

Darwin Green 2/3 Allocation

Statement of Common
Ground

Drainage Strategy

March 2015

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INTRODUCTION

- 1.1 This Technical Note has been prepared on behalf of Barratt Eastern Counties and the North West Cambridge Consortium of Landowners in support of the allocation of the Darwin Green 2/3 (DG2/3) sites to the northwest of Cambridge.
- 1.2 A Site Location Plan indicating the DG2/3 sites is given in **Appendix 1**. (Bidwells drg. no. B.10/902F)
- 1.3 The foul drainage strategy has been agreed with Anglian Water who are currently designing the Darwin Green One (DG1) Foul Pumping Station that will also accommodate the DG2/3 flows.
- 1.4 The Surface Water Strategy is based upon the parameters contained within the approved DG1 Flood Risk Assessment and the approved Surface Water Strategy prepared by Woods Hardwick Infrastructure in April 2014 (Rev. E), which was approved by both Cambridge City Council and South Cambridgeshire District Council.
- 1.5 The Note demonstrates that there are no drainage issues associated with the development of DG2/3 and as such it should be fully supported.

FOUL DRAINAGE STRATEGY

- 2.1 The DG2/3 Development indicated in pink and red hatching on the plan given in Appendix 1, will discharge into stubs provided as part of the DG1 strategic infrastructure network upstream of the gravity feed to a new foul pumping station.
- 2.2 The Foul Pumping Station will be located to the North of the new Histon Road access immediately to the East of the existing electricity pylon.
- 2.3 The foul pumping station has got the benefit of a detailed planning application being granted by SCDC on 20th August 2014.
- 2.4 In addition to serving the residential elements of the DG2/3 Development, the DG1 infrastructure will also accommodate the existing 225mm diameter foul drainage sewer from Girton to the West which currently crosses the site.
- 2.5 The existing foul sewer will be relaid through the development to suit the final layout under a Section 185 Agreement with Anglian Water,
- 2.6 In order to improve the gradient to the existing run which will improve self-cleansing velocity and enable the sewer to be diverted to the latest sewer for adoption requirements, the invert of the stub at the DG1 interface has been set at a lower level.
- 2.7 Given that this existing sewer is in a poor state of repair this realignment and re-grading work will represent a significant benefit to the existing network, which currently does not come up to the latest standards.
- 2.8 The rising main from the proposed pumping station will run back through the DG1 development, following the planning approved infrastructure road alignment, up to the point where a gravity outfall can be provided to the western end of Windsor Road.
- 2.9 From this point a new gravity sewer will be laid along Windsor Road, discharging into the outfall manhole from which there is sufficient capacity to accommodate the flows.
- 2.10 The new gravity sewer along Windsor Road will run alongside the existing sewer, which will be retained with any existing connections encountered enroute being diverted into the new sewer.
- 2.11 The pumping station, rising main and off site works along Windsor Road are currently being designed by Anglian Water and their consultants with the works being undertaken as part of a S98 Requisition Procedure. This design will include emergency storage in the network in the event of a pump failure.
- 2.12 The DG1 on site works and future gravity foul sewers on DG2/3 are being designed by Woods Hardwick Infrastructure on behalf of the Developers with the completed networks being adopted by Anglian Water under S104 and S185 Agreements for the new and diverted sewers respectively.
- 2.13 In conclusion the DG2/3 site will be drained by gravity into the stub being provided as part of the DG1 development.
- 2.14 **There are therefore no technical issues relating to foul drainage for the DG2/3 proposals.**

SURFACE WATER STRATEGY

- 3.1 The Darwin Green 2/3 Surface Water Strategy is indicated on drg. no. 16877/2002K given in **Appendix 2**. The DG2/3 site ultimately drains into the Histon Brook to the north of the A14 via Award Drain No 1 (164) which crosses the A14 in a culvert.
- 3.2 Award Drain No. 1 (164) which runs east to west past Impington Farm and Woodhouse Farm and Award Drain No. 7 (359) to the northwest of the site will be retained on their existing alignments and the legal easements kept clear of any built form.
- 3.3 Award Drain No. 1 (164) will be regraded and cleaned out between the proposed restricted outfalls and the existing A14 culvert to suit the detailed level requirements.
- 3.4 The geology of the Darwin Green sites consist of clayey sand and gravel, overlying Gault Clays with Lower Greensand below.
- 3.5 The groundwater levels on the site vary throughout the year but given the visible surface flooding at certain times it has been proven that infiltration will not be possible in the detailed design and as such it has been ignored in the assessment which follows.
- 3.6 It should also be noted that in the approved Detailed Surface Water Strategy for DG1 infiltration was ignored with the solution being based upon restricting discharge and attenuating additional run-off within the site in various ways.
- 3.7 The DG2/3 site has been checked against the flood maps which are available from the Environment Agency (EA) website. A copy of this map is given in **Appendix 3**.
- 3.8 The flood map shows that none of the Darwin Green sites are within an area at risk of flooding from fluvial rivers (up to 1 in 100 annual probability – Flood Zone 3) nor at risk from an extreme flood (up to 1 in 1000 annual probability – Flood Zone 2). Therefore in accordance with the Environment Agency Standing Advice, all of the Darwin Green sites lie within Flood Zone 1 being suitable for all types of development including residential.
- 3.9 The DG2/3 development site currently drains naturally into Award Drain No 1 (164) following the existing topography which falls towards the A14 to the north.
- 3.10 In order to calculate the existing greenfield run-off rate from the Darwin Green sites the Institute of Hydrology Report No 124, "Flood estimation for small catchments" has been used. This is recommended for all catchments up to 200ha with catchments smaller than 50ha being based upon the Greenfield run-off rate per ha being applied.
- 3.11 The Greenfield run-off rate for a 1 in 100 year (plus 30%) return period for the DG1 site of 53ha is 9.1 l/s.ha (481l/s).
- 3.12 Applying this to DG2/3 site gives the following existing Greenfield run-off rates of:

	Area	Greenfield run-off
DG2/3	31.627ha	287.8 l/s

- 3.13 Given at the time that the FRA for DG1 was approved it was felt that some form of infiltration would be acceptable and as such it was agreed that the allowable discharge for DG1 would be restricted to only 78 l/s. This being equivalent to only 1.47 l/s.ha representing only 16% of the Greenfield run-off rates calculated using the industry recognised standard IH124.

- 3.14 In order to provide a robust solution the technical viability for the residential site for DG2/3 is based upon this extremely low discharge rate (1.47 l/s.ha) giving the following allowable discharge rate.

Site	Area	Maximum Discharge
DG2/3	31.627ha	46.49 l/s

- 3.15 The surface water drainage strategy for DG1 is based upon a maximum discharge into the existing east west watercourse of only 78 l/s with the additional run-off resulting from the development being attenuated on the site.
- 3.16 This attenuation consists of a series of on line swales, permeable paving within the private parking courts, attenuation ponds within the public open spaces and a feature pond at the northern part of the site which stores the balance required upstream of the flow control.
- 3.17 The balancing feature immediately upstream of the DG1 outfall is currently located within the DG2/3 development site and as such will need to be relocated in order to provide this area for development.
- 3.18 The DG1 northern pond has an approximate area of 5600m² which will be relocated in a northerly direction between the proposed DG2/3 boundary and south of Awarded Drain No1 as shown in blue on the Strategy Plan.
- 3.19 The DG1 northern pond accounts for about 70% of the total attenuation required for the DG1 site with 30% being provided within the extensive green spaces within the development.
- 3.20 Based upon the above a 70/30 split has also been assumed for DG2/3.
- 3.21 In order to assess the total attenuation required as a result of developing DG2/3 the following have been applied.

Site	Gross Area	Impermeable Area (60%)	Maximum Discharge (l/s)
DG2/3	31.627 ha	18.96 ha	46.49

- 3.22 Run off from the development will be stored in an attenuation pond located to the north of the development boundary but to the south of the drain and south of the A14 as indicated on the Strategy Plan.
- 3.23 In order to assess the attenuation required for the DG2/3 elements, the quick storage programme facility in MicroDrainage has been used applying the following parameters for the 1 in 100 year event with an allowance of 30% being applied throughout for climatic change.
- 3.24 The parameters are as follows:

Site	Gross Area	Impermeable Area	Maximum Discharge (l/s)
DG2/3	31.627ha	18.96ha	46.49l/s

- 3.25 The print-outs for these simulations are given in **Appendix 4** giving the following range of total attenuation required:

DG2/3 - 12119m³ to 15545m³ (Assume average 13832m³)

3.26 As stated above for the elements of DG2/3 30% of the total attenuation required will be provided within the development area in the various forms available leaving the following volumes to be stored in the pond.

DG2/3 - 9682m³

3.27 The attenuation pond has been drawn assuming a maximum water depth of 1m which is in line with the depth of the existing watercourses providing a low level dry feature when not in use for surface water attenuation purposes.

3.28 In addition to the above robust assessment, all properties with gardens will probably have water butts for harvesting rainwater for irrigation purposes and where possible driveways and car parks will slope towards gardens/open spaces to encourage run-off to infiltrate into the ground rather than into the surface water drainage system.

3.29 The above surface water assessment demonstrates that the additional run-off from DG2/3 can be accommodated on the site within 1 m deep depressions in the 1 in 100 year event with an allowance of 30% for climatic change. This is based upon allowable discharge rates of only 16% of those determined using the industries recognised IH124 standard.

3.30 There is therefore considerable betterment in terms of surface water run-off from the site if DG2/3 is developed with reduced flows discharging into the awarded drain and to all culverts and watercourses downstream of the discharge points.

Cambridgeshire Surface Water Management Plan

3.31 In addition to reviewing the EA indicative flood mapping, Hyder Consulting have been commissioned to undertake an assessment of what the impact of the DG2/3 development will have on the Cambridgeshire Surface Water Management Plan using the approved DG1 scenario as the base position.

3.32 Hyders findings are contained in their Technical Note dated 6th March 2015. This note concludes that 'the DG2 and DG3 post development scenario gives the greatest reduction in flooding across the DG2 and DG3 sites as well as downstream areas to the north of the A14'.

3.33 Figure 4 in the report clearly demonstrates the above where the blue areas represent where the depth of flooding has been reduced and those in orange where the controlled flood depths have increased. The orange areas being located between the proposed development boundary and the A14.

3.34 **There are therefore no technical issues relating to surface water for DG2/3.**

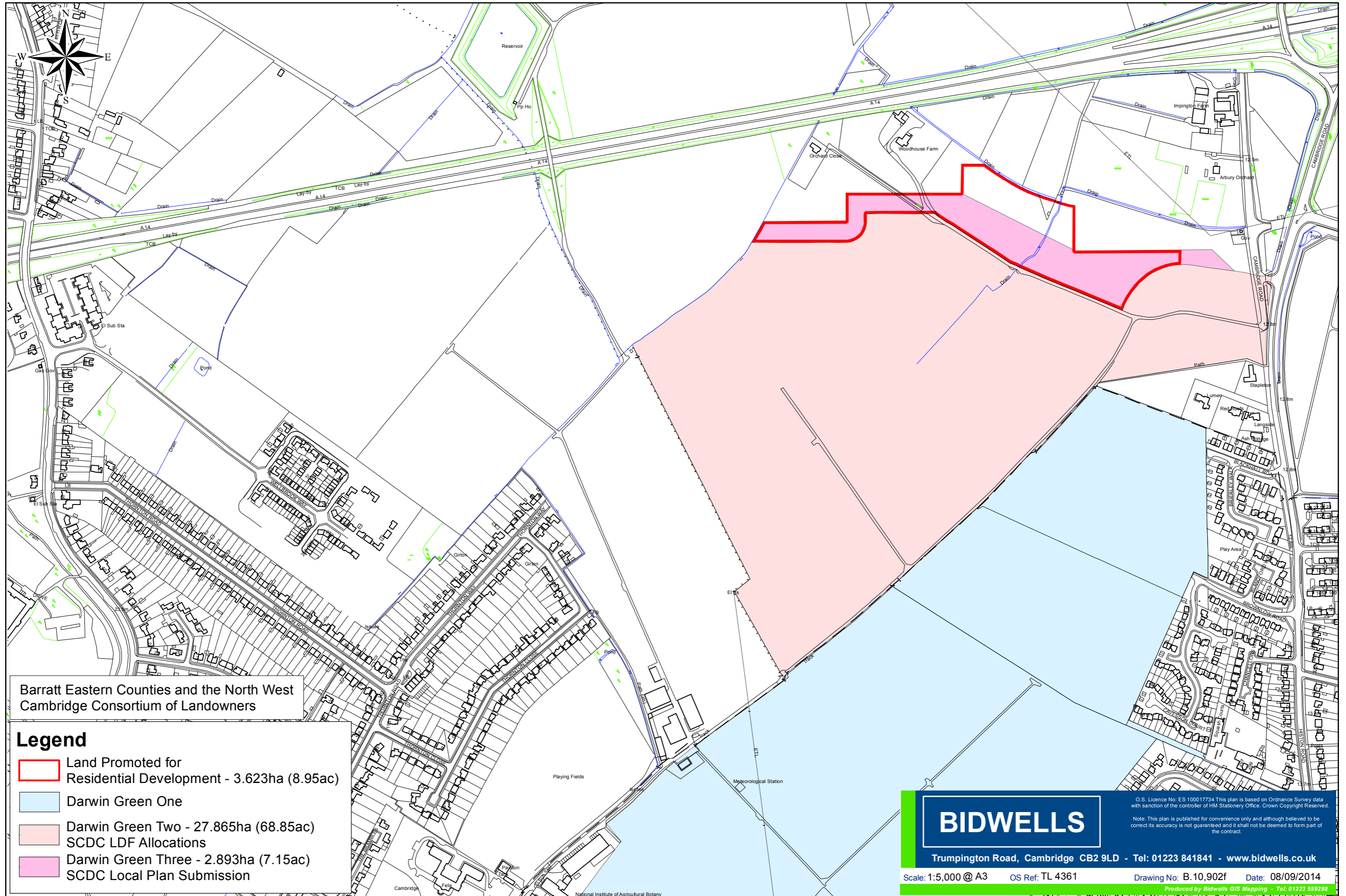
SUMMARY AND CONCLUSIONS

- 4.1 The foul drainage strategy for the Darwin Green site has been agreed with Anglian Water who are currently designing the pumping station, rising main and off-site works along Windsor Road via a S98 requisition.
- 4.2 The DG1 foul infrastructure will be designed to accommodate DG2/3 which will also make due allowance for the existing Girton outfall which will be diverted into the new network.
- 4.3 The surface water strategy for DG2/3 is based upon extremely robust discharge rates as used in the approved strategy for DG1 which are considerably lower than the existing Greenfield run-off figures derived using IH124.
- 4.4 With the attenuation features proposed in conjunction with the low discharge rates there will be a reduction of flows downstream of the site representing significant betterment.
- 4.5 Hyders independent assessment of the DG2/3 scenario supports the development of DG2/3 as within their executive summary they state, "overall, the proposed Darwin Green 2/3 development presents a unique opportunity to reduce flood risk issues downstream of its catchment area and take an innovative approach to surface water management, which has the potential to deliver wider environmental and water quality benefits".
- 4.6 **It can therefore be concluded that DG2/3 has satisfactory foul and surface water outfalls and as such the sites should be fully supported.**

APPENDIX 1

Location Plan
(Bidwells drg. no. B.10,902F)

Land Promoted for Release Darwin Green Two & Three



Barratt Eastern Counties and the North West
Cambridge Consortium of Landowners

Legend

- Land Promoted for Residential Development - 3.623ha (8.95ac)
- Darwin Green One
- Darwin Green Two - 27.865ha (68.85ac)
SCDC LDF Allocations
- Darwin Green Three - 2.893ha (7.15ac)
SCDC Local Plan Submission

BIDWELLS

Trumpington Road, Cambridge CB2 9LD - Tel: 01223 841841 - www.bidwells.co.uk

Scale: 1:5,000 @ A3

OS Ref: TL 4361

Drawing No: B.10,902f

Date: 08/09/2014

Produced by Bidwells GIS Mapping - Tel: 01223 559288

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Note: This plan is published for convenience only and although believed to be correct its accuracy is not guaranteed and it shall not be deemed to form part of the contract.

APPENDIX 2

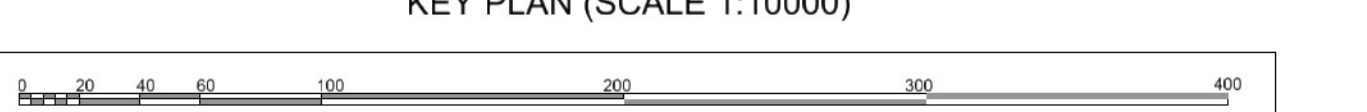
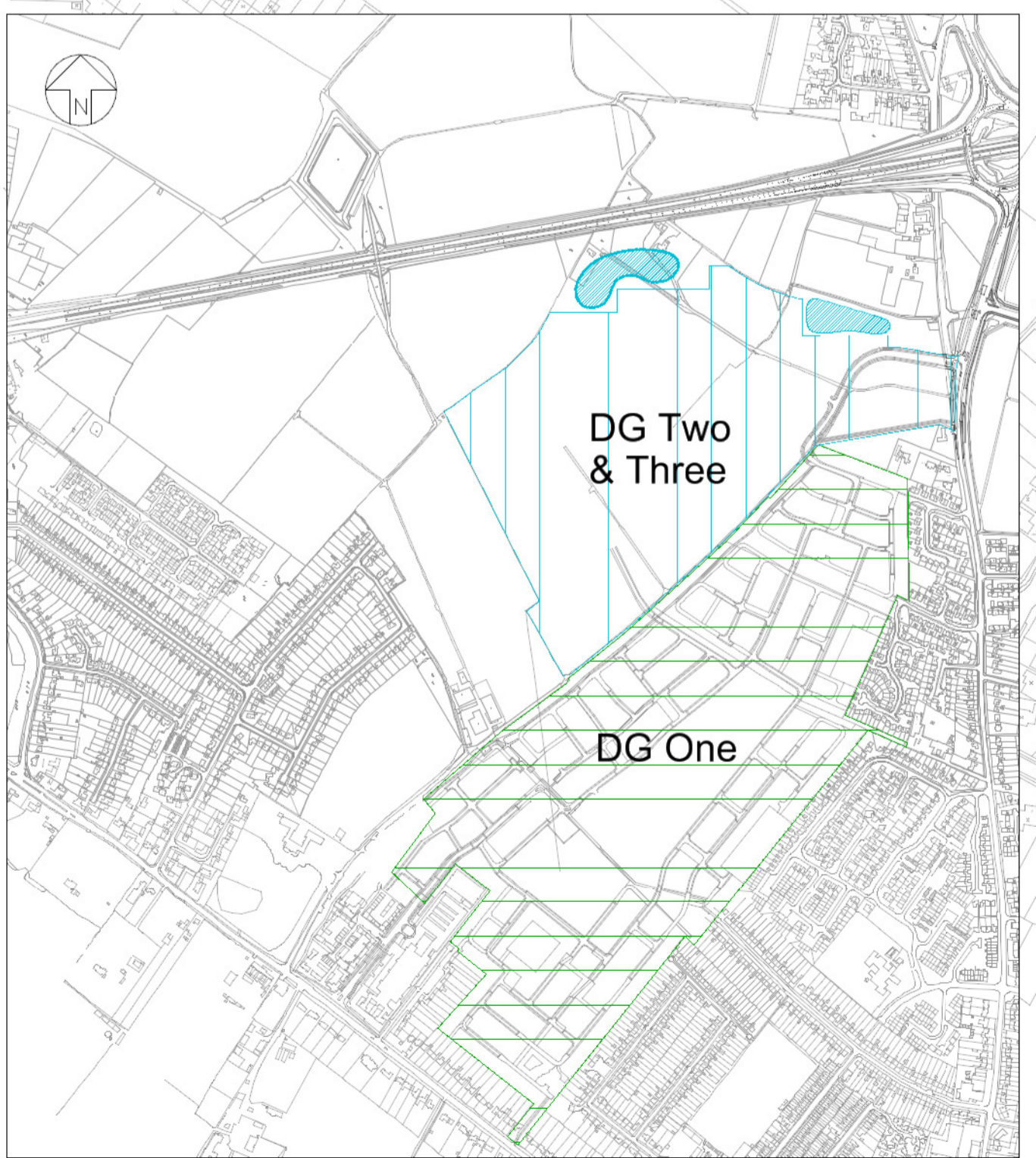
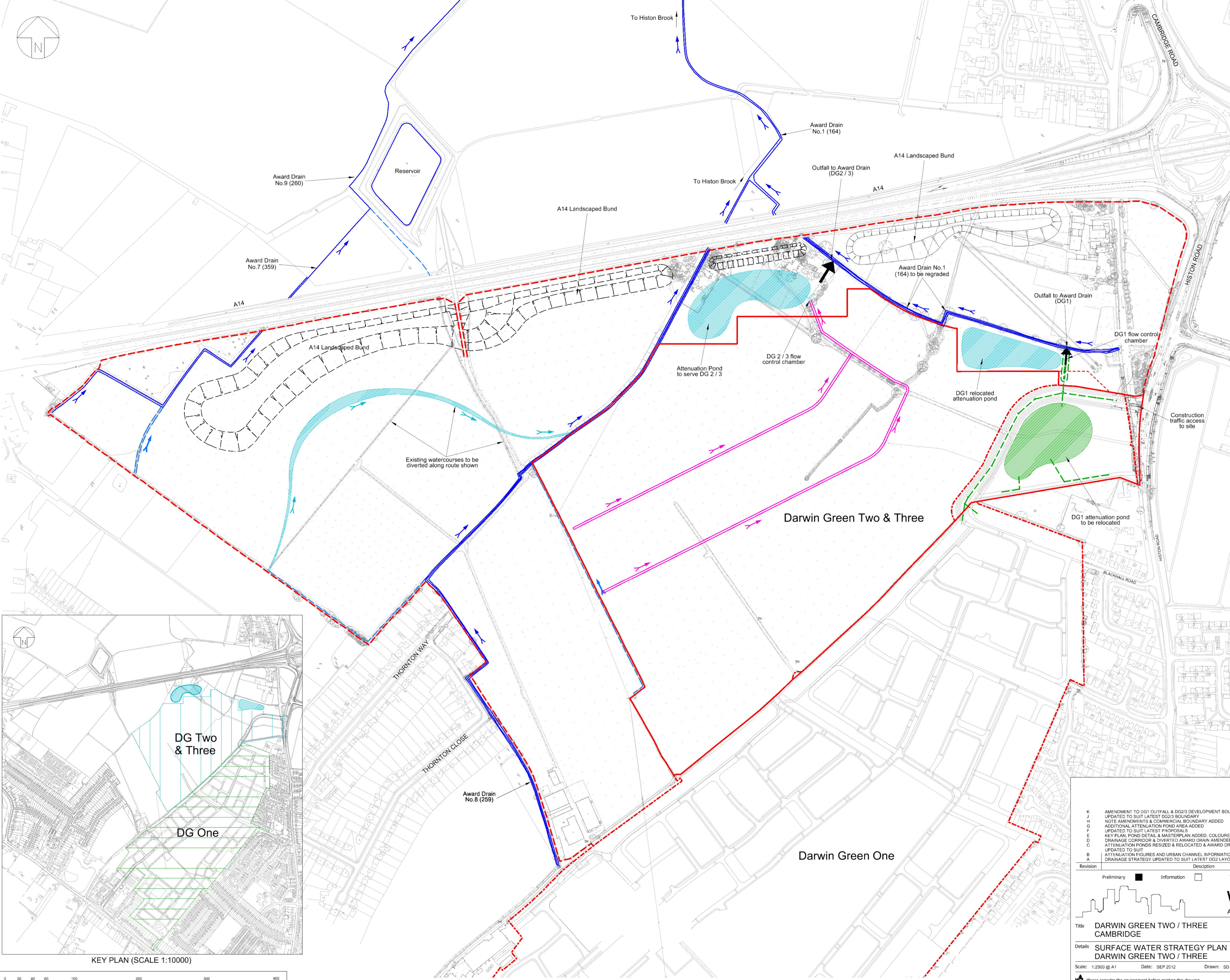
Darwin Green 2/3 Surface Water Strategy

(Drg.No.16877/2002K)

- Contractors must check all dimensions on site. Only figured dimensions are to be worked from. Discrepancies must be reported to the Architect or Engineer before proceeding. © This drawing is copyright
- Reproduced from OS Sitemap © by permission of Ordnance Survey® on behalf of The Controller of Her Majesty's Stationary Office. © Crown copyright 2008. All rights reserved. Licence number 100007126.
- Attenuation ponds based upon an allowable discharge rate of 1.47 l/s.ha and 1in100 year (+30%) return.
- Maximum depth of ponds to be 1.0m due to depth of existing ditches.

- DG 1 Site Boundary
- DG 2 / 3 Ownership Boundary
- DG 2 / 3 Development Boundary
- DG 3 SCDC Local Plan Submission Extent
- Award Drain (and direction)
- Existing watercourse (and direction)
- DG 1 Drainage
- DG 2 / 3 Drainage
- DG 2 / 3 Drainage Corridor "Urban Swales" (and direction)

DG1 Relocated	= 5,600m ³
DG2 / 3 (South)	= 9,682m ³
Overall Total	= 15,282m ³



Revision	Description	Drawn	Checked	Date
K	AMENDMENT TO DG1 OUTFALL & DG2/3 DEVELOPMENT BOUNDARY	SD	IDB	08-09-2014
J	UPDATED TO SUIT LATEST DG2/3 BOUNDARY	SD	IDB	05-09-2014
H	NOTE AMENDMENTS & COMMERCIAL BOUNDARY ADDED	SD	IDB	11-10-2013
G	ADDITIONAL ATTENUATION POND AREA ADDED	SD	JGF	10-10-2013
F	UPDATED TO SUIT LATEST PROPOSALS	SD	JGF	16-09-2013
E	KEY PLAN, POND DETAIL & MASTERPLAN ADDED. COLOURED AMENDED FOR CLARIFICATION	SD	JGF	03-05-2013
D	DRAINAGE CORRIDOR & DIVERTED AWARD DRAIN AMENDED	SD	JGF	03-05-2013
C	ATTENUATION PONDS RESIZED & RELOCATED & AWARD DRAIN DIVERTED. FIGURES	SD	JGF	02-05-2013
B	UPDATED TO SUIT	SD	IDB	27-02-2013
A	ATTENUATION FIGURES AND URBAN CHANNEL INFORMATION ADDED	SD	IDB	15-02-2013
	DRAINAGE STRATEGY UPDATED TO SUIT LATEST DG2 LAYOUT	SD	IDB	15-02-2013

Preliminary Information Tender Construction As Built

Woods Hardwick
 Architects, Engineers and Development Consultants

Title: **DARWIN GREEN TWO / THREE CAMBRIDGE**
 Details: **SURFACE WATER STRATEGY PLAN DARWIN GREEN TWO / THREE**
 Scale: 1:2500 @ A1 Date: SEP 2012 Drawn: SD Chk: IDB

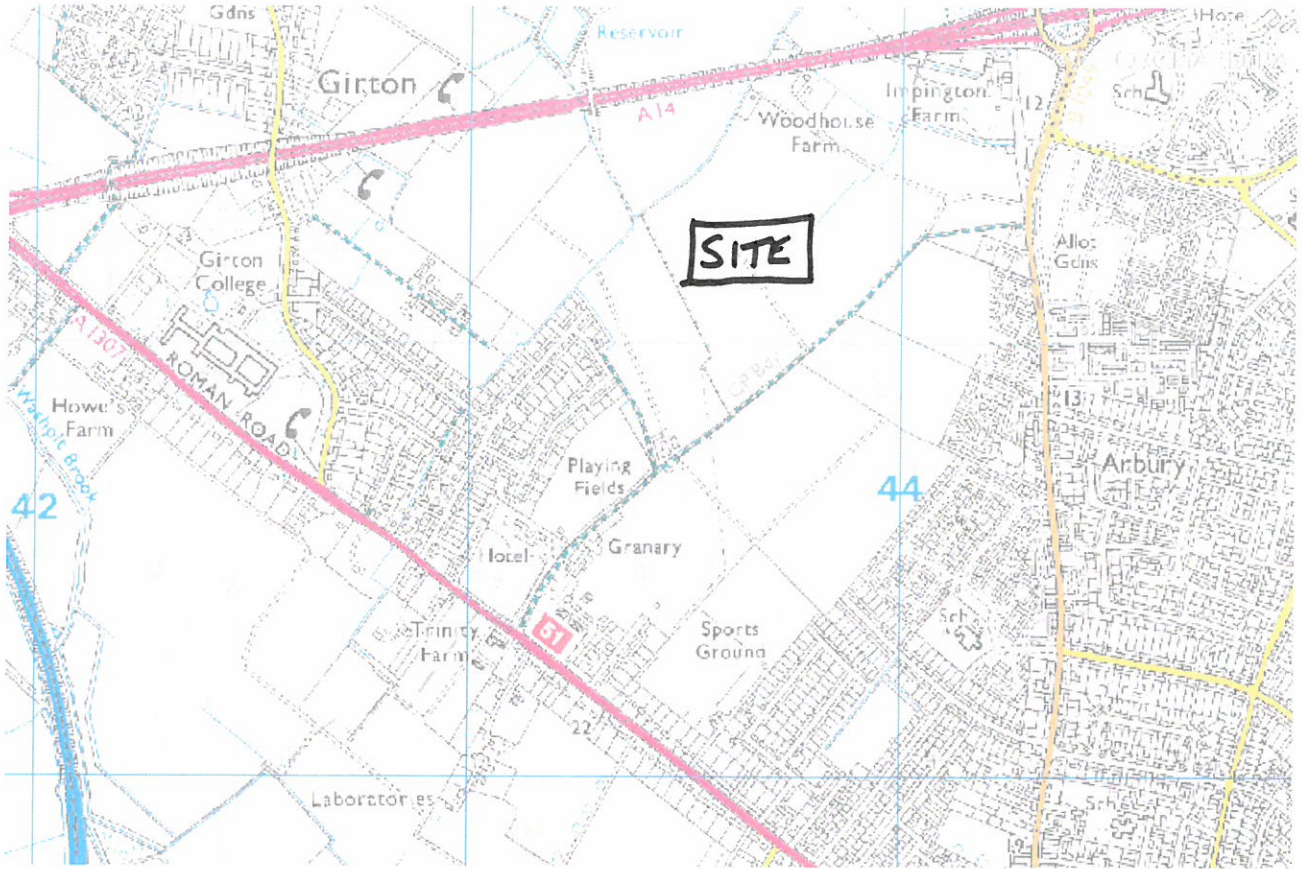
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16877-2002 K

Please consider the environment before printing this drawing

APPENDIX 3

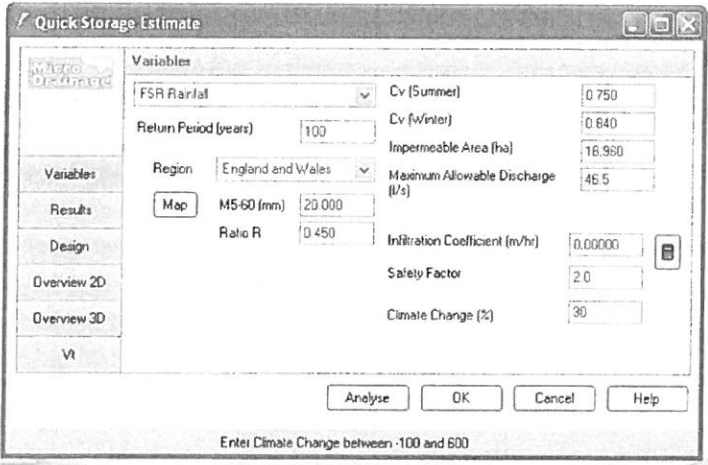
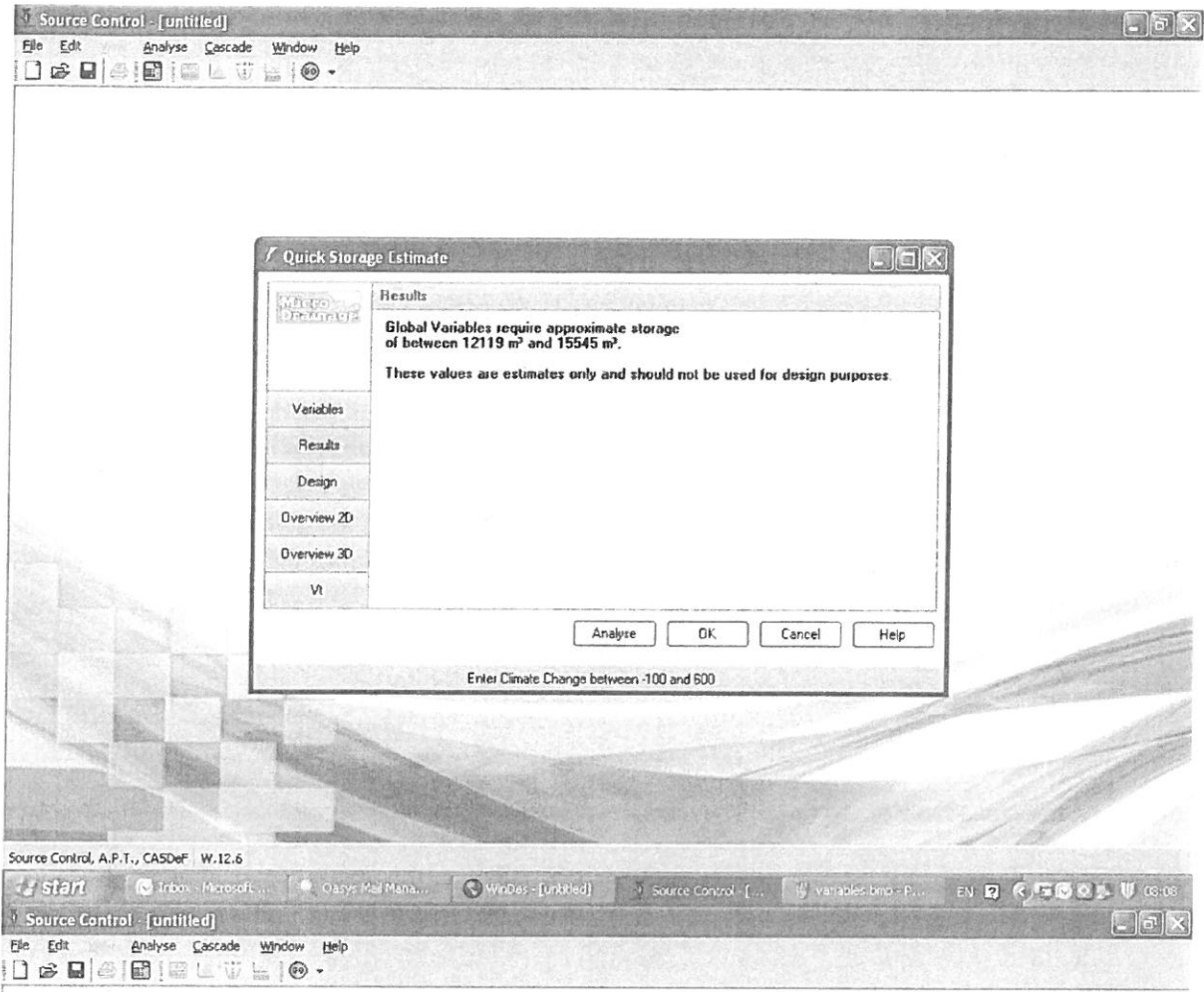
Environment Agency Indicative Flood Map



4/1.

APPENDIX 4

Microdrainage Quick Storage Printouts



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DG2/3 SOUTH