

**Land off Wilberforce Road  
Cambridge**

**Site Appraisal  
September 2013**

**Bidwells**





## Document History

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# 1 Introduction

- 1.1 EAS has been commissioned by Bidwells to prepare a Site Appraisal for the Land to the West of Wilberforce Road, Cambridge. This document has been prepared to inform the submission of representations made to Cambridge City Council's consultation on the Cambridge Local Plan 2014: Proposed Submission July 2013.
- 1.2 The contents of this report form a preliminary assessment of the site in terms of flood risk, highways, access, transportation and utilities.
- 1.3 The 6.5ha site is currently made up of sports fields, including a pavilion, club house, and tennis courts.
- 1.4 The site falls within Flood Zone 1 of the Environment Agency (EA) Flood Zone maps indicating a low risk of flooding. Although unlikely to be at direct risk of flooding, as the development site is over 1 hectare a full Flood Risk Assessment is required to be submitted with a future planning application to demonstrate that the development will not result in an increased risk of flooding elsewhere. An initial appraisal of flood risk is included within this feasibility report.
- 1.5 This report is based on a site visit, traffic surveys, speeds surveys, EA Flood Maps, Local authority Strategic Flood Risk Assessment (SFRA), ground investigation, BGS geological information, and OS mapping.
- 1.6 The report is set out as follows:
  - Section 2 – provides background including a description of the site, location/setting, existing land use and development proposals.
  - Section 3 – discusses the flood risk to the development and the future development drainage.
  - Section 4 – summarises the findings of the highways access and pedestrian and cycle access appraisal and discusses the sustainability of the site.
  - Section 5 – provides a summary of the combined utilities search.
  - Section 6 – summarises the findings of the report.



## 2 Background

- 2.1 The site is located approximately 1.5km to the west of Cambridge City Centre and 200m to the south of Madingley Road (A1303), located off Wilberforce Road, Cambridge.
- 2.2 A site plan indicating the location of the development is contained in Appendix A.
- 2.3 The site is currently used as a sports ground for the Emmanuel College, and is also the location of the Cambridge Lawn Tennis Club.
- 2.4 The site is bordered by the residential streets of Bulstrode Gardens and Hedgeley Close to the north, by Wilberforce Road to the east, by Stacey Road and University Sports Grounds to the south and by the residential streets of Perry Court and The Lawns to the west.
- 2.5 It is proposed that the site be considered for future residential development.

### Proximity to Watercourses

- 2.6 The site is located approximately 400m to the northwest of the Bin Brook and its associated floodplain and approximately 1km to the west of the River Cam. The Coton Stream runs along the southern border of the site and terminates at the end of Stacey Lane. The watercourse is then expected to be culverted under the development site and becomes an open channel to the east of Wilberforce Road at a point approx, 50m to the north of the Pavilion.
- 2.7 From Wilberforce Road the stream then outfalls to a large pond approximately 150m to the east of Wilberforce Road, prior to continuing to the east to form part of the catchment to the River Cam.
- 2.8 The stream accepts the runoff from adopted surface water sewers in both Clark Maxwell Road, and Wilberforce Road.

### Site Levels

- 2.9 OS mapping and site observation has shown that the site has an average height of around 15m AOD with levels falling at approximately 1:100 from the northwest to the southeast of the site.



## 3 Flood Risk

### National Policy

- 3.1 The contents of this FRA are based on the advice set out in The National Planning Policy Framework (NPPF) and the Technical Guidance to the NPPF, published March 2012.
- 3.2 The Technical Guidance to the NPPF Table 1 defines each Flood Zone along with appropriate land use and FRA requirements. The flood risk zones are defined as follows:
- Flood Zone 1 – This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river flooding (<0.1%).
  - Flood Zone 2 – This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding.
  - Flood Zone 3a – This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%).
  - Flood Zone 3b – This zone comprises land where water has to flow or be stored in times of flood.
- 3.3 A copy of the Environment Agency's current Flood Map is included in Appendix B. The mapping shows that the entirety of the redevelopment site is located within Flood Zone 1 and therefore deemed to be at a low risk of fluvial flooding.
- 3.4 The NPPF requires that for a development site located within Flood Zone 1 which is larger than one hectare, a FRA must accompany the planning application which demonstrates that the proposals would not be exposed to an unsatisfactory level of flood risk, and would not result in an increase in the existing level of flood risk to the surrounding area.

### Local Policy

- 3.5 The Cambridge and South Cambridgeshire Level 1 Strategic Flood Risk Assessment (SFRA) published September 2010 and prepared by WSP Group, replaces the previous SFRA from 2006, and forms the main source of flood risk data to inform this site appraisal.
- 3.6 The SFRA is based principally, upon the EA's Flood Zone Maps and modelled outlines provided by the EA for the River Cam Flood Risk Mapping Project (2010). The Level 1 SFRA also takes into consideration flood risk from all other non fluvial sources of flooding, these included historic flood data from the following sources:
- South Cambridgeshire District Council and Cambridge City Council Archive data.
  - Parish Councils and Residents Associations;
  - Water companies- Cambridge Water and Anglian Water Services Ltd;
  - Internal Drainage Boards; and

- Cambridge Police.
- 3.7 The SFRA flood zone map for Cambridge is contained in Appendix C. It can be seen that the site is located over 400m from the Bin Brook and associated floodplain, the closest main river to the development site, and is therefore shown to be located within Flood Zone 1, which indicates no risk of flooding from rivers and sea, with an annual probability of under 0.1%.
- 3.8 A copy of the historic flood map for Cambridge City is also contained in Appendix C, which illustrates the combination of all of the sources of data highlighted above. The map indicates that a fluvial flood event has been recorded on Wilberforce road, and in addition a sewer flood event has been recorded on Madingley Road to the west of the junction with Wilberforce Road.
- 3.9 Table 4 within Appendix B of the SFRA identifies the source of flooding and data source for each of these historic events. The Wilberforce Road historic fluvial event is highlighted as occurring as a result of flooding from the Coton Stream and this data has been provided by the EA.
- 3.10 The Madingley Road sewer flooding event is identified to be as a result of a water leak and the data source is from Cambridgeshire Police. No other information is provided regarding these events within the SFRA.
- 3.11 A surface water flooding map based on modelling undertaken by the EA is provided within the SFRA and a copy is contained in Appendix C. The surface water flooding map illustrates a low surface water flood risk along the course of the Coton Stream within the vicinity of the site.

### Sources of Flooding

- 3.12 A Level 1 assessment has been made of the various potential sources of flooding. The assessment has been based on a review of the OS map data, geological survey data; together with a site visit.
- 3.13 **Main River:** As discussed, the site is not in close proximity to a main river. The Environment Agency (EA) flood zone mapping contained in Appendix B indicates that the site is within Flood Zone 1 and is therefore deemed to be at little or no risk of flooding from rivers and sea, with an annual probability of under 0.1%.
- 3.14 **Ordinary Watercourses:** As described above the site is within close proximity to the Coton Stream which accepts surface water runoff from the local surface water sewer network.
- 3.15 Due to the local topography this watercourse would be unexpected to pose a significant flood risk to the development site; however a historic fluvial flood event has been identified from EA records as having occurred on Wilberforce Road as a result of flooding from the Coton Stream. It is therefore recommended that a more detailed examination of the details of the historic event, as well as the form of watercourse and the culverted section under the development site is undertaken as part of a Level 2 Flood Risk Assessment.



- 3.16 **Groundwater:** There is no indication within the SFRA that groundwater flooding is an issue at this site.
- 3.17 The geology of the City consists of free-draining terraces of glacial gravels over poorly draining dark brown clay. This type of geology is not typically associated with groundwater flooding which is associated with more permeable soils such as chalk, limestone and sandstone.
- 3.18 **Sewers:** Anglian Water sewer records are contained in Appendix D. There are adopted foul and surface water sewers located within Wilberforce Road, a foul sewer south of Stacey Lane, and a surface water sewer system serving Perry Court and The Lawns which runs down Clerk Maxwell Road. As discussed the surface water sewers outfall to the Coton Stream.
- 3.19 As these sewers are generally within the highway network any water emanating from the sewers is likely to be contained within the carriageway and is therefore unlikely to pose a risk to the development site. An historic sewer flood event was highlighted within the SFRA however this appears to be the result of a water leak and would therefore be unlikely to re-occur in the future.
- 3.20 **Surface Water Flooding / Overland Flow:** The site is not in a location that would suggest significant volumes of overland flows from urban areas. The surface water flooding map based on modelling undertaken by the EA contained within the SFRA illustrates a low surface water flood risk along the course of the Coton Stream within the vicinity of the site.
- 3.21 **Climate Change:** As the site is not within the area of influence of a main river it is highly unlikely that the development will be affected by the consequences of climate change.
- 3.22 It is recommended that a Level 2 FRA is carried out to further examine the Coton Stream and its relationship to the site as a result of the historic fluvial flood event identified within the SFRA along Wilberforce Road. In addition a detailed drainage strategy will need to be prepared for the development as part of the Level 2 FRA to ensure flood risk is not increased downstream of the site.

## Development Drainage

- 3.23 The NPPF states that in Flood Zone 1, “*developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage systems*”.
- 3.24 The proposed surface water drainage strategy should take account of the use of SuDS techniques within the existing constraints, and where SuDS techniques are not possible, the drainage will need to be designed to ensure that the flood risk is not increased elsewhere. The reason for this is that, if the rate of surface water discharged from the site was to increase, the flood risk to both the site and the surrounding area could potentially be increased during heavy rainfall events.
- 3.25 Sustainable drainage systems will generally discharge water in one of three ways. The Building Regulations Approved Document H (DTLR, 2002) lists the discharge options in order of priority:





- *Infiltration to the ground via a soakaway or other system (which will ultimately reach groundwater).*
  - *Discharge to a watercourse or other surface water.*
  - *Discharge to a sewer.*
- 3.26 The SuDS management train incorporates a hierarchy of techniques which are set out in the 2004 Ciria report 'Interim Code of Practice for Sustainable Drainage Systems'.
- 3.27 A hierarchical approach to SUDS selection should be taken with the most sustainable techniques meeting all three SUDS criteria of flood reduction, pollution reduction, and landscape and wildlife benefit.
- 3.28 The local geology would indicate that infiltration techniques may not be suitable for the site and there is likely to be a need to provide some form of source control to limit discharge rates from the development site.
- 3.29 As discussed the AW adopted surface water sewer system located in Clerk Maxwell Road outfalls to Coton Stream to the south west and to the east of the development site (believed to be culverted under the development site). It is expected that the development site would also discharge surface water runoff either directly to the Coton Stream or via an Anglian Water sewer connection. Any discharge to either the adopted sewer system or direct to the watercourse will need to be agreed at a future stage with Anglian Water and the Environment Agency.
- 3.30 With the amount of open space on this site it is likely that one or more balancing ponds/ open water features could be provided on site, to provide attenuation for a restricted discharge. Other than offering a solution to limiting the runoff to greenfield runoff rates this would improve the biodiversity of the area and also act as a focal point for residents and visitors. Tanked or piped solutions are at the bottom of the SuDS hierarchy and should only be used as a last resort.
- 3.31 It is expected that a balancing pond/open water feature could be provided in the southwest corner of the site where the boundary of the site is located adjacent to the Coton Stream and an outfall could be achieved without the need to requisition a sewer. The suitability of this position would need to be confirmed following the completion of a topographical survey.
- 3.32 Any surface water run-off generated from the impermeable surfaces on site included highways and roof areas will be expected to be restricted to greenfield runoff rates, and any excess attenuated on site for all rainfall events with a return period of up to 100 years (including for climate change).
- 3.33 Greenfield runoff calculations for the site have been carried out using the method outlined in Environment Agency (EA) report, 'R&D Technical Report W5-074/A – Preliminary rainfall runoff management for developments (Revision B)', which is based on the loH124 methodology. The calculations were carried out using the drainage programme MasterDrain and are contained in Appendix E, and are summarised below for a number of return periods:
- 1 Year – 1.19 l/s/ha



- 30 Year – 3.27 l/s/ha
- 100 Year – 4.91 l/s/ha

3.34 An initial estimate has been made of the attenuation requirements for the site based on the new residential development being considered as wholly greenfield with a proposed impermeable area of 50% of the total site area. The required level of storage has been calculated based on the W5-074/A method with a 30% allowance for climate change, using the drainage programme MasterDrain. The results are contained in Appendix E and confirm that a storage area of 1877m<sup>3</sup> would be required to attenuate the 1 in 100 year plus climate change critical storm. This volume could include the storage within all of the surface water system, and include temporary storage within public open space.

3.35 It is recommended that a more detailed assessment of the future development drainage is made as part of a Level 2 FRA to identify: the existing drainage systems and capacities; the potential future runoff; drainage proposals; and illustrate that the future development will not impact on downstream flood risk.

### **Foul Water Strategy**

3.36 Foul Water is likely to outfall to the AW adopted network following agreement with AW, it is not expected to require pumping. Early consultation regarding the capacity in the local sewer network and the cost of any reinforcement works is recommended.

## 4 Access and Sustainability

### Highway Access

- 4.1 The pavilion is currently accessed from Wilberforce Road, with all other facilities such as the parking for the tennis facilities accessible via Stacey Lane. Stacey Lane is a narrow driveway accessed via a footway crossover from Wilberforce Road, and as such is not suitable as a vehicular access point for future residential development but could serve as a route for pedestrians and cyclists.
- 4.2 SK02 in Appendix F illustrates various potential access points which could serve the development, which includes:
- The cul-de-sac of Perry Court
  - The cul-de-sac of The Lawns
  - Wilberforce Road
- 4.3 As illustrated two access points in the form of simple give way junctions are readily achievable off Wilberforce Road. Wilberforce Road has an approximate width of 7.3m with two footways of between 2.0-2.5m wide.
- 4.4 Wilberforce Road is blocked to vehicular traffic 40m to the north east of the development boundary with all vehicular traffic accessing Wilberforce Road either via Clarkson Road to the north or Adams Road to the south of the site.
- 4.5 The cul-de-sacs of Perry Court and The Lawns could be used to serve the development either by extending the existing cul-de-sacs into the site, or alternatively by providing a loop between the two cul-de-sacs. Each cul-de-sac currently has an approximate carriageway width of 5.5m with two 1.8m footways. In total the two cul-de-sacs serve 27 dwellings, and therefore capacity is readily available for additional traffic movements.
- 4.6 Clerk Maxwell Road provides access between the cul-de-sacs of Perry Court and The Lawns and the A1303 Madingley Road. It is blocked to vehicular traffic just to the south of Perry Court.
- 4.7 The Manual for Streets (MfS) recommends an 'x' distance of 2.4m within most built up situations and a minimum 'y' distance of 43m for a measured speed of 30mph. Visibility splays of 2.4m x 90m well above the minimum recommended 'y' distance have been shown to be achievable for all the potential access points. In order to provide the minimum required visibility splays from the site some level of parking restriction may be required in the future on Wilberforce Road which currently has un-restricted parking adjacent to the site.
- 4.8 A significant level of development could be served from any combination of the four access points highlighted above, the level of which would depend on the connectivity through the site and to the

surrounding area. It can therefore be shown that highway access is readily achievable within recommended standards from a number of individual potential access points.

- 4.9 It should be noted that the ownership of the land between the existing spurs from Perry Court /The Lawns and the development boundary, required to secure access via the cul-de-sacs, is unknown at this stage.

### **Pedestrian/Cycle Access and Sustainability**

- 4.10 Wilberforce Road, The Lawns, Perry Road and Clerk Maxwell Road all have a footway provision to a minimum standard of 1.8m wide. These connect the site to the surrounding area and to the City Centre via an off road footway/cycleway 'Burrell's Walk' which commences at the end of Adams Road to the southeast of Wilberforce Road.
- 4.11 A cycle route map of central Cambridge is contained in Appendix G. It can be seen that the site is very well served in terms of both on road and off road cycle routes, with Wilberforce Road signed as an on-road primary link and Madingley Road to the north as an off-road primary link. There is also an off-road footway / cycleway running along the southern boundary of the site which links Wilberforce Road to the Cavendish Laboratory / Campus, including a link to the development site at the end of Stacey Lane and to Clerk Maxwell Road.
- 4.12 The development site is approximately 1.5km from the edge of the city centre accessible via either Madingley Road or the off road footway/cycleway 'Burrell's Walk' detailed above. Therefore the site has access to a huge range of retail, work, educational and leisure opportunities in a walk of between 15 to 20 minutes and a cycle ride of between 5-7 minutes.
- 4.13 It can be clearly illustrated that the development is well located for pedestrian access to a wide range of facilities, and therefore represents a sustainable location for residential development. Everyday needs can therefore be provided for without the need to make use of a car.

### **Public Transport**

- 4.14 The site is very well served by buses being located off Madingley Road, which is a major route from Cambridge City Centre to the University, Park and Ride and beyond to the local villages and the wider road network via the A1303 and M11. Appendix H contains a map of bus services serving central Cambridge.
- 4.15 Bus stops located within close proximity of the junction of Wilberforce Road and Madingley Road and within 100m of the site boundary provide access to a number of bus routes including:
- Service C4/U4 every 10 minutes – Addenbrooks to Cambourne via City Centre and University Campus (also via Grange Road).
  - Service X5 every 30 minutes between City Centre and Bedford.



- Service 77, park & ride bus every 10 minutes to City Centre.
  - Services 305, 314 & 350, National Express services to a number of destinations including Birmingham, Coventry, Northampton, Bedford, St Neots, Sheffield
  - And a number of other less regular services which include services to the Colleges and Schools.
- 4.16 The U4 service which stops at both Madingley Road and Grange Road can also be used to access the railway station via Hills Road, which is located approximately 0.5km from the railway station. The development site itself is located approximately 3km to the north west of the Railway Station.
- 4.17 Cambridge Railway Station is a transport interchange between the City of London and East Anglia / Midlands. Therefore there are a large number of services provided by a number of operators including:
- First Capital Connect services to Kings Cross (frequency of approx. 2 trains per hour).
  - First Capital Connect services to King Lynn (frequency of approx. 1 train per hour).
  - National Express East Anglia services to London Liverpool Street (frequency of approx. 2 trains per hour).
  - National Express East Anglia services to Norwich (frequency of approx. 1 train per hour).
  - Cross Country services to Birmingham New Street (frequency of approx. 1 train per hour).
  - Cross Country services to Stanstead Airport (frequency of approx. 1 train per hour).
- 4.18 It can therefore be seen that the development site is well served in terms of public transport links to the local area including Cambridge City Centre, the Universities, Addenbrokes Hospital and additionally to wider destinations in the south and east of England; reducing the need to travel by car.



## 5 Combined Utilities Search

- 5.1 A combined utilities plan SK03 illustrating the major service providers in the local area can be found in Appendix I. Each of the services has been summarised below, please note an assessment of the available capacity in each of the networks has not been determined at this stage:

### **Anglian Water (Foul Water)**

- 5.2 The proposed surface water drainage is discussed in detail in Section 3. AW records indicate that there are 225mm and 600mm foul water sewers located within Wilberforce Road. The presence of the sewers is a good indication that foul water can be dealt with via positive drainage. There are no main sewers on the site itself that would require diverting as a result of the development proposals.

### **Cambridge Water (Potable Water)**

- 5.3 Cambridge Water records indicate that there are water mains serving all the surrounding roads, with a 6inch main located within Clerk Maxwell Road and a 5inch and 18inch trunk main within Wilberforce Road. The presence of the trunk main as well as the medium size mains would indicate that potable water can be provided at this location. There are no water mains on the site itself other than the private supplies that would require diverting as a result of the development proposals.

### **EDF Energy**

- 5.4 It can be seen on SK03 that there are a number of low voltage cables located along Wilberforce Road, Stacey Lane and in cul-de-sacs of The Lawns & Perry Court. There is also a high voltage cable located within Wilberforce Road that terminates at the sub-station located at the entrance to Stacey Lane adjacent to the pavilion. The presence of the HV cable and the sub-station is a good indication that an electricity supply can be provided to the site. There is a low voltage supply to the tennis club house that may be removed or require a minor alteration in the future.

### **National Grid**

- 5.5 National Grid records indicate that there are low pressure gas mains serving Wilberforce Road, The Lawns & Perry Court and as such it is expected that the network could be extended to serve the development site in the future. There are no mains within the development site other than potential private supplies that would require diverting as a result of the development proposals.

### **BT**

- 5.6 BT records indicate that there are underground cables serving the roads adjacent to the site and as such



it is very likely that the communications network could be extended to serve the development site in the future. There are no BT cables or overhead lines other than private connections that would require diverting as a result of the development proposals.

- 5.7 In summary it has been shown that the site is in close proximity to utility provider networks for sewage, water, electricity, gas and telecommunications; and that no major diversionary works are expected as a result of future development, although it should be noted that any S278 works within the highway to facilitate access may require services within the existing highway/verge to be lowered or protected to accommodate the access works.

## 6 Summary and Conclusions

- 6.1 The report has considered the deliverability of the development site based on: flood risk and development drainage, highways, access, pedestrian and cycle access, and site sustainability.
- 6.2 The site is currently used as a sports ground for the Emmanuel College, and is also the location of the Cambridge Lawn Tennis Club.
- 6.3 It is recommended that a Level 2 FRA is carried out to further examine the relationship of the Coton Stream with the site as a result of the historic fluvial flood event identified within the SFRA along Wilberforce Road. In addition a detailed drainage strategy will need to be prepared for the development as part of the Level 2 FRA to ensure flood risk is not increased downstream of the site.
- 6.4 It has been shown that highway access is readily achievable within recommended standards from a number of individual potential access points including direct from Wilberforce Road; however the ownership of the land between the existing spurs from Perry Court/The Lawns and the development boundary, required to secure access via the cul-de-sacs, is unknown at this stage.
- 6.5 It has been clearly illustrated that the development is well located for pedestrians and cyclists to access a wide range of facilities available within Cambridge City Centre in addition to the local area, and therefore represents a sustainable location for residential development.
- 6.6 The development site has also been shown to be well served in terms of public transport links to the local area including Cambridge City Centre, the Universities, Addenbrokes Hospital and additionally to wider destinations in the south and east of England; reducing the need to travel by car.
- 6.7 It has been shown that the site is in close proximity to utility provider networks for sewage, water, electricity, gas and telecommunications; and that no major diversionary works are expected as a result of future development, although it should be noted that any S278 works within the highway to facilitate access may require services within the existing highway/verge to be lowered or protected to accommodate the access works.
- 6.8 In conclusion the proposed development site is deliverable in terms of access, sustainability, flood risk and drainage.





## 7 Appendices

- Appendix: A Site Location Plan
- Appendix: B EA Flood Map
- Appendix: C SFRA Flood Map
- Appendix: D Sewer Records
- Appendix: E Greenfield Runoff and Attenuation Calculations
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## **Appendix: A**

## **SITE LOCATION PLAN**





## **Appendix: B**

## **EA FLOOD MAP**



Enter a postcode or place name:

Other topics for this area...

Risk of Flooding from Rivers and Sea

Map legend

Click on the map to see what is the Risk of Flooding at a particular location.

- Flood Maps
- Flooding from rivers or sea without defences
- Extent of extreme flood
- Flood defences (Not all may be shown\*)
- Areas benefiting from flood defences (Not all may be shown\*)
- Main rivers

X: 544,219;Y: 258,775 at scale 1:20,000

[Data search](#) [Text only version](#)



Customers in Wales - From 1 April 2013 Natural Resources Wales (NRW) will take over the responsibilities of the Environment Agency in Wales.  
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 This service is designed to inform members of the public, in line with our [terms and conditions](#). For business or commercial use, please [contact us](#).

**More about flooding:**

**Information Warning: Newport, South Wales**

We are aware of problems with the flood map for the Newport area. Please contact your local Natural Resources Wales office for accurate information. We are currently working to correct this information. [Natural Resources Wales Website](#)

**Understanding the flood map**

A more detailed explanation to help you understand the flood map shown above.

**Current flood warnings**

We provide flood warnings online 24 hours a day. Find out the current flood warning status in your local area.

**Flood map - your questions answered**

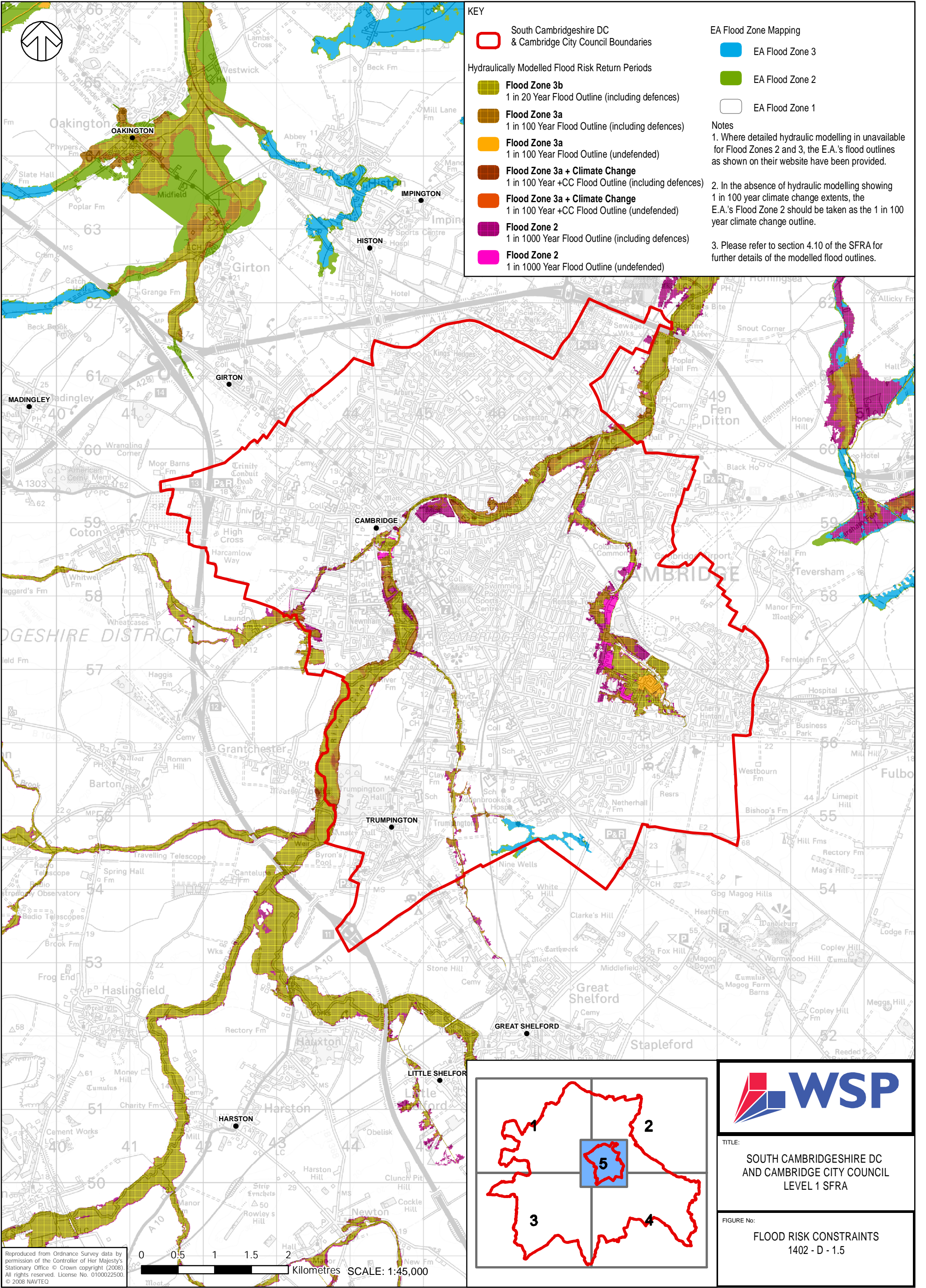
Answers to commonly asked questions about the flood map.

\* **Legend Information:** Flood defences and the areas benefiting from them are gradually being added through updates. Please contact your local environment agency office for further details.



## **Appendix: C**

## **SFRA FLOOD MAP**



TITLE:  
SOUTH CAMBRIDGESHIRE DC  
AND CAMBRIDGE CITY COUNCIL  
LEVEL 1 SFRA

FIGURE No:  
FLOOD RISK CONSTRAINTS  
1402 - D - 1.5



## **Appendix: D**

## **SEWER RECORDS**





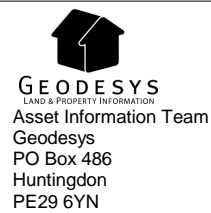
Map Centre 543417, 258820

Scale: 1250

Date: 31/10/2008 13:02

Data updated: September 2008

This plan is provided by Anglian Water pursuant to its obligations under the Water Industry Act 1991 sections 198 or 199. It must be used in conjunction with any search results attached. The information on this plan is based on data currently recorded but the position must be regarded as approximate. Service pipes, private sewers and drains are generally not shown. Users of this map are strongly advised to commission their own survey of the area shown on the plan before carrying out any works. The actual position of all apparatus MUST be established by trial holes. No liability whatsoever, including liability for negligence, is accepted by Anglian Water for any error or inaccuracy or omission, including the failure to accurately record, or record at all, the location of any water main, discharge pipe, sewer or drain or disposal main or any item of apparatus. This information is valid for the date printed. The plan is produced by Anglian Water Services Limited, trading as Geodesys from Ordnance Survey © Crown Copyright, WU 100018507. This map is to be used for the purposes of viewing the location of Anglian Water plant only. Any other use of the map data or further copies are not permitted. This notice is not intended to exclude or restrict liability for death or personal injury resulting from negligence.



**SEWER ASSET LEGEND**

- |                      |                         |
|----------------------|-------------------------|
| Surface Sewer        | Gravity Sewer           |
| Foul Sewer           | Vent Column             |
| Combined Sewer       | Manhole (Combined)      |
| S104/Private Sewer   | Manhole (Foul Water)    |
| Decommissioned Sewer | Manhole (Surface Water) |
| Rising Main          |                         |

Property Address: SITE AT, WILBERFORCE ROAD, CAMBRIDGE, CAMBRIDGESHIRE

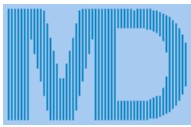
Customer: EAS Transport Planning

Title: A762138(1) (Joshua Mayes)



## **Appendix: E**

## **GREENFIELD RUNOFF AND ATTENUATION CALCULATIONS**



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Job No.		
Sheet no.		1
Date 18/09/13		
By	Checked	Reviewed

MasterDrain  
HY 8.21

Project		
Title	IoH 124 Runoff calcs for CAMBRIDGE	

### Hydrological Data:-

#### FSR Hydrology:-

Location = CAMBRIDGE	Grid reference = TL4658
M5-60 (mm) = 19.8	r = 0.44
Soil runoff = 0.30	SAAR (mm/yr) = 560
WRAP = 2	Area = England & Wales
Hydrological area = 5	Hydrological zone = 8

Soil classification for WRAP type 2

- i) Very permeable soils with shallow ground water;
- ii) Permeable soils over rock or fragipan, commonly on slopes in western Britain associated with smaller areas of less permeable wet soils; (fragipan - a natural subsurface horizon having a higher bulk density than the solum above. Seemingly cemented when dry but showing moderate to weak brittleness when moist. The layer is low in organic matter, mottled and slowly or very slowly permeable to water. It is found in profiles of either cultivated or virgin soils but not in calcareous material).
- iii) Moderately permeable soils, some with slowly permeable subsoils.

### Design data:-

Area = 0.01 Km<sup>2</sup> - 1.0 Ha - 10000 m<sup>2</sup>

### Calculation method:-

Runoff is calculated from:-

$$Q_{BAR(rural)} = 0.00108 \text{ AREA}^{0.89} \cdot \text{SAAR}^{1.17} \cdot \text{SOIL}^{2.17}$$

where

AREA = Site area in Km<sup>2</sup>  
 SAAR = Standard Average Annual Rainfall (mm/yr)  
 SOIL = Soil value derived from Winter Rainfall Acceptance Potential  
 Q<sub>BAR(rural)</sub> = Runoff (cumecs)

Q<sub>BAR(rural)</sub> is then multiplied by a growth factor - GC(T) - for different storm return periods derived from EA publication W5-074/A.

### Calculated data:-

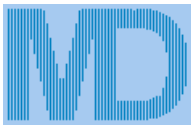
For areas less than 50Ha, a modified calculation which multiplies the 50Ha runoff value by the ratio of the site area to 50Ha is used  
 Reducing factor used for these calculations is 0.020

$$\text{Mean Annual Peak Flow } Q_{BAR(rural)} = 1.40 \text{ l/s}$$

Values for Q<sub>BAR(rural)</sub>

1 year	2 year	5 year	30 year	100 year	200 year	Units
0.001	0.001	0.002	0.003	0.005	0.006	cumecs
1.19	1.40	1.82	3.27	4.91	6.11	l/s
1.19	1.40	1.82	3.27	4.91	6.11	l/s/Ha
0.850	1.000	1.300	2.330	3.500	4.350	GC (T)

The above is based on the Institute of Hydrology Report 124 to which you are referred for further details (see Sect 7). Note that the 200 year growth curve was taken from W5-074/A.



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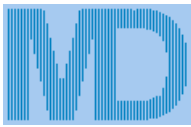
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Job No.		
Sheet no.		1
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SW

Project		
Title	Attenuation storage volume for CAMBRIDGE	

Hydrological region	(R)	<input type="text" value="5"/>		Note 1
Hydrological rainfall zone	(Z)	<input type="text" value="8"/>		Note 2
Development area - ha	(A)	<input type="text" value="6.500"/>	ha	Note 3
Proport. of imp.area requiring storage	(a)	<input type="text" value="1.000"/>		Note 4
Greenfield flow rate per unit area	( $Q_{BAR}/A$ )	<input type="text" value="4.91"/>	l/s/ha	Note 5
% impermeable area of catchment	(PIMP)	<input type="text" value="50.0"/>	%	Note 6
Attenuation storage volumes per unit area:-				
	( $Uvol_{1yr}$ )	<input type="text" value="65.0"/>	m <sup>3</sup> /ha	Note 7
	( $Uvol_{30yr}$ )	<input type="text" value="140.0"/>	m <sup>3</sup> /ha	
	( $Uvol_{100yr}$ )	<input type="text" value="180.0"/>	m <sup>3</sup> /ha	
Basic storage volumes :-				
( $Uvol \times a \times A$ )	( $BSV_{1yr}$ )	<input type="text" value="422.5"/>	m <sup>3</sup>	Note 8
	( $BSV_{30yr}$ )	<input type="text" value="910.0"/>	m <sup>3</sup>	
	( $BSV_{100yr}$ )	<input type="text" value="1170.0"/>	m <sup>3</sup>	
Climate change factor	(CC)	<input type="text" value="1.3"/>		Note 9
FEH factor		<input type="text" value="1.0"/>		Note 10
Critical storm duration		<input type="text" value="4.0"/>	hrs	Note 11
FEH Rainfall factor :-				
	( $FF_{1yr}$ )	<input type="text" value="1.10"/>		Note 12
	( $FF_{30yr}$ )	<input type="text" value="1.00"/>		
	( $FF_{100yr}$ )	<input type="text" value="0.90"/>		
Storage volume ratio :-				
f (CC/FF)	( $SVR_{1yr}$ )	<input type="text" value="1.247"/>		Note 13
	( $SVR_{30yr}$ )	<input type="text" value="1.408"/>		
	( $SVR_{100yr}$ )	<input type="text" value="1.604"/>		
Adjusted storage volumes :-				
( $SVR \times BSV$ )	( $ASV_{1yr}$ )	<input type="text" value="527.0"/>	m <sup>3</sup>	Note 14
	( $ASV_{30yr}$ )	<input type="text" value="1281.28"/>	m <sup>3</sup>	
	( $ASV_{100yr}$ )	<input type="text" value="1877.2"/>	m <sup>3</sup>	



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Project	
Title	Attenuation storage volume for CAMBRIDGE

*Growth curve factors :-*

(GC <sub>1yr</sub> )	<input type="text" value="0.85"/>	Note 15
(GC <sub>30yr</sub> )	<input type="text" value="1.00"/>	
(GC <sub>100yr</sub> )	<input type="text" value="1.00"/>	

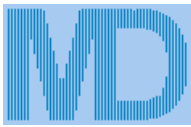
*Hydrological region volume storage ratio :-*

(HR <sub>1yr</sub> )	<input type="text" value="0.97"/>	Note 16
(HR <sub>30yr</sub> )	<input type="text" value="1.00"/>	
(HR <sub>100yr</sub> )	<input type="text" value="1.00"/>	

*Final estimated attenuation storage volumes:-*

(HR x ASV)	(AtVol <sub>1yr</sub> )	<input type="text" value="508.8"/>	m <sup>3</sup>	Note 17
	(AtVol <sub>30yr</sub> )	<input type="text" value="1281.3"/>	m <sup>3</sup>	
	(AtVol <sub>100yr</sub> )	<input type="text" value="1877.2"/>	m <sup>3</sup>	

Printed from Masterdrain Hydrology program.



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Project		
Title	Attenuation storage volume for CAMBRIDGE	

## Notes:-

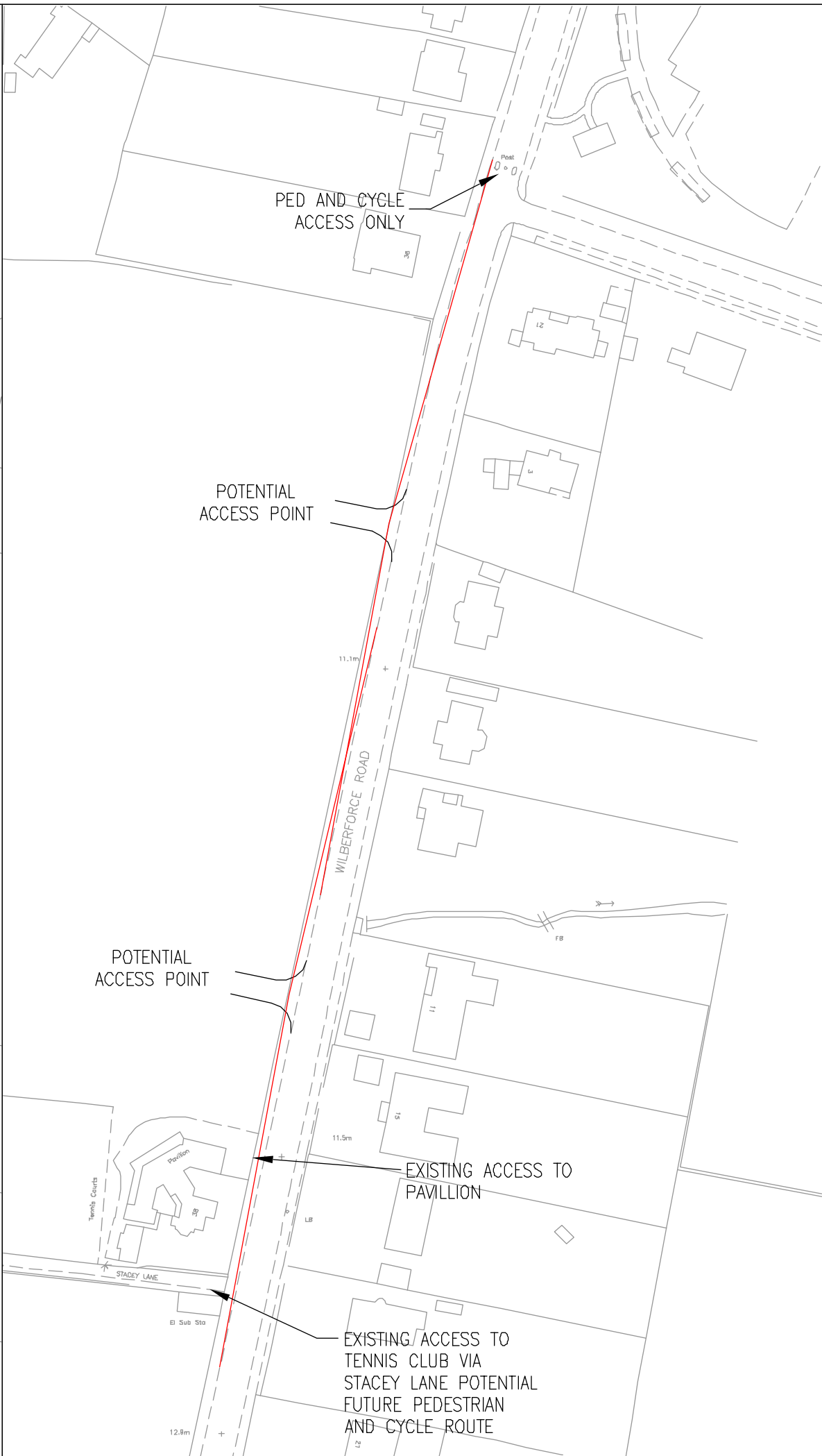
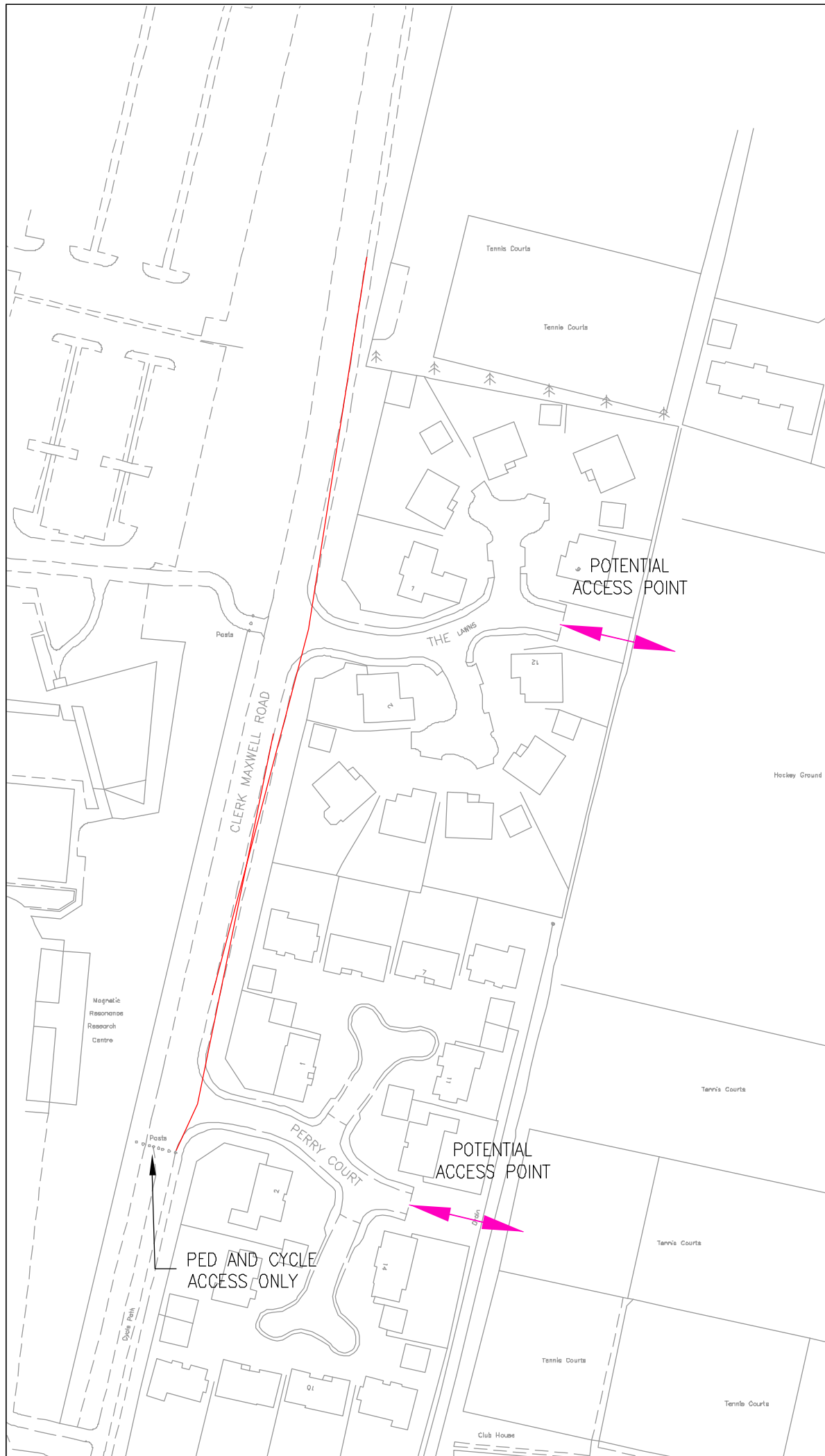
References to Appendix 1 refer to 'R&D Technical Report W5-074/A - Preliminary rainfall runoff management for developments (Revision C) Defra/EA

- Note 1 - UK is divided into 10 Hydrological regions reflecting the different flood frequency growth curves (Appendix 1, fig 1.1). This data is included in the database.
- Note 2 - Zones 1 - 8 based on FSR rainfall characteristics. This data is included in the database.
- Note 3 - Excluding public open spaces not modified Or drained by the proposed development.
- Note 4 - Impermeable area served by direct drainage / total area of impermeable surface.
- Note 5 - From previous calculation.
- Note 6 - For catchments where the PIMP value is less than 50%, a more detailed study should be made as the storage estimates may be undersized.
- Note 7 - These values are generated by the program, based on the graphs in Appendix 1, figures 7.1 - 7.8.
- Note 8 - Storage units may serve areas of different densities of development. If necessary, calculations should be based on each development zone, then cumulated.
- Note 9 - The Defra guidance on the impact of climate change on river flows is to apply a factor of 1.2. As there is a non-linear relationship between rainfall and runoff, it is suggested that a factor of 1.1 should be applied to rainfall +depths in this procedure.
- Note 10 - FEH factor is calculated by the program. It is used to derive the critical storm duration for the appropriate hydrological zone. (App. 1, fig. 11)
- Note 11 - The critical storm duration for the location. This should be used to select the FSR/FEH ratio map in Appendix 1, figures 6.1.1 to 6.3.4.
- Note 12 - This is derived from the maps in Appendix 1, 6.1.1 to 6.3.4
- Note 13 - This is a function of the Climate change factor and the FEH rainfall factor. See App 1, Figs 8.1 to 8.8
- Note 14 - Storage volumes adjusted for climate change and FEH rainfall.
- Note 15 - Growth curve factors for each hydrological region obtained from Appendix 1, figure 1.2 (table inset in figure).
- Note 16 - These are a function of the Storage Volume Ratio and the growth curves.
- Note 17 - Required attenuation storage.



## **Appendix: F**

## **ACCESS OPPORTUNITIES**



PLEASE NOTE:

VISIBILITY SPLAYS OF 2.4m x 90m SHOWN FROM EACH POTENTIAL ACCESS POINT

REV	DATE	BY	DESCRIPTION	CHK	APD
DRAWING STATUS:					



Unit 10 The Mallings, Stanstead Abbots, Hertfordshire, SG12 8HG  
Tel: 01920 871777  
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CLIENT: **BIDWELLS**

ARCHITECT:

PROJECT: **LAND OFF WILBERFORCE ROAD  
CAMBRIDGE**

TITLE: **POTENTIAL ACCESS OPPORTUNITIES**

SCALE @ A3: 1:1250	DESIGN-DRAWN: SA	DATE: 12/11/08
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PROJECT No: <b>090/2008</b>	DRAWING No: <b>SK02</b>
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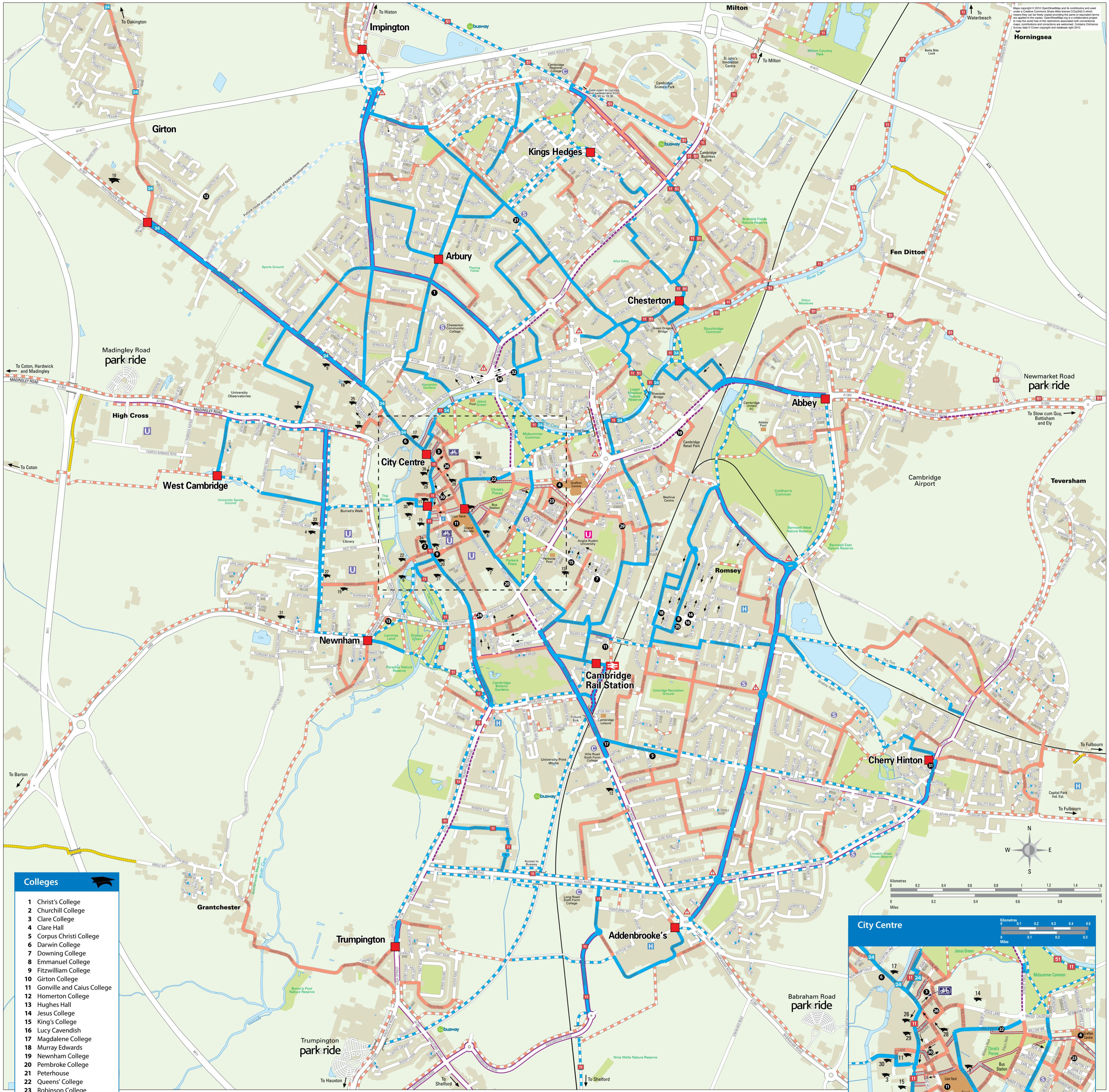




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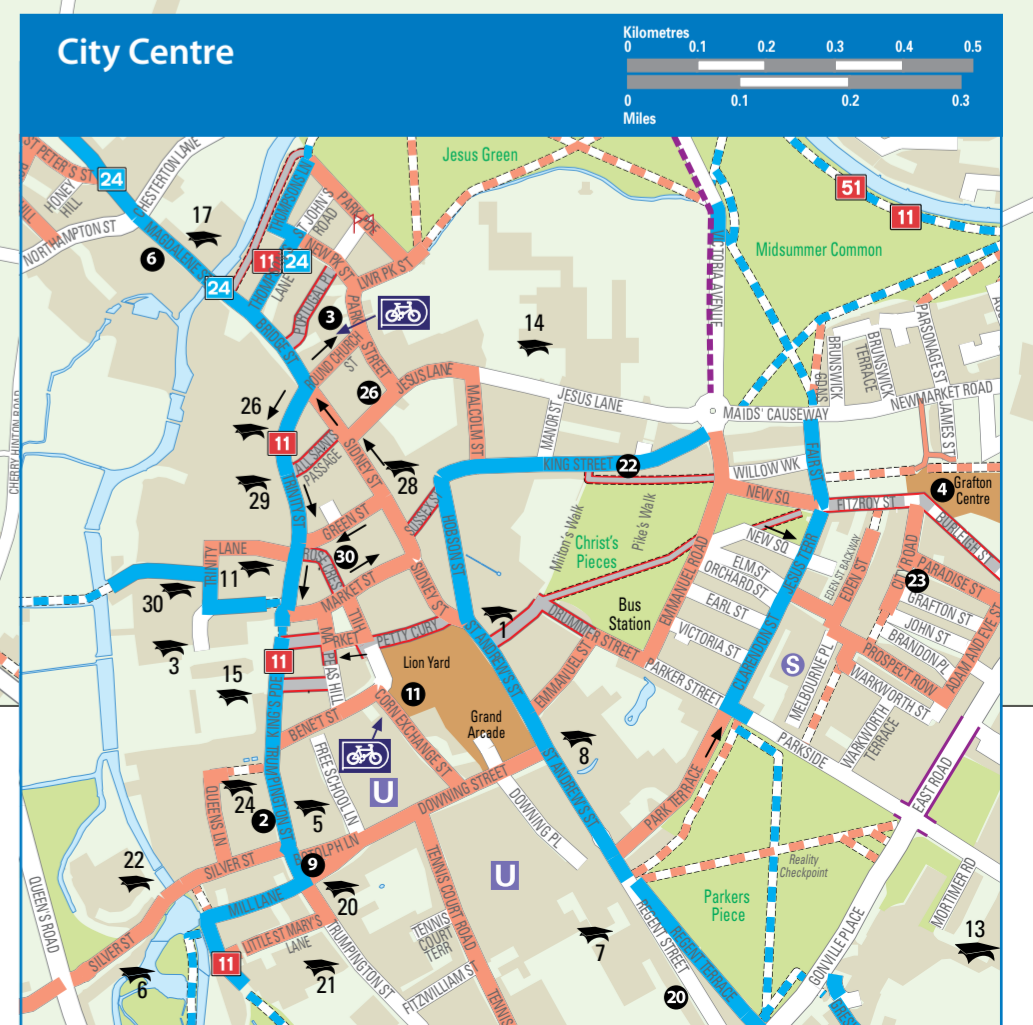
## **Appendix: G**

## **CAMBRIDGE CYCLE MAP**



- ### Colleges
- 1 Christ's College
  - 2 Churchill College
  - 3 Clare College
  - 4 Clare Hall
  - 5 Corpus Christi College
  - 6 Darwin College
  - 7 Downing College
  - 8 Emmanuel College
  - 9 Fitzwilliam College
  - 10 Girton College
  - 11 Gonville and Caius College
  - 12 Homerton College
  - 13 Hughes Hall
  - 14 Jesus College
  - 15 King's College
  - 16 Lucy Cavendish
  - 17 Magdalene College
  - 18 Murray Edwards
  - 19 Newnham College
  - 20 Pembroke College
  - 21 Peterhouse
  - 22 Queens' College
  - 23 Robinson College
  - 24 St Catharine's College
  - 25 St Edmund's College
  - 26 St John's College
  - 27 Selwyn College
  - 28 Sidney Sussex College
  - 29 Trinity College
  - 30 Trinity Hall
  - 31 Wolfson College

Signed primary network on road	On-road cycle lane	National Cycle Network	Cambridge University locations	Pinch points. Restricted width for trailers
Signed primary network separate from traffic	Cycle and bus lane	Sustrans' local route	University / College locations	Blue sign destinations
Local links and links to villages on road	Cycling prohibited at all times	Cycle Park	Other university locations	Colleges and secondary schools
Local links and links to villages separate from traffic	Cycling prohibited Mon-Sat 10am-4pm	Busy roundabout or junctions. Take care	Hospital	One-way street
	Bridleway (useable when dry)	Railway line	Bike shops (see other side for details)	



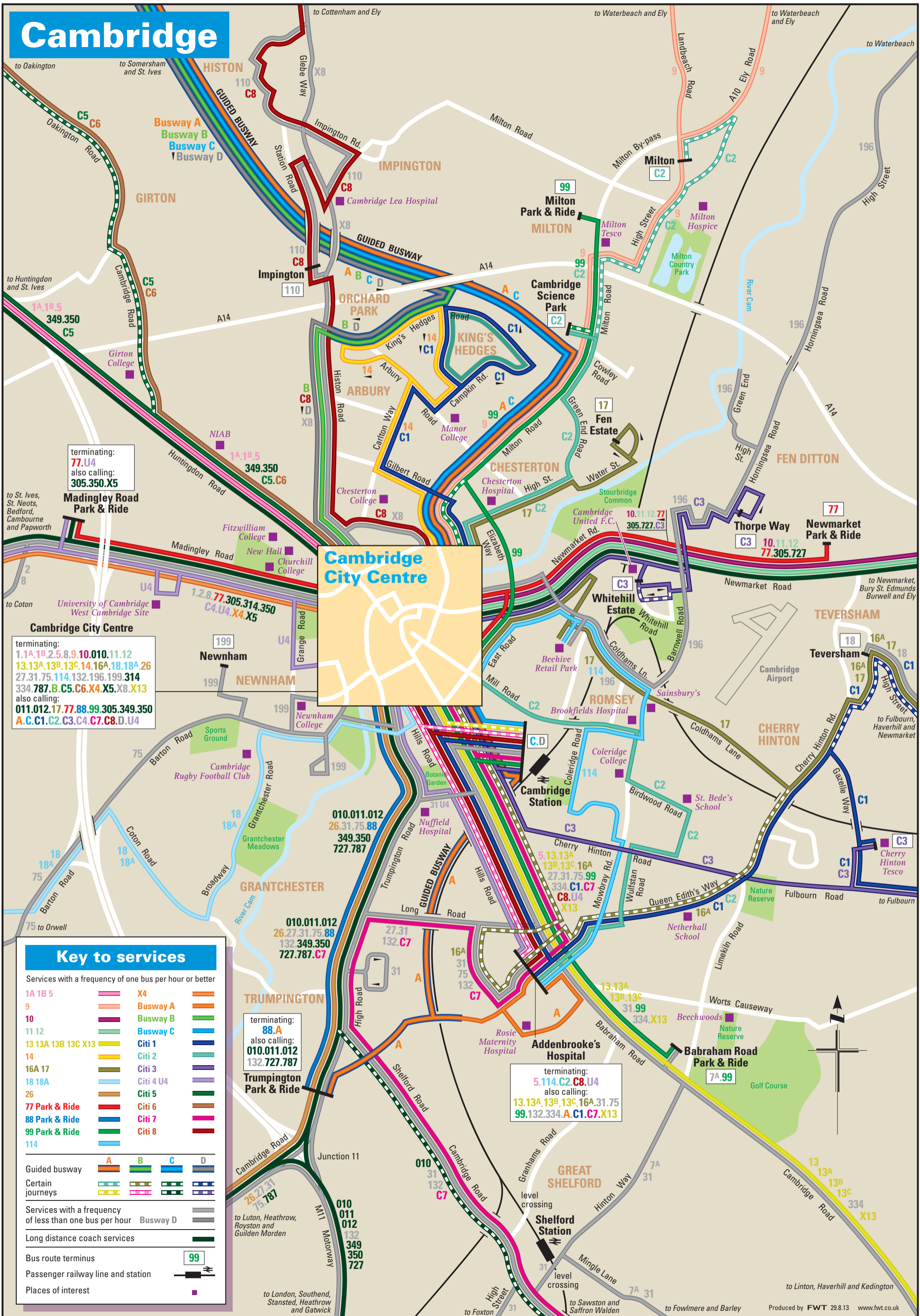


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## **Appendix: H**

## **CAMBRIDGE BUS MAP**

# Cambridge



terminating:  
77.U4  
also calling:  
305.350.X5

**Cambridge City Centre**  
terminating:  
1.1A.1B.2.5.8.9.10.010.11.12  
13.13A.13B.13C.14.16A.18.18A.26  
27.31.75.114.132.196.199.314  
334.787.B.C5.C6.X4.X5.X8.X13  
also calling:  
011.012.17.77.88.99.305.349.350  
A.C.C1.C2.C3.C4.C7.C8.D.U4

### Key to services

Services with a frequency of one bus per hour or better

1A 1B 5	X4	Busway A
9	Busway B	Busway C
10	Busway C	Busway D
11 12	Citi 1	Citi 2
13 13A 13B 13C X13	Citi 3	Citi 4 U4
14	Citi 5	Citi 6
16A 17	Citi 7	Citi 8
18 18A	77 Park & Ride	88 Park & Ride
26	99 Park & Ride	114

Guided busway: A B C D

Certain journeys: (various dashed line styles)

Services with a frequency of less than one bus per hour: Busway D

Long distance coach services: (thick line)

Bus route terminus: 99

Passenger railway line and station: (black line with cross-ticks)

Places of interest: (purple square)

terminating:  
88.A  
also calling:  
010.011.012  
132.727.787

terminating:  
5.114.C2.C8.U4  
also calling:  
13.13A.13B.13C.16A.31.75  
99.132.334.A.C1.C7.X13



## **Appendix: I**

## **UTILITIES PLAN**

