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ENVIRONMENT

HB (South Caldecotte) Limited
South Caldecotte
Milton Keynes
Sustainable Drainage Statement

ENVIRONMENT

HB (South Caldecotte) Limite
South Caldecotte
Milton Keynes
Sustainable Drainage Statement

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1. INTRODUCTION

1.1 A Sustainable Drainage Statement (SDS) sets out the principles of drainage design for a development and summarises the reasoning behind the chosen design. This includes consideration of national and local guidance, justification of specific flow rates, volumes of attenuated storage, as well as the appropriate level of treatment to be provided to surface water runoff.

1.2 This SDS has been produced by BWB Consulting on behalf of HB (South Caldecotte) Limited in respect of a site located approximately 6km to the south-east of Milton Keynes. The site is bound to the north by a railway line, to the east by Brickhill Street and to the west by the A5.

1.3 A Flood Risk Assessment has been developed for the site (reference SCD-BWB-ZZ-XX-RP-YE-0001_FRA) and this Sustainable Drainage Statement accompanies this overarching document.

1.4 This SDS is intended to support a planning application for a commercial development comprising of industrial units and as such the level of detail included is commensurate and subject to the nature of the proposals at the planning stage. A proposed layout plan is included for reference as **Appendix 1**.

1.5 The location of the site is illustrated within **Figure 1.1**, with contextual information provided within Error! Reference source not found..

Table 1.1: Site Details

Site Name	South Caldecotte
Location	Milton Keynes
NGR (approx.)	489250, 234320
Application Site Area (ha)	58 (approximately)
Development Area (ha)	43.54
Development Type	Commercial
Lead Local Flood Authority	Milton Keynes Council
Local Planning Authority	Milton Keynes Council
Internal Drainage Board	Bedford Group

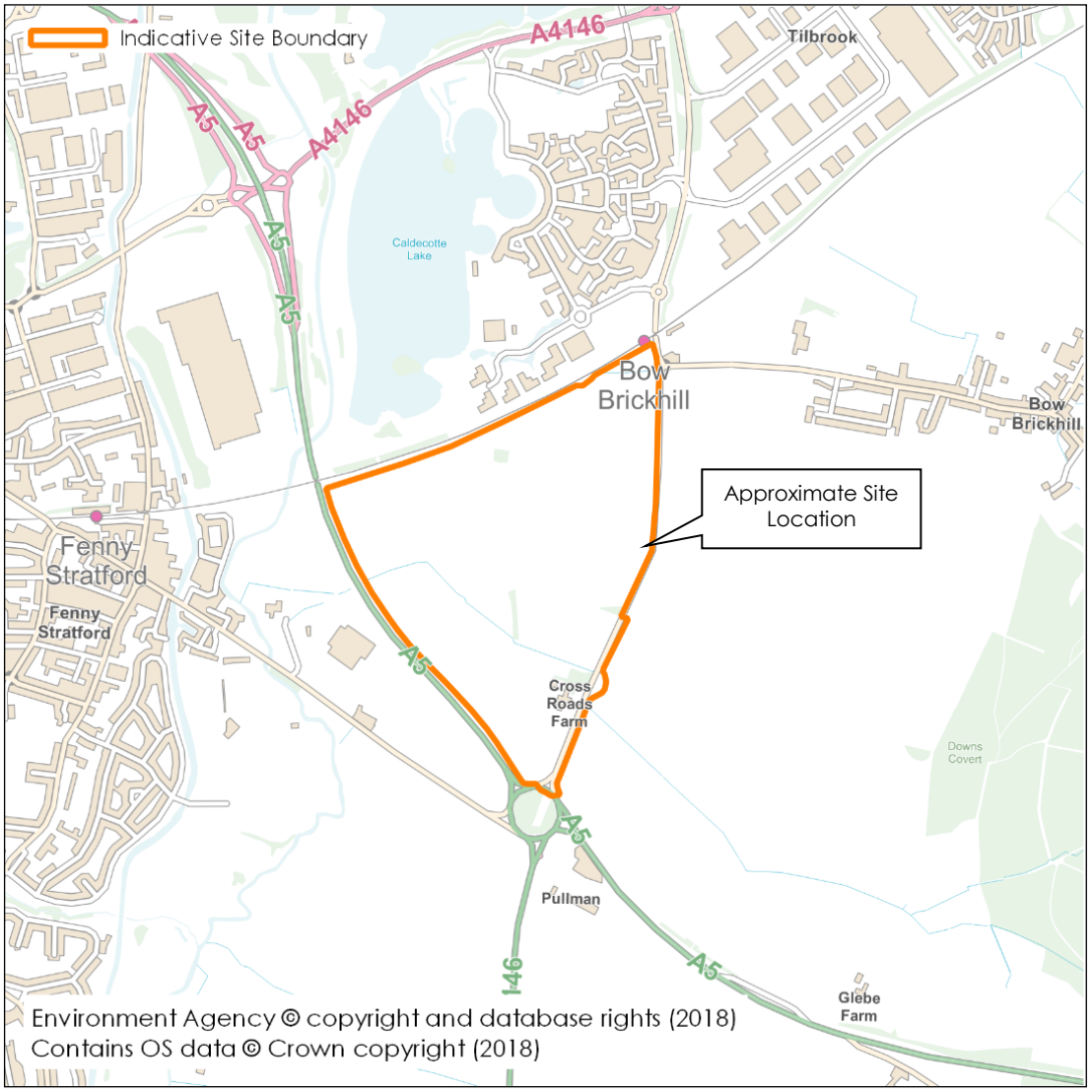

Figure 1.1: Site Location

Sustainable Drainage Guidance

1.6 Milton Keynes Council, as the Lead Local Flood Authority (LLFA), have produced a guidance document for planning applications[1], along with a Surface Water Pro-forma for new developments which has been completed and included as **Appendix 2.**

1.7 Consultation has also been sought with the Bedford Group Internal Drainage Board, **Appendix 3,** which has identified that there is a requirement to restrict discharge into their drainage network to 2 l/s per impermeable hectare.

[1] Milton Keynes Council, 'Surface Water Drainage; Local Guidance for Planning Applications

2. EXISTING CONDITIONS

2.1 The existing site is entirely greenfield, with an IDB watercourse shown within the central portion of the site, running through the site in a westerly direction, before discharging into the River Ouzel (Main River) approximately 360m to the west of the site. A drain is also noted as being present alongside the railway, on the northern boundary of the site.

2.2 The majority of the site slopes down towards the north west corner, with levels ranging approximately between 77m AOD and 65m AOD. A topographical survey is included for reference as **Appendix 4**.

2.3 The current runoff is considered to be towards the central drain and the northern drain.

2.4 The underlying geology is identified by British Geological Survey mapping as being comprised of Oxford Clay Formation (Mudstone), superficial deposits of Clay, Silt, Sand and Gravel are identified.

2.5 A typical view of the site is included below as **Figure 2.1**.

Figure 2.1: Typical View of the Existing Site

Existing Runoff Rates

2.6 An assessment of the equivalent greenfield surface water runoff rates from the site has been undertaken based on the rate per hectare, the results are summarised within **Table 2.1**.

2.7 The runoff rates have been estimated using the IH124 method, with appropriate prorated adjustments for a site of less than 50ha, as recommended in Interim Code of Practice for Sustainable Drainage[2]. This was undertaken within Micro Drainage, which makes the necessary adjustments for small sites automatically. The Micro Drainage greenfield calculation is included as **Appendix 5.**

Table 2.1: Existing Greenfield Runoff Rates from the Site

Return Period (Yrs.)	Runoff Rate per Hectare (l/s)
1	3.4
Mean Annual Flow Rate (QBAR)	4.0
30	9.1
100	12.9

Existing Runoff Volume

2.8 An assessment of the existing surface water runoff volume from the proposed development area (43.54ha) has been made for a 1 in 100-year, 6-hour storm.

2.9 As the existing site is permeable, the runoff volume has been calculated using the Source Control module within Micro Drainage to be **9,576m³**, results are included within **Appendix 5**.

[2] The National SUDS Working Group (2004), Interim Code of Practice for Sustainable Drainage

3. SURFACE WATER DRAINAGE STRATEGY

Drainage Hierarchy

3.1 The Planning Policy Guidance[3] and the SuDS Manual[4] identify that surface water runoff from a development should be disposed of as high up the following hierarchy as reasonable practicable:

i. into the ground (infiltration);
ii. to a surface water body;
iii. to a surface water sewer, highway drain, or another drainage system;
iv. to a combined sewer.

3.2 The aim of this is approach is to manage surface water runoff close to where it falls and mimic natural drainage as closely as possible.

3.3 Due to the unfavourable underlying ground conditions and groundwater levels, disposal of surface water via infiltration is not considered feasible in this instance.

3.4 Therefore, it is proposed that the development continue to discharge to the local watercourses at a restricted discharge based upon a plot by plot basis. **Table 3.1** below outlines the proposed restriction rates per plot based upon the guidelines supplied by the Bedford Group IDB of 2 l/s per impermeable ha.

Table 3.1: Plot by Plot Restriction Rates

Plot	Plot Area (ha)	Proposed Restriction Rate (l/s)
1	8.52	17.0
2	10.64	21.3
3	6.03	12.1
4	4.04	8.1
5, 6, 7 & 8	5.03	10.1
9	3.31	6.6
10	4.68	9.4
Highway	1.28	2.6
Total	**43.54**	**87.2**

[3] Planning Practice Guidance. http://planningguidance.planningportal.gov.uk/.
[4] The SuDS Manual (C753). CIRIA 2015.

Peak Flow Control

3.5 In order to comply with the Non-Statutory Technical Standards for Sustainable Drainage Systems S2-S3[5], runoff from greenfield developments should not exceed the equivalent greenfield rates for the 1 and 100-year return period events.

3.6 For previously developed sites, the proposed runoff rate must be "as close as reasonably practicable" to the greenfield runoff rates but should never exceed the rate of discharge prior to redevelopment for that event.

3.7 A comparison between the calculated greenfield rates and the requirement set by the IDB is shown within **Table 3.2**. The greenfield rate per ha is greater than the rates being proposed. Therefore, an element of betterment is being proposed as part of the development.

Table 3.2: Existing & Proposed Runoff Rates

Return Period (Yr.)	Existing Runoff Rate (l/s/ha)	Proposed Discharge Rate (l/s/ha)
1	3.4	2.0
QBAR	4.0	2.0
30	9.1	2.0
100	12.9	2.0
100 + 20%	-	2.0

Attenuated Storage

3.8 As the development proposals require a restricted runoff rate, it will be necessary to provide attenuated storage to balance the excess volume is a safe manner within the site.

3.9 A series of outline simulations have been run using Micro Drainage to estimate the approximate storage provision when considering the 1 in 100 year+20% event. The results are summarised in **Table 3.3**.

3.10 The proposals are to attenuate on a plot by plot basis primarily utilising below ground cellular storage. The storage is proposed to be below the service yard areas of each plot.

3.11 The attenuated surface water volume from the highway is proposed to be accommodated within oversized pipes beneath the carriageway.

3.12 While the drainage will be designed to the 1 in 100 year+20% event, each plot will be designed to consider exceedance in the 1 in 100 year+40% event. This will be

[5] 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems

accommodated by allowing services yards and car parking area to flood to shallow depths.

3.13 The proposed storage volumes for each plot are summarised below as **Table 3.3**.

Table 3.3: Outline Plot by Plot Storage Volumes

Plot	1 in 100-year+20% Storage Volume (m^3)
1	6189
2	7729
3	4381
4	2390
5, 6, 7, & 8	3651
9	2407
10	3399
Highway	931
Total	**31, 077**

3.14 The surface water storage should be located within the site in a position where it can receive runoff from the development and discharge from the site by gravity, and also is a position where it is hydraulically isolated from any fluvial floodplain or external surfaces.

3.15 Proposed surface water drainage drawings and calculations are included for reference as **Appendix 6**.

3.16 It is envisaged that the final required attenuated storage volume will be determined during the detailed design stage, once the development layout and drainage areas are fixed.

Runoff Volume Control

3.17 The Non-Statutory Technical Standards for Sustainable Drainage Systems S4-S6[6] states that where reasonably practical the runoff volume from a development for the 1 in 100-year 6-hour rainfall event should not exceed the runoff volume prior to development or redevelopment. Additionally, if practicable on previously developed sites, the runoff volume should not exceed the equivalent greenfield runoff volume.

3.18 Where it is not reasonably practicable to constrain the volume of runoff from a development at or below the existing volume, then the runoff must be discharged in a manner that does not adversely affect flood risk, i.e.:

[6] 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems

i. The additional runoff volume resulting from the development (the 'long term storage volume') should be discharged separately from the site at a rate of 2l/s/ha or less. Or,

ii. All the runoff volume from the development should be discharged at a rate equivalent to the mean annual flow rate (QBAR) rate under greenfield conditions or less. Or,

iii. All the runoff volume from the development should be discharged at a rate of 2l/s/ha or less.

3.19 An estimate of the post-development runoff volume from the 1 in 100-year 6-hour storm can be derived from the Micro Drainage calculations. The existing and post-development runoff volumes are compared within **Table 3.4**.

Table 3.4: Runoff Volume Comparison

Existing Volume (m^3)	Proposed Volume (m^3)	Difference (m^3)
13,726	28,997	15,271

3.20 The 1 in 100-year 6-hour storm runoff volume from the site has been shown to increase as a result of the proposed development, therefore volume control measures will be required.

3.21 It is proposed to discharge the runoff from the development at a rate set by the local IDB. This is below the mean annual flow rate (QBAR) rate under greenfield conditions therefore volume control criteria are fulfilled.

Sustainable Drainage Systems

3.22 Downstream of the surface water storage, a series of filter drains are proposed to convey surface water from the development and to the downstream watercourses.

3.23 The commercial nature of the development is such that there is limited opportunity for Sustainable Drainage features, however where possible they have been incorporated into the development. These include;

- Filter Drains
- Permeable paving
- Proprietary vortex separators

3.24 Further details on the proposals are shown on the proposed drainage drawings, included within **Appendix 6**.

Residual Risk and Designing for Exceedance

3.25 It is recommended that the final layout uses the proposed road infrastructure to provide drainage exceedance (overland flood flow) routes through the development and towards the ponds for events in excess of the capacity of the drainage system.

3.26 In the event that the capacity of the attenuation is exceeded, flood water will be directed away from buildings and pool within the car parking areas and service yards. Significant excess flow would leave the site via the vehicular entrance/exit and drain to the adjacent car parking area thus preventing flooding to downstream property.

3.27 In addition to the volume of storage provided within the main attenuation, there will be capacity within upstream pipes and manholes which has not been accounted for at this stage and a further level of redundancy to the network will therefore be provided.

4. FOUL WATER DRAINAGE

4.1 It is proposed that the site connects into the existing sewer located on Watling Street to the south of the development, via a rising main from an onsite pumping station.

4.2 An alternative would be to direct flows in a northerly direction, beneath the railway to the existing foul sewer. Such an option would be subject to discussion with Network Rail.

4.3 Both strategy options above would require a pumping station to be located within the site.

4.4 Anglian Water sewer records are included for reference as **Appendix 7**.

5. MAINTENANCE

5.1 Unless adopted, it is likely that a management company would adopt the SuDS features, and maintenance of these, including vegetation maintenance, trash screen clearing and regular outfall inspections.

5.2 Requirements for ongoing maintenance of the drainage network should form part of the Operation and Maintenance manual for the site and should be undertaken by the site management. Any specialist or proprietary products that are specified at detailed design should have a manufacturer specific maintenance regime which should be included within the document.

5.3 It is envisaged that the Operation and Maintenance manual will be developed at the detailed design stage, but some examples are included below.

i. All drainage features should be located in open areas which are readily accessible.
ii. Gullies should be inspected and de-silted at least once a year, where necessary.
iii. Pipes, manholes, cellular storage and silt traps should be inspected and de-silted at least once a year, where necessary.
iv. If permeable paving is incorporated within the layout, it should be swept a minimum of every 6 months to maintain flow capacity of the joints between blocks.
v. Hydro-brakes should be inspected every 6 months, litter/debris and silt build up should be removed as necessary.

6. SUMMARY

6.1 This statement and supporting appendices demonstrate that the drainage design for the development will comply with the relevant local and national standards, specifically the hierarchy of discharge, runoff rate and volume criterion.

6.2 This SDS is intended to support an outline planning application and as such the level of detail included is commensurate and subject to the nature of the proposals.

Table 6.1: Sustainable Drainage Statement Summary

		Existing Site	Proposed Development
Site Area (Ha)		58	
Impermeable Area (Ha)		-	43.54
Outfall Location		Watercourse	Watercourse
Peak Runoff Rate (l/s/ha)	**QBAR**	3.4	2.0
	1 in 30-Year	4.0	2.0
	1 in 100-Year	9.1	2.0
	1 in 100-Year + CC	-	2.0
Infiltration Rate		N/A	N/A
Runoff Volume (100yr RP 6 hour Storm)		9,576m^3	28,997 m^3
Volume Control		-	Discharge rate limited to 2.0l/s/ha
Proposed Storage Volume		-	31, 077m^3
Interception Volume		-	2,177m^3
Flow Control Type		-	Vortex
SuDS Features		-	Permeable Paving Oil Seperator Filter Drains
Maintenance Responsibility		-	Management Company

6.3 A restricted discharge of 2.0 l/s /ha has been proposed, as defined by the Bedford Group Internal Drainage Board.

6.4 SuDS features where possible have been proposed, including permeable paving and filter drains.

6.5 The preferred options for foul flows is to direct them to the existing sewer located on Watling Street, with a pumping station located within the site to enable this. Further discussion with Anglian Water at the appropriate juncture is required to confirm this.

6.6 It is envisaged that the final drainage strategy will be determined during the detailed design stage, as the development layout is finalised.

APPENDICES

APPENDIX 1: Proposed Development Plan

Ref:

Site	GIA (ft²)	NDA (ac)	Plot Density (%)
Unit 1	473,200	27.13	51.2
Unit 2	615,400	21.2	52.1
Unit 3	369,708	15.87	53.5
Unit 4	254,200	10.68	54.7
Unit 5	61,400	3.47	40.7
Unit 6 (office)	10,400	1.22	19.7
Unit 7	53,700	4.33	28.5
Unit 8	49,800	2.87	39.9
Unit 9	164,800	8.39	45.2
Unit 10	278,500	12.24	52.3
Total	**2,331,108**	**107.40**	49.9
	Total	**139.9**	

Revisions:

P1: 07/06/19 kbl Masterplan updated, drawing number P005 updated to PAS 1192 standard.
P2: 24/06/19 kbl Client / team comments.
P3: 27/06/19 kbl Client comments.
P4: 02/07/19 kbl Redline updated.
P5: 04/07/19 kbl Redline updated.

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South Caldecotte

Drawing Name:
Indicative Masterplan 23

Drawing Status:	PLANNING
Suitability:	S2
Rev:	P5
SGP Project:	16-048
Drawn:	KBL
Team:	IY
Date:	13/11/2018
Scale:	1:2500@ A1

Drawing Number:
16-048-01-SGP-XX-00-DR-A-1006-P5

APPENDIX 2: Milton Keynes Council Drainage Pro Forma

Surface Water Drainage Pro-forma for new developments

This pro-forma accompanies our “Surface Water Drainage; Local Guidance for Planning Applications” note. It is expected that applicants/developers should complete and submit the pro-forma to present a summary of the surface water drainage strategy for the site and demonstrate compliance with the National Planning Policy Guidance and Non-Statutory Technical Standards. The pro-forma will then be used to support the LPA in making a decision on the suitability of the proposal and, if the LPA is minded to find the completed pro-forma acceptable, then it may be used as an evidence base for a relevant surface water condition to be appended to the decision notice, stating that the developments drainage proposal will be constructed in accordance with the details set out in the relevant pro-forma.

It must however be noted that this pro-forma submitted alone, will not be considered a suitable surface water drainage strategy. It should be clearly referenced within the pro-forma where in the other submission documents the details provided are taken from.

The pro-forma is supported by the Defra/EA guidance on Rainfall Runoff Management. and uses the storage calculator on www.UKsuds.com. The pro-forma should be considered alongside other supporting SuDS Guidance, but focuses on ensuring flood risk is not made worse elsewhere. This proforma is based upon current industry standard practice.

1. Site Details

Site	South Caldecotte, Milton Keynes
Address & post code or LPA reference	Land South of Railway, east of A5
Grid reference	489250, 234320
Is the existing site developed or Greenfield?	Greenfield
Total Site Area	58 ha (approx.)
Total Site Area served by drainage system (excluding open space) (Ha)*	43.54
Pre-application sought? (Ref)	No

***** The Greenfield runoff off rate from the development which is to be used for assessing the requirements for limiting discharge flow rates and attenuation storage from a site should be calculated for the area that forms the drainage network for the site whatever size of site and type of drainage technique. Please refer to the Rainfall Runoff Management document or CIRIA manual for detail on this.

2. Impermeable Area

	Existing	Proposed	Difference (Proposed-Existing)	Notes for developers
Impermeable area (ha)	0	43.54	43.54	If proposed > existing, then runoff rates and volumes will be increasing. Section 6 must be filled in. If proposed ≤ existing, then section 6 can be skipped & section 7 filled in.
Drainage Method (infiltration/sewer/watercourse)	Watercourse	Watercourse	-	If different from the existing, please fill in section 3. If existing drainage is by infiltration and the proposed is not, discharge volumes may increase. Fill in section 6.

3. Proposing to Discharge Surface Water via

	Yes	No	Justification and Evidence that this is possible	Notes for developers
Infiltration		X	Unfavourable ground conditions: Oxford Clay Formation (Mudstone)	Soakage tests will need to be provided and results included in drainage strategy. Section 7 (infiltration) must be filled in if infiltration is proposed.
To watercourse	X		IDB contacted with hydraulic modelling undertaken.	If infiltration is not possible - is there a watercourse nearby? Have the EA or IDB provided input where necessary?
To surface water sewer		X	-	This should be a last resort. If required, has sewer provider confirmed that sufficient capacity exists for this connection? Has an appropriate connection detail been agreed?
Combination of above		X	-	e.g. part infiltration, part discharge to sewer or watercourse. Provide evidence as above.

4. Peak Discharge Rates – This is the maximum flow rate at which storm water runoff leaves the site during a particular storm event.

	Existing Rates (l/s/ha)	Proposed Rates (l/sha)	Difference (l/s/ha) (Proposed-Existing)	Notes for developers
Greenfield QBAR	4.0 l/s/ha	2.0 l/s/ha	-2 l/s/ha	QBAR is approx. 1 in 2 storm event. Provide this if Section 7 (QBAR) is proposed.
1 in 1	3.4 l/s/ha	2.0 l/s/ha	-1.4 l/s/ha	
1 in 30	4.0 l/s/ha	2.0 l/s/ha	-2 l/s/ha	

1in 100	9.1 l/s/ ha	2.0 l/s/ha	-7.1 l/s/ha	Proposed discharge rates (with mitigation) should be no greater than existing rates for all corresponding storm events. E.g. discharging all flow from site at the existing 1 in 100 event increases flood risk during smaller events.
1 in 100 plus climate change	-	2.0 l/s/ha	-	To mitigate for climate change the proposed 1 in 100 +CC must be no greater than the existing 1 in 100 runoff rate. If not, flood risk increases under climate change. - It is expected that the applicants will design on-site surface water drainage to accommodate the 1:100 year +20% allowance, whilst also assessing the performance of the proposal to fully understand any flooding implications of the 40% CC allowance. Where implications prove to be significant (e.g. the development puts people at risk or has the potential to flood a neighbouring site), the development will be expected to incorporate additional mitigation measures, for example extra attenuation, to ensure no risk to third parties/onsite users for the extreme 40% CC scenario.

5. Calculate additional volumes for storage –The total volume of water leaving the development site. New hard surfaces potentially restrict the amount of storm water that can go to the ground, so this needs to be controlled so not to make flood risk worse to properties downstream.

	1 in 100-year 6hour storm			
	Existing Volume (m^3)	**Proposed Volume (m^3)**	**Difference (m^3) (Proposed-Existing)**	**Notes for developers**
1 in 1	2,611	9,631	7,020	Proposed discharge volumes (without mitigation) should be no greater than existing volumes for all corresponding storm events. Any increase in volume increases flood risk elsewhere. Where volumes are increased section 6 must be filled in.
1 in 30	6,936	22,318	15,382	
1in 100	13,726	28,997	15,271	
1 in 100 plus climate change	-	34,797	-	To mitigate for climate change the volume discharge from site must be no greater than the existing 1 in 100 storm event. If not, flood risk will increase under climate change.

6. Calculate attenuation storage – Attenuation storage is provided to enable the rate of runoff from the site into the receiving watercourse to be limited to an acceptable rate to protect against erosion and flooding downstream. The attenuation storage volume is a function of the degree of development relative to the greenfield discharge rate.

		Notes for developers
What Storage Attenuation volume (Flow rate control) is required to retain rates as existing (m^3)	31,077	Volume of water to attenuate on site if discharging at existing rates. Can't be used where discharge volumes are increasing
Where is the storage to be accommodated on site?	Below ground storage, shallow flooding of carparks and service yards	

7. How is Storm Water stored on site?

Storage is required for the additional volume from site but also for holding back water to slow down the rate from the site. This is known as attenuation storage and long term storage. The idea is that the additional volume does not get into the watercourses, or if it does it is at an exceptionally low rate. You can either infiltrate the stored water back to ground, or if this isn't possible hold it back with on site storage. Firstly, can infiltration work on site?

			Notes for developers
Infiltration	**State the Site's Geology and known Source Protection Zones (SPZ)**	BGS identifies underlying geology to comprised of Oxford Clay.	- Infiltration rates are highly variable, soakage tests should be comprehensive. - Avoid infiltrating in made ground. - Refer to Environment Agency website to identify and source protection zones (SPZ)
	Infiltration Rate (m/s)?	N/A	Infiltration rates should be no lower than $1x10^{-6}$ m/s.
	State the distance between a proposed infiltration device base and the ground water (GW) level	Ground water likely to be shallow, as site falls within IDB area	Need 1m (min) between the base of the infiltration device & the water table to protect Groundwater quality & ensure GW doesn't enter infiltration devices. Avoid infiltration where this isn't possible.
	Were infiltration rates obtained by desk study or infiltration test?	N/A	Infiltration rates can be estimated from desk studies at most stages of the planning system if a back up attenuation scheme is provided.
	Is the site contaminated? If yes, consider advice from others on whether infiltration can happen.	No	Water should not be infiltrated through land that is contaminated. The Environment Agency may provide bespoke advice in planning consultations for contaminated sites that should be considered.
In light of the above, is infiltration feasible?	**Yes/No? If the answer is No, please identify how the storm water will be stored prior to release**	No – storm water to be stored within cellular storage and oversized pipes.	If infiltration is not feasible how will the additional volume be stored? The applicant should consider the following options in the next section.

Storage requirements

The developer must confirm one of the two methods for dealing with the amount of water that needs to be stored on site.

Option 1 Simple – Store both the additional volume and attenuation volume in order to make a final discharge from site at **QBAR** (Mean annual flow rate). This is preferred if no infiltration can be made on site. This very simply satisfies the runoff rates and volume criteria.

Option 2 Complex – If some of the additional volume of water can be infiltrated back into the ground, the remainder can be discharged at a very low rate of 2 l/sec/hectare. A combined storage calculation using the partial permissible rate of 2 l/sec/hectare and the attenuation rate used to slow the runoff from site.

		Notes for developers
Please confirm what option has been chosen and how much storage is required on site.	Simple (IDB 2l/s/ha – less than QBAR): 31,077m^3	The developer at this stage should have an idea of the site characteristics and be able to explain what the storage requirements are on site and how it will be achieved.

8. Please confirm

		Notes for developers
a) Which Drainage Systems measures have been used? Provide an overview of the SuDS design scheme used? - Is the runoff managed at, or close to, the surface wherever possible. - Where the system serves more than one property, is public space used and integrated with the drainage system in an appropriate and beneficial way?	Permeable paving in parking area Cellular storage beneath parking areas and service yards. Oil separators. Filter drains used to convey storm water to outfall to watercourse.	SUDS can be adapted for most situations even where infiltration isn't feasible e.g. impermeable liners beneath some SUDS devices allows treatment but not infiltration. See CIRIA SUDS Manual C697.
b) Functionality Are the design features sufficiently durable to ensure structural integrity over the system design life (residential 100 years and commercial 60 years), with reasonable maintenance requirements?	All features proposed in open areas for ease of maintenance	
Are all parts of the SuDS system outside any areas of flood risk?	Yes	If not, provide justification and evidence that performance will not be adversely affected.

Has runoff and flooding from all sources (both on and off site) been considered and taken into account in the design?	Yes	
Has residual risk been addressed?	Yes	• Does the drainage system contain the 1 in 30 storm event without any flooding (include description of how any exceedance of surface water systems will be routed exceptional rain fall away from property)? • Are 1 in 100 year flows contained or stored on-site within safe exceedance storage areas and flow paths? • Is any flooding between 1 in 30 and 100 +CC storm events safely contained on site, without causing property flooding or a hazard to site users? • Has it been ensured that there is no flooding from the system to downstream property or access routes for the 100 year + climate change event?
How are rates being restricted (hydro brakes etc.)?	Hydrobrake	- Hydrobrakes to be used where rates are between 2l/s to 5l/s. - Orifices not to be used below 5l/s as the pipes may block. - Pipes with flows < 2l/s are prone to blockage.
c) Please confirm the owners/adopters of the entire drainage systems throughout the development. Please list all the owners.	TBC	If these are multiple owners then a drawing illustrating exactly what features will be within each owner's remit must be submitted with this Proforma.
How is the entire drainage system to be maintained? An acceptable maintenance plan, clearly defining the operating and maintenance requirements of the drainage system will need to be submitted and approved.	Private maintenance company	If the features are to be maintained directly by the owners as stated in answer to the above question please answer yes to this question and submit the relevant maintenance schedule for each feature. If it is to be maintained by others than those above, please give details of each feature and the maintenance schedule. Clear details of the maintenance proposals of all element of the proposed drainage system must be provided. Poorly maintained drainage can lead to increased flooding problems in the future.

9. Evidence Please identify where the details quoted in the sections above were taken from. i.e. Plans, reports etc. Please also provide relevant drawings that need to accompany your pro-forma, in particular exceedance routes, ownership and location of SuDS (maintenance access strips etc.)

Pro-forma Section	Document reference where details quoted above are taken from	Page Number
Section 2	SCD-BWB-ZZ-XX-RP-CD-0001_SDS	3
Section 3	SCD-BWB-ZZ-XX-RP-CD-0001_SDS	5
Section 4	SCD-BWB-ZZ-XX-RP-CD-0001_SDS	4 & 5
Section 5	SCD-BWB-ZZ-XX-RP-CD-0001_SDS	4 & 8
Section 6	SCD-BWB-ZZ-XX-RP-CD-0001_SDS	7
Section 7	SCD-BWB-ZZ-XX-RP-CD-0001_SDS	6
Section 8	SCD-BWB-ZZ-XX-RP-CD-0001_SDS	8 & 11

The above form is completed using factual information and evidence from the Surface Water Drainage Strategy, Flood Risk Assessment and site plans and can be used as a summary of the surface water drainage strategy on this site, clearly showing that the proposed surface water rate and volume will not be increasing as a result of the development. Where an increase in rate or volume is shown the appropriate sections of the pro-forma have been completed setting out how the additional rate/volume is being dealt with, to ensure no increased flood risk on or off site.

Where the pro-forma is found to be acceptable to the Local Planning Authority then the surface water drainage system design must be built in accordance with the details provided here.

Form completed by: …Robin Green……..

Qualification of person responsible for signing of this pro-forma: …….BSc (Hons)……

Company: ……BWB Consulting Ltd……..

On behalf of (Client's details): ……HB (South Caldecotte) Limited……

Date: ……09/07/19……

APPENDIX 3: Bedford Group IDB Correspondence

Keith Alger

From: Chris Dodd
Sent: 15 November 2018 08:33
To: Keith Alger
Subject: FW: Proposed Development Query
Attachments: Fenny.pdf

Hi Keith

See below. 2l/s/ha is correct.

Thanks for checking.

Chris Dodd BEng(Hons) IEng MICE
Associate | BWB Consulting Limited

5th Floor, Waterfront House, Station Street, Nottingham, NG2 3DQ
M 07501 778 860 **T** 0115 924 1100 **D** 0115 851 7416 **W** www.bwbconsulting.com

---

From: Trevor Skelding [mailto:Trevor.Skelding@idbs.org.uk]
Sent: 04 August 2017 14:29
To: Chris Dodd
Subject: RE: Proposed Development Query

Chris

Please find attached a plan indicating the extent of the Board's district at this location and the EA's flood zones.

Any development within FZ3 will require level for level compensation.

The Board's byelaw of 9m extends from bank top both sides of the watercourse. No development should be proposed within this area.

Any proposed surface water discharge should be restricted to the equivalent of 2 l/s per impermeable hectare.

Any discharge to the watercourse or proposed works within the byelaw will require the Board's prior approval and consent.

No flood records exist for this location.

Regards

Trevor Skelding MSc IEng MICE
Principal Engineer

Bedford Group of Drainage Boards|Vale House|Broadmead Road|Stewartby|Bedfordshire|MK43 9ND

Tel: 01234 767995 | Fax: 01234 768582 | www.idbs.org.uk

From: Chris Dodd [mailto:Chris.Dodd@bwbconsulting.com]
Sent: 03 August 2017 11:50
To: Frances Bowler <Frances.Bowler@idbs.org.uk>
Subject: Proposed Development Query

Hello

I am looking a site which appears to fall within your boundary, and contains a watercourse annotated number 36 on your map (see below). The site is to the south of Milton Keynes. Please would you provide some further information regarding the watercourse/catchment and any factors which should be considered when developing around and draining to the watercourse.

Key:
Hatched Areas – Drainage Districts
Heavy Blue Lines – Arterial Watercourses subject to Boards' statutory & byelaw control

Please feel free to contact me to discuss.

Thank you in advance.

Kind Regards,

Chris Dodd BEng(Hons) IEng MICE
Associate | BWB Consulting Limited

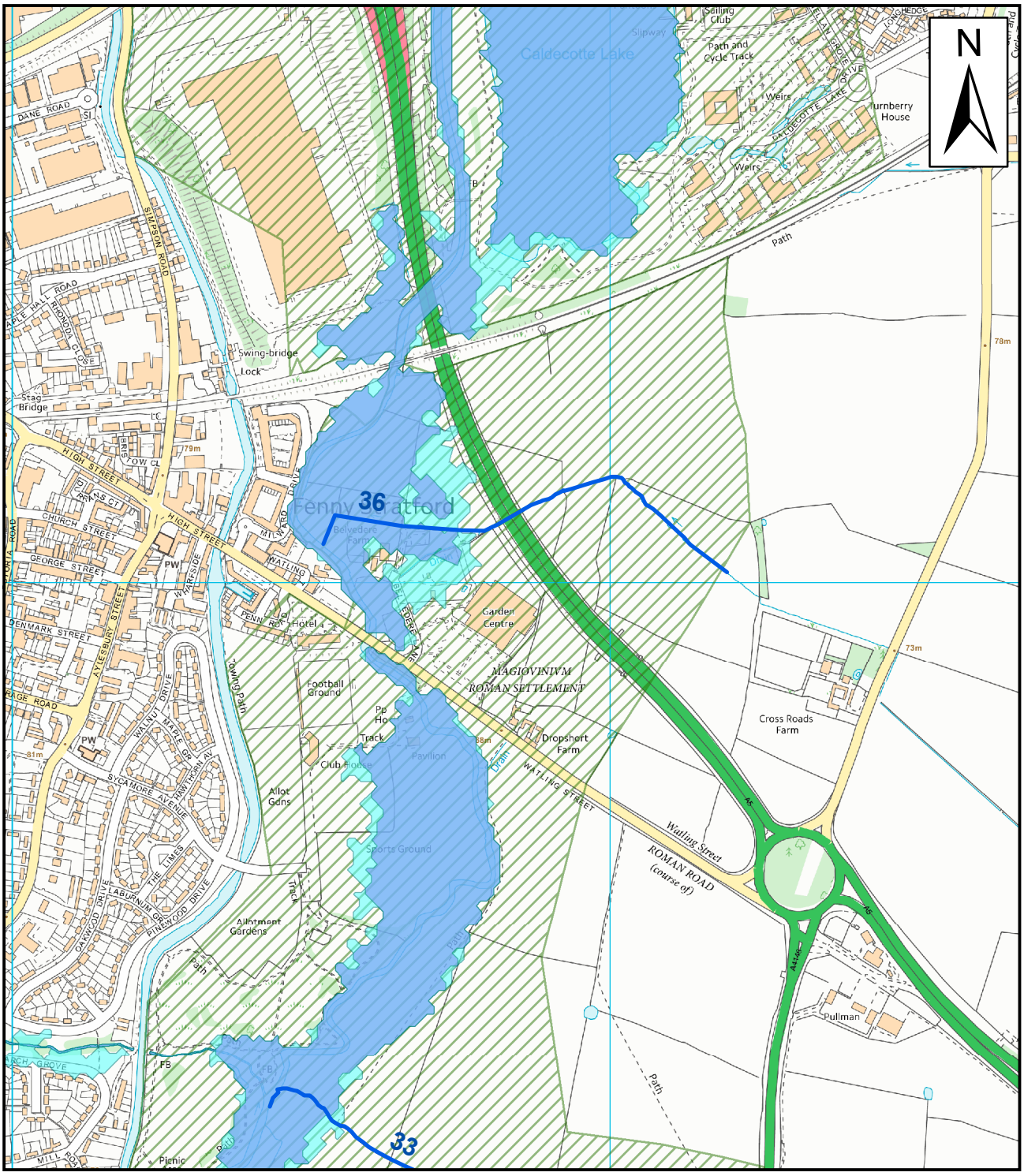
5th Floor, Waterfront House, Station Street, Nottingham, NG2 3DQ

tel 0115 9241100 **dir** 0115 851 7416 **mob** 07501 778860
web www.bwbconsulting.com

Registered in England and Wales
Registered Office: 5th Floor, Waterfront House, Station Street, Nottingham, NG2 3DQ
Company No. 5265863
VAT Reg No. 648 1142 45

Bedford Group of Drainage Boards

Buckingham & River Ouzel



Scale 1 = 10,000

Legend

- IDB Watercourse
- EA Flood Zone 3
- EA Flood Zone 2

Meters

0 100 200 400

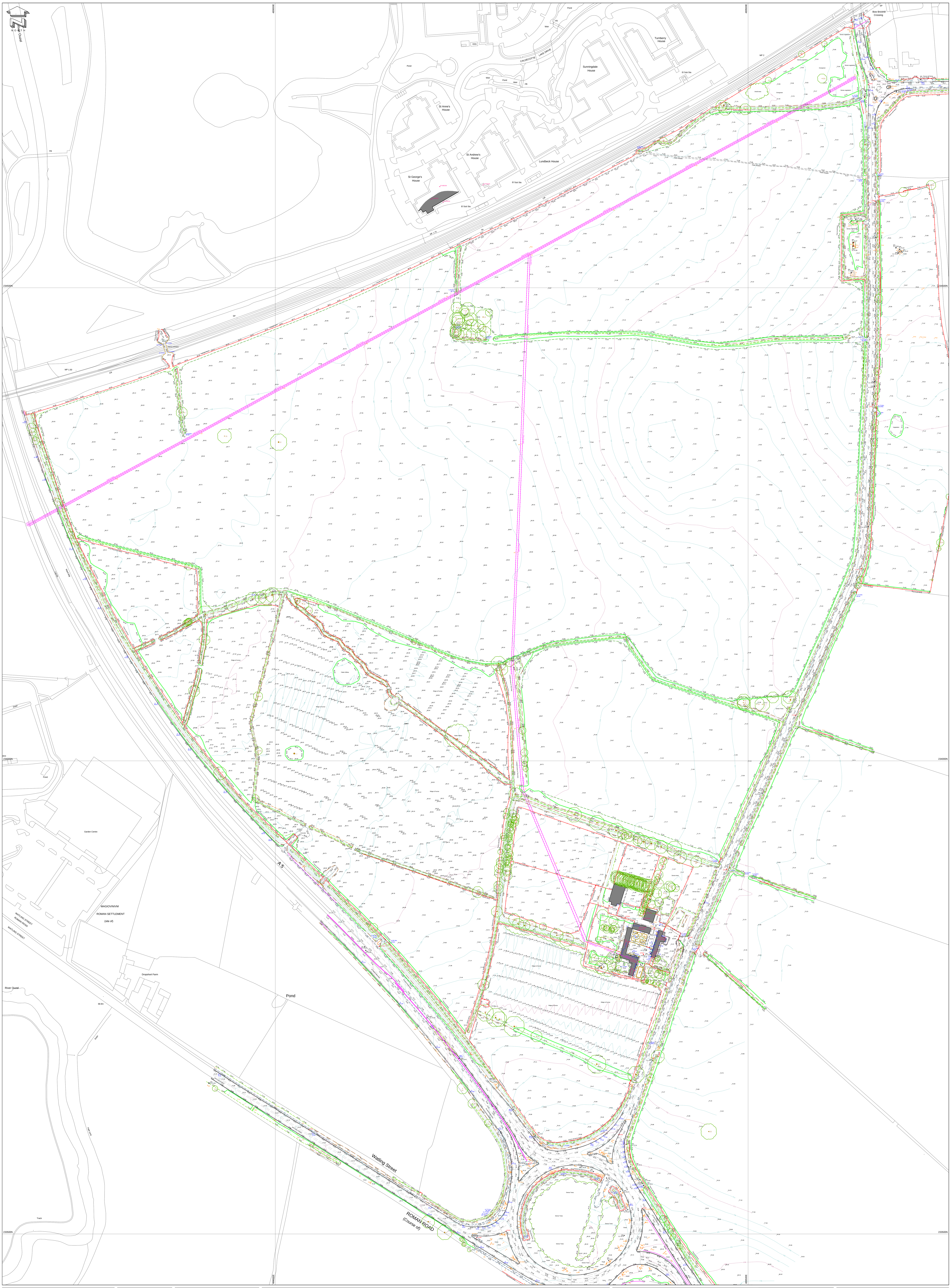
IDB District

Fenny Stratford

BOARD

Buckingham and River Ouzel IDB

APPENDIX 4: Topographical Survey



SITE	SCALE	CLIENT
SOUTH CALDECOTTE	1:1250 @ A0	HamptonBrook Creative Development & Investment www.hamptonbrook.com
	DATE: 06-09-2017	
PROJECT: TOPOGRAPHICAL SURVEY	DRAWING No.: 9439a	

NOTES

Boundaries surveyed are physical features and may not necessarily represent the legally conveyed ownership.

Tree Spreads, Girths and Heights are approximate, any tree species identified should not be relied upon and checked by a specialist if critical

Underground drainage depths, pipe sizes and runs have been recorded from the surface and may have been estimated or assumed

Features surveyed off site such as buildings and trees may have been recorded remotely and may not be shown in full detail due to access / sighting restrictions

SURVEY CONTROL

CO-ORDINATES & DATUM DERRIVED USING GEOID MODEL OSGM15(GB) & HORIZONTAL TRANSFORMATION OSTN15

THIS SURVEY IS ORIENTATED TO ORDNANCE SURVEY GRID NORTH WITH A TRUE OSGM15 CO-ORDINATE NEAR THE CENTRE OF THE SURVEY.

THE SURVEY IS PLOTTED TO A FLAT PLANE GRID. HORIZONTAL MEASUREMENTS TAKEN FROM THIS SURVEY WILL BE TRUE DISTANCES

REFER TO SURVEY CONTROL STATION LISTING FOR RE-ESTABLISHING CONTROL ON SITE

Name	Easting	Northing	Height
STNA	489363.218	233605.041	77.630
STNB	489437.029	233812.595	72.755
STNC	489477.506	233885.623	72.930
STND	489550.436	234048.265	73.625
STNE	489619.801	234203.039	75.014
STNF	489631.911	234376.302	78.078
STNF1	489389.304	233795.439	72.031
STNF2	489400.757	233823.562	72.258
STNF3	489353.107	233846.821	71.624
STNF4	489370.116	233834.671	71.961
STNG	489634.428	234591.278	74.945
STNH	489627.134	234714.783	74.853
STNH1	489635.534	234701.577	75.231
STNH2	489622.075	234774.593	73.853
STNI	489722.863	234719.623	76.493
STNJ	489830.728	234721.510	78.543
STNK	489973.268	234715.875	81.752
STNL	489267.814	233573.958	78.020
STNL1	489109.853	233803.910	72.861
STNM	489388.039	233526.609	79.252
STNN	489320.836	233420.502	80.561
STNO	489244.066	233502.834	78.726
STNP	489213.154	233496.207	78.689
STNQ	489035.589	233610.135	74.346

stafsurv LAND SURVEYORS

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T 01283 584800 > F 01284 584844 > E info@stafsurv.com

APPENDIX 5: Greenfield Runoff Calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years)	2	Soil	0.450
Area (ha)	1.000	Urban	0.000
SAAR (mm)	650	Region Number	Region 6

Results l/s

QBAR Rural	4.0
QBAR Urban	4.0
Q2 years	3.5
Q1 year	3.4
Q30 years	9.1
Q100 years	12.9

Greenfield Runoff Volume

FEH Data

Return Period (years)	100
Storm Duration (mins)	360
FEH Rainfall Version	2013
Site Location	GB 488650 234050 SP 88650 34050
Data Type	Catchment
Areal Reduction Factor	1.00
Area (ha)	43.540
SAAR (mm)	630
CWI	92.400
SPR Host	36.950
URBEXT (1990)	0.0000

Results

Percentage Runoff (%)	33.23
Greenfield Runoff Volume (m^3)	9576.925

APPENDIX 6: Proposed Drainage Plans and Calculations

Notes

1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.

Legend

- Attenuation Cells (Aquacell Plus)
- Proposed Surface Water Manhole
- Proposed Surface Water
- Proposed Foul Water Manhole
- Proposed Adoptable Foul Water Manhole
- Proposed Adoptable Foul Water
- Proposed Foul Water
- Proposed Adoptable Rising Main

Plot 1
FFL 70.650m AOD

Plot 2
FFL 69.600m AOD

Plot 3
FFL 70.450m AOD

Plot 4
FFL 72.150m AOD

Plot 5
FFL 73.550m AOD

Plot 6
FFL 74.400m AOD

Plot 7
FFL 74.600m AOD

Plot 8
FFL 75.450m AOD

Plot 9
FFL 72.900m AOD

Plot 10
FFL 71.850m AOD

2m wide filter trench with 225Ø perforated pipe @ 1 in 500 at base of trench
Filter trench to intercept run off from plots prior to discharging into watercourse

Watercourse IL 65.810
Headwall IL: 66.030
Headwall IL: 66.154
Weir cills headwall
Subject to Watercourse Design

Note:

Pipe sizes shown indicatively and are subject to change at detailed design stage

CUT LINE SEE VIEWPORT 2

CUT LINE SEE VIEWPORT 1

VIEWPORT 1

VIEWPORT 2

P3	10.07.19	Updated to suit new masterplan	RAL	RAL
P2	26.06.18	Revised following client meeting	MR	RAL
P1	18.05.18	Preliminary issue	MR	RAL
Rev	Date	Details of issue / revision	Drw	Rev

Issues & Revisions

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☐ London | 020 7407 3879
☐ Manchester | 0161 233 4260
☐ Nottingham | 0115 924 1100
www.bwbconsulting.com

Client
HB (South Caldecotte) Ltd

Project Title
South Caldecotte

Drawing Title
Proposed Drainage Layout

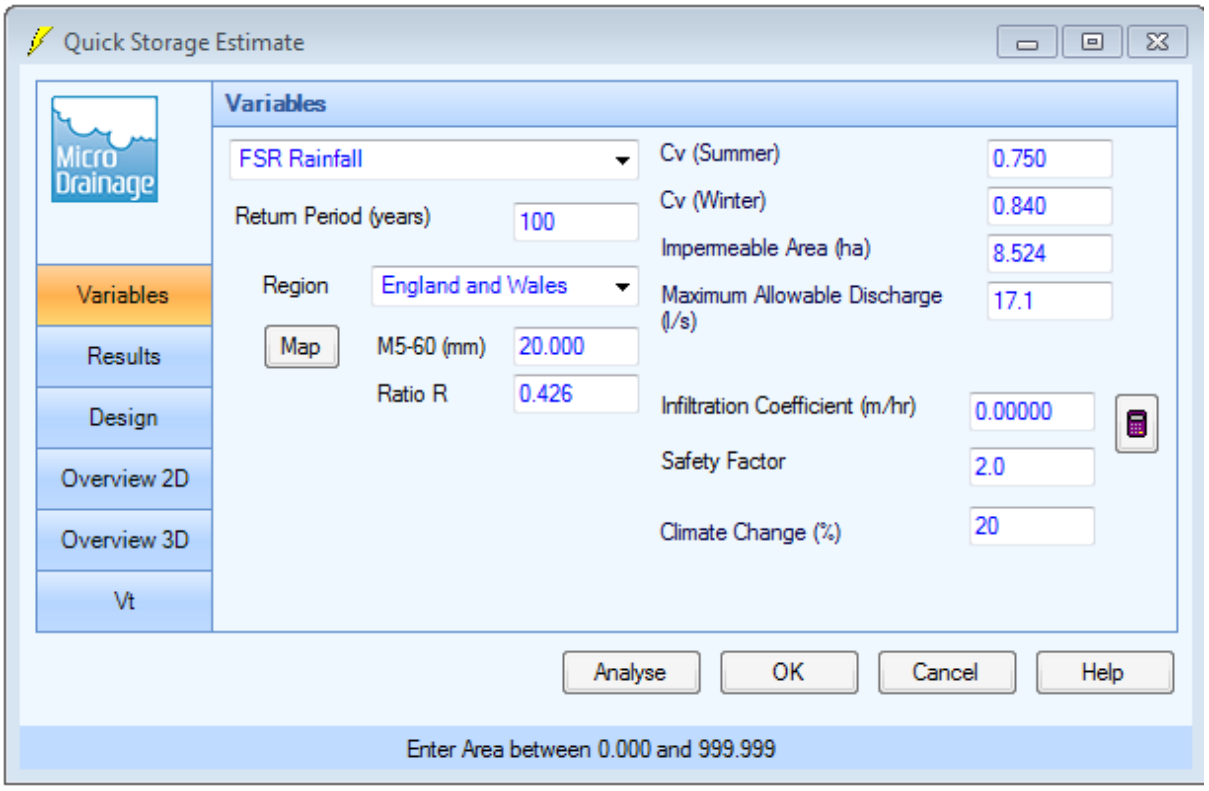
Drawn:	M. Ross		Reviewed:	R. Leyland	
BWB Ref:	NTS 2682	Date:	18.05.18	Scale@A0:	1:1250

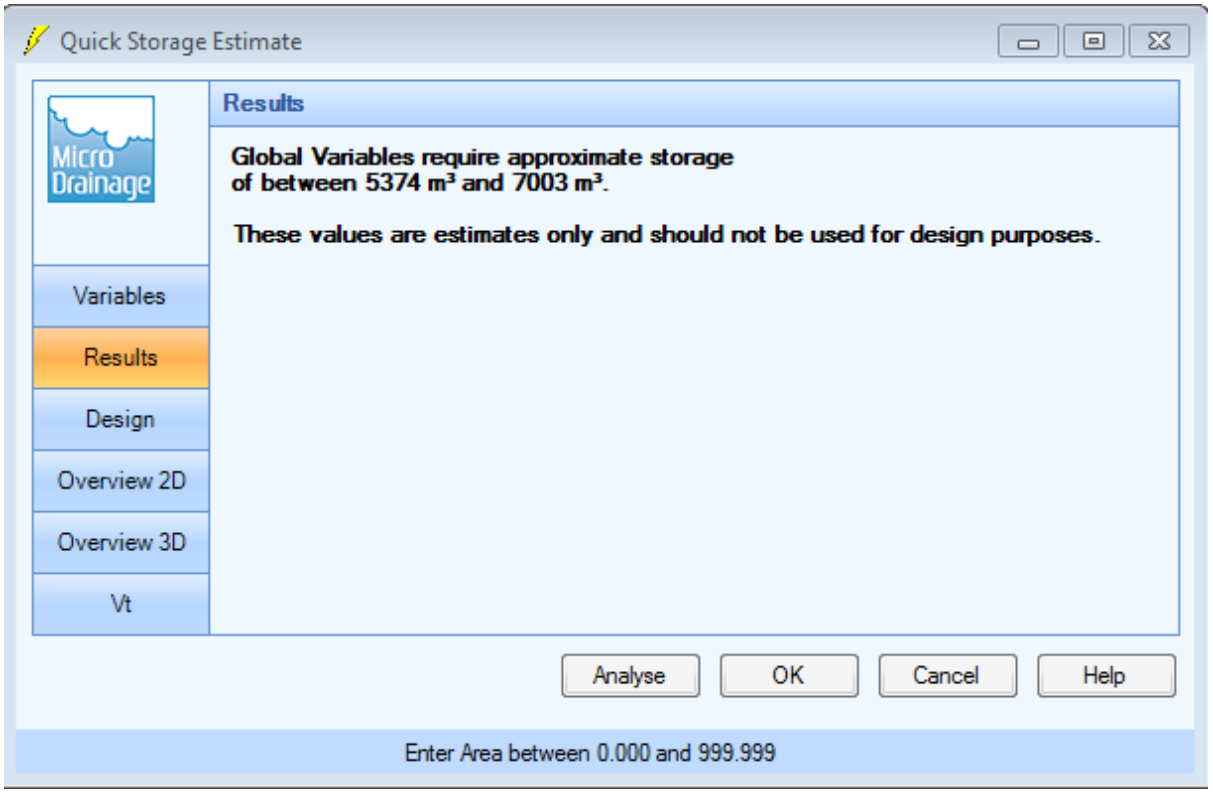
Drawing Status
Preliminary

Project - Originator - Zone - Level - Type - Role - Number:	Status	Rev
SCD-BWB-DDG-XX-DR-D-500	**S1**	**P3**

Y:\NTS\NTS2682_South Caldecotte, MK02\2. Project Delivery\01. WIP\Drawings\SCD-BWB-DDG-XX-DR-D-500_Proposed Drainage Layout.dwg

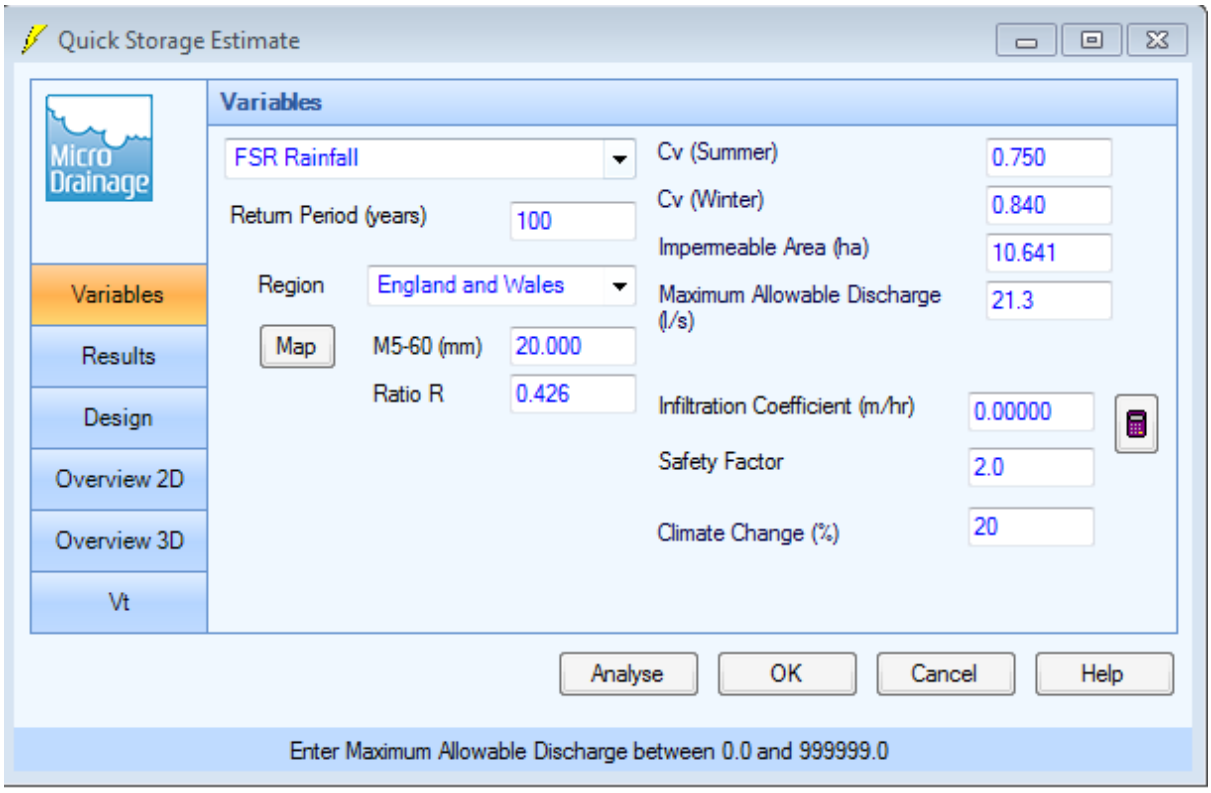
Plot 1 (FSR)

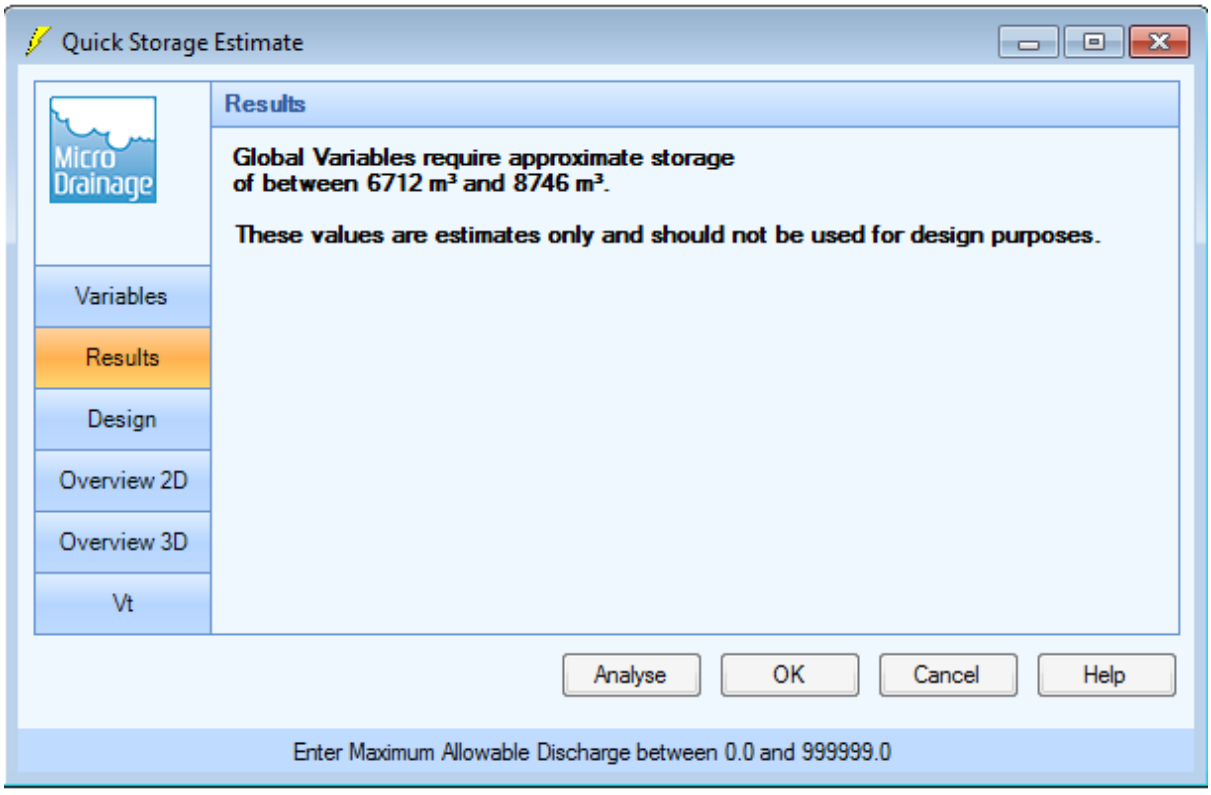




(5374+7003)/2 = 6189m³ Storage required

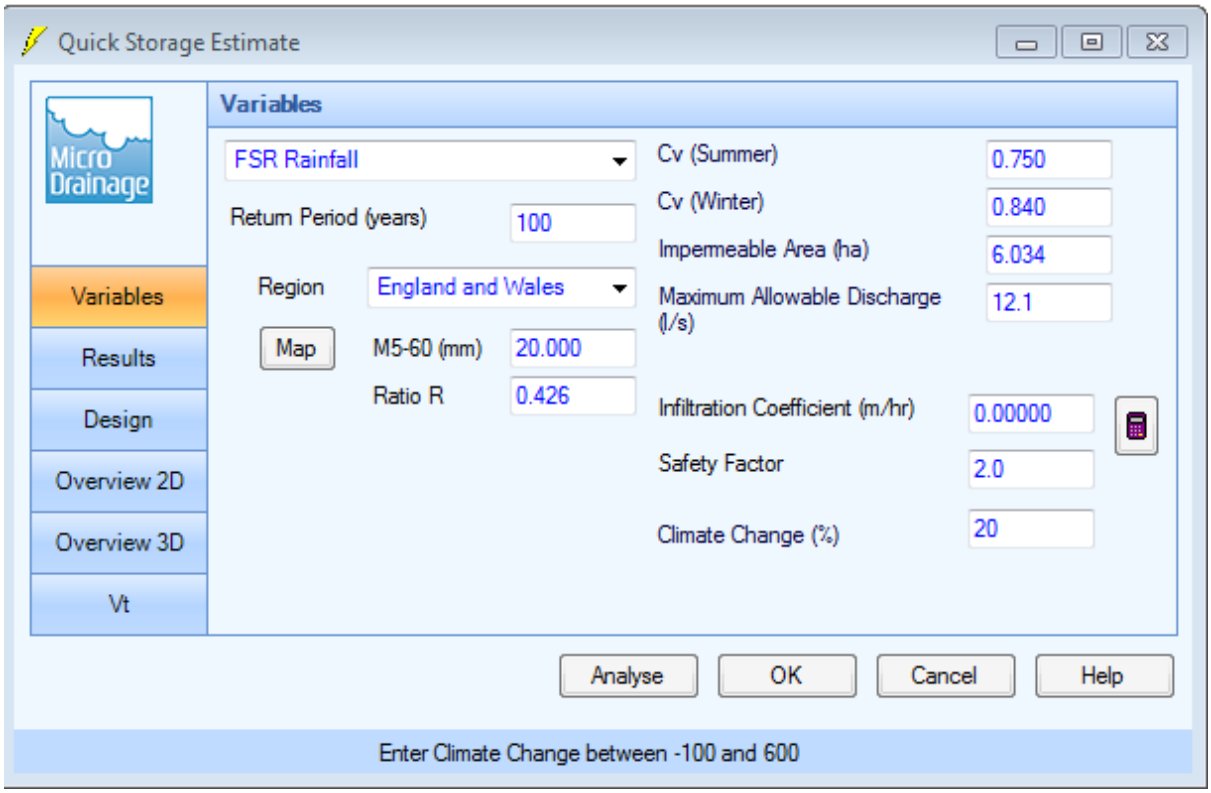
Plot 2 (FSR)

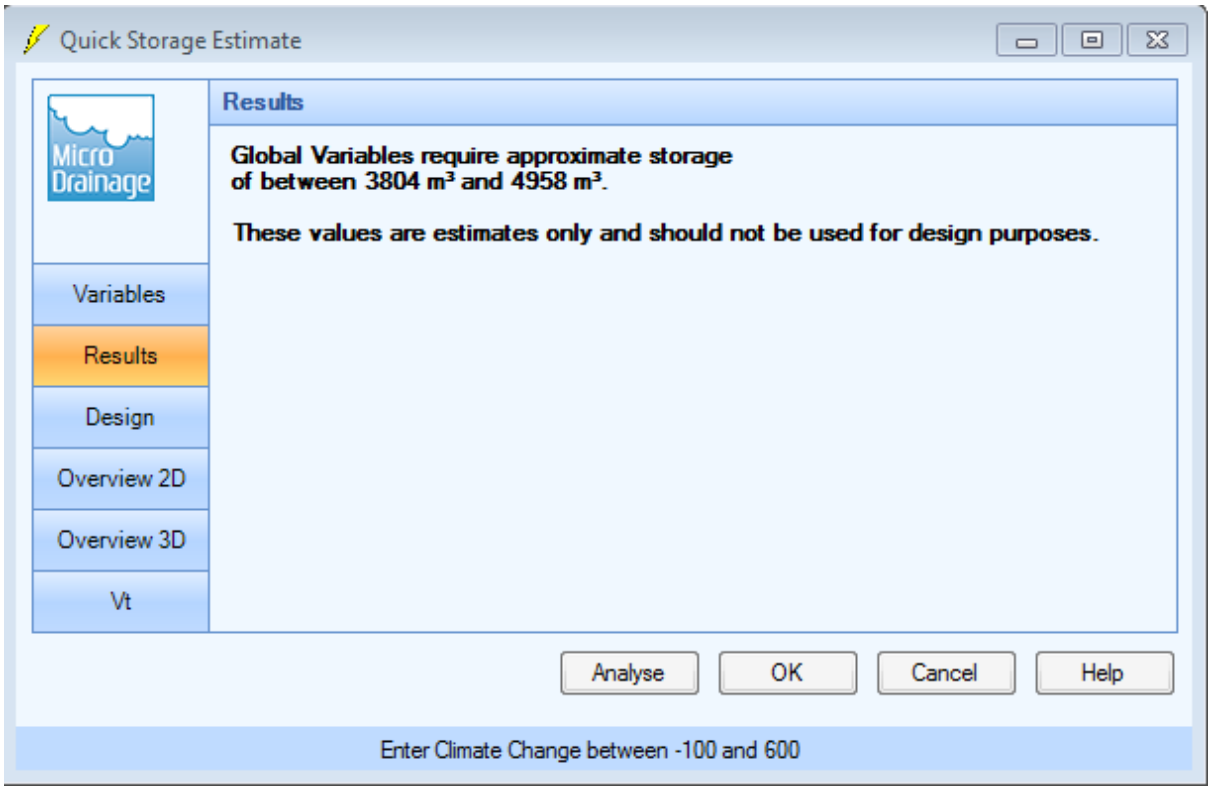




(6712+8746)/2 = 7729m³ Storage required

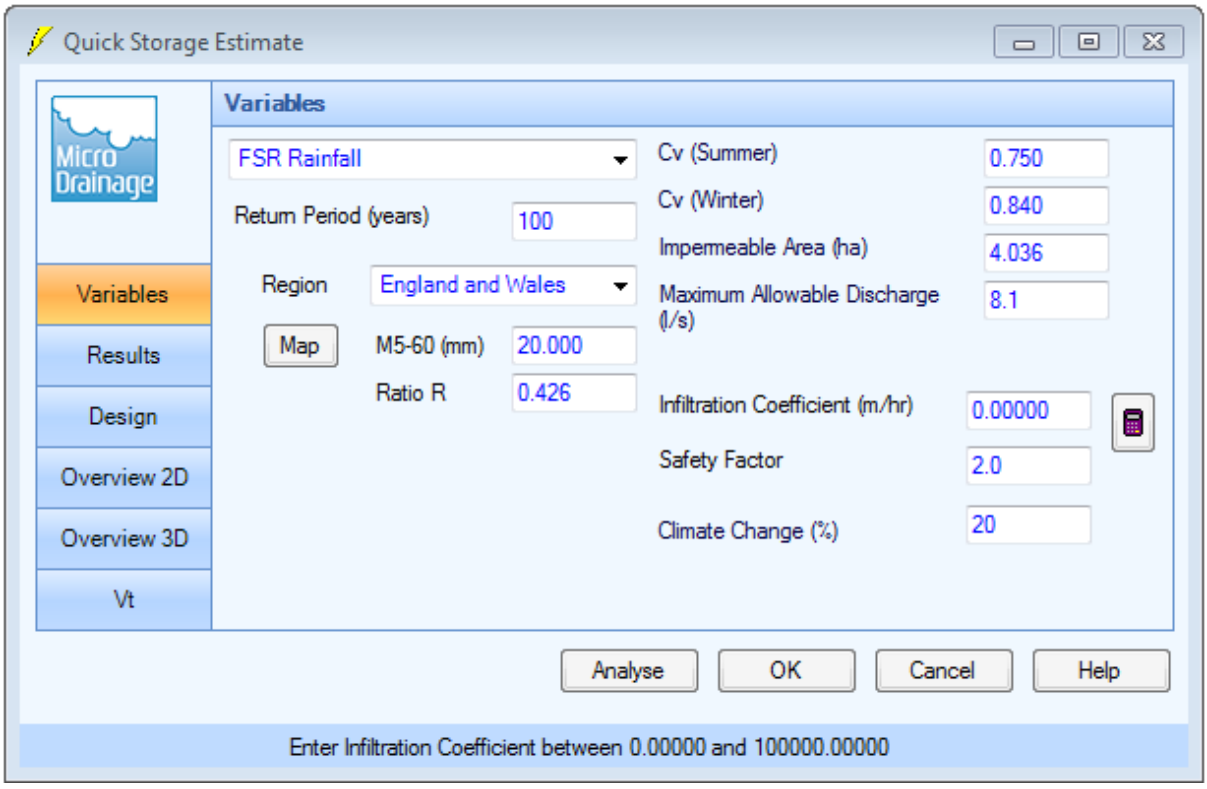
Plot 3 (FSR)

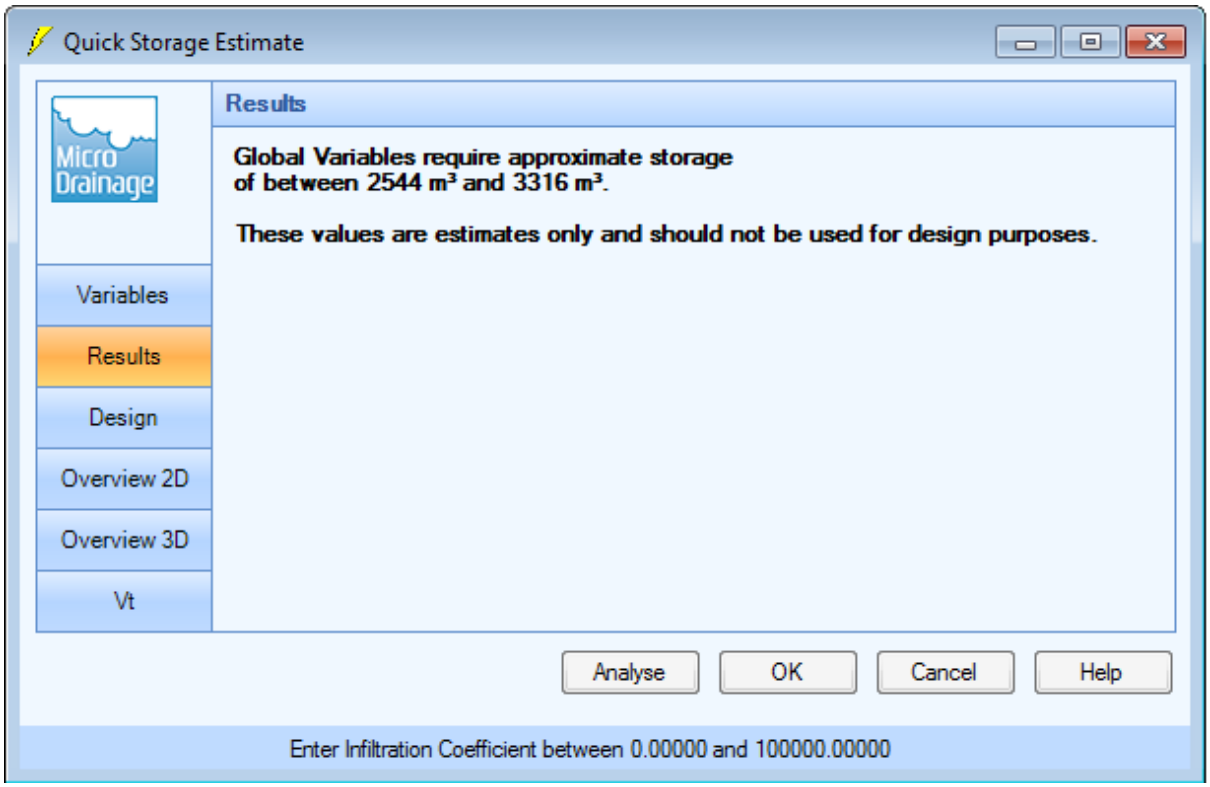




(3804+4958)/2 = 4381m³ Storage required

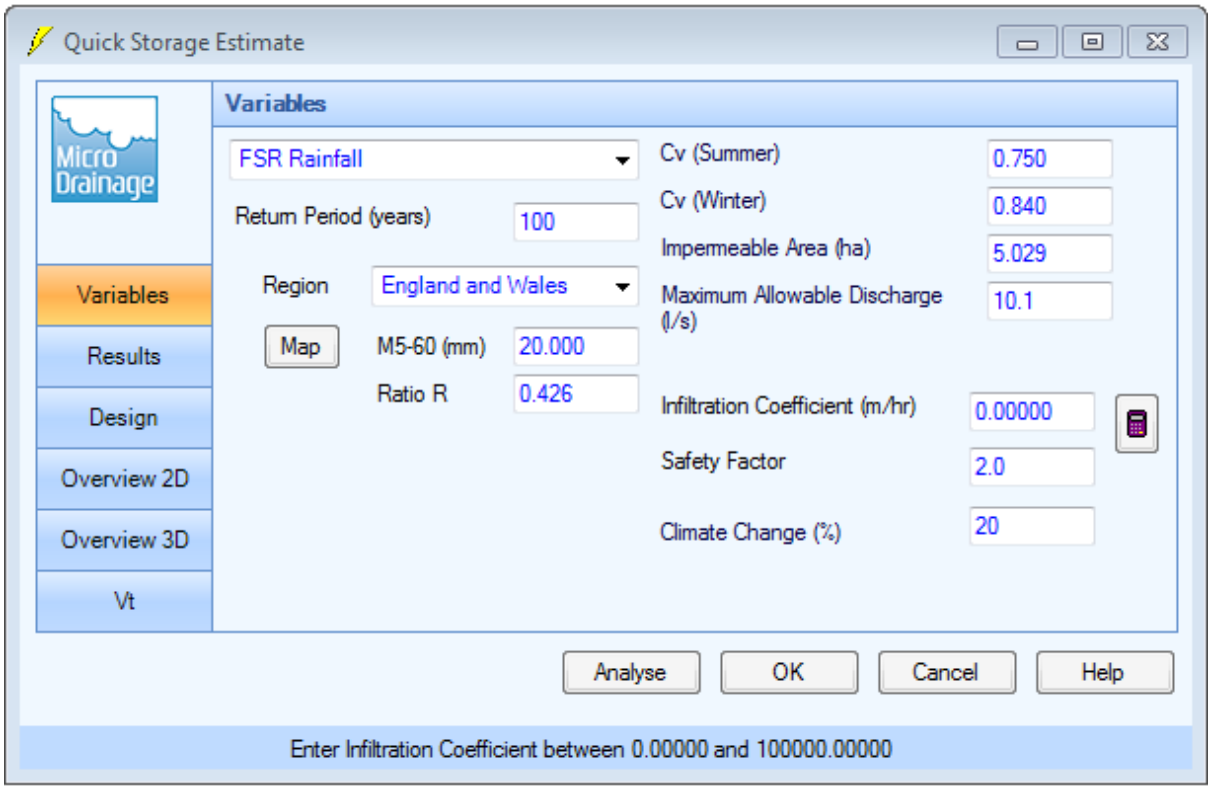
Plot 4 (FSR)

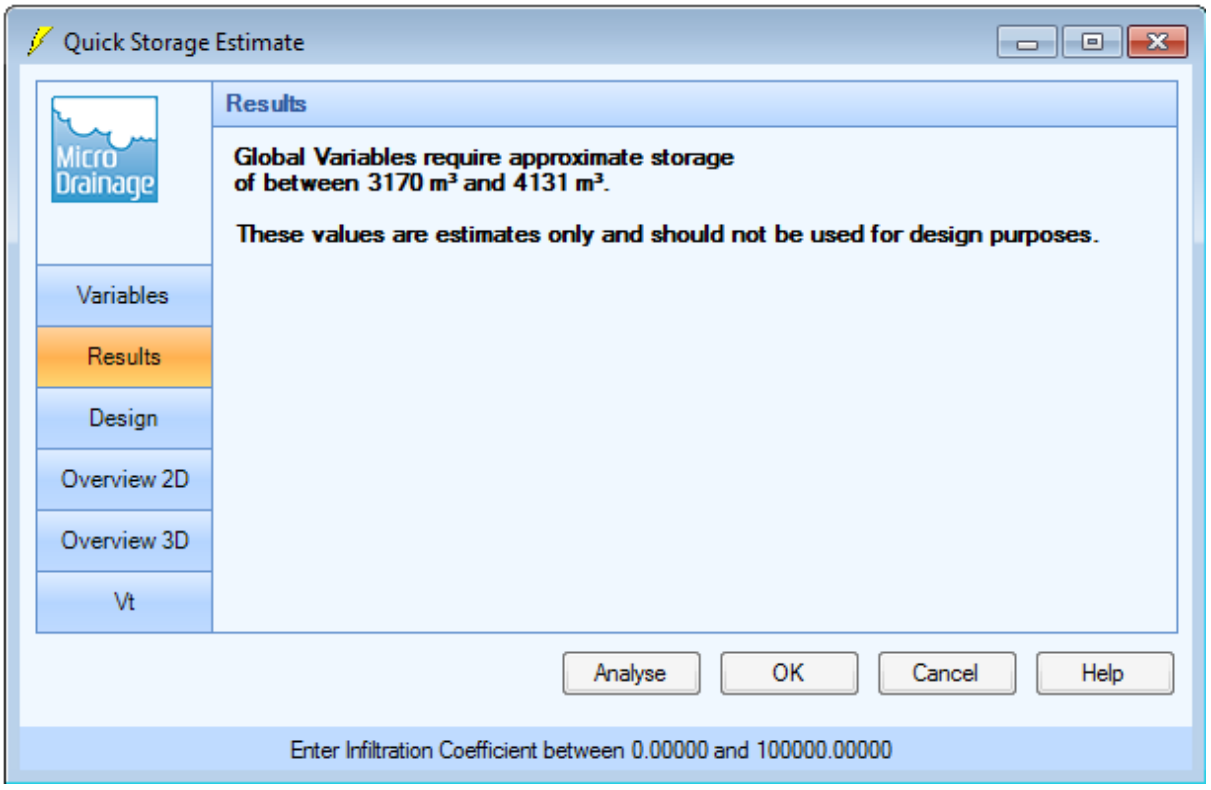




(2544+3316)/2 = 2390m³ Storage required

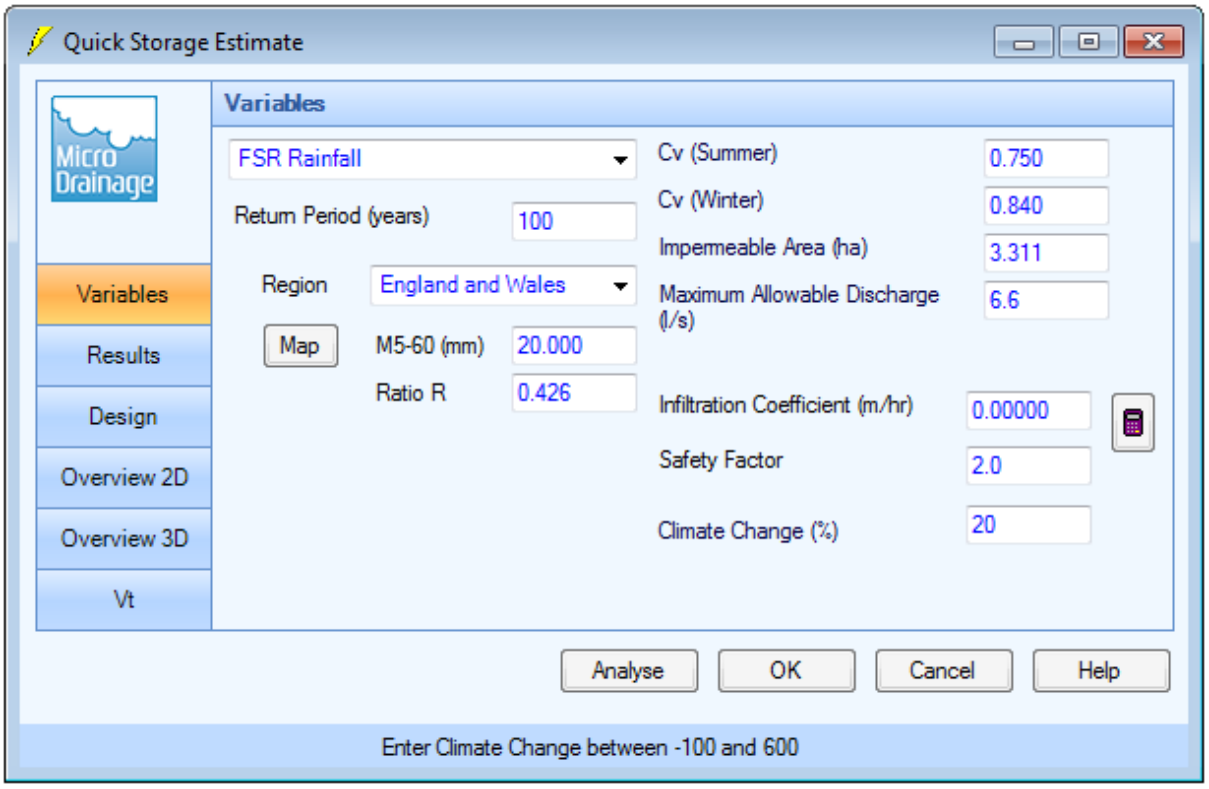
Plot 5,6,7,8 (FSR)

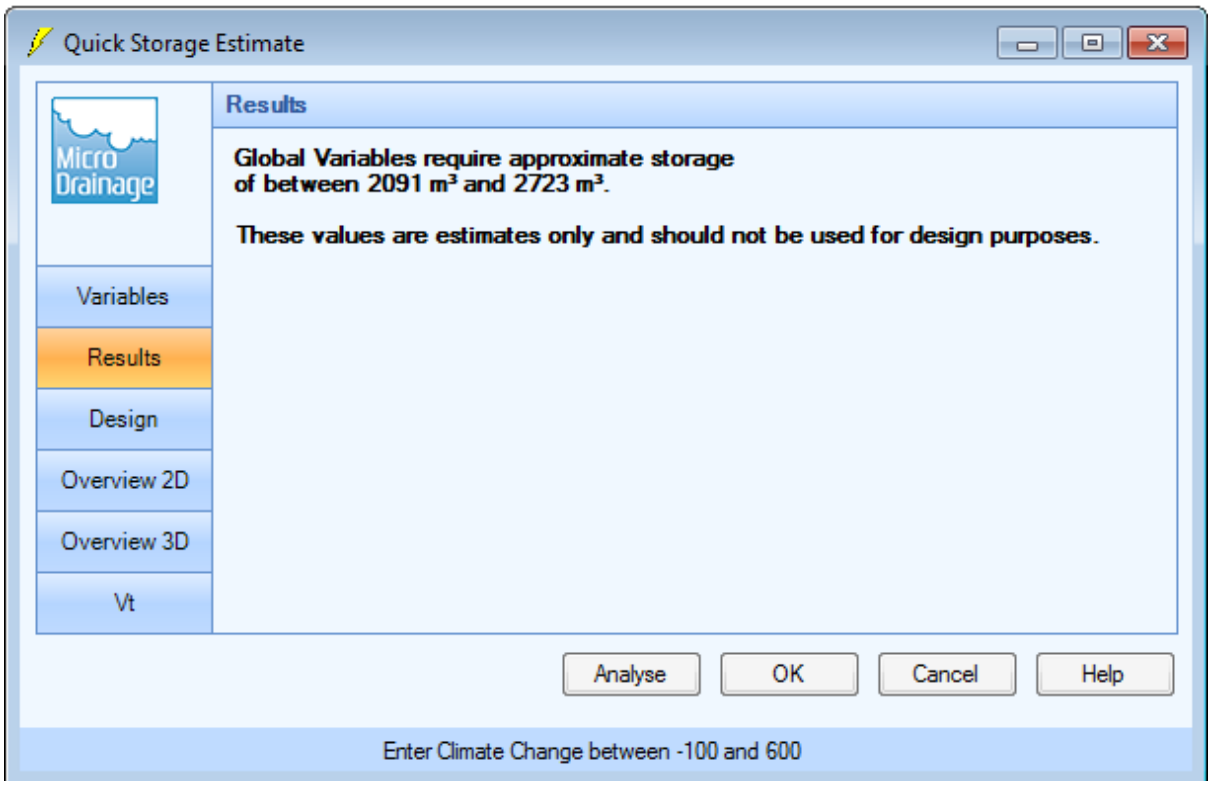




(3170+4131)/2 = 3651m³ Storage required

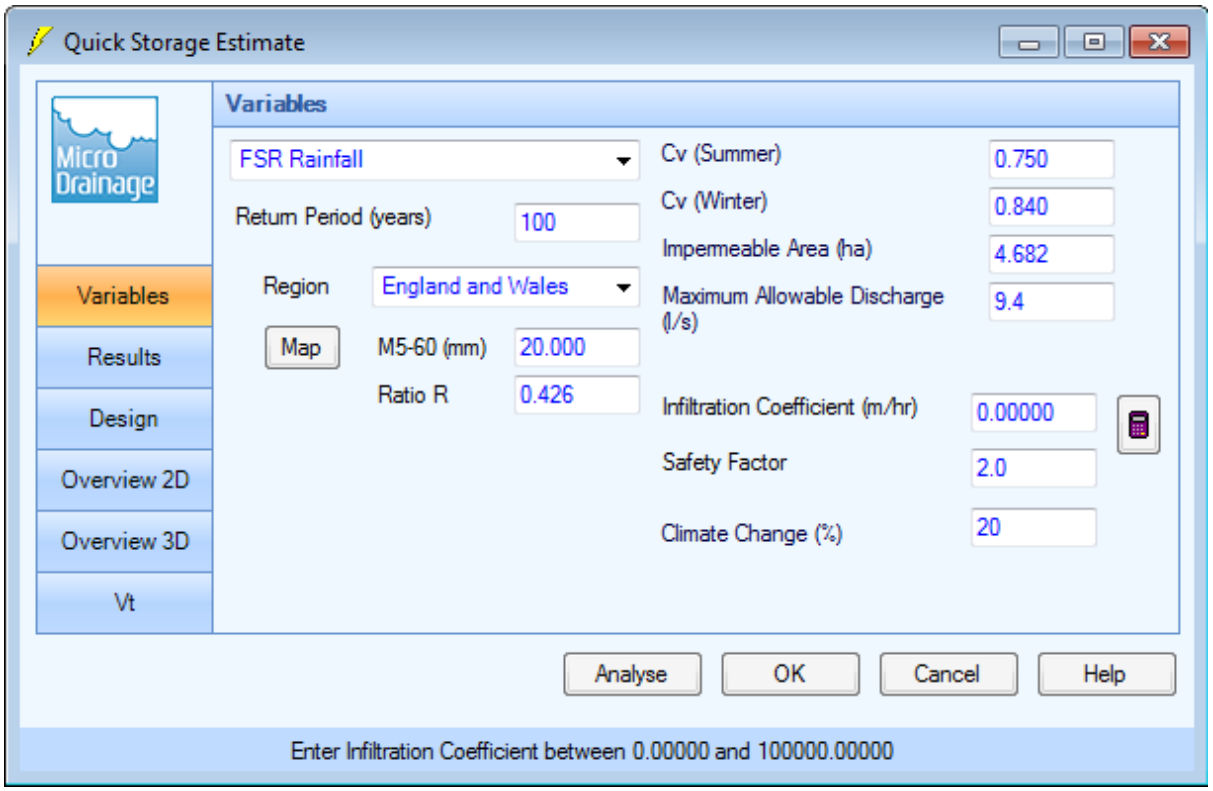
Plot 9 (FSR)

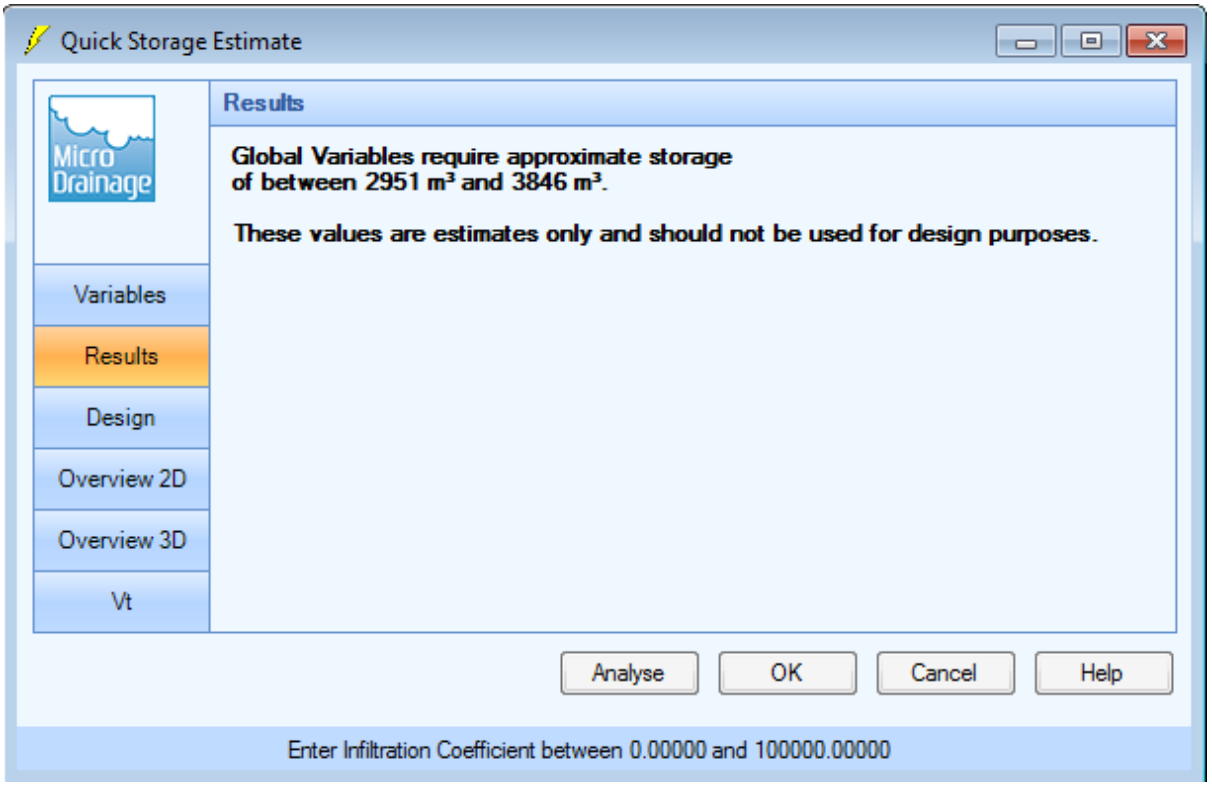




(2091+2723)/2 = 2407m³ Storage required

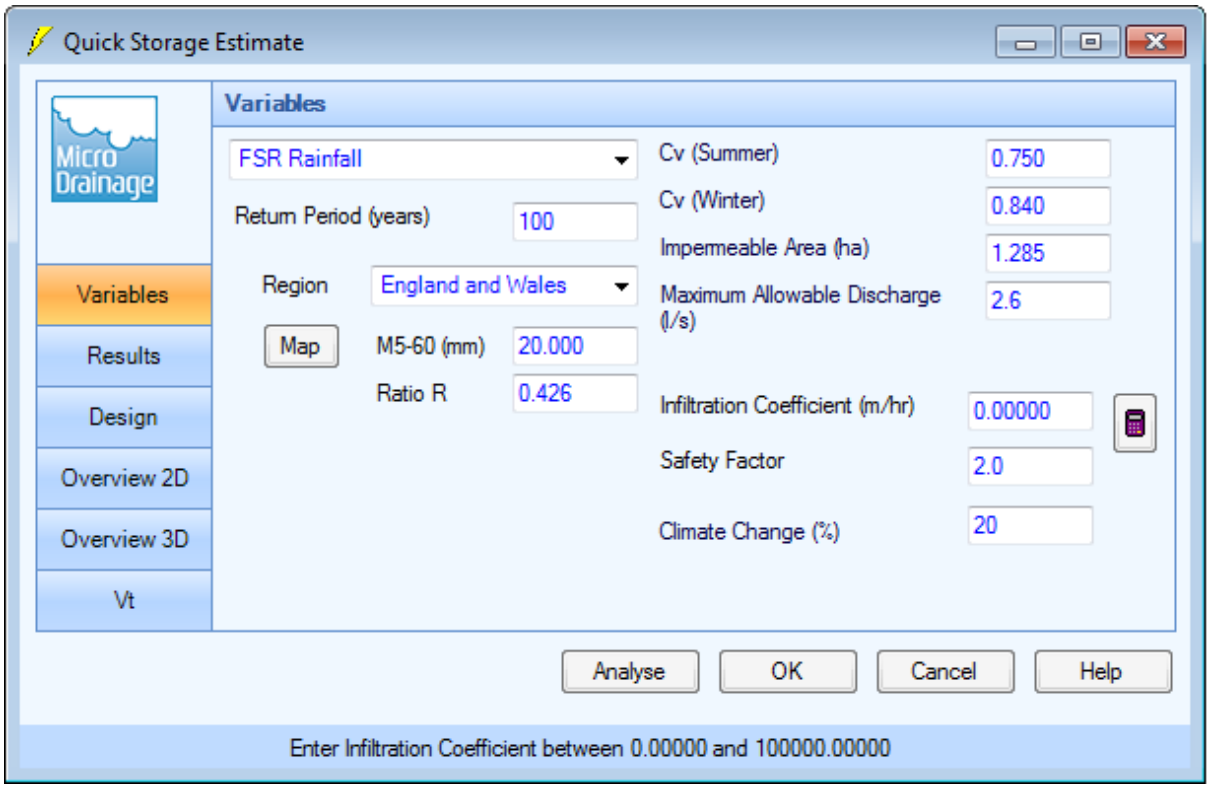
Plot 10 (FSR)

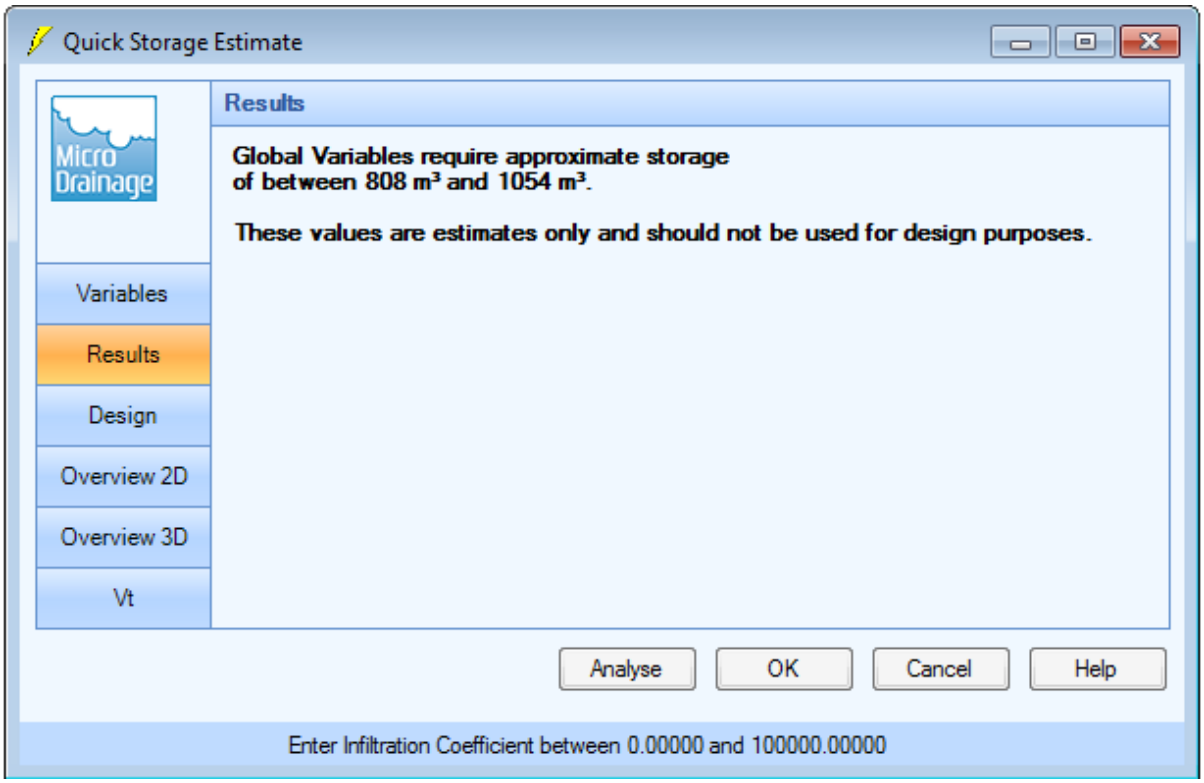




(2951+3846)/2 = 3399m³ Storage required

Road (FSR)





(808+1054)/2 = 931m³ Storage required

APPENDIX 7: Anglian Water Sewer Records

(c) Crown copyright and database rights 2017 Ordnance Survey 100019209

Data updated: 01/10/17

Scale: 1:1250 | Date: 06/11/17 | Wastewater Plan A0

Map Centre: 489239,234132 | Our Ref: 242145 - 2 | Powered by digdat

Foul Sewer		Outfall*	
Surface Sewer		Inlet*	
Combined Sewer		Manhole*	
Final Effluent		Sewage Treatment Works	
Rising/Vacuum Main*		Pumping Station	
Private Sewer*			
Decommissioned Sewer*			

*Colour denotes effluent type

Please note: Not all fittings are shown on the map

armani.akbar-roy@bwbconsulting.com

NTS2682 - Caldecotte

love every drop anglianwater

Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert
0501	489083	233566	F	76.69	75.45	1.24
0501	489032	234531	F	66.5	59.75	6.75
0601	489013	233610	F	74.81	73.33	1.48
1501	489170	233513	F	78.02	76.57	1.45
1501	489134	234568	F	-	-	-
1601	489195	234699	F	68.26	64.59	3.67
1701	489199	234726	F	-	-	-
2401	489252	233455	F	79.24	77.71	1.53
2601	489224	234642	F	69.09	65.365	3.725
2602	489286	234633	F	69.7	66.4	3.3
2603	489206	234677	F	68.26	64.87	3.39
2604	489237	234678	F	68.7	65.274	3.426
2605	489265	234632	F	69.5	66.094	3.406
2701	489214	234752	F	-	-	-
2702	489204	234723	F	-	-	-
3601	489352	234666	F	-	-	-
3701	489389	234711	F	69.642	68.129	1.513
4601	489476	234696	F	-	-	-
4701	489466	234714	F	-	-	-
4702	489427	234733	F	70.665	68.509	2.156
5601	489560	234695	F	-	-	-
6701	489654	234705	F	-	-	-
7701	488757	233790	F	66.8	65.4	1.4
7701	489743	234710	F	-	-	-
7702	488788	233768	F	67.3	65.91	1.39
8401	488872	234468	F	66.25	59.88	6.37
8701	488865	233712	F	69.28	67.23	2.05
9601	488942	233658	F	72.08	70.9	1.18
1751	489134	234703	S	67.8	65.517	2.283
1752	489178	234712	S	68.1	65.703	2.397
1753	489200	234733	S	68.4	65.893	2.507
1754	489152	234707	S	67.9	65.59	2.31
2751	489284	234746	S	69.259	66.253	3.006
3651	489399	234692	S	70.148	67.785	2.363
3751	489304	234763	S	69.609	66.385	3.224
3752	489397	234793	S	70.896	68.1	2.796
3753	489389	234708	S	70.105	67.4	2.705
3754	489349	234780	S	70.33	66.837	3.493
3755	489337	234795	S	70.236	66.722	3.514
4751	489444	234714	S	70.805	68.11	2.695

Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert

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