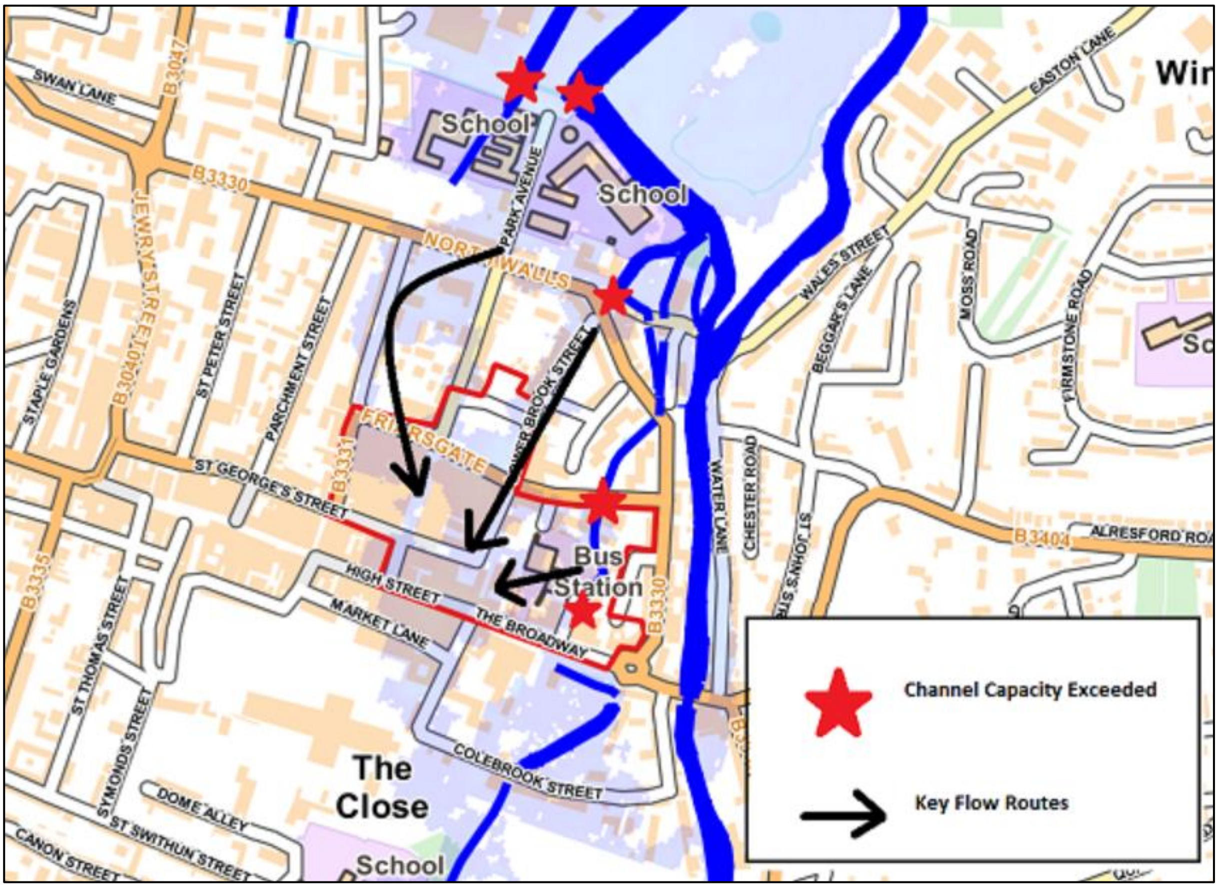


Figure 10 – Key Flood Risk Mechanisms

3.6 Winchester and River Itchen Flood Defences/Flood Alleviation Scheme

The current EA flood map does not show that any formal defences are present in Winchester. This is reflected by the fact that no areas in central Winchester are shown to be benefitting from flood defences. Despite this however, it is understood that flood protection has been and is being implemented as part of a flood alleviation scheme following the flooding of 2013/2014.

Winchester City Council have been working with the LLFA (Hampshire County Council) and the EA to implement a “dwarf” wall along Water Lane. The objective of this is to replicate the former sandbag wall in this location that was erected following the flooding in 2014. The wall is approximately 400-500mm high and stretches for some 171 metres along Water Lane. The highway drainage in the area has also been altered to prevent water backing up from the river Itchen onto the road. It is hoped that this scheme will reduce the flood risk to the surrounding properties during any future flood event.

The north Winchester flood alleviation scheme is also being implemented along Park Avenue. This scheme aims to protect the River Park Leisure Centre, St Bedes CE Primary School, the University Of Southampton School Of Art, residential properties in Park Road, and reduce the risk of flooding in other residential streets such as Middlebrook Street, Upper Brook Street and the High Street. Park Avenue is also one of the main overland flow routes that lead to the site. Therefore, this scheme may reduce the flood extents around the central Winchester Regeneration area. All three phases of the works are hoping to be completed by the end of March, 2017. They include:

- A flood barrier wall at Park Avenue.
- Improvements to the sleeper wall, north of the Rotunda Building.
- Additional drainage improvements.
- Permanent piles and capping beams around St Bedes School Bridge.

It is recommended that any future modelling of the River Itchen through Winchester be updated to incorporate these works. This will provide a more representative assessment of flood risk and allow the areas benefiting from defences to be quantified as well as confirm the standard of protection afforded by the new defences.

3.7 Functional Floodplain

Review of the 2007 SFRA report confirms that at the time of reporting, there was insufficient modelling work and/or historical data to determine the functional floodplain. Therefore, a precautionary principle was adopted where it was assumed that Zone 3B covers all of Zone 3. This has implications for development planning, in that only water compatible and essential infrastructure land uses are permitted in Zone 3B. Therefore, the SFRA recommended that where the Sequential Test led to a more vulnerable development being considered for a Zone 3 area, an Exception Test should be applied with a more detailed Level 2 assessment to distinguish between Zones 3A and 3B.

The Functional Flood Zone is commonly defined as the predicted 1 in 20 year flood extent. This is not available from the existing dataset. Therefore, it is recommended that modelling be undertaken to define the Functional Floodplain. This will provide a much more refined understanding of flood risk for the study area, and will ensure that development of existing areas is not restricted due to overly conservative flood zone mapping.

3.8 Limitations of the Existing Data

Whilst the 2008 Halcrow model has been formally accepted by the EA and subsequently used to derive Flood Zone 2 and 3 for the EA Flood Map, it must be recognised that there have been notable updates and improvements to the methodologies and techniques used to calculate peak flows and model flood risk since 2008. These have been summarised below, together with recommendations on how the existing information can be updated to provide a more up to date understanding of flood risk through the Winchester Central Area:

- Topography and Survey Data – An up to date topographic survey of the regeneration area incorporated into a hydraulic model will provide a refined understanding of flood risk to the site. The existing hydraulic model is also based on a river channel survey undertaken in 1996. It is understood that, at the time of writing this report, the EA have just completed a detailed river channel survey for the River Itchen and associated tributaries. It is recommended that this data be used to inform an updated hydraulic modelling assessment.
- FEH and ReFH – Improvements have since been made to the method of predicting peak flows. The FEH web service has since been released, as well as ReFH Version 2 and WINFAP version 4.0. These software updates both contain updated methods for calculating peak flows and are considered industry standard by the EA. The notable flood event in 2013-2014 will also have affected the estimate of QMED since the previous hydrology assessment.
- Climate Change Allowances - As of February 2016, the climate change allowances for England have been updated. The guidance now specifies that a River Basin District approach is taken when considering climate change. The appropriate climate change allowances for the River Itchen are shown in Table 2. The area of interest lies within the south-east river basin district, with advised

climate change additions ranging from 35% to 45% for the central and higher central allowances respectively.

Table 2 – Climate Change Allowances

River Basin District	Allowance category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
South East	Upper End	25%	50%	105%
	Higher Central	15%	30%	45%
	Central	10%	20%	35%

- Modelling Software – Updates in modelling software have also occurred, with TuFLOW version 2016 and Flood Modeller Pro being released. These contain updates to the methods to which structures are represented, which may have an effect on design flood levels.

In addition, the model runs have not simulated the 1000-year return period. Whilst there is no strict planning policy regarding the 1000-year event, it can be useful to consider to provide a robust analysis of residual flood risk. In the absence of the modelled 1 in 1000 year fluvial event, Flood Zone 2 for the central Winchester area is defined by the 2004 National Flood Mapping study.

3.9 Future Work

Liaison with the EA has confirmed that the EA Flood Map for the River Itchen through Winchester is based on a combination of detailed ISIS-TuFlow modelling from 2008 and generalised JFLOW modelling undertaken in 2004. However, hydraulic modelling is due to be updated with a new River Itchen catchment-wide model which will be used to inform and update the EA Flood Map in late 2017. As part of this, there is a detailed river channel survey currently being undertaken at the time of writing this document. This will include an updated detailed analysis of the River Itchen catchment, a brand new catchment-wide hydraulic model using new river channel survey data and the latest model software build. This future work will also incorporate the Flood Alleviation Scheme which serves the Winchester City area.

This updated modelling will also help to determine the Functional Floodplain. The functional floodplain is typically determined by the 1 in 20yr flood extents, and is referred to as flood zone 3b according to the NPPF and its associated technical guidance. The functional floodplain is referred to as an area where water must be stored or conveyed during flood events, and therefore only essential infrastructure and water compatible infrastructure is permitted. The derivation of flood zone 3b will hence dictate where future development within the site boundary will not be permitted in accordance with NPPF guidance.

4 Flood Risk Assessment

4.1 Planning Policy Requirements

The Central Winchester Regeneration Area comprises a brownfield area of circa 2.3ha. The existing EA Flood Zone data indicates that the study area comprises Flood Zones 1, 2 and 3. The current land uses within the study area comprise a mixture of residential development and commercial and public use development. According to Table 2 within the technical guidance for the NPPF, residential development is classified as 'more vulnerable' and commercial development is classified as 'less vulnerable' in terms of flood risk. Guidance is provided in Table 3 of the technical guidance to the NPPF regarding which development vulnerability classes are permitted in each EA flood zone. This guidance is replicated in Table 3. The vulnerability classification and associated flood zone designation also determine the criteria which must be satisfied before any proposed development can be approved.

Table 3 - Flood zone compatibility

Flood Risk Vulnerability	Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone					
1	√	√	√	√	√
2	√	√	**Exception test required**	√	√
3a	**Exception test required**	√	**X**	**Exception test required**	√
3b	**Exception test required**	√	**X**	**X**	**X**

It is clear then that all flood risk sources should be considered when planning future development within the study area. This FRA has highlighted the key flood mechanisms and overland flow routes through the area. Parts of the site are affected by flooding even during the 1 in 50-year probability event. Consideration should be given to the maximum flood depths, velocities and hazard rating to ensure that the area is developed appropriately. For instance, it would not be appropriate to develop areas where floodwaters are shown to be deepest for more vulnerable land uses. The potential consequences of flooding can be increased by either changing the existing land use to a more vulnerable category, or increasing the number of people within the flood risk area without appropriate mitigation.

As parts of the study area lie within the current flood risk zone 2 and 3, a site-specific flood risk assessment will be required, and the site must pass the exception test, demonstrating and justifying the requirement for development. As set out in the NPPF, all planning applications within flood risk zones 2 or 3 should only be considered if accompanied by a flood risk assessment that fulfils the requirements of the NPPF. The flood risk assessment is expected to "identify and assess the risks of all forms of flooding to and from the development and demonstrate how these flood risks will be managed so that the development remains safe throughout its lifetime".

A level 1 FRA (scoping study) is likely to include the following as a minimum:

- Qualitative assessment of flood risk from all potential sources.
- Any known surface water/flood risk issues.
- Consider the residual flood risk.
- Utilization of the SFRA for the area.

4.2 Justification for Development

Flood risk management is a clear consideration for the local planning authority due to the proximity of Winchester to the River Itchen, as well as the history of flooding in the area. The area of the floodplain is heavily urbanised, indicating that flood risk, particularly fluvial, is a main priority for Winchester City Council.

The regeneration area lies within the heavily urbanised city centre of Winchester, which already includes a mixture of residential and commercial development. Therefore, the plans to regenerate the area involve no change to the broader flood risk vulnerability classification. Given the nature of the existing land use, it is understood that existing drainage networks are in place which attenuate both foul and surface water. Planning consent for the development has also been granted during 2009 and again in 2014, suggesting that the principles of development have been agreed in the past.

Notably, the site has been highlighted in the Winchester City Council local plan, and is believed to be in the best interest for the people of Winchester. Regeneration has been sought after by the council since the late 1990's, to improve both the residential and commercial opportunities throughout the Silver Hill area. The plans also include a new bus station and associated facilities for the area. It is considered that the regeneration will benefit the local population, improving both the aesthetics and social opportunities in the city of Winchester. The revised scheme also plans to create a city centre community, with the opportunity for higher quality but affordable residential development suitable for families.

4.3 Potential Flooding Mechanisms

As stated in Section 102 of the NPPF, a site-specific FRA must demonstrate that the development can be safe from flooding during its lifetime. In this case, a design life of 100 years has been considered, indicating that the design event for the development is the 100-year return period plus the effects of climate change.

The main flood mechanism to the site is considered to be fluvial from the River Itchen. This has been supported by the analysis of the hydraulic model outputs from the currently available data, which originates from the 2008 hydraulic modelling study. The available model outputs indicate that for the 100yr+CC event, a maximum flood level within the site boundary is predicted to be 37.15mAOD, which is shown to inundate parts of the existing site. This event is considered to be the most critical for the planning of any future development, as the threshold of flooding for commercial residential properties is 1%, including the impacts of climate change. The main mechanism of flooding is from overland flow paths from the north.

Whilst the fluvial design event is the most critical issue to consider in the planning process, the effects of surface water flooding and groundwater flooding should be considered given the history of flooding within the vicinity of the site.

Notwithstanding the above, it is noted that the EA are intending to carry out an updated hydraulic modelling study of the River Itchen Catchment and associated tributaries, with completion scheduled for late 2017. This study will also incorporate an updated river channel survey, and a detailed hydrological analysis of the catchment using the latest FEH and REFH techniques and methodologies. It will also include the flood defence works currently being constructed. The outputs of this study will provide a more refined understanding of flood risk within the study area, including updated peak flood depths, levels, velocities and hazard ratings. It is recommended that any future development of the area uses this up to date data to quantify the food risk within the boundary of the regeneration area.

As part of this assessment, the study area has been crudely divided into the main landuse types. This is shown in Figure 11 below. Area No. 1 is currently open land utilised as a car park for the City Centre. Areas No. 2-5 consist of existing commercial development; Area No. 6 is a Surgery; Area No. 7 is currently vacant commercial buildings; and Area No. 8 is utilised as the Bus Station. Also shown in Figure 11 is the modelled flood extent for the 1 in 100 year plus climate change scenario. The range of predicted flood depths within each Area is provided in Table 4.

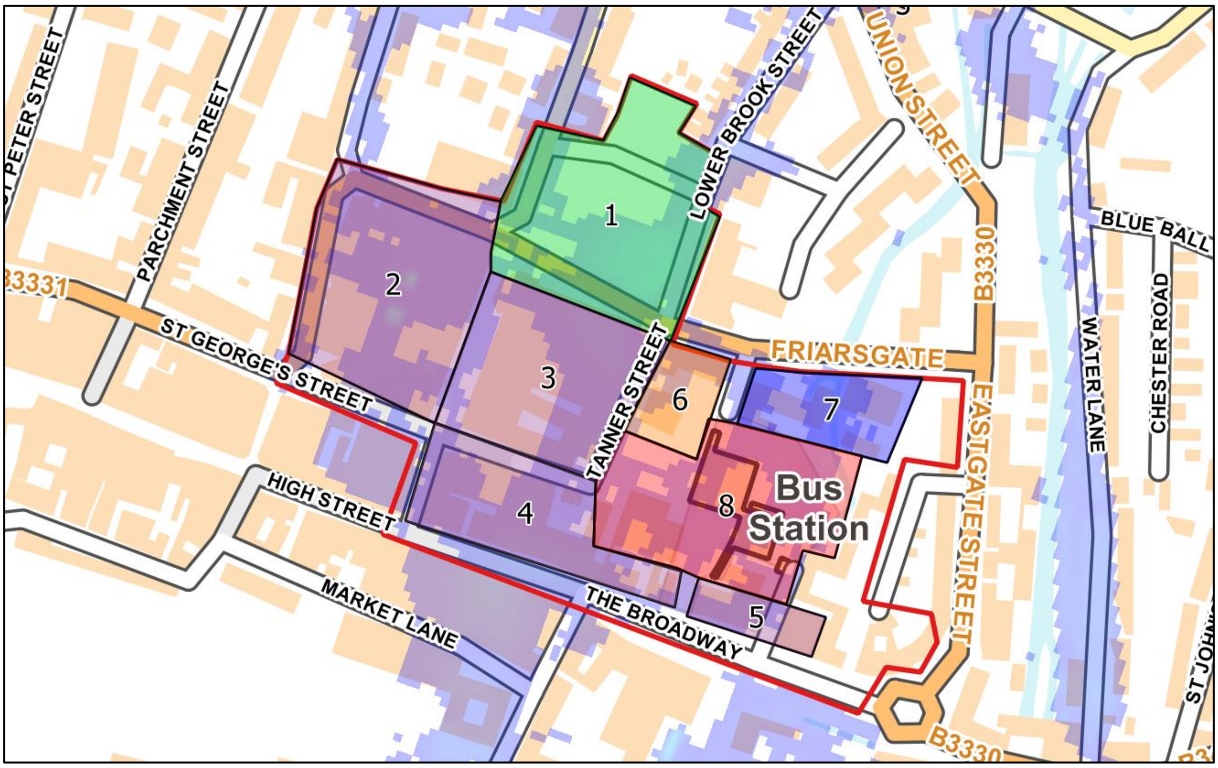


Figure 11 – Landuse types within study area

Due to the existing commercial use of Area Nos. 2-5, then these areas can be retained as commercial use, which is classified as 'less vulnerable' development in terms of flood risk. Area No. 1, which is currently open car park, exhibits the area of greatest flood depths, and measures could be taken to try and manage floodwaters within this area. Area No. 7 and Area No. 8 provide an opportunity to open up the culverted section at this point and manage overland flows emanating from this section of watercourse. If this can be achieved, it is considered that the central Area No. 8 could be developed for either commercial and/or mixed use (including residential use). Area No. 6 exhibits a low risk of flooding, with minimal depths predicted during the 1 in 100 year +CC event. Therefore, residential and/or commercial development in this area is likely to be possible. It should be noted however that all proposed development will need to demonstrate compliance with the requirements set out in the NPPF and it is recommended that updated hydraulic modelling is carried out in order to quantify the risk of flooding and any possible detrimental impacts.

Table 4 – Predicted flood depths for each identified Area within study area

Area No.	Range of modelled flood depths (m)
1	0.01-0.75m
2	<0.1m, with 2 small areas of localised deep flooding of 1.1m. These deeper areas are in the middle of an existing building and are not thought to be representative
3	0.01-0.20m
4	0.01-0.30m
5	0.01-0.07m
6	<0.01m
7	0.01-0.50m
8	0.01-0.18m

4.4 Proposed Mitigation Measures

The model output data used to inform this FRA indicates that some flooding occurs within the area of interest during the design flood event. In addition to this, the EA flood maps confirm that parts of the regeneration area lie within flood zone 3a i.e. an annual probability of flooding greater than 1%. For any new build future development, it is recommended that finished floor levels are raised out of the design event flood zone, plus a freeboard to be agreed with the LLFA/EA. This approach would ensure that any new build development remains flood free during the design event, therefore being compliant with NPPF flood risk guidance.

Whilst it is critical to ensure that future development remains flood free, it is equally as important to safeguard against any 3rd party impacts on flood risk. This is required if proposed development is to pass the exception test. This can be achieved by taking measures through the layout and form of the development to ensure that flood risk is not increased elsewhere, or, if required, to provide an agreed level of betterment. This can be done by modifying ground levels either on or off site to provide compensatory floodplain storage, and/or to retain key flood flow routes. Again, it is recommended that the latest modelling be used to quantify these key flow paths and storage requirements. It is clear that any future development of the area will need to retain key flow routes emanating from the existing channel to the north east and from the north. For the purpose of this Level 1 assessment, a list of potential mitigation options has been developed in Table 5.

Table 5 - List of potential mitigation options

Potential mitigation option	Suitability/comments
Opening up of the river channel to the east of the bus station to increase capacity	Opening up of watercourses is in accordance with EA policy and may enhance the amenity value; Must ensure flood risk is not increased downstream
Ground modifications within the site to channel overland flows using road network and/or relief channels	Must ensure no third party detriment, and that peak flood depths and velocities do not create dangerous access/egress routes.
Flood storage upstream, north of Swifts Lake	Could provide a significant betterment for much of Winchester Central area Will require further quantitative assessment to ensure benefits outweigh costs;
Compensatory storage downstream south of Colebrook Street	Will require quantitative hydraulic assessment to ensure sufficient volume can be achieved
Construction of flood resilient development	Incorporate flood resilience measures into development to reduce impact of flooding and ensure that flood risk is managed to an acceptable level

4.5 Residual Flood Risk

Residual flood risk refers to the risk of flooding post implementation of any flood risk mitigation measures. As advised by Section 103 of the NPPF, residual risk should form a critical component of all FRA's. Beyond the design event, the site is expected to flood in the extreme fluvial event. However, even with adequate flood mitigation measures in place, it may still not be sensible to allow higher vulnerability development to take place. It is considered prudent to demonstrate that any residual risks can be managed effectively, and this can be achieved by adopting a combination of the following approaches:

- Flood warning systems and evacuation plans.
- Flood resistant development.
- Flood resilient development.
- Secondary flood defences.
- Safeguarding flood access/egress routes.

4.5.1 Flood warning systems and evacuation plans

Whilst residual risk is imminent in the centre of Winchester due to its proximity to the River Itchen, it is important to demonstrate that this risk can be appropriately managed. One of the ways in which this can be achieved is through the implementation of an efficient flood warning system in combination with an adequate evacuation plan. Whilst this approach does not directly influence the economic damages caused by flooding, it remains prudent to ensure the risk to life is minimal which can be an issue particularly in the extreme fluvial event.

Flood warning systems are generally provided by the EA/LLFA. They form a critical component of residual risk management, as the time to peak hazard during residual flooding is often short, particularly for areas near existing flood defences. It is recommended that any future development implements an adequate flood warning system and evacuation plan, so that residents/local people are well informed on what steps to take when residual risk occurs. The EA has a duty to warn the public on river banks overtopping 2 hours before it occurs, and it is recommended that all local residents sign up to Flood Warnings Direct (FWD). This is a multimedia system that can issue flood warnings over text, phone or email.

4.5.2 Flood resistant/resilient development

Flood resistance refers to reducing the amount of the flooding that encroaches properties by taking the implementation of food resistance measures such as flood gates and waterproof coatings on buildings. This is related to the design of particular properties, and is generally the responsibility of individual property/landowners. However, in some larger scale flood prone areas, funding may be provided given a sufficient business case is made.

Flood resilience differs from flood resistance in that to a certain extent flooding is accepted, but measures are taken within a specific development to reduce the consequences of that flooding through the internal layout and design. The purpose of this is to reduce the time it takes to recover after flooding has occurred. This can be achieved by simple methods such as using tiled flooring which can be easily cleaned after flood events, or by raising electrical sockets and circuits to decrease any resulting damage. It is recommended that any future development at high risk explores these options to appropriately manage residual risk.

4.5.3 Access/Egress

As stated in paragraph 103 of the NPPF, any future development should demonstrate that dry access/egress is achievable for the design flood event. This will ensure that risk to life is kept to a minimum which may be necessary, particularly during higher return period events. An important factor to consider when deciding on principal access/egress routes is that flood hazard rating. This is the product of the flood velocities and depths plus an appropriate debris factor. This is useful as it determines the direct risk to people, with a study by DEFRA classifying the hazard ratings and their implications. These are displayed in Table 6.

Table 6 - DEFRA flood hazard guidance

Flood Hazard Rating	Degree of Hazard	Implication
0.00 to 0.75	Low	Caution: Shallow flowing waters or deep standing water
0.75 to 1.25	Moderate	Danger for some e.g. small children: Deep or fast flowing water
1.25 to 2.50	Significant	Danger for most: Flood zone with deep and fast flowing water
>2.50	Extreme	Danger for all: Flood zone with extremely deep and fast flowing water

It is important to ensure that access/egress routes are located with the lowest hazard rating possible beyond the design flood event. Therefore, the principal access/egress routes which serve the regeneration area have been assessed in light of the best available data. The resultant flood hazard map for the design event (1 in 100yr+CC) is displayed in Figure 12.

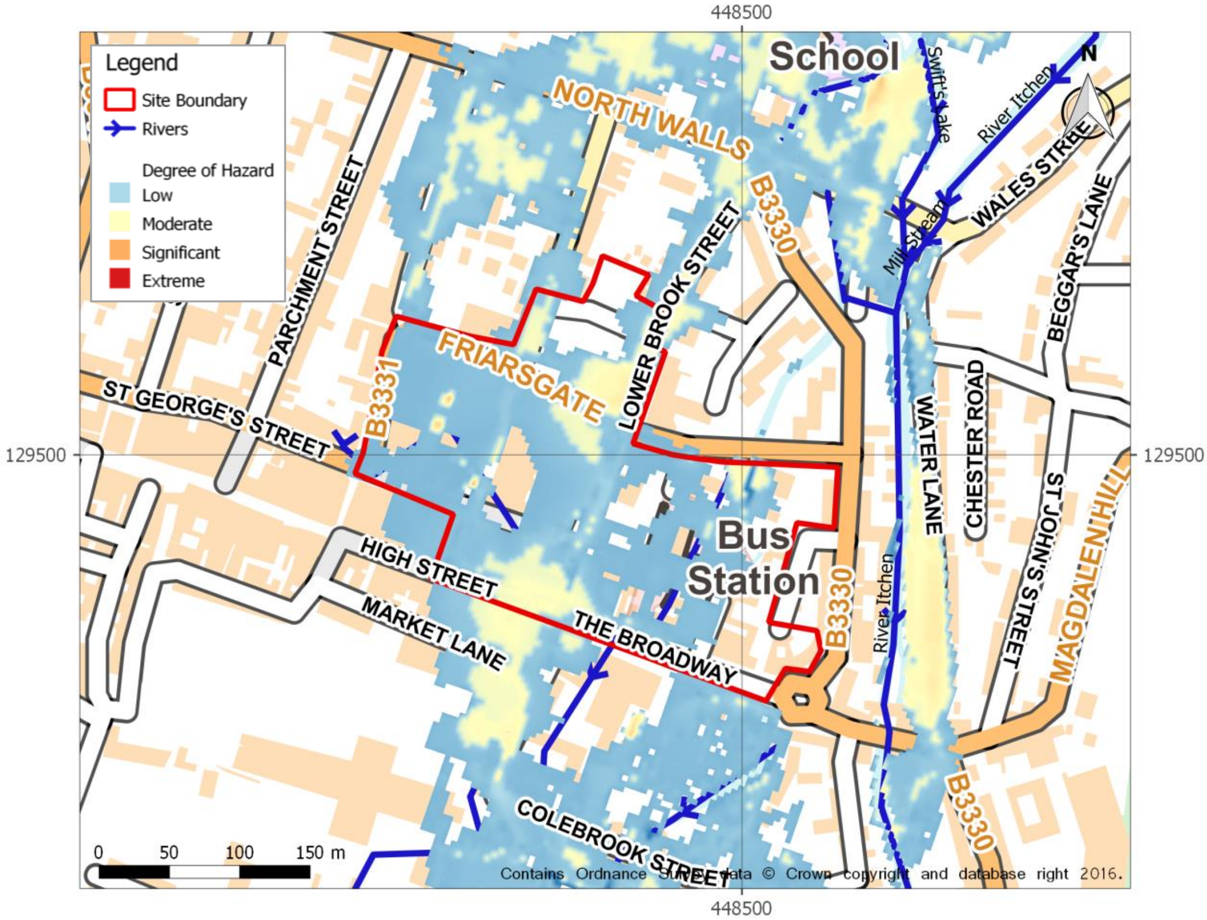


Figure 12 - 100yrCC max hazard

With reference to Figure 12, the obvious access route would appear to be to the east of the site onto the B3330 which remains flood free for the design event. It is therefore recommended that this route is utilized when possible, and that any future development recognises the importance of safeguarding access/egress routes in times of flooding. Roadways within the study area are affected by floodwaters, albeit at hazard ratings generally classified as 'Low'. Careful consideration will need to be given to the proposed landuse and layout to ensure that a safe access route is maintained.

4.6 Disposal of surface water

As stated in Paragraph 100 of the NPPF, it is crucial to ensure that development within the floodplain does not increase flood risk elsewhere. One of the main methods to address this is through the implementation of appropriate Sustainable Drainage Systems (SuDS) that will manage any increase in run off that has occurred due to an increase in impermeable area. Due to the existing area being heavily urbanised, the increase in impermeable area is not expected to be significant. However, this will have to be further investigated during the detailed design stage to ensure that any future infrastructure adheres to the requirements of the NPPF. This FRA will therefore recommend potential ways in which surface water run off can be managed, and reference any possible steps necessary for their implementation.

4.6.1 Hierarchy of SuDS Strategies

A widely-recognised requirement for development is that the pre-development run off rates should be maintained i.e. post development rates need to be effectively managed to ensure that flood risk is not increased downstream, as increased run-off rates will result in a flashier hydrograph during storm periods.

To ensure that surface water run-off from the site does not increase flood risk downstream, the application of SuDS strategies has been assessed using a sequential approach, in line with the latest relevant guidance. This refers to a "SuDS hierarchy" which outlines the preferred methods of run-off management, however these may differ per each individual site. The following options were considered for the development in order of preference:

- **Infiltration systems –** Surface water is drained into an infiltration device where suitable ground conditions prevail.
- **Attenuated discharge to water course –** Surface water run-off is attenuated and discharged into an existing watercourse at a controlled run-off rate.
- **Attenuated discharge to a sewer –** Where the above is not favourable, surface water should be discharged into a sewer at a controlled rate.

4.6.2 Infiltration SuDS

The method of infiltration is generally the most sustainable solution, and is the preferred option throughout the site. A review of the LiDAR data indicates that the site's topography is relatively flat, which should allow sufficient infiltration into the subsoil, providing that the ground within the area of interest is permeable.

A brief review of BGS borehole data indicates that infiltration may be possible. There are several boreholes within the vicinity of the site of varying age which reference sandy soils and organic clay/chalk compounds. However, given the history of groundwater flooding within the area, infiltration may not be possible due to high water tables. This however will be determined during the detailed design stage, whereby the viability of infiltration at the site will be determined by a ground investigation. It also recommended that a geotechnical investigation takes place to assess soil permeability and infiltration rates. This will confirm whether or not infiltration will be the way forward in terms of a SuDS strategy for the site.

If the viability of infiltration SuDS is confirmed, a certain level of pre-treatment will need to be incorporated into their design to avoid contamination of groundwater. Permission may also need to be sought from private landowners should the infiltration system cross and land owner boundaries.

4.6.3 Attenuated discharge to a watercourse

Due to the viability of infiltration not being confirmed at this stage, it is necessary to qualitatively assess the role that watercourses can play in the sustainable drainage of the site. Review of the LiDAR data has indicated that there is an existing watercourse within the site boundary to the north of the bus station. This may provide a means of capturing any run-off from the site, however, the viability of this will need to be confirmed with the appropriate calculations at the detailed design stage.

The site is also located approximately 40m west of the main river Itchen. However, the discharge would need to be conveyed under Eastgate Street and the adjacent infrastructure to the east. Therefore, if this option was to be considered, the relevant land owners permission would be required.

4.6.4 Attenuated discharge to a sewer

As the practicality of the preceding SuDS solutions cannot be verified at this stage, the possibility of discharging runoff into a surface water, or combined sewer is evaluated.

The preferred option would be to discharge surface water run-off into a surface water sewer. Within the context of the site, there is likely to be multiple connection points. A copy of the Southern Water Sewer plans for the site were obtained for the study and reviewed (available in Appendix B). These indicate that there is an existing surface water drainage network in place to attenuate run off from the current development. This is located around the south of the site, around Busket Lane, The Broadway and the Silver Hill area. A surface water network also runs along Eastgate Street to the east.

The alternative is to discharge surface water run-off into a combined sewer. The sewer plans show that there is an existing network in place at the site which runs parallel to Eastgate Street. However, this is to be considered as a last resort only, and may involve further hydraulic assessment.

Liaison with Mike Tomlinson from Southern Water suggests that there are no known capacity issues with regards to surface water or combined sewers at the site during the last 5 years. A copy of hydraulic overload data was obtained for the last 5 years at the site to inform this FRA, which indicated that there have been no reported capacity issues in either surface water or combined sewers. This data is included in Appendix B. However, a capacity check and quantitative assessment will likely be required for any future development at the detailed design stage to confirm that there is scope to discharge surface water into the existing drainage network.

4.6.5 SuDS Design Criteria

The criteria for SuDS design at the site has been reviewed in line with the non-statutory technical guidance for SuDS. It is recommended that the following is complied with at the detailed design stage of any SuDS techniques to be incorporated into the development design:

Peak Flow Control

- **S3.** The peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100-year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.

Volume Control

- **S5.** The runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6-hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event.

- **S6.** Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer, or surface water body in accordance with the above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.

Flood Risk Within the Development

- **S7.** The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30-year rainfall event.

- **S8.** The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100-year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.

- **S9.** The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100 year rainfall event are managed in exceedance routes that minimise the risks to people and property.

More specifically for soakaways and infiltration SuDS the following criteria should be used in detailed design:

- Any infiltration SuDS infrastructure should be designed for the 1 in 30-year rainfall event.

- Infiltration testing of the soils should be carried out in accordance with BRE Digest 365.

- The base of any infiltration structure should be at least 1m from the groundwater table and 5m from any building foundations.

5 Foul Water Drainage

A review of the existing drainage arrangement at the site indicates that there is an extensive foul drainage network in place to manage the foul water from the existing developments. These networks are located around Tanner Street, Middle Brook Street, The Broadway and Eastgate Street. To complete a high-level assessment of the foul water drainage capacity at the site, the reported incident data supplied by Southern Water was utilized. The data indicates that there have been 3 reported cases of foul capacity issues within the last 5 years. These are summarised below in Table 7.

Table 7 - Southern water reported issues

Location (Grid ref)	Sewer Type	Description/Problem
SU48290 29549	Foul	Hydraulic overload
SU 48356 29437	Foul	Hydraulic overload
SU 48430 29402	Foul	Hydraulic overload

This dataset suggests that a quantitative assessment will be required at the detailed design stage for any future development within the site boundary. This will ensure that all foul water can be drained and managed sufficiently within the existing network. If this is not the case, then it is possible that an improvement to the sewer capacity may be appropriate. It is recommended that if any subsequent sewer adoption is required that all sewers must be designed and built in accordance with the requirements of Sewers for Adoption, Edition 7 (WRc 2012). This document provides guidance on suitable return periods for use in the design of sewerage systems for various development types.

It is recommended that the local sewerage undertaker, Southern Water, is consulted at the earliest possible opportunity as part of any development proposals.

6 Conclusions and Recommendations

The following key points are considered to influence future development proposals at the site:

- The study area is designated as a mixture of all EA flood zones, indicating that the probability of flooding ranges from <0.1% to >1%.

- Parts of the site are also at risk of surface water flooding as shown by the EA detailed surface water flood risk maps.

- Historic flood data highlights the role of groundwater flooding in the Winchester area.

- The worst cases of flooding to date occurred in winter 2000/2001 and winter 2013/2014, where flooding was a result of a combination of high groundwater levels and overtopping of the River Itchen.

- The drainage ditch to the north of the bus station is liable to flooding, and provides the principal route of flooding into the study area.

- Areas most susceptible to flooding include the bus station, Friarsgate and Lower Brook Street.

- For the 100yr+20%CC flood event, a maximum flood level of 37.15mAOD was extracted from the available flood map information, located just north of the bus station.

- Future development within the area will likely require updated modelling to include the latest climate change allowances for the south-east river basin district, as well as the 1000-year flood event.

- The residual risk has been considered, along with appropriate strategies to manage risk. These include a robust evacuation plan, flood warning system and flood resilient development in areas where residual risk is highest.

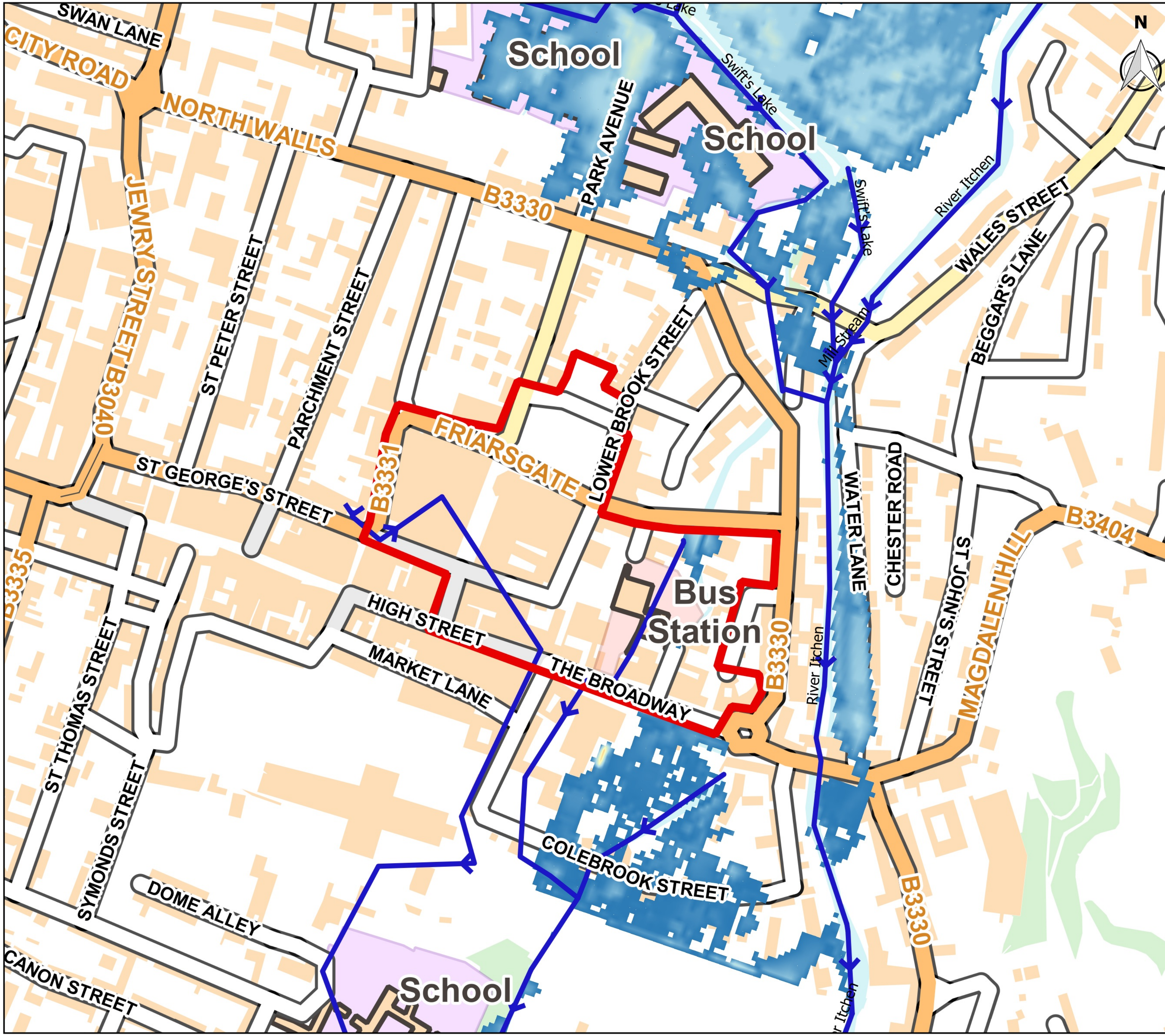
- Surface water run-off will need to be considered for future development due to a change in impermeable area.

- Appropriate techniques to manage increases in surface water run-off have been assessed in terms of the SuDS hierarchy process (refer to section 4.6).

- The viability of SuDS strategies will need to be confirmed at the detailed design stage as recommended.

- It is likely that a quantitative assessment will need to be undertaken to determine the capacity of the existing drainage network at the detailed design stage of any future development

Appendix A



Project :

WHS1483 - Central Winchester Regeneration Area FRA

Client :

Winchester City Council

Legend :

Site Boundary

Rivers

Flood Depth (m)

0.000

0.500

1.000

1.500

>1.500

Scale : 0 50 100 m

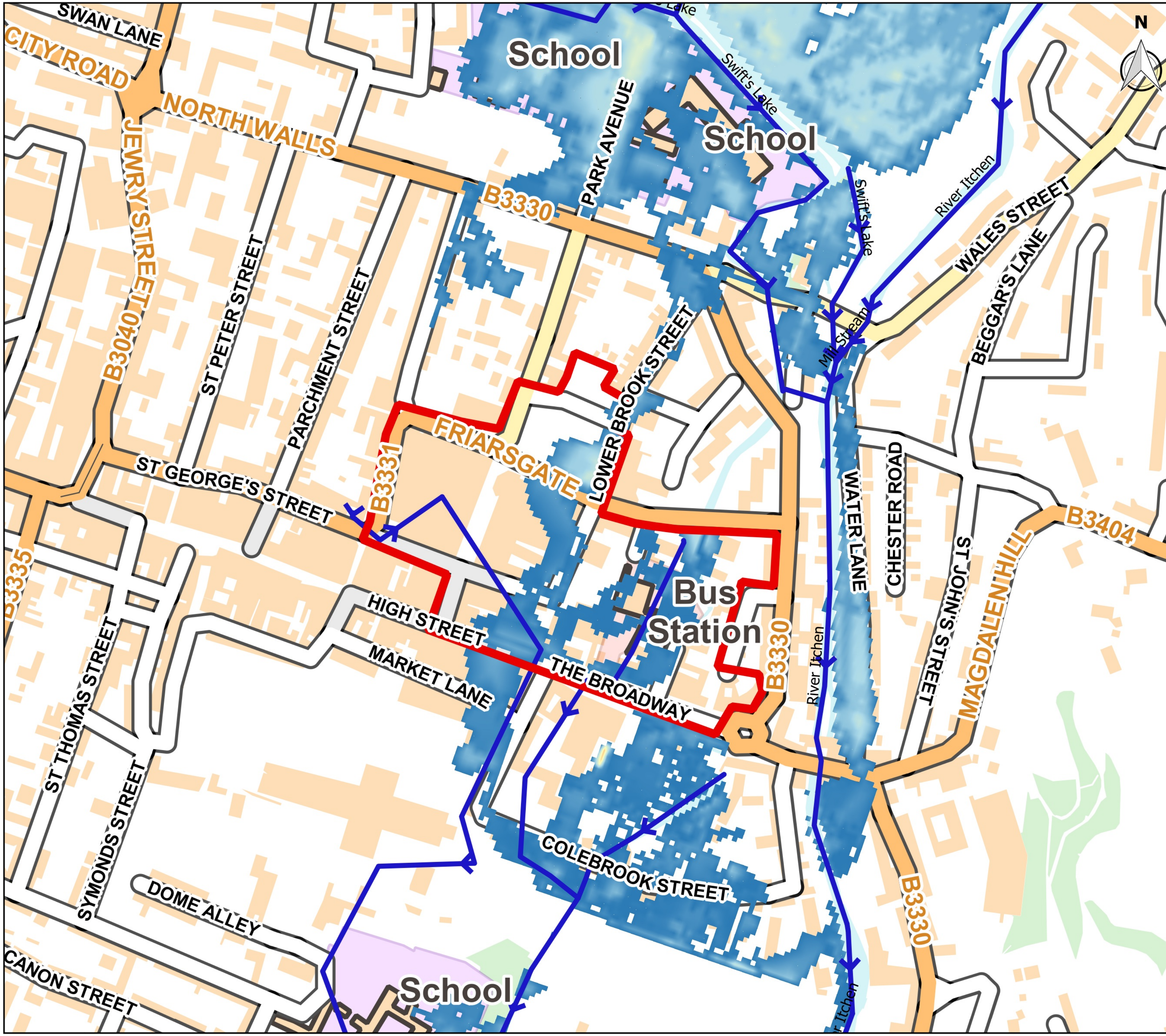
Title :

25yr maximum flood depth.

Drawing : WHS1483-T01-004

Rev : 1

WHS



Project :

WHS1483 - Central Winchester Regeneration Area FRA

Client :

Winchester City Council

Legend :

Site Boundary

Rivers

Flood Depth (m)

0.000

0.500

1.000

1.500

>1.500

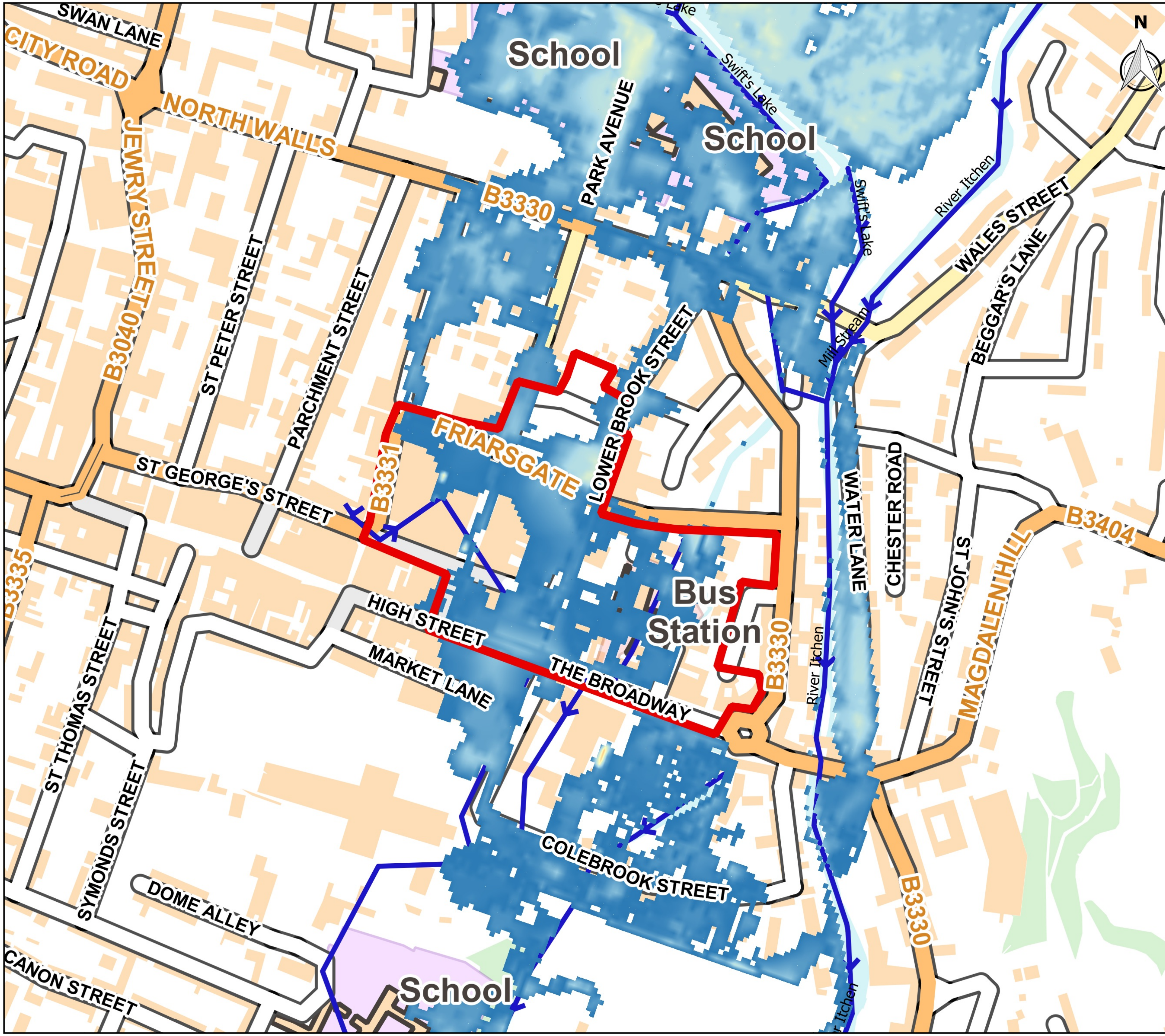
Scale : 0 50 100 m

Title :

50yr maximum flood depth.

Drawing :	Rev :
WHS1483-T01-003	1

WHS



Project :

WHS1483 - Central Winchester Regeneration Area FRA

Client :

Winchester City Council

Legend :

Site Boundary

Rivers

Flood Depth (m)

0.000

0.500

1.000

1.500

>1.500

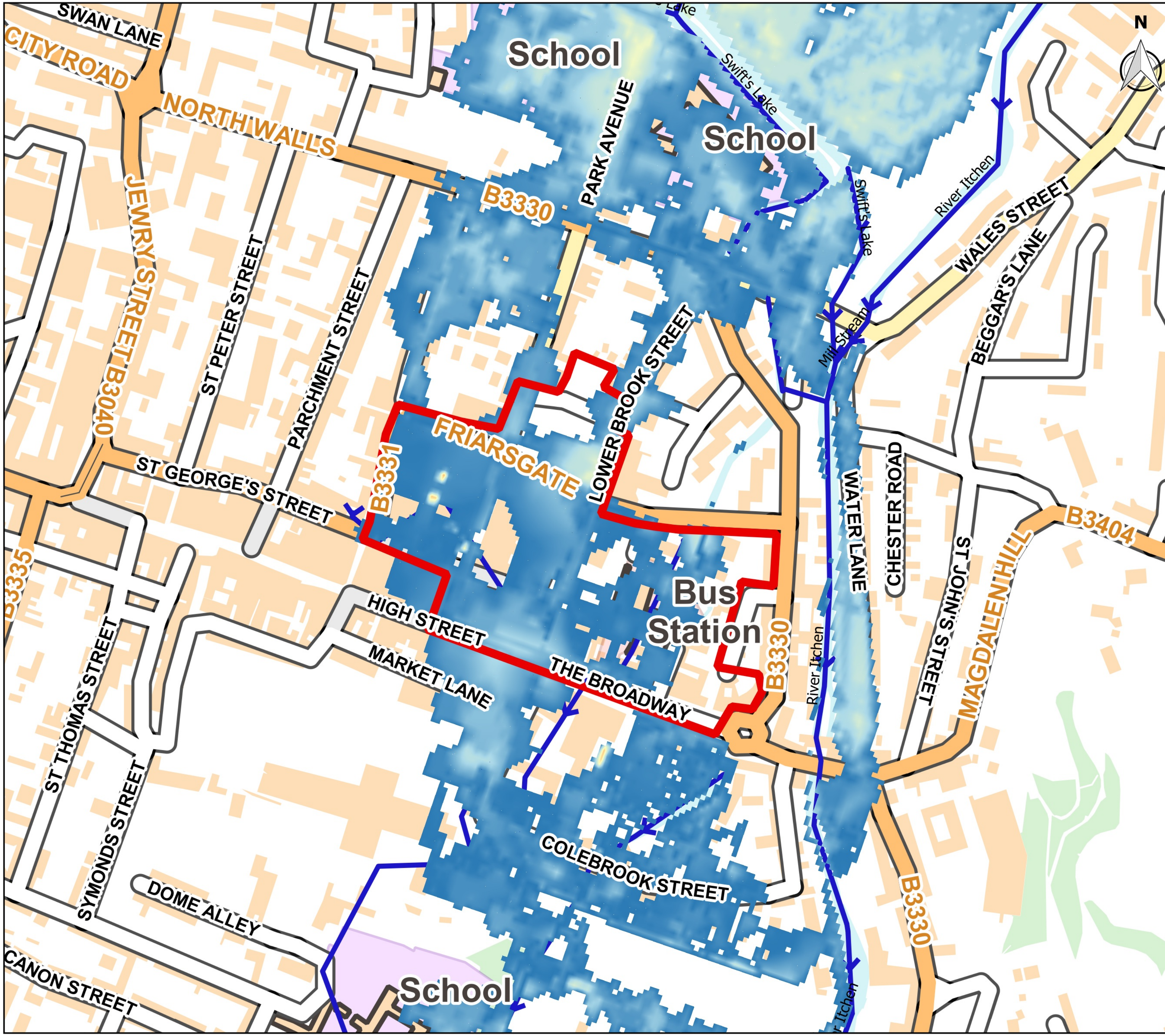
Scale : 0 50 100 m

Title :

100yr maximum flood depth.

Drawing :	Rev :
WHS1483-T01-002	1

WHS



Project :

WHS1483 - Central Winchester Regeneration Area FRA

Client :

Winchester City Council

Legend :

- Site Boundary
- Rivers

Flood Depth (m)

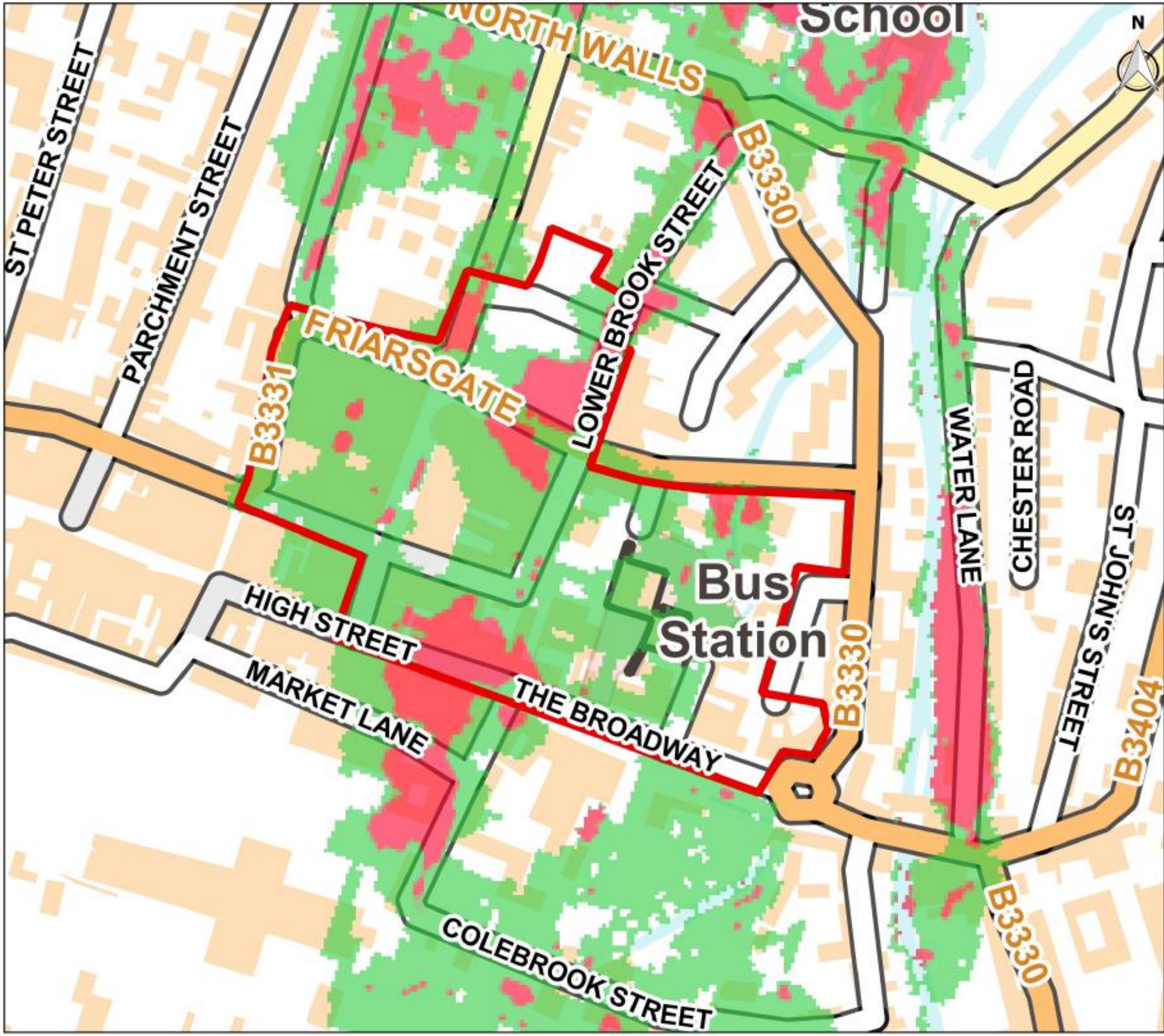
- 0.000
- 0.500
- 1.000
- 1.500
- >1.500

Scale : 0 50 100 m

Title :

100yr+20%CC maximum flood depth.

Drawing :	Rev :
WHS1483-T01-001	1



Project :

WHS1483 - Central Winchester Regeneration Area FRA

Client :

Winchester City Council

Legend :

Site Boundary

Areas of lower hazard

Areas of greater hazard

Scale : 0 25 50 75 m

Title :

Areas of lower and greater hazard rating (as a function of depth and velocity

Drawing :	Rev :
WHS1483-T01-005	1

WHS

Appendix B

Wallingford HydroSolutions Ltd
Castle Court, 6
Cathedral Road
Cardiff
CF11 9LJ

Your ref	WHS1483
Our ref	231994
Date	11 January 2017
Contact	searches@southernwater.co.uk Tel 0845 272 0845 0330 303 0276 Fax 01634 844514

Attention: Alexandros Petrakis

Dear Customer

Re: Provision of public sewer and water main record extract

Location: 166C High Street, Winchester, Glamorgan

Thank you for your order regarding the provision of extracts of our sewer and/or water main records. Please find enclosed the extracts from Southern Water's records for the above location.

We confirm payment of your fee in the sum of £49.92 and enclose a VAT receipt for your records.

Customers should be aware that there are areas within our region in which there are neither sewers nor water mains. Similarly, whilst the enclosed extract may indicate the approximate location of our apparatus in the area of interest, it should not be relied upon as showing that further infrastructure does not exist and may subsequently be found following site investigation. Actual positions of the disclosed (and any undisclosed) infrastructure should therefore be determined on site, because Southern Water does not accept any responsibility for inaccuracy or omission regarding the enclosed plan. Accordingly it should not be considered to be a definitive document.

Should you require any further assistance regarding this matter, please contact the LandSearch team.

Yours faithfully

LandSearch

VAT receipt

Ordered by:

Wallingford HydroSolutions Ltd
Cathedral Road
Cardiff
CF11 9LJ

VAT registration number: 813 0378 56
Order reference: 231994
Your reference: WHS1483

Receipt for provision of an extract from the public sewer and/or water main records.

Location	Costs
166C High Street Winchester Glamorgan	£41.60
Net total	£41.60
VAT	£8.32
Total	£49.92
Paid	**Paid in full**

Thank you for your payment:

Received on: 10 January 2017

For enquiries regarding the information provided in this receipt, please contact the LandSearch team:

Tel: 0845 270 0212
0330 303 0276 (individual consumers)

Email: searches@southernwater.co.uk

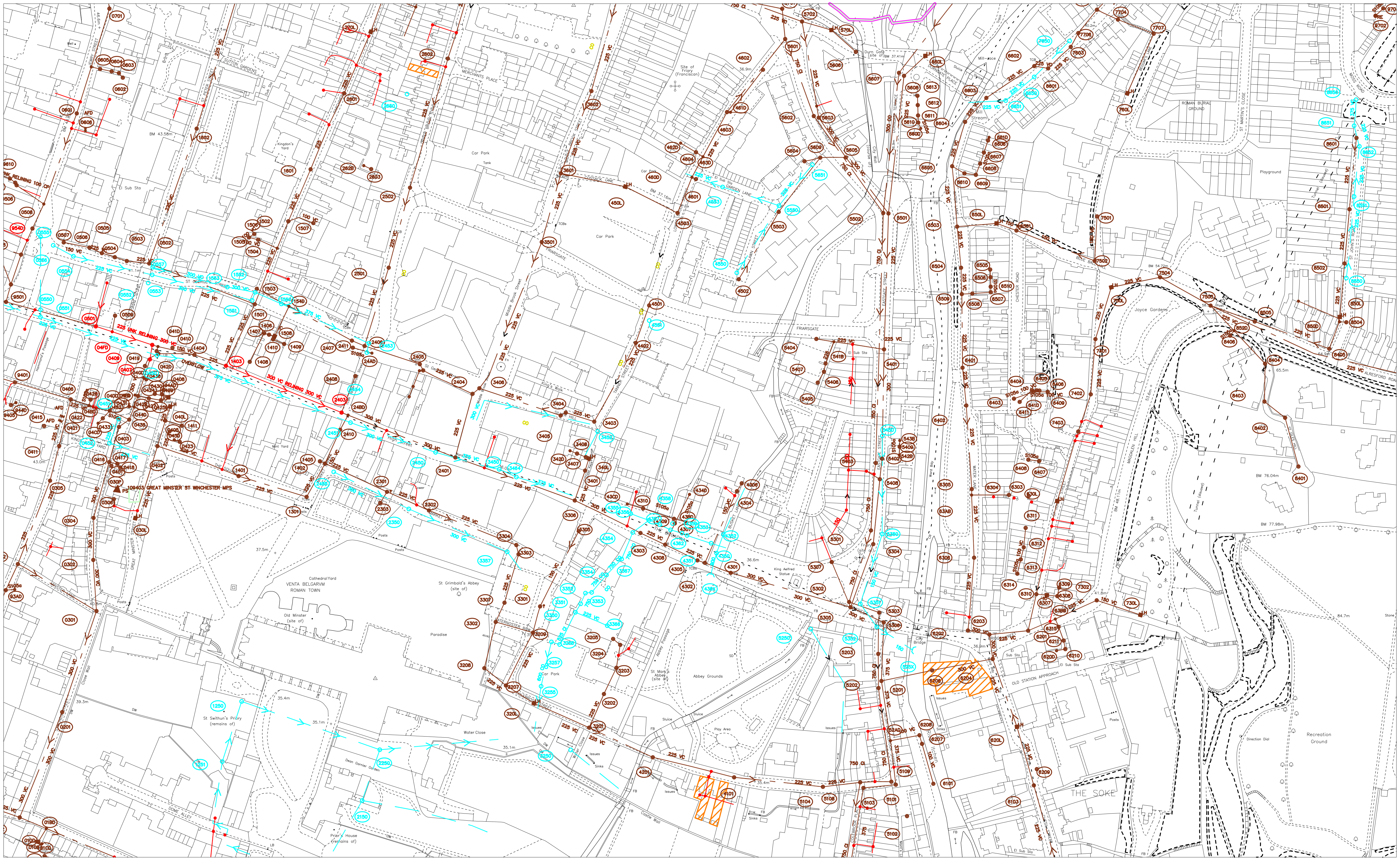
Web: www.southernwater.co.uk

LandSearch
Southern Water Services
Southern House
Capstone Road
Chatham
Kent
ME5 7QA

Southern Water

SEWER RECORDS PAGE 1 OF 2

129722



129144

O.S. REF.	Drawn by: yadavsa	The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. WARNING: BAC pipes are constructed of Bonded Asbestos Cement WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement
SU4829SW	Scale: 1:2500	
Title: 231994_166C High Street, Winch	Date: 11/01/2017	Based upon Ordnance Survey Digital Data with the permission of the controller of H.M.S.O. Crown Copyright Reserved Licence No. WU 298530.

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448922

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Southern Water

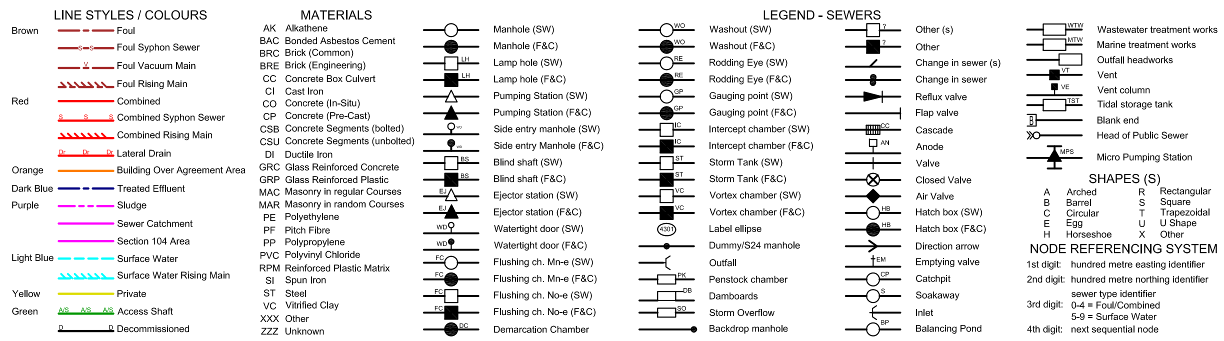
SEWER RECORDS PAGE 2 OF 2

Node	Cover	Invert	Size	Material	Shape	
0107X			UNK	UNK	CIRC	
0108X	0.7		150	VC	CIRC	
01BDX			UNK	UNK	CIRC	
01CDX			100	VC	CIRC	
01DDX			100	VC	CIRC	
0201X	38.01		300	VC	CIRC	
0301X	39.49		300	VC	CIRC	
0302X	40.1	36.1	300	VC	CIRC	
0304X	40.68		300	VC	CIRC	
0305X	42.27	39.96	225	VC	CIRC	
0306X			UNK	UNK	UNK	
030LX	39.94	36.89	225	VC	CIRC	
031DX			UNK	UNK	CIRC	
032DX			225	VC	CIRC	
0402X	38.82		225	VC	CIRC	
0403X	39.65		300	VC	CIRC	
0405X			225	VC	CIRC	
0406X	41.34	38.3	225	VC	CIRC	
0407X	39.96		300	VC	CIRC	
0408X			UNK	UNK	CIRC	
0409X	39.9	36.13	150	VC	CIRC	*
0409X	39.9	37.6	300	VC	CIRC	*
040DX			225	VC	CIRC	
040LX	39.62		225	VC	CIRC	
0411X			225	VC	CIRC	
0416X			300	VC	CIRC	
0417X			100	UNK	CIRC	
0418X			100	UNK	CIRC	
0419X			UNK	UNK	CIRC	
041DX			150	VC	CIRC	
0420X			UNK	UNK	CIRC	
0423X			UNK	UNK	CIRC	
0424X			UNK	UNK	CIRC	
0425X			UNK	UNK	CIRC	
0426X			UNK	UNK	CIRC	
0427X			UNK	UNK	CIRC	
0428X			300	VC	CIRC	
0430X			UNK	UNK	CIRC	
0432X			UNK	UNK	CIRC	
0433X			UNK	UNK	CIRC	
0435X			300	VC	CIRC	
0436X			UNK	UNK	CIRC	
044DX			300	VC	CIRC	
0450X			375	VC	CIRC	
0451X	39.75	39.23	225	VC	CIRC	
0452X	39.7	39.09	225	VC	CIRC	
04ADX			UNK	UNK	CIRC	
04BDX			225	VC	CIRC	
04CDX			UNK	UNK	CIRC	
04DDX			100	VC	CIRC	
04EDX			UNK	UNK	CIRC	
04GDX			300	VC	CIRC	
0502X	41.17		225	VC	CIRC	
0503X	42.8	39.9	225	VC	CIRC	
0504X	43.42	40.98	UNK	UNK	CIRC	
0505X	44.85	41.84	UNK	UNK	CIRC	
0506X	44.85	41.84	225	VC	CIRC	
0507X	45.85	44.45	150	VC	CIRC	
0508X			UNK	UNK	CIRC	
0509X			UNK	UNK	CIRC	
050DX			225	VC	CIRC	
051DX			UNK	UNK	CIRC	
052DX			300	VC	CIRC	
0550X			UNK	UNK	CIRC	
0551X			225	VC	CIRC	

Node	Cover	Invert	Size	Material	Shape	
0553X	40.97	39.09	300	VC	CIRC	
0554X	46.34	42.37	225	VC	CIRC	
0555X			UNK	UNK	CIRC	
0556X	46.34	44.82	UNK	UNK	CIRC	
0557X	41.06	38.59	300	VC	CIRC	
0601X			300	VC	CIRC	
0602X			UNK	UNK	UNK	
0603X			UNK	UNK	UNK	
0604X			UNK	UNK	UNK	
0605X			UNK	UNK	UNK	
060BX			300	VC	CIRC	
060DX			UNK	UNK	CIRC	
061BX			300	VC	CIRC	
061DX			UNK	UNK	CIRC	
062DX			UNK	UNK	CIRC	
063DX			300	VC	CIRC	
064DX			300	VC	CIRC	
0701X	46.57		300	VC	CIRC	
110DX			UNK	UNK	CIRC	
111DX			UNK	UNK	CIRC	
1250X			UNK	UNK	CIRC	
1251X			UNK	UNK	CIRC	
1301X	37.59	35.36	225	VC	CIRC	
1401X	37.98		225	VC	CIRC	
1402X	37.02		225	VC	CIRC	
1403X	37.27		300	VC	CIRC	
1404X	37.88		225	UNK	CIRC	
1405X	36.95		UNK	UNK	CIRC	
1406X			UNK	UNK	CIRC	
1407X			UNK	UNK	CIRC	
1408X			UNK	UNK	CIRC	
1409X			UNK	UNK	CIRC	
140DX			225	VC	CIRC	
1410X			UNK	UNK	CIRC	
1411X			UNK	UNK	CIRC	
141DX			225	VC	CIRC	
1501X	38.11		225	VC	CIRC	
1502X	38.49	35.63	225	VC	CIRC	
1503X	38.17	35.85	UNK	UNK	CIRC	
1504X			UNK	UNK	UNK	
1505X			100	VC	CIRC	
1506X			100	VC	CIRC	
1507X			100	VC	CIRC	
1508X			UNK	UNK	CIRC	
150DX			UNK	UNK	CIRC	
151DX			225	VC	CIRC	
153DX			225	VC	CIRC	
154DX			UNK	UNK	CIRC	
1550X			375	VC	CIRC	
1551X	38.26	36.96	UNK	UNK	CIRC	
1552X	38.21	36.21	UNK	UNK	CIRC	
1553X	38.58	37.05	300	VC	CIRC	
1601X	38.08		225	VC	CIRC	
1602X	42.65		225	VC	CIRC	
160DX			UNK	UNK	CIRC	
161DX			UNK	UNK	CIRC	
162DX			UNK	UNK	CIRC	
163DX			225	VC	CIRC	*
163DY			225	VC	CIRC	*
2150X			UNK	UNK	CIRC	
2250X			UNK	UNK	CIRC	*
2250Y			UNK	UNK	CIRC	*
2301X			225	VC	CIRC	
2302X	36.44		225	VC	CIRC	
2303X			UNK	UNK	CIRC	

Node	Cover	Invert	Size	Material	Shape	
230DX			225	VC	CIRC	
2350X	36.53	35.02	300	VC	CIRC	
2401X	35.24	32.99	225	VC	CIRC	
2403X	36.07		300	VC	CIRC	
2404X	36.33		225	VC	CIRC	
2405X	36.3		225	VC	CIRC	
2406X	36.77		UNK	UNK	CIRC	
2407X			UNK	UNK	CIRC	
2408X			UNK	UNK	CIRC	
2409X			225	VC	CIRC	
240DX			300	VC	CIRC	
2410X			UNK	UNK	CIRC	
2411X			UNK	UNK	CIRC	
241DX			UNK	UNK	CIRC	
242DX			UNK	UNK	CIRC	
243DX			UNK	UNK	CIRC	
2450X	35.26	34.25	375	VC	CIRC	
2451X	35.9	34.87	300	VC	CIRC	
2453X	36.76	35.4	UNK	UNK	CIRC	
2454X	36.76	35.41	UNK	UNK	CIRC	
2455X	37.05	36.54	300	VC	CIRC	
24BDX			300	VC	CIRC	*
24BDY			UNK	UNK	CIRC	*
2501X	36.85	34.89	225	VC	CIRC	
2502X	37.12	35.12	225	VC	CIRC	
2601X			225	UNK	CIRC	
2602X	37	35.4	225	VC	CIRC	
260BX			225	VC	CIRC	
260DX			UNK	UNK	CIRC	
261BX			225	VC	CIRC	
261DX			UNK	UNK	CIRC	
262BX			UNK	UNK	CIRC	
262DX			UNK	UNK	CIRC	
263DX			225	UNK	CIRC	
264DX			225	VC	CIRC	
270LX	37.36	36.04	225	VC	CIRC	
273DX			UNK	UNK	CIRC	
27CBX			UNK	UNK	CIRC	
3201X	35.09	35.1	225	VC	CIRC	
3202X	35.57	33.83	225	VC	CIRC	
3203X	37.77	35.75	UNK	UNK	CIRC	
3204X	36.12	34.12	150	VC	CIRC	
3205X	36.18	34.66	UNK	UNK	CIRC	
3207X	35.62		225	VC	CIRC	
3208X	35.63	34.05	225	VC	CIRC	
3209X	35.81		225	VC	CIRC	
320DX			150	VC	CIRC	
320LX	35.4		225	VC	CIRC	
3250X			UNK	UNK	CIRC	
3255X	35.82	34.32	UNK	UNK	CIRC	
3256X	36.28	34.46	525	CI	CIRC	
3257X	36.33		600	CO	CIRC	
3301X	35.93	34.1	UNK	UNK	CIRC	
3302Y	35.93		UNK	UNK	CIRC	*
3302X	35.93		UNK	UNK	CIRC	*
3303X	36.04		225	VC	CIRC	
3304X			UNK	UNK	CIRC	
3305X	36.14	34.56	150	VC	CIRC	
3306X	35.57		300	VC	CIRC	
3307X	35.83	34.27	UNK	UNK	CIRC	
3350X	36.26		525	CI	CIRC	
3351X			UNK	UNK	CIRC	
3352X	36.48	34.71	750	UNK	CIRC	
3353X	36.65	34.85	UNK	UNK	CIRC	
3354X	36.35	34.65	750	CO	CIRC	

Node	Cover	Invert	Size	Material	Shape	
3357X	35.98	34.61	375	CO	CIRC	
3366X	36.49	35.37	225	VC	CIRC	
3367X			750	CO	CIRC	
3401X	36.21		225	VC	CIRC	
3403X	36.3	34.37	225	VC	CIRC	
3404X	36.44	34.36	UNK	UNK	CIRC	
3405X	36.43	34.25	225	VC	CIRC	
3406X	36.55	34.34	UNK	UNK	CIRC	
3407X			UNK	UNK	CIRC	
3408X			UNK	UNK	CIRC	
340DX			UNK	UNK	CIRC	
340LX	36.26	33.69	UNK	UNK	CIRC	
341DX			225	VC	CIRC	
342DX			UNK	UNK	CIRC	
3450X	34.95	34.96	UNK	UNK	CIRC	
3452X			UNK	UNK	CIRC	
3464X	35.96		375	VC	CIRC	
3501X	36.92	34.53	225	VC	CIRC	
3601X	36.68		225	VC	CIRC	
3602X	36.9	35.28	225	VC	CIRC	
4101X	35.33		225	VC	CIRC	
410DX			UNK	UNK	CIRC	
411DX			UNK	UNK	CIRC	
412DX			UNK	UNK	CIRC	
4201X	36.72		225	VC	CIRC	
420DX			UNK	UNK	CIRC	
421DX			225	VC	CIRC	
4301X	36.49	33.38	300	VC	CIRC	
4302X	36.61		UNK	UNK	CIRC	
4303X	36.57		225	VC	CIRC	
4304X	36.64		150	VC	CIRC	
4305X	36.6	33.46	UNK	UNK	CIRC	
4306X			UNK	UNK	CIRC	
4307X			UNK	UNK	CIRC	
4308X			225	VC	CIRC	
4309X			UNK	UNK	CIRC	
430DX			UNK	UNK	CIRC	
4310X			UNK	UNK	CIRC	
431DX			UNK	UNK	CIRC	
432DX			150	VC	CIRC	
433DX			300	VC	CIRC	
434DX			UNK	UNK	CIRC	
4350X	36.79	35.25	900	UNK	CIRC	
4351X	36.81		UNK	UNK	CIRC	
4352X	36.7		UNK	UNK	CIRC	
4353X	36.6		UNK	UNK	CIRC	
4354X	36.27	35.07	750	CO	CIRC	
4355X	36.31		UNK	UNK	CIRC	
4356X	36.42		UNK	UNK	CIRC	
4357X	36.46		UNK	UNK	CIRC	
4359X	36.54	35.16	UNK	UNK	CIRC	
4362X	36.61	35.21	UNK	UNK	CIRC	
43BDX			UNK	UNK	CIRC	
4402X	36.58	34.65	225	VC	CIRC	
4501X	36.74	34.67	UNK	UNK	CIRC	
4502X	37.71	36.29	UNK	UNK	CIRC	
4503X	36.57		UNK	UNK	CIRC	
450LX			UNK	UNK	CIRC	
4550X	37.29	35.62	UNK	UNK	CIRC	
4553X	36.68	36.01	225	VC	CIRC	
4601X	36.67	34.86	UNK	UNK	CIRC	
4602X			UNK	VC	CIRC	
4603Y	36.83		UNK	UNK	CIRC	*
4603X	36.83		225	VC	CIRC	*
4604X			UNK	UNK	CIRC	

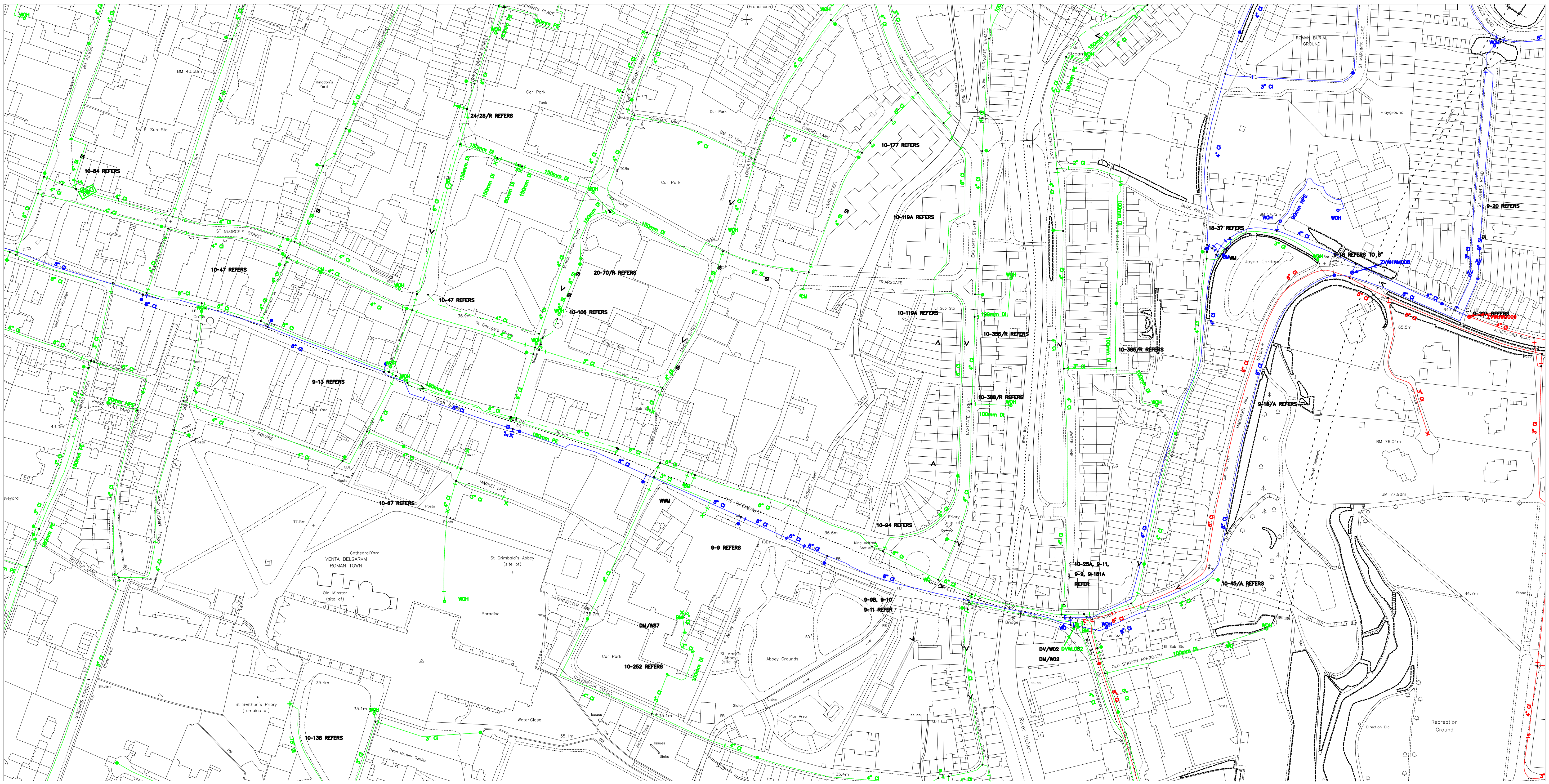


Drawn by: yadavsa

Title: 231994_166C High Street, Winch

Date: 11/01/2017

Southern Water



LEGEND - MAINS

	Distribution Main / Communication pipe
	Trunk Main
RAW	Raw water main
NP	Non potable
	Abandoned main
P P	Proposed Main
FM	Fire main
	Non SWS
	Sluice valve
	Closed valve
AV	Air valve
	Butterfly valve
	Pressure reducing valve
	Reflux valve
mv	Motorised valve
	Clockwise closing valve
	Fire Hydrant
WO	Washout
WOH	Washout hydrant
M	Meter
	Capped end
EP	Emptying plug
	Stopcock
SP	Leak Noise Correlator Survey Point
AN	Anode
TC	Telemetry cable
AP	Access point / hatchbox
D	Dialysis machine
BPT	Break pressure tank
	Change node
	Pumping station
	Booster station
	Insertion Flow Meter Point
	Water tower
	Service reservoir
	Water Supply Works
	Bore hole / Well
	Intake
	Customer site
	Swab insertion point

MATERIALS

Alkathene	AK
Cast iron	CI
Spun (grey) iron	SI
Concrete	CO
Ductile iron	DI
Bonded Asbestos Cement	BAC
Glass reinforced plastic	GRP
Glass reinforced epoxy	GRE
(Unplasticised) Polyvinyl chloride	PVC
Polyethylene	PE
Steel	ST
Concrete segments bolted	CSB
Concrete segments unbolted	CSU
Galvanised iron	GI
Ductile sleeve	DS
Concrete pre-stressed	CPS
High performance polyethelene	HPE
Unknown	??

WARNING: BAC pipes are constructed of Bonded Asbestos Cement

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement

Drawn by:	yadavsa
Scale:	1:2500
Date:	11/01/2017

O.S.Ref: SU4829SW

TITLE: 231994_166C High Street, Winch

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd. accept no responsibility in the event of inaccuracy. The actual positions of pipes should be determined on site.

N

Nr_Years_Data	Postcode	PostCode_Centroid_X	PostCode_Centroid_Y	Catchment_Code	Street	PostTown	District_Council	Sewer_Type	Sewer_Status	Reporting_Problem_Desc	Date_Most_Recent_Incident	Nr_Location_Occupied_Building	Nr_Location_UnInhab_Cellar	Nr_Location_Detached_Garage	Nr_Location_Curtilage	Nr_Location_Highway	Nr_Location_Public_Space	Nr_Location_Agricultural	Nr_Evidence_Toilet
5	SO238QY	448290	129549.04	MORE	THE BROOKS	WINCHESTER	Winchester District (B)	FOUL	PUBLIC	HYDRAULIC OVERLOAD	2/27/2014	0	0	0	0	0	0	0	0
5	SO239AY	448356.705	129437.1703	MORE	HIGH STREET	WINCHESTER	Winchester District (B)	FOUL	PUBLIC	HYDRAULIC OVERLOAD	3/4/2014	0	0	0	0	0	0	0	1
5	SO239BA	448430.215	129402.0842	MORE	HIGH STREET	WINCHESTER	Winchester District (B)	FOUL	PUBLIC	HYDRAULIC OVERLOAD	2/10/2014	0	0	0	0	0	0	0	0

Appendix C

Winter 2013/2014 Flooding in Winchester City Centre

Internal Brief

Background

Around 600mm of rain fell in the Itchen catchment over the December 2013-February 2014 period (average expected for same period is 230mm). This led to exceptionally high groundwater levels and hence high spring flows in the groundwater-dominated Itchen.

Highest flow ever recorded at Easton for the River Itchen – 12.9m^3/s on 13/02/14.

Flooding impacts

4 properties reported as flooded. Internal flooding reported at Pizza Express adjacent to City Mill and house adjacent to Shears Mill. Flooding of basement/cellar of property on Bridge Street and at Abbey Mill also reported.

St Bede's School and Riverside Park Leisure Centre temporarily closed at the peak of the flooding due to drainage problems, however neither reported any internal flooding.

Temporary road closures at Park Avenue and Water Lane.

Response

The Environment Agency and other partners worked closely together to reduce the impact of flooding in Winchester.

Two areas north of the city were created to hold back river water to reduce the risk of flooding in the city centre. One holding pond was on land east of M3, where 60 one-tonne sandbags were lowered off the motorway. The second was just upstream of the A33/A34 junction, where 200 one-tonne sandbags were installed. Following the flooding we are currently reviewing the effectiveness of these measures.

Other measures were put in place in the city centre to reduce the risk of flooding, including at St Bede's School and Winchester Art College. This included the deployment of the Environment Agency's demountable flood barrier at Park Avenue combined with pumping by the Fire Brigade, as well as the deployment of sandbags across the city by the military, Hampshire County Council and Winchester City Council.

Previous Work

Following the 2000/01 flooding a Halcrow report commissioned by the Environment Agency identified a number of actions for the various organisations involved. These included an operational flood plan by WCC, the latest version of which was produced in 2007.

The Environment Agency also commissioned the River Itchen Flood Strategy Scoping Study in 2003, which assessed the appropriateness of a number of measures to manage flood risk in the city. These measures were never taken forward due to the low cost-benefit.

A detailed flood model for Winchester was produced in 2008, which built upon the earlier modelling work in 2003 and 2005. Whilst we have high confidence in the model results the recent flooding did not produce the extent of flooding predicted. This is due to the model assuming that a number of key sluices through the city were partly closed – in the flood event these were fully open.

Recently HCC has produced their Local Flood Risk Management Strategy, as well as a Groundwater/Surface Water Management Plan.

Following the flooding we are arranging a CCTV survey of the culverts under the city centre. Based on previous surveys this is likely to identify that some sections of the culvert are failing (particularly around the Cathedral).

Future schemes

The Environment Agency has included a bid for FDGiA funding for a Winchester Fluvial Flood Scheme on the MTP, building on the lessons learnt during the recent flooding. HCC have also included a bid for a surface water strategy – we are currently working with them on this.

Options to be considered for a fluvial scheme could include:

1. Making permanent some of the temporary barriers installed around the city using low level flood walls and drop boards/ other demountable barriers.
2. Improving floodplain connectivity upstream of the city and increasing floodplain storage – in effect replicating the temporary dams installed by the A34/M3.
3. Increasing conveyance capacity through the city
4. Improving/removing obstructions to flow.

5. Reviewing/improving the operation of hatches through the city.
6. Property level protection.

A feasible scheme would likely be option 1 with elements of options 3-6. Initial scheme costs for option 1 are estimated at around £750k. The Partnership Funding score for this is estimated to be around 80% (excluding contributions). A contribution of £145k is required to bring this score up to 100% (for reference a £250k contribution would take it to 123%).

Costs for options 2 are likely to be prohibitively expensive, and would likely require other options to be constructed in part or full to be effective. For reference, with an initial estimate of £1m for the upstream storage option (though we believe this to be a low estimate, costs would likely be higher) the PF score drops to 33% (assumes option 1 and 2 combined – cost of £1.75m).

Ways forward

- Identify and secure contributions towards a future scheme. For EA, HCC and WCC*
- Consider setting up a Strategic Flood Board. WCC to lead?
- Revise operational flood plan to take account of lessons learnt in recent event. WCC/HCC to lead?
- Review culvert condition through city centre and identify remedial works required. EA to lead.

*WCC adopted their CIL on 07/04/14 but it does not include flood risk management within the list of infrastructure. However it does still allow for contributions to be made via Section 106 agreements. For reference, major developments currently planned/commencing soon that could potentially contribute to a scheme include:

  - Silver Hill – redevelopment of the city centre including the bus station. Various culverts run under the site and part of the site is in Flood Zone 3. Already has planning permission but revised application likely to be submitted this year.
  - Barton Farm – major development of 2000 house in north of city. Not directly affected by recent floods though part of site in Flood Zone 3. Has outline planning permission, construction likely to start later this year.
  - River Park Leisure Centre – reconstruction/relocation of leisure centre. In Flood Zone 3, closed in recent flood event though internal flooding not reported. Still at very early stages – no planning application yet.