URS

North West Cambridge – Potable Water Supply Strategy

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For Information

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UNITED KINGDOM & IRELAND

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1 INTRODUCTION

This document presents the Potable Water Supply Strategy which has been prepared in response to Condition 29 for the planning consent for the North West Cambridge development (reference 11/1114/OUT and S/1886/11). This document develops the information presented in the Utilities Chapter of the Environmental Statement which was prepared in support of the Planning Application for the development.

1.1 Planning Conditions

The following Planning Conditions have been considered in the preparation of this Potable Water Supply Strategy.

Condition 26
Prior to, or concurrently with, the submission of the first reserved matters application, a strategic site wide surface water strategy building on that set out in the Surface Water Management Strategy within the Environmental Statement shall be submitted to and approved in writing by the local planning authority.

The strategy will complement the site wide phasing plan, secured by condition 5, and shall include the provision of details of any alterations to the Washpit Brook associated with flood reduction measures (if applicable), surface and foul water drainage infrastructure (as set out in the agreed Site wide Strategy), and pollution control measures.

The development shall be fully carried out in accordance with the approved details prior to the occupation of any building.

REASON In order to safeguard against the risk of flooding, to ensure adequate flood control, maintenance and efficient use and management of water within the site, to ensure the quality of the water entering receiving water courses is appropriate and monitored and to promote the use of sustainable urban drainage systems to limit the volume and pace of water leaving the site. North West Cambridge Area Action Plan Policies NW25, NW26 and NW27.

Condition 29
Prior to commencement of development a strategy to outline the provision of water supply to the site shall be submitted to and approved by the Local Planning Authority. The water supply strategy should identify how the supply meets the requirements of the Code for Sustainable Homes Level 5, and identify adoption, management and maintenance bodies for the water supply.

REASON To ensure that there is adequate supply of water for the site and long term management. North West Cambridge Area Action Plan Policies NW25, NW26 and NW27.

Condition 31
No infiltration of surface water drainage into the ground is permitted other than with the express written consent of the Local Planning Authority, which may be given for those parts of the site where it has been demonstrated that there is no resultant unacceptable risk to controlled waters. The development shall be carried out in accordance with the approval details.

REASON To protect the quality of inland fresh waters and groundwaters in accordance with Policies P9-6 and P4-1 to P4-12 of the Environment Agency's Groundwater Protection: Policy and Practice (GP3) document. The infiltration of surface water through land affected by contamination can result in the pollution of coastal waters, inland fresh waters and groundwaters. We encourage the use of sustainable drainage systems; however they must be carefully considered and controlled. North West Cambridge Area Action Plan Policies NW25, NW26 and NW27.

1.2 Planning Policy

Planning Policy requirements can be found in Appendix A.

2 POTABLE WATER SUPPLY

2.1 Existing Potable Water Supply

No major water mains are located within the site boundary; however, there are water mains servicing existing developments along Madingley Road and Huntington Road.

The NWC development and other strategic sites will impose an additional demand on existing resources. The Cambridge Water Company Water Resource Management Plan indicates that sufficient potable water is available to accommodate the development and the other strategic sites, providing that a new 3.2km long 450mm diameter extension to the existing ring main is provided. Drawings NWC1-URS-SW-SWD-XX-DRG-UE-0001 to NWC1-URS-SW-SWD-XX -DRG-UE-0008 in Appendix **B** show a schematic route for the extension to the ring main.

2.2 Proposed Potable Water Supply

Discussions have taken place with Cambridge Water Company in relation to the supply of potable water to the development. An extract from their letter of 21 November 2011 is provided below.

The local network in the vicinity of your site has no spare capacity. Water is available from our 18" main adjacent to the Coton footpath some 1.5km to the south of your site.

I also confirm that in order to service this site and others in the area in the future, the Company *has identified the need for a ring main through NW Cambridge to reinforce the existing network. The required main will start at the 18" main mentioned above and travel south to north through your site, and end near the Histon junction of the A14 trunk road.*

Based *on the water demands set out at the meeting (including non-potable water needs), and potential additional demand from the proposed development to the north of Huntingdon Road, our modelling has confirmed that a 450mm nominal bore ring main will be required. The estimated capital cost of the entire ring main is likely to be in the region of £2 million. The NW Cambridge development contribution towards this will be in the region of £950,000. No allowance at this stage has been made for archaeology. Although the general route is known, parts* of *it, particularly through the West Cambridge site, would need to be agreed before any estimate could be firmed up.*

Due to the elevation of your site, water from the proposed ring main will require boosting to provide a satisfactory level of service. This will take the form of a booster station located on your site, which will draw water from the proposed ring main, then boost it to the whole of your site. The estimated capital cost of the booster station will be in the region of £250,000. We should be in a position to firm this up once supplier enquiries have been received. We have looked at the footprint required for the booster, and expect this to be 15m x 15m. A suitable location would be adjacent to the main access road, between it and the playing fields at the Huntingdon Road end of the site. The booster will require a power supply, likely to be in the region of 25Kw. Bearing in mind that properties on the site would lose their water supply in the event of a mains power failure, we plan to include an emergency standby generator as part of the booster station.

A potable water network will be taken from the booster station to serve the development as shown on drawings Drawings NWC1-URS-SW-SWD-XX-DRG-UE-0001 to NWC1-URS-SW-SWD-XX -DRG-UE-0008 in Appendix **B**. Connections to development plots will be taken from the new potable water network (not the ring main Cambridge Water Company are providing).

3 MINIMISING POTABLE WATER DEMAND

3.1 Code for Sustainable Homes

The residential properties within the development are to comply with Level 5 of the Code for Sustainable Homes. This requires the reduction of potable water use to 80 litres per person per day.

Potable water demand will be minimised using a three stage approach involving demand reduction, water use management (water efficient fittings) and the provision of a sitewide non-potable water network.

3.2 Non-potable supply

A reduction in water demand to 80 litres per person per day is required by the commitment to Code for Sustainable Homes level 5. This reduction cannot be met by water efficiency alone, and requires some water recycling onsite to generate a supply of non-potable water for the development. A range of sitewide water recycling schemes has been considered which would reduce the demand for offsite water supplies to the development. The option selected is summarised below.

Surface water recycling facilities will be provided across the site to meet non-potable demand. 8 new surface water drainage networks will be installed across the site to allow surface water runoff to be intercepted, treated and attenuated via a cascading system of SUDS (further information on the SuDS systems and drainage networks can be found in the Surface Water Drainage Strategy which has been prepared in response to Condition 26).

Attenuation Storage will be provided ‘on plot’ and within both the SUDS features in the green fingers and a series of ponds in the Western Edge to allow the discharge from each network to be limited to existing greenfield runoff rates.

The storage ponds within the Western Edge will be sized to accommodate both the attenuation storage and the greater of either the long-term storage requirement for each network or the non-potable water demand for the development parcels within the catchment of each network. Further details are provided in the Surface Water Drainage Strategy.

Water will be extracted from the storage ponds before being treated at a series of water treatment package plants. A non-potable water network will re-distribute the non-potable water from each treatment plant to buildings within each drainage network.

Wastewater (blackwater) will be discharged offsite to a conventional wastewater treatment plant using pumping stations.

3.3 Design standards

The following design standards/guidance documents will be used, amongst other documents, to inform the design of the potable and non-potable water networks and the non-potable water treatment plant:

- Civil Engineering Specification for the Water Industry (CESWI) and
- Sustainable Drainage, Cambridge Design and Adoption Guide.

3.4 Adoption and maintenance

The potable water system will be adopted and maintained by Cambridge Water Company.

Discussions have taken place with Cambridge Water Company who have confirmed that they will adopt and maintain the non-potable water treatment plants, which will be located close to the Western Edge.

The non-potable water network will be adopted and maintained by Cambridge Water Company.

3.5 Long-term storage

The Flood Risk Assessment submitted with the Planning Application has identified that 'long-term storage' is required to prevent the volume of runoff that discharges to the Washpit Brook being increased by the development. Similarly, the Code for Sustainable Homes contains a mandatory credit for rates and volumes of rainwater runoff from the development to be controlled.

Surface water recycling, along with other types of SuDS to be provided at the development, will remove rainwater runoff from the network and provide long-term storage. The surface water recycling system will capture surface water runoff and prevent it from discharging to the Washpit Brook through re-use as non-potable water within the development.

The Surface Water Drainage Strategy assumes that the surface water recycling system forms part of the long-term storage provision at the development.

3.6 Ecological constraints

The greenfield runoff from the development to the Washpit Brook will be maintained to encourage ecological habitats to be created along the watercourse. Table 1 presents the calculated greenfield runoff rates for the development which were included in the Flood Risk Assessment submitted with the Planning Application.

The Surface Water Drainage Strategy explains how the greenfield runoff will be maintained.

Using the methodology presented in the Flood Estimation Handbook, the greenfield runoff from a site can be determined for different types of ground conditions. The following percentages have been assumed for the calculations presented in this document:

- Clay - 35% of the runoff from a storm will be discharged to the Washpit Brook; and
- Chalk/gravel - 25% of the runoff from a storm will be discharged to the Washpit Brook.

TABLE 1 - CALCULATED GREENFIELD RUNOFF RATES

Return Period (years)	Permitted Discharge for area of site overlying Clay (l/sec/ha)	Permitted Discharge for area of site overlying Gravel (l/sec/ha)	Permitted Discharge for area of site overlying Chalk (l/sec/ha)
QBar	3.29	1.37	1.37
1	2.87	1.20	1.20

TABLE 1 - CALCULATED GREENFIELD RUNOFF RATES

Return Period (years)	Permitted Discharge for area of site overlying Clay (l/sec/ha)	Permitted Discharge for area of site overlying Gravel (l/sec/ha)	Permitted Discharge for area of site overlying Chalk (l/sec/ha)
30	7.92	3.30	3.30
100	11.74	4.90	4.90

3.7 Meteorological data

The Cambridge Botanic Garden has been measuring rainfall since 1904 and supplies daily figures to the Meteorological Office at Bracknell. Table 2 shows the month-by-month rainfall figures over the past seven years at the Cambridge Botanic Garden.

Rainfall is not consistent over the year. Examination of monthly averages indicates that the average for March and April is lower than for the remainder of the year.

Section 5 of this strategy compares the demand for non-potable water within each of the 8 networks with the available supply of surface water runoff for each network. The data presented in Table 2 will be used to identify the potential supply of surface water runoff.

TABLE 2 - RAINFALL (mm) AT CAMBRIDGE BOTANIC GARDEN

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2005	28.1	25.5	20.7	20.8	47.0	52.1	29.0	58.8	101.5	55.8	40.3	16.5	495.1
2006	17.8	26.6	34.8	29.2	66.2	19.2	44.6	66.4	53.2	48.4	61.4	42.4	510.3
2007	55.7	49.3	21.4	1.9	131.1	68.3	68.2	51.1	22.0	55.2	34.3	38.7	597.2
2008	56.9	14.9	71.3	42.8	64.1	33.7	50.8	84.8	61.0	49.3	76.0	21.4	627.0
2009	38.0	55.7	32.6	13.2	28.5	37.5	108.6	56.3	11.2	33.8	102.7	71.6	589.7
2010	44.0	65.9	21.4	11.2	27.7	39.3	23.0	136.4	55.1	55.2	26.0	22.7	527.9
2011	61.6	31.4	3.0	1.7	16.4	64.0	34.5	48.9	24.9	16.9	29.9	47.2	380.4
Total	***302.1***	***269.3***	***205.2***	***120.8***	***381***	***314.1***	***358.7***	***502.7***	***328.9***	***314.6***	***370.6***	***260.5***	
average /month (mm)	*43.16*	*38.47*	*29.31*	*17.26*	*54.43*	*44.87*	*51.24*	*71.81*	*46.99*	*44.94*	*52.94*	*37.21*	
average /month (m)	*0.04*	*0.04*	*0.03*	*0.02*	*0.05*	*0.04*	*0.05*	*0.07*	*0.05*	*0.04*	*0.05*	*0.04*	

4 DEMAND FOR POTABLE AND NON-POTABLE WATER

4.1 Residential demand for potable and non-potable water

The Environment Agency estimates the average consumption of freshwater in England as 150 litres per person per day. The Code for Sustainable Homes requires the maximum indoor water consumption to be reduced to 80 litres per person per day to meet Level 5.

The residential development has an estimated future population of 10,809 people (including 2,004 students[1]) based on the occupation assumptions provided in Table 3 below.

TABLE 3 - OCCUPANCY ASSUMPTIONS

No. of beds / units	No. of persons/unit
Studio Flat	1
1 bed Flat	1
2 bed Flat	2
2 bed duplex	2
3 bed Flat	3
2 Bed terrace	3
3 Bed terrace	4
4 bed terrace	5
2 bed semi	3
3 bed semi	4
4 bed semi	5
3 bed detached	4
4 bed detached	5
5 bed detached	6

Based on the predicted residential population of 10,809 people, 1,621,350 litres of potable water would be required per day if conventional fittings were provided and the average potable water consumption was maintained.

An estimate of the daily potable and non-potable water requirement for the development has been made using two approaches – a ‘simplified’ approach and a ‘demand-led’ approach.

[1] The population of students has been included within the residential population of the development in order to calculate the non-potable water demand for residential uses.

4.1.1 Simplified approach

Adopting the Code for Sustainable Homes requirement of 80 litres per head per day, reduces the use of potable water to 864,720 litres per day.

BS 8515:2009 Rainwater Harvesting Systems – Code of Practice assumes a daily non-potable water demand of 50 litres per person per day. 540,450 litres of non-potable water per day would correspondingly be required to provide a population of 10,809 people with 50 litres of non-potable water each.

Water efficiency can be achieved through the use of water efficient measures and behaviour change. The 'simplified' approach presented above does not consider these aspects and could over-estimate the demand for both potable and non-potable water. An alternative 'demand-led' approach has therefore been considered below.

4.1.2 Demand-led approach

The table below presents the potential potable and non-potable water uses of a home built to Code for Sustainable Homes Level 5 which incorporates water efficiency measures. Table 4 considers possible uses for non-potable water such as toilet flushing, washing clothes and the provision of water for irrigating gardens (information taken from the Code for Sustainable Homes Water Calculator).

TABLE 4 - STANDARD SPECIFICATION OF WATER USE FOLLOWING APPLICATION OF 'DELIVERABLE' WATER EFFICIENCY MEASURES

Feature	Water use estimation litres/person/day (including normalisation factor)	Water Demand Type
WC	12.3	Non-potable
Taps (excluding kitchen taps)	7.2	Potable
Bath	15.5	Potable
Shower	23.9	Potable
Kitchen sink taps	11.8	Potable
Washing machine	14.3	Non-potable
Dishwasher	3.3	Potable
Garden	5.0	Non-potable
Total Potable Demand/person	**61.7**	
Total Non-Potable Demand/person	**31.6**	
Total Demand/person	**93.3**	

Table 4 shows the potential non-potable demand is approximately 31.6 litres per person per day where advanced efficiency measures are used. The non-potable demand is influenced by the specification of water efficient fittings and would reduce by approximately 50% if it excluded the provision of non-potable water for washing machines.

For the purposes of the calculations presented within this strategy, the non-potable demand for WC flushing, washing machine use and the irrigation of gardens has been assumed at 31.6 litres per person per day.

Using the figures above and based on a residential population of 10,809 people, 666,915 litres of potable water and 341,564 litres of non-potable water would be required for the development per day. Section 4.2 below considers the demand for non-potable water from non-residential uses in order that a comparison can be made, on a network by network basis, of non-potable water demand and surface water runoff for each of the surface water drainage networks.

4.2 Non-residential demand for non-potable water

A water load assessment has previously been undertaken for the proposed development at North West Cambridge. This assessment provided a diversified peak load for water in litres/second for each plot.

The calculations for non-potable demand assume that the non-potable water will supply 25% of the daily demand for water for the non-residential plots (based on an 8 hour day).

4.3 Total non-potable water demand

Table 5 below provides the non-potable water demand for each network. Networks 1 and 2 of the surface water drainage system will share the same pond on the Western Edge. The demand for non-potable water within Networks 1 and 2 has to be considered together.

TABLE 5 – NON-POTABLE WATER DEMAND BY NETWORK

Network	Residential population (people)	Residential non-potable water demand (m^3/month) [2]	Non-residential non-potable water demand (m^3/month)[3]	Total non-potable water demand (m^3/month)
1 & 2	6,933	6,572	670	7,242
3	817	775	14	789
4	1,722	1,632	32	1,664
5	925	877	0	877
6	0	0	23	23
7	412	391	0	391
8	0	0	30	30
Total	**10,809**	**10,247**	**769**	**11,016**

[2] Based on a 30 day month.
[3] Based on a 20 day month.

5 SUPPLY OF SURFACE WATER RUNOFF

5.1 Introduction

It is not possible to capture 100% of the surface water runoff from each network as losses will occur due to evapotranspiration (assumed at 40%) and the greenfield runoff to the Washpit Brook must be maintained (between 25% and 35% of each storm event depending on ground conditions).

It has therefore been assumed for Networks 5-8 that between 25% and 35% of the surface water runoff from each network can be recycled to provide a non-potable water supply for each network (the yield coefficient). The catchments forming Networks 1-4 include areas which do not currently discharge to the Washpit Brook and the yield coefficient within these areas has been increased accordingly.

The sections below present the following information for each network:

- Month by month comparison of surface water runoff against non-potable water demand (for a 1 year cycle);
- Volume of storage (assumed to be fully charged at start of 1 year cycle);
- Ground conditions; and
- Yield coefficient (derived to ensure pond remains fully charged at the end of the 1 year cycle).

The volume of storage provided below is based on a minimum of 30 days (following discussions with Cambridge Water Company).

5.2 Networks 1 and 2

Networks 1 and 2 of the surface water drainage system will share the same pond on the Western Edge. The supply of non-potable water within Networks 1 and 2 has to be considered together. Table 6 presents the parameters for Networks 1 and 2.

- Volume of storage - 7,800 m^3
- Ground conditions - 7% gravel, 39% clay, 43% gravel (from an area that does not historically discharge to the Washpit Brook), 11% clay (from an area that does not historically discharge to the Washpit Brook)
- Yield coefficient - 45%

TABLE 6 - PARAMETERS FOR NETWORKS 1&2

Month	Volume (m^3)	Yield Coefficient	Monthly Demand (m^3)	Monthly Balance	Water Remaining (m^3)
January	17,038	7,667	7,242	425	8,225
February	11,573	5,208	7,242	-2,034	5,784
March	6,813	3,066	7,242	-4,176	1,608
April	21,488	9,670	7,242	2,428	4,035
May	17,715	7,972	7,242	730	4,765
June	20,231	9,104	7,242	1,862	6,627

TABLE 6 - PARAMETERS FOR NETWORKS 1&2					
Month	**Volume (m^3)**	**Yield Coefficient**	**Monthly Demand (m^3)**	**Monthly Balance**	**Water Remaining (m^3)**
July	28,352	12,759	7,242	5,516	12,143
August	18,550	8,348	7,242	1,105	13,249
September	17,743	7,985	7,242	742	13,991
October	20,902	9,406	7,242	2,164	16,155
November	14,692	6,612	7,242	-631	15,525
December	17,038	7,667	7,242	425	8,225

5.3 Network 3

Table 7 presents the parameters for Network 3.

- Volume of storage - 800 m^3
- Ground conditions - 10% gravel, 55% clay, 31% gravel (from an area that does not historically discharge to the Washpit Brook), 4% clay (from an area that does not historically discharge to the Washpit Brook)
- Yield coefficient - 38%

TABLE 7 - PARAMETERS FOR NETWORK 3					
Month	**Volume (m^3)**	**Yield Coefficient**	**Monthly Demand (m^3)**	**Monthly Balance**	**Water Remaining (m^3)**
January	2,223	845	789	56	856
February	1,982	753	789	-36	820
March	1,510	574	789	-215	605
April	889	338	789	-451	154
May	2,804	1,065	789	276	430
June	2,311	878	789	89	520
July	2,640	1,003	789	214	734
August	3,699	1,406	789	617	1,351
September	2,420	920	789	131	1,481
October	2,315	880	789	91	1,572
November	2,727	1,036	789	247	1,820
December	1,917	728	789	-60	1,759

5.4 Network 4

Table 8A presents the parameters for Network 4.

- Volume of storage - 1,900 m^3
- Ground conditions - 18% gravel, 67% clay, 15% gravel (from an area that does not historically discharge to the Washpit Brook)
- Yield coefficient - 32%

TABLE 8A - PARAMETERS FOR NETWORK 4

Month	Volume (m^3)	Yield Coefficient	Monthly Demand (m^3)	Monthly Balance	Water Remaining (m^3)
January	3,855	1,234	1,664	-430	1,470
February	3,437	1,100	1,664	-564	905
March	2,619	838	1,664	-826	79
April	1,542	493	1,664	-1,171	-1,092
May	4,862	1,556	1,664	-108	-1,200
June	4,008	1,283	1,664	-381	-1,582
July	4,577	1,465	1,664	-199	-1,781
August	6,415	2,053	1,664	389	-1,392
September	4,197	1,343	1,664	-321	-1,713
October	4,015	1,285	1,664	-379	-2,093
November	4,729	1,513	1,664	-151	-2,244
December	3,324	1,064	1,664	-600	-2,844

Table 8A demonstrates that the supply of rainfall within the catchment of Network 4 is insufficient to meet the demand for non-potable water for the development plots within Network 4 based on the approach outlined in section 4 of this strategy.

In order for the available rainwater to meet the demand for non-potable water in Network 4, the yield coefficient has to be increased from 32% to 42% by reducing the losses in the network through evapotranspiration or the demand for non-potable water from the development plots within Network 4 has to be reduced.

Table 8B has been developed based on a reduced residential non-potable demand. The daily non-potable demand for residential units has been reduced by 14.3 litres/head/day on the assumption that washing machines will not be connected to the non-potable water supply. With this assumption, the demand for non-potable water can be met.

TABLE 8B - PARAMETERS FOR NETWORK 4					
Month	**Volume (m^3)**	**Yield Coefficient**	**Monthly Demand (m^3)**	**Monthly Balance**	**Water Remaining (m^3)**
January	3,855	1,234	925	308	2,208
February	3,437	1,100	925	174	2,383
March	2,619	838	925	-87	2,295
April	1,542	493	925	-432	1,863
May	4,862	1,556	925	630	2,493
June	4,008	1,283	925	357	2,851
July	4,577	1,465	925	539	3,390
August	6,415	2,053	925	1,127	4,518
September	4,197	1,343	925	418	4,935
October	4,015	1,285	925	359	5,295
November	4,729	1,513	925	588	5,883
December	3,324	1,064	925	138	6,021

5.5 Network 5

Table 9 presents the parameters for Network 5.

- Volume of storage - 900 m^3
- Ground conditions - 41% clay, 59% gravel
- Yield coefficient - 31%

TABLE 9 - PARAMETERS FOR NETWORK 5					
Month	**Volume (m^3)**	**Yield Coefficient**	**Monthly Demand (m^3)**	**Monthly Balance**	**Water Remaining (m^3)**
January	3,103	962	877	85	985
February	2,766	857	877	-20	965
March	2,107	653	877	-224	742
April	1,241	385	877	-492	249
May	3,913	1,213	877	336	586
June	3,226	1,000	877	123	709
July	3,684	1,142	877	265	974

TABLE 9 - PARAMETERS FOR NETWORK 5					
Month	**Volume (m^3)**	**Yield Coefficient**	**Monthly Demand (m^3)**	**Monthly Balance**	**Water Remaining (m^3)**
August	5,163	1,600	877	724	1,697
September	3,378	1,047	877	170	1,867
October	3,231	1,002	877	125	1,992
November	3,806	1,180	877	303	2,295
December	2,675	829	877	-48	2,248

5.6 Network 6

Table 10 presents the parameters for Network 6.

- Volume of storage - 30 m^3
- Ground conditions - 88% clay, 12% gravel
- Yield coefficient - 26%

TABLE 10 - PARAMETERS FOR NETWORK 6					
Month	**Volume (m^3)**	**Yield Coefficient**	**Monthly Demand (m^3)**	**Monthly Balance**	**Water Remaining (m^3)**
January	652	170	23	147	177
February	582	151	23	128	305
March	443	115	23	92	397
April	261	68	23	45	442
May	823	214	23	191	633
June	678	176	23	153	786
July	775	201	23	178	964
August	1,086	282	23	259	1,223
September	710	185	23	162	1,385
October	679	177	23	154	1,539
November	800	208	23	185	1,724
December	563	146	23	123	1,847

5.7 Network 7

Table 11 presents the parameters for Network 7.

- Volume of storage - 400 m^3
- Ground conditions - 82% clay, 18% gravel
- Yield coefficient - 27%

TABLE 11 - PARAMETERS FOR NETWORK 7

Month	Volume (m^3)	Yield Coefficient	Monthly Demand (m^3)	Monthly Balance	Water Remaining (m^3)
January	1,694	457	391	67	467
February	1,510	408	391	17	484
March	1,150	311	391	-80	404
April	677	183	391	-208	196
May	2,136	577	391	186	382
June	1,761	475	391	85	467
July	2,011	543	391	152	619
August	2,818	761	391	370	990
September	1,844	498	391	107	1,097
October	1,764	476	391	86	1,182
November	2,078	561	391	170	1,353
December	1,460	394	391	4	1,356

5.8 Network 8

Table 12 presents the parameters for Network 8.

- Volume of storage - 40 m^3
- Ground conditions - Clay
- Yield coefficient - 25%

TABLE 12 - PARAMETERS FOR NETWORK 8

Month	Volume (m^3)	Yield Coefficient	Monthly Demand (m^3)	Monthly Balance	Water Remaining (m^3)
January	2,173	543	30	513	553
February	1,937	484	30	454	1,007
March	1,476	369	30	339	1,346
April	869	217	30	187	1,533
May	2,741	685	30	655	2,188

TABLE 12 - PARAMETERS FOR NETWORK 8

Month	Volume (m^3)	Yield Coefficient	Monthly Demand (m^3)	Monthly Balance	Water Remaining (m^3)
June	2,259	565	30	535	2,722
July	2,580	645	30	615	3,337
August	3,616	904	30	874	4,211
September	2,366	591	30	561	4,772
October	2,263	566	30	536	5,308
November	2,666	666	30	636	5,944
December	1,874	468	30	438	6,382

5.9 Storage ponds

The storage ponds within the Western Edge will be sized to accommodate both the attenuation storage and the greater of either the long-term storage requirement for each network or the non-potable water demand for the development parcels within the catchment of each network. Storage ponds will be provided within the Western Edge for surface water networks 1-7. The Surface Water Drainage Strategy presents the calculations to derive the size of each storage pond.

Network 8 does not have a storage pond on the Western Edge. The surface water runoff from this network will be attenuated within the plots that fall within the catchment of network 8. The water treatment plant for network 8 will also need to be provided within one of the plots within the catchment of network 8.

6 CONCLUSIONS

The potable water network within Cambridge will be reinforced to supply potable water to the development.

A combination of water efficient devices with sitewide recycling of surface water runoff will enable the potable water demand at the development to be reduced to 80 litres per person per day, in accordance with the requirements of Level 5 of the Code for Sustainable Homes, meeting the requirements of Condition 29.

The greenfield runoff from the development to the Washpit Brook will be maintained in order to meet the Environment Agency's requirements.

APPENDIX A – PLANNING POLICY REQUIREMENTS

The Code for Sustainable Homes

The Code for Sustainable Homes has been introduced to drive a step-change in sustainable home building practice. It is a standard for key elements of design and construction which affect the sustainability of a new home. The Code uses a sustainability rating system – indicated by 'stars', to communicate the overall sustainability performance of a home. The table below summarises the mandatory minimum standards which exist under the Code for each assessment level relating to indoor water consumption:

Level 1(★)	Maximum Internal potable water consumption measured in litres per person per day (l/p/d)	120 l/p/d
Level 2(★★)		120 l/p/d
Level 3(★★★)		105 l/p/d
Level 4(★★★★)		105 l/p/d
Level 5(★★★★★)		80 l/p/d
Level 6(★★★★★★)		80 l/p/d

Mandatory minimum performance standards are set for some issues irrespective of the code level rating that is sought. One of these is the management of surface water runoff from developments which in turn relates to:

- Peak rate of runoff into watercourses – to ensure that this is no greater for the developed site than it was for the pre-development site.
- The additional predicted volume of runoff generated by the development is reduced to zero wherever possible by means of infiltration to groundwater and/or by harvesting it for reuse within the buildings as a replacement for potable water in non-potable applications such as toilet flushing or washing machine operation.

Additional credits are available for using SuDS to improve water quality of the rainwater discharged or for protecting the quality of the receiving waters.

Future Water – The Government's Water Strategy for England

'Future Water' presents the Government's water strategy for England – its vision for sustainable delivery of secure water supplies and an improved and protected water environment.

The Government's water strategy for England aims to secure water supplies and improve the protection of the water environment. Increases in housing and climate change will make it vital to manage demand better and new reservoirs may be needed. Work to improve water quality must continue, flooding must to be managed better and metering of household use may become compulsory.

Local Policy, Strategy & Guidance

The Application site lies astride the administrative boundaries of South Cambridgeshire District Council (SCDC) and Cambridge City Council (CCC). As a result, water related policies contained within both of the authorities' emerging Local Development Frameworks are relevant to the Proposed Development and have been referenced here.

North West Cambridge Area Action Plan

The principal Local Development Document that has been produced jointly by SCDC and CCC and that relates specifically to the Application site is the North West Cambridge Area Action Plan which was adopted in October 2009. The Plan contains the following policies relevant to water resources:

- NW24: Climate Change & Sustainable Design and Construction
  1) 'Development will be required to demonstrate that it has been designed to adapt to the predicted effects of climate change'
  2) 'Residential development will be required to demonstrate that:
  a) All dwellings approved on or before 31 March 2013 will meet Code for Sustainable Homes Level 4 or higher, up to a maximum of 50 dwellings across the site. All dwellings above 50 will meet Code for Sustainable Homes Level 5 or higher (these Levels include water conservation measures);
  b) All dwellings approved on or after 1 April 2013 will meet Code for Sustainable Homes Level 5 or higher;
  c) There is no adverse impact on the water environment and biodiversity as a result of the implementation and management of water conservation measures.'
  3) 'Non residential development and student housing will be required to demonstrate that:
  f) It will incorporate water conservation measures including water saving devices, greywater and/or rainwater recycling in all buildings to significantly reduce potable water consumption; and
  g) There is no adverse impact on the water environment and biodiversity as a result of the implementation and management of water conservation measures.'

  'The East of England has the lowest rainfall in the country and is described officially as semi-arid. A high proportion of the available water resource is already being exploited and as such, even allowing for the impacts of climate change, careful management of water resources will be crucial if the economic potential of the Cambridge Sub-Region is to continue to be realised. Development at North West Cambridge provides an opportunity to design water conservation measures into the infrastructure and buildings in order to reduce per capita demand for water. This should be a fundamental approach of the development. It is important that water conservation measures are applied to each building to ensure that there is a comprehensive strategy to water use reduction across the site and measures are not applied to some buildings and not others. The CSH provides appropriate targets to improve water conservation over time, using the same dates and Code levels as for energy reduction and other sustainability requirements set out in the Code. For residential development, the 30% reduction required at Code Level 4 compared to 2006 levels equates to 105 litres/head/day, while the 47% reduction required by Code Level 5 equates to 80 litres/head/day.'

  'The principle of reuse and recycling of water is also an important part of an integrated approach to water management that will facilitate the use of water from drainage as a design feature of the development. Care must be taken to ensure that water reuse and recycling does not have an adverse effect on biodiversity, or the wider water environment, in accordance with the requirements of the Water Framework Directive.'

Phase 1 Water Cycle Strategy for Major Growth Areas in and around Cambridge (October 2008)

A Phase 1 Water Cycle Strategy (WCS) was completed by consultants for Cambridgeshire Horizons. It assesses the potential impacts and constraints associated with the proposed major development areas by considering flood risk, water resources and supply, foul sewerage, wastewater treatment, water quality and water related ecology. This study establishes the most effective foul drainage and water supply strategy for all development in the Cambridge catchment and contains the following conclusions and recommendations in relation to the Proposed Development.

This strategic planning document considers how the water services infrastructure can be achieved to meet the target of 42,500 new homes in Cambridge and South Cambridgeshire by 2021. Cambridge is supplied by groundwater abstraction and is situated in an area of *Serious Water Stress* as classified by the EA. It is vital

that practices are put into place to reduce water consumption significantly in the new developments and that wherever practical, rainwater is harvested and recycled within the house and on the garden. Greywater systems also need to be considered. Water neutrality i.e. no increase in water supplies for the area over the next 10 years, is potentially achievable through:

- Compulsory implementation of the Code for Sustainable Homes (aiming for Level 6)
- Compulsory metering
- Installing water smart measures in existing homes

The following conclusions were drawn from the study relating to the water resources of the proposed North West Cambridge development site:

- Flood Risk Management
  - most of the site appears to fall within the EA's Flood Zone 1
  - There is a known history of flooding on the Beck Brook/Cottenham Lode catchment downstream of the site therefore the surface water discharge from the development must be managed by means of flow attenuation and long term storage to prevent any increase in flood risk downstream and should seek where possible to reduce the present risk.
  - It is advised that developers on this catchment undertake an independent hydraulic modelling study to:
    - Assess the current standard of protection for Histon and Impington.
    - Demonstrate that the flood risk in the Cottenham Lode catchment will not increase as a result of the combined cumulative effect of developments in the catchment.
    - Assess the opportunity for strategic flood risk mitigations options in the catchment.
    - Assess the opportunity for enhancing the level of service to areas where there is a known flood risk and make a contribution towards the cost of a scheme to enhance the level of service.
  - A site specific FRA is required by PPS25

- Groundwater and SuDS
  - The site is on variable geology of limited permeability; hence site specific surveys would be required to prepare a suitable SuDS strategy.

- Foul Drainage, Sewage Treatment and Water Quality
  - Foul water from the site will be discharged to the Cambridge WwTW. The discharge consent at the Works will not require revision to accommodate the increased flows from the strategic development sites including the NW Cambridge site before 2016; however, improvements may be needed to the treatment works in order to maintain the quality of the effluent discharged to the River Cam. Some of these improvements may be required before 2016 if the EA decide to tighten the discharge quality limits of the consent as the volume of discharge from the works increases with the increase in new development, in order to comply with the requirements of the Freshwater Fish Directive of the WFD. AWS will seek investment to facilitate these improvements through its regulatory periodic review process for implementation in AMP 5 (2010 - 2015) or AMP 6 (2015 - 2021).
  - The large diameter sewer network can accommodate al of the flow from the strategic developments without upgrade. The NW Cambridge site will connect into the branches of the tunnel network on Madingley and Histon Road but downstream of the junction of Madingley Road and Wilberforce Road to avoid connections to existing sewers that have insufficient capacity.
  - The strategic development sites around Cambridge will not be connected to the sewerage system upstream of the four combined sewer overflows (CSOs) (except that at Cambridge WwTW) and therefore the discharge volume from these CSOs is not expected to increase as a result of the strategic development sites including the North West Cambridge site.

- Water Supply

- Currently provided by Cambridge Water Company which will also be responsible for strategic water resources for the North West Development site.
- No specific technical constraints have been identified which might prevent growth in the study area including the Application Ste which will require a new 3.2km long 450mm diameter extension to the existing ring main to provide the required capacity.

Phase 2 Water Cycle Strategy for Major Growth Areas in and around Cambridge (October 2010)

A Phase 2 report was completed by consultants for Cambridge Horizons and considered the recommendations made in the Phase 1 report which focused on identifying a strategy and providing the technical evidence base to show how new sustainable water services infrastructure for the Major Sites in and around Cambridge (including the North West Cambridge University site) could be delivered to maximise three opportunities:

- aspiring to water neutrality;
- improving biodiversity by protecting environmental water quality and hydromorphology, and;
- protecting and enhancing communities through sustainable surface water management.

The findings and recommendations of the WCS have been incorporated into the development proposals. The following is a summary of the findings relevant to the Proposed Development presented under the following water infrastructure headings used in the WCS report:

- Water Resources – *CSH Level 5/6 should be the target for all new homes built after 2016. To meet CSH level 5/6 will require progressive implementation of greywater recycling (GWR) and/or rainwater harvesting (RWH) systems at either a household or community scale, in addition to implementation of water efficient appliances and changes in consumers' behaviours/attitudes towards water consumption. GWR and RWH are not currently widely implemented in the UK. Challenges remain with widespread implementation of GWR and RWH, not least because of the issues surrounding adoption of GWR or RWH systems; no consistent model or legislation is currently in place to support consistent adoption and water companies are currently not permitted to charge for non-potable water.*

- Sustainable Surface Water Management – taken from Section 4.5 of the Phase 2 WCS

  4.5.4 Achieving the vision for sustainable surface water management relies on the development and subsequent implementation of planning policies and vigilant management of development through the planning process.

  Planning applications should:
  - *demonstrate the ambition for achieving 100% above ground drainage through implementation of a range of SuDS measures from source control (e.g. green roofs) to large-scale attenuation storage;*
  - *provide justification and evidence where achieving 100% above ground drainage will not be feasible due to proposed densities, topography, ground conditions, or the location of development; demonstrate that drainage proposals are aligned with the forthcoming National SuDS Standards and will be accepted by Cambridgeshire County Council (as the new SuDS Approval Body); demonstrate that proposed SuDS measures will be integrated into the built environment to provide amenity and contribute to a network of open space, and; demonstrate that proposed SuDS measures will be used to enhance the local environment and biodiversity.*

  4.5.5 The planning authorities will be responsible for implementing the recommendations through the development of planning policies and determination of planning applications, although other technical stakeholders (e.g. the Environment Agency) will provide technical advice and scrutiny of planning applications to support the planning authorities.

4.5.6 Development where vision for sustainable surface water management may not be achievable.

4.5.7 Overall, the evidence base supports a local policy approach which aims for 100% above ground drainage for future developments, and using SuDS to create or enhance amenity and biodiversity and contribute to the provision of green infrastructure. However, it is recognised that there are a number of site-by-site circumstances which may make it difficult to achieve the aspiration with regards to surface water management.

- *High water table – a high water table may preclude the use of above ground drainage, as was the case at the Orchard Park development. In such cases, the planning application must provide evidence that above ground drainage is not possible and provide a strategy which ensure surface water runoff to the receiving watercourse is greenfield equivalent (on greenfield sites) or at a reduced rate (on brownfield sites). In some locations with a high water table it may be possible to utilise SuDS at a shallow depth, although it must be noted that this could increase the potential land take required for drainage.*
- *Topography – where there is insufficient gradient to drain surface water and the potential to infiltrate surface water is poor, it may be necessary to utilise underground drainage to ensure surface water is effectively drained away from domestic and non-domestic dwellings.*

- Environmental Water Quality – taken from Section 5.4 of the Phase 2 WCS
  The Phase 2 WCS has also set out the evidence base (from the CIRIA SUS Manual) to ensure surface and ground waters are adequately protected from polluted surface water runoff, including;

  - *ensuring a sufficient number of treatment stages are provided depending on the source of surface water runoff:*
  - *roofs only – 1 treatment stage; residential roads, parking areas, commercial zones – 2 treatment stages; refuse collection/industrial areas/loading bays/lorry parks/highways – 3 treatment stages;*
  - *ensuring that typical pollutants which are generated in the urban environment are considered and treated through SuDS approaches.*

- Wastewater Infrastructure – the WCS has made an assessment of treatment capacity available for the proposed new development in the Cambridge area including the potential impacts on flood risk and river quality downstream of the Cambridge WwTW. No significant increase was predicted to flood risk as a result of increases in treated flows. There are two sources of potential pollution to receiving watercourses as a result of increases in discharges to treatment works. These are:

  - *Increase in final treated discharge load*
  - *Increase in intermittent discharges from combined sewer overflows (CSOs), pumping stations and storm tanks at WwTW.*

  In the foreseeable future, consent limits will be set with a view to meeting the requirements of the Water Framework Directive (WFD) whose aim is to ensure that good river quality standards are met throughout each waterbody. The intention will be to set the discharge consent limits based upon the quality and volume of the receiving watercourse and the volume of wastewater effluent at the point of discharge. To maintain water quality in the watercourses, the consent standards in the future on the effluent discharges from the Cambridge WwTW will need to be periodically reviewed by the EA. Improvements to the treatment works will be required as the new developments come on stream to maintain the current discharge consent standards. This has been accepted by Anglian Water and planned for in their future AMP6 programme.

- Ecological Assessment – taken from Section 7.6 of the Phase 2 WCS

7.6.2 This assessment has followed DCLG guidance on HRA. Coarse screening has identified three European sites with the potential to be affected by hypothetical water management changes associated with proposed new developments around Cambridge. One of these (Wicken Fen Ramsar site) was discounted at the coarse screening stage since its hydrology cannot be affected by any of the proposed developments. The others (Breckland SAC and SPA and Ouse Washes SAC and Ramsar site) were discounted at the more detailed screening stage as it has been determined that the proposals will not have any discernible effect on their hydrology or water quality.

7.6.3 Thus, it can be concluded that No Significant Effect would result from implementing the proposals and projections that are identified in the Cambridge WCS, noting that this assessment has only considered water environment consequences.

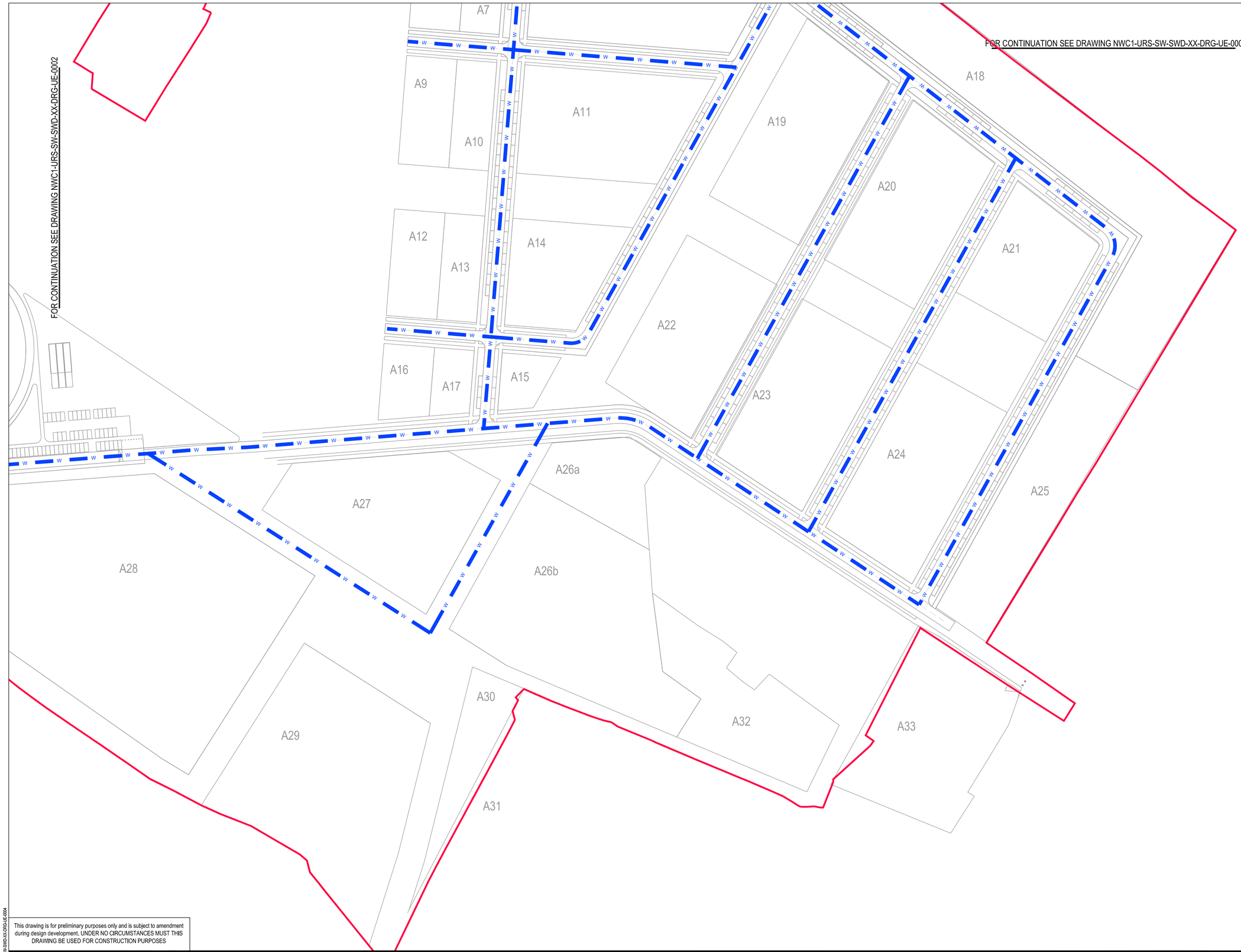
Catchment Abstraction Management Strategy

Catchment Abstraction Management Strategies (CAMS) are developed by the Environment Agency to manage water resources at a local level. Through consultation with stakeholders and data acquisition within a CAMS area the documents present the current status of groundwater and outline a future framework for water use. CAMS incorporate a resource assessment that identifies how much water is available, known as the 'resource availability status', and where it is located.

The Application site falls within the Cam and Ely Ouse Catchment Abstraction Management Strategy[4] area which has identified the Washpit Brook as within the Old West River and Old West Level Dependent Management Unit (LDMU). The area has a current water resource availability status of 'No Water Available'. The target status of the area for 2013 and indeed up to 2019 is 'No Water Available'.

[4] Cam & Ely Ouse Catchment Abstraction Management Strategy, Environment Agency (March 2007)

APPENDIX B – DRAWINGS



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KEY

- PROPOSED DISTRIBUTION WATER MAIN
- PROPOSED TRUNK WATER MAIN
- APPLICATION SITE BOUNDARY

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Project Title: NORTH WEST CAMBRIDGE

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Designed	Drawn	Checked	Approved	Date
AS	SG	SES	DAJS	11/02/2013

URS Internal Project No.: Project No

Suitability: S1 CO-ORDINATION

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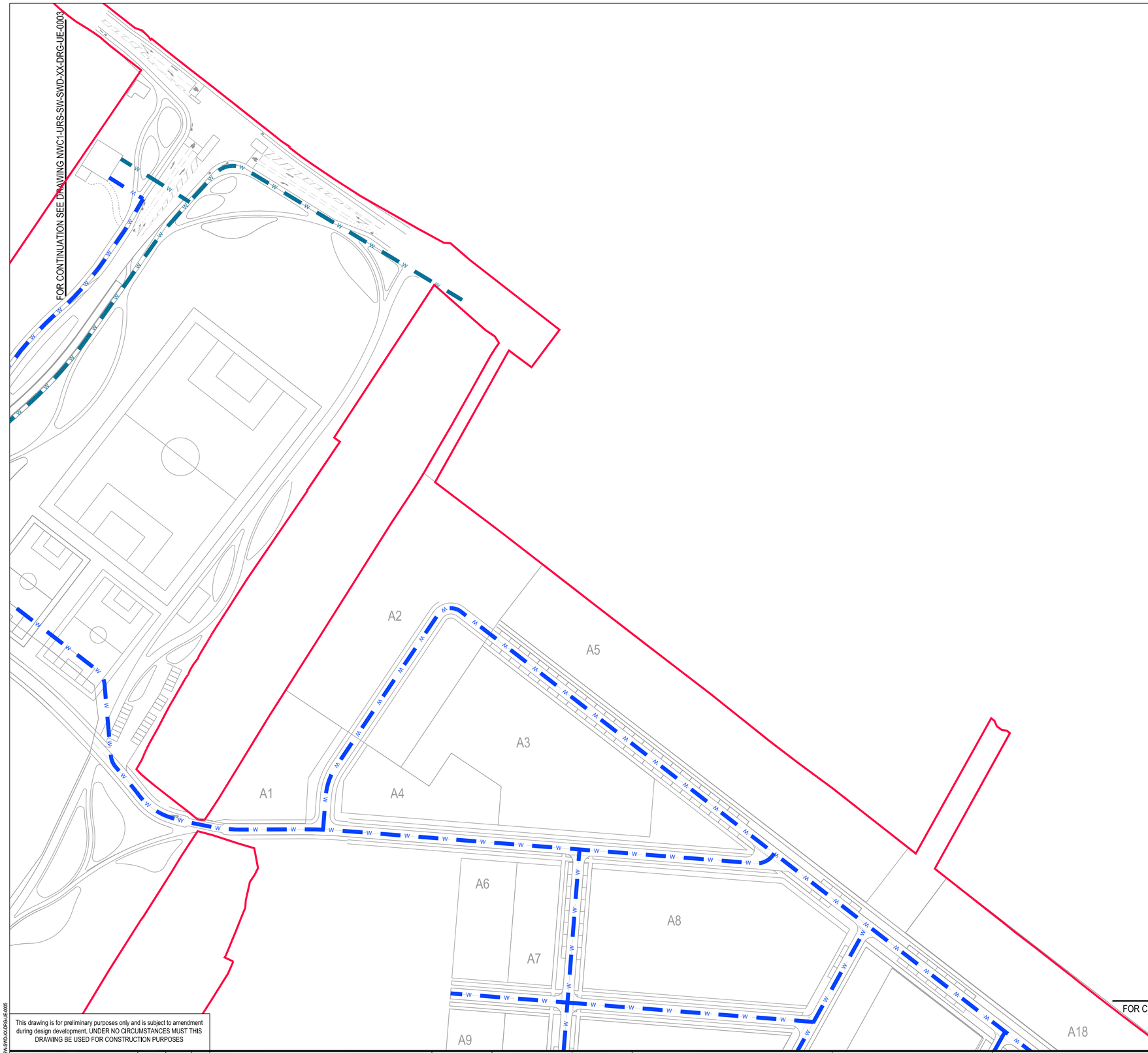

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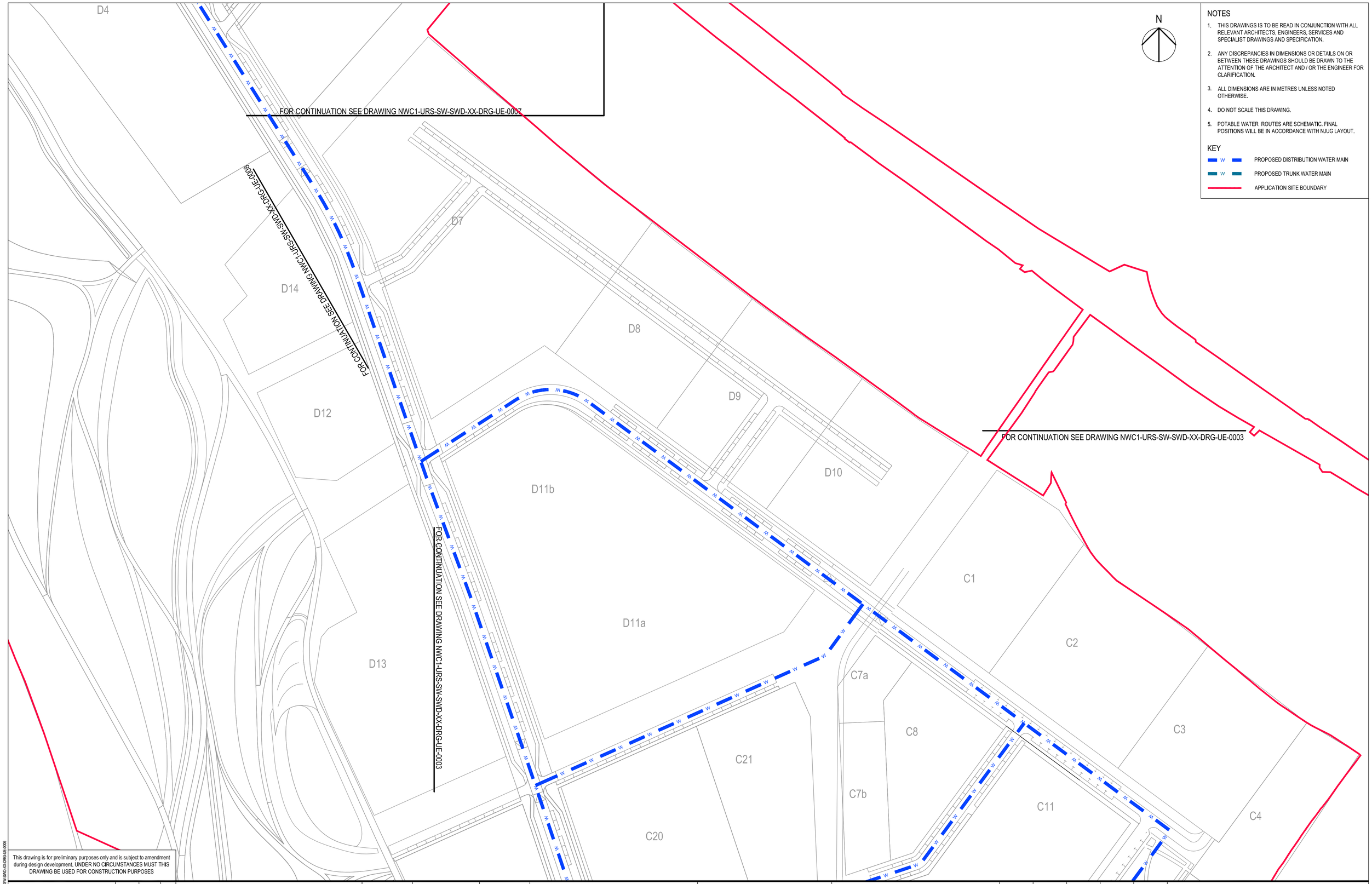

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Rev: 1.0

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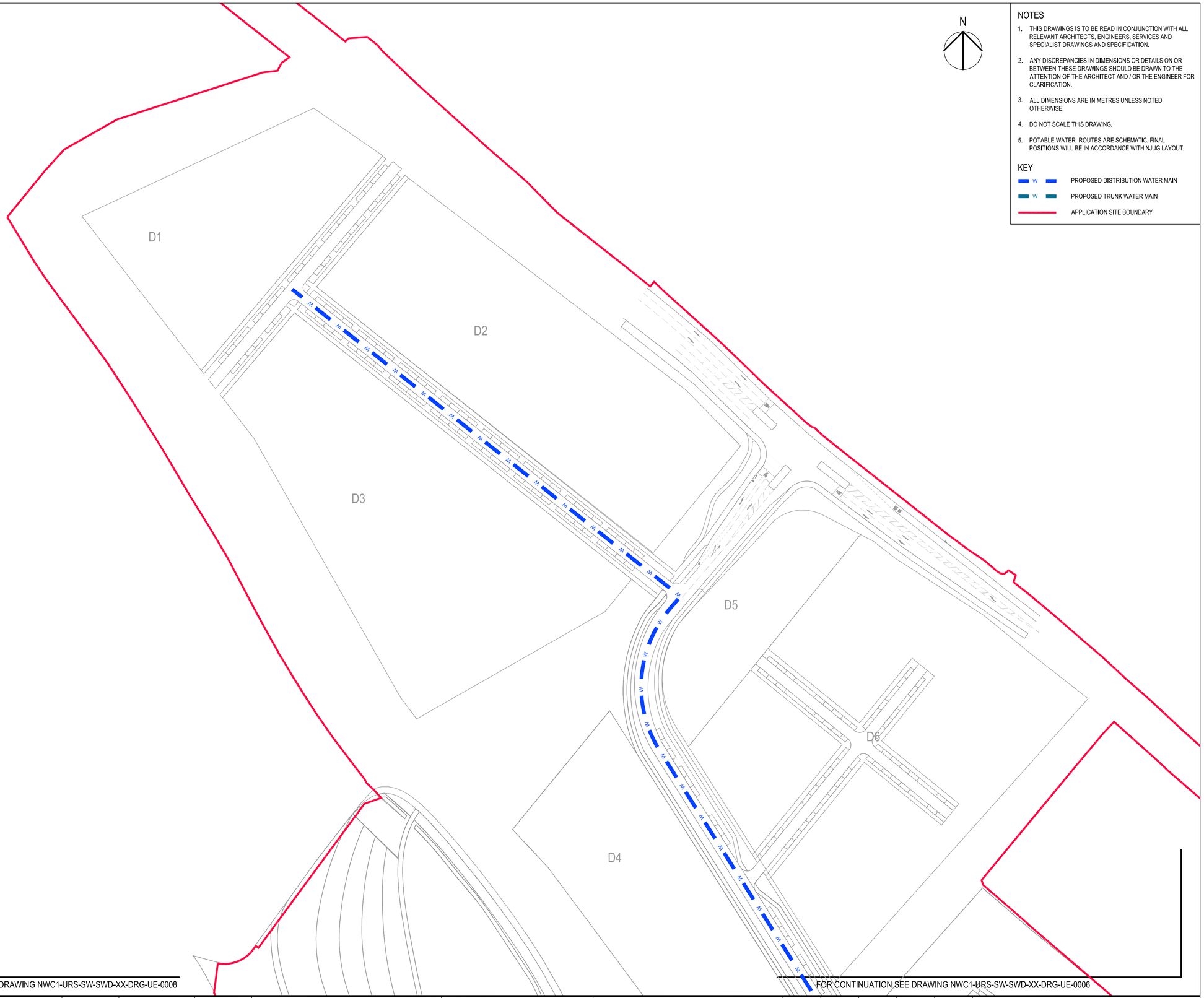

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Drawing Title: POTABLE WATER STRATEGY GENERAL ARRANGEMENT SHEET 7 OF 11

Designed	Drawn	Checked	Approved	Date
AS	SG	SES	DAJS	11/02/2013

URS Internal Project No.: Project No

Suitability: S1 CO-ORDINATION

Scale @ A1: 1:1000

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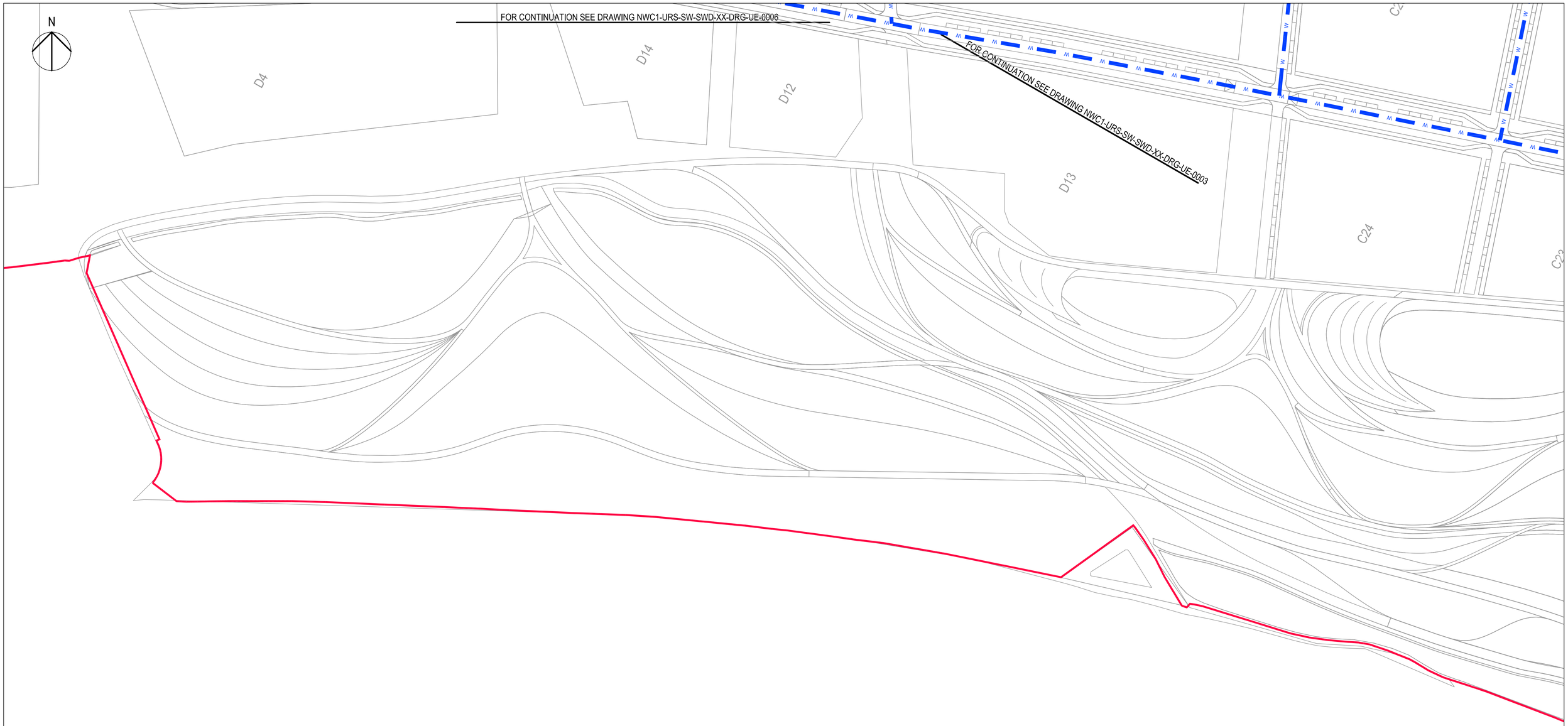
Drawing Number: NWC1-URS-SW-SWD-XX-DRG-UE-0007

Rev: 1.0

File Date : 14/02/2014 08:58:58 PM
File Name : K:\NWC014_GA2\SW\NWC1-URS-SW-SWD-XX-DRG-UE-0007



NOTES

1. THIS DRAWINGS IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS, SERVICES AND SPECIALIST DRAWINGS AND SPECIFICATION.
2. ANY DISCREPANCIES IN DIMENSIONS OR DETAILS ON OR BETWEEN THESE DRAWINGS SHOULD BE DRAWN TO THE ATTENTION OF THE ARCHITECT AND / OR THE ENGINEER FOR CLARIFICATION.
3. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
4. DO NOT SCALE THIS DRAWING.
5. POTABLE WATER ROUTES ARE SCHEMATIC. FINAL POSITIONS WILL BE IN ACCORDANCE WITH NJUG LAYOUT.

KEY

- W — PROPOSED DISTRIBUTION WATER MAIN
- W — PROPOSED TRUNK WATER MAIN
- APPLICATION SITE BOUNDARY

This drawing is for preliminary purposes only and is subject to amendment during design development. UNDER NO CIRCUMSTANCES MUST THIS DRAWING BE USED FOR CONSTRUCTION PURPOSES

Revision Details	By / Check	Date	Suffix
FIRST ISSUE	SG / AS	14/02/13	1.0

NOTES

CONSTRUCTION RISKS	MAINTENANCE / CLEANING RISK	DEMOLITION RISKS

In addition to the hazard/risks normally associated with the types of work detailed on this drawing take note of above. It is assumed that all works on this drawing will be carried out by a competent contractor working, where appropriate, to an appropriate method statement.

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION BOX

Purpose of Issue: FOR INFORMATION

Client: UNIVERSITY OF CAMBRIDGE

Project Title: NORTH WEST CAMBRIDGE

Drawing Title: POTABLE WATER STRATEGY GENERAL ARRANGEMENT SHEET 8 OF 11

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Drawing Number: NWC1-URS-SW-SWD-XX-DRG-UE-0008

Rev: 1.0

Plot Date : 14/02/2013 08:51:58PM
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