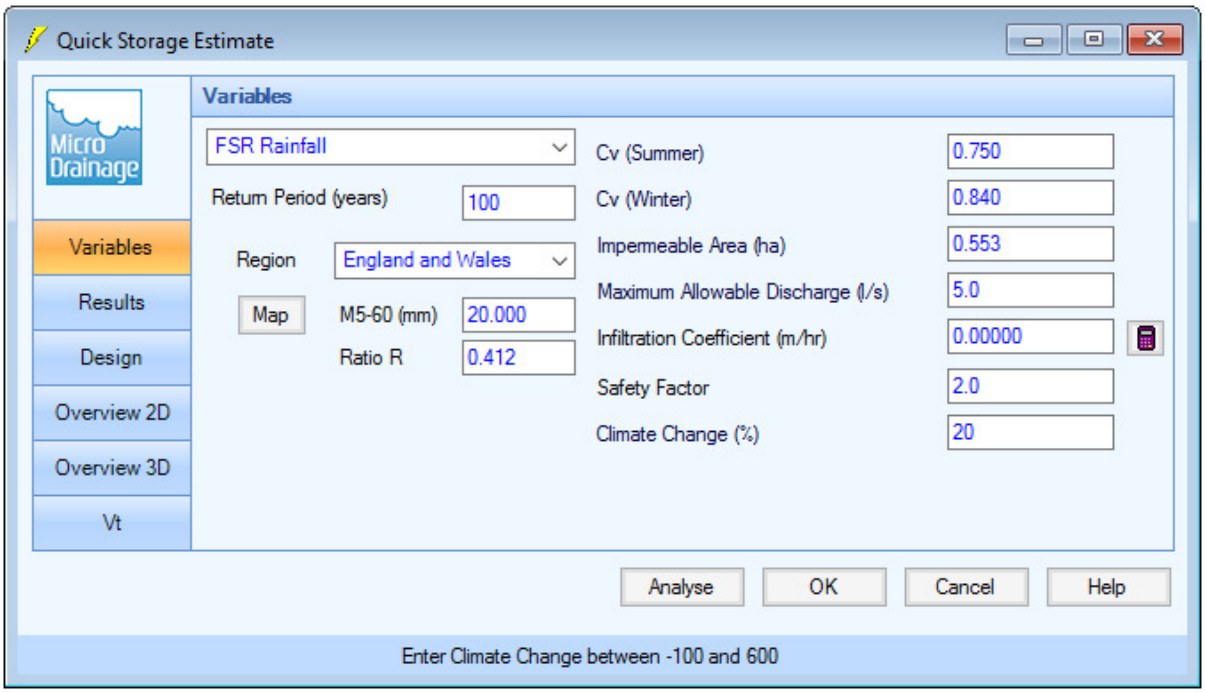
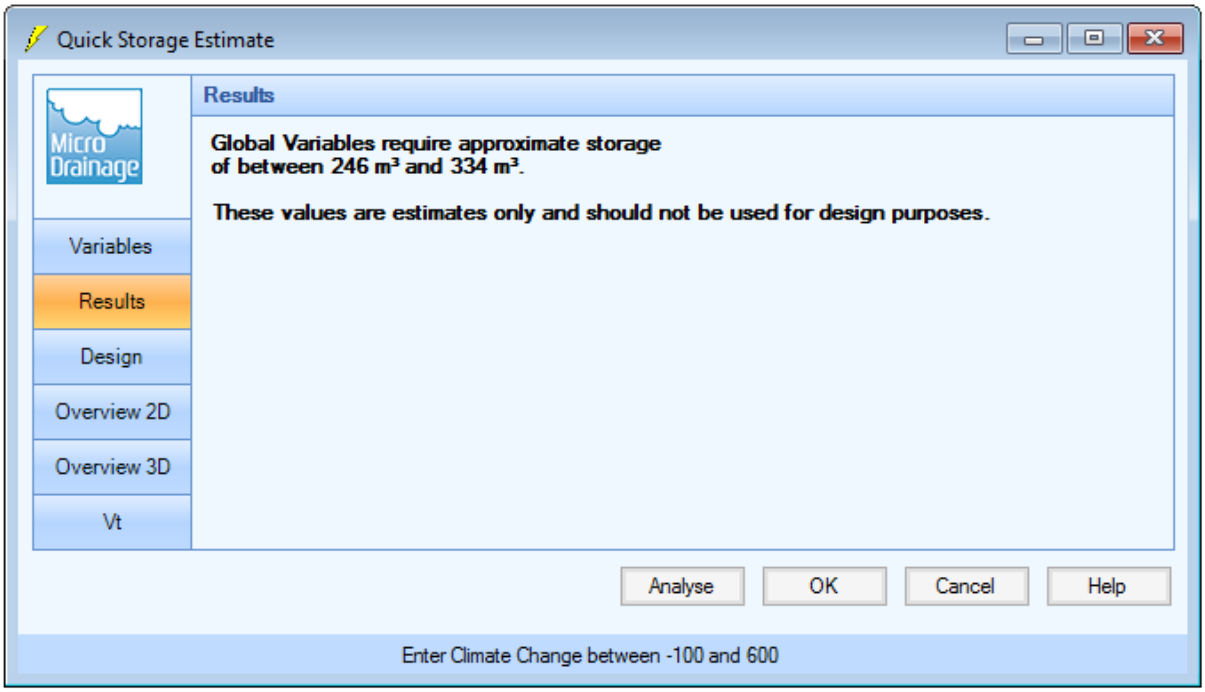
Appendix J

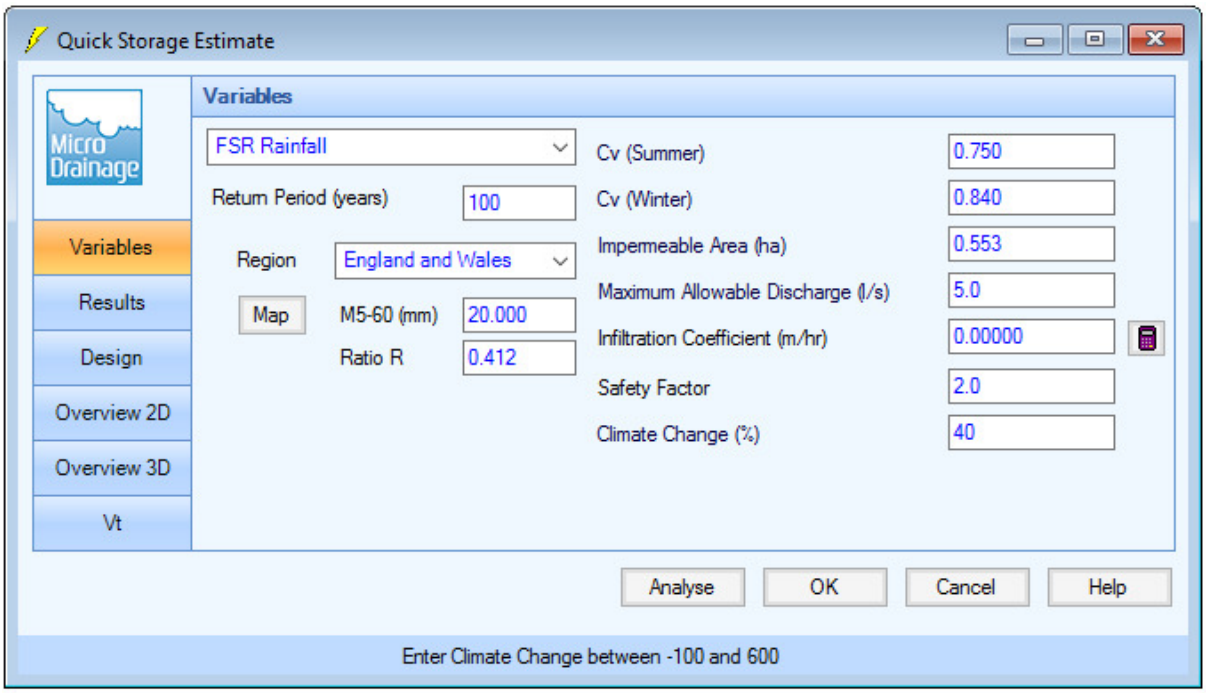
Attenuation Storage Calculations

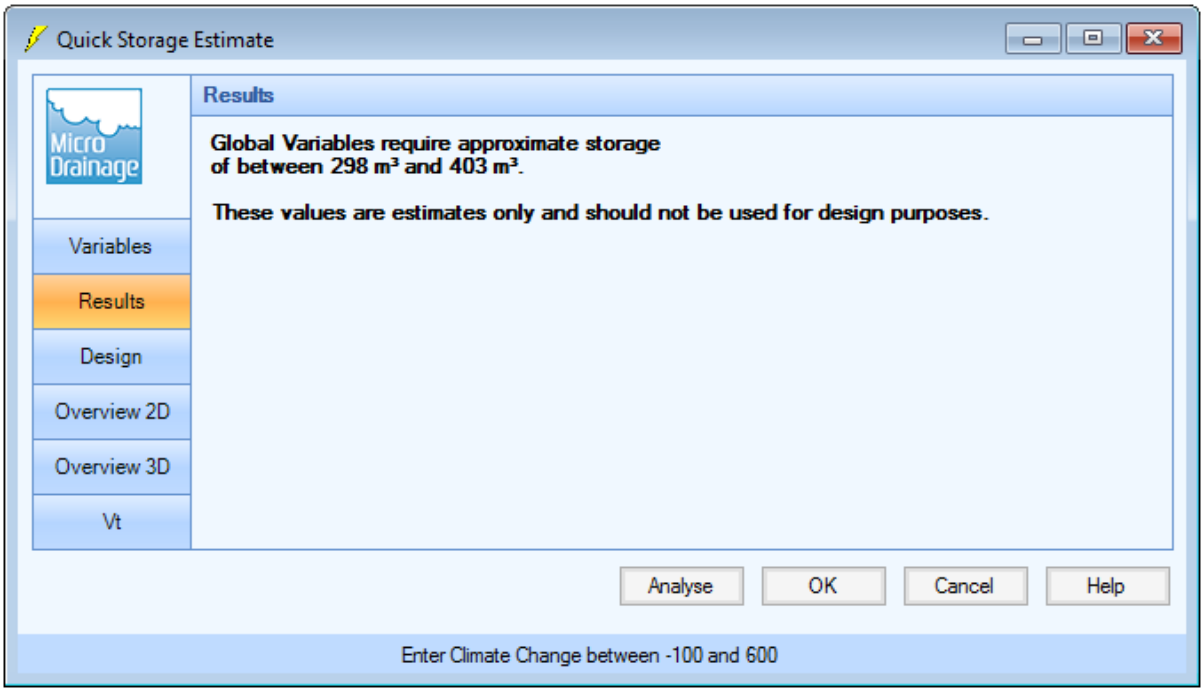
Attenuation volume storage incorporating 20% CC





Attenuation volume storage incorporating 40% CC





Appendix K

Outline Surface Water Drainage Strategy

PLAN

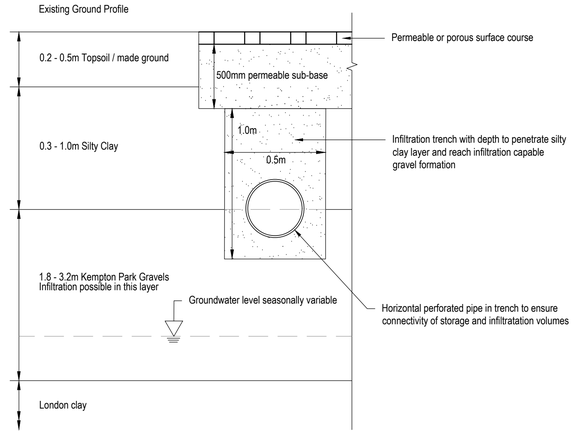
Scale 1 : 500

Key:

- Proposed porous paving with 500mm permeable sub-base.
- Non-porous surfacing (stone flags proposed) with 500mm permeable sub-base.

Total volume storage in permeable sub-base = 270m³

- Proposed Infiltration / Conveyance Trench. See cross-section for typical trench detail. Total volume storage in trench = 30m³
- Proposed geocellular attenuation crate. Total volume storage in crates = 120m³
- Proposed Horizontal Conveyance / Connectivity pipe
- Proposed surface water sewer
- Proposed foul water sewer



PERMEABLE PAVEMENT / INFILTRATION TRENCH CROSS SECTION

N.T.S.

Rev.	Description	Date	Chkd
P2	Planning Issue.	12.08.16 MM	LM
P1	Preliminary Issue.	11.08.16 MM	LM

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Client : Beechcroft Developments Ltd

Project : St Michaels Convent, Ham Common

Title : Outline Drainage Strategy

Project Engineer :	L. McGregor	Scale :	As shown
Project Director :	K. Rayner	Date :	August 2016
Status :	Preliminary		

Drawing No. 8151310/001 Rev P2

Appendix L

Richmond Borough Council SuDS Checklist

Treatment – Improving the quality of water by physical, chemical and/or biological means.
Watercourse – A term including all rivers, streams, ditches, drains, cuts, culverts, dykes, sluices, and passages through which water flows.

Water table (or groundwater table) – The point where the surface of groundwater can be detected. The water table may change with the seasons and the annual rainfall.

Appendix 1:

DESIGN ASSESSMENT CHECKLIST: SCHEME

Table 1: Scheme Design Assessment Checklist

Requirements			
Site ID	ST MICHAEL'S CONVENT, HAM		
Site Location and co-ordinates	TQ 17704 72228		
Site description		Drawing Reference(s)	
Date of assessment	10/08/16	Specification Reference	
Type of development	RESIDENTIAL	Site Area	1.69 ha

	SuDS Manual Page Ref*	Y	N	Summary of details	Comments / Remedial actions
PRINCIPLES					
Is the runoff managed at or close to its source, wherever possible? If not, give reasons.		✓		POROUS PAVING USED EXTENSIVELY	
Is the runoff managed at or close to the surface, wherever possible? If not, give reasons e.g. infiltration systems are being used to manage the runoff.			✓	INFILTRATION SYSTEMS IN USE	
Where the drainage system serves more than one property, is public space used and integrated with the drainage system in an appropriate and beneficial way ? If not, give reasons.		✓		PUBLIC HARDSTANDING IS PART OF POROUS PAVING STRATEGY	
Have the opportunities afforded by the drainage system in terms of green infrastructure, biodiversity, urban design, climate adaptation and amenity provision been maximised?		✓		NO ALTERATION TO HISTORIC LAWNS, ORCHARD + GARDENS. FAVOURABLE SUDS INFILTRATION INTRODUCED.	
Has an appropriate SuDS Management train been provided?		✓		POROUS PAVING TO FILTER LOW CONTAMINATION RUN-OFF	
Are the operating and maintenance requirements of the drainage system adequately defined?			✓	TO BE CONFIRMED AT DETAILED DESIGN. TO BE MAINTAINED BY PRIVATE MANAGEMENT COMPANY	
Is operation and maintenance achievable at an acceptable cost?		✓			
POINT OF DISCHARGE					
Does the design meet the following discharge hierarchy 1. Infiltration is preferred where it is safe and acceptable to do so; 2. If infiltration is not possible discharge to water course; 3. Discharge to sewer as last resort.		✓		SOME INFILTRATION SUPPORTED BY CONTROLLED DISCHARGE	
If infiltration is used: Confirm that an acceptable infiltration assessment has been undertaken and submitted?			✓	TO BE COMPLETED AT DETAILED DESIGN. CONSERVATIVE ASSUMPTION MADE.	

	SuDS Manual Page Ref*	Y	N	Summary of details	Comments / Remedial actions
If discharge is to sewer, rather than a surface water body, provide justification.		✓		NO SURFACE WATER BODIES ~~WERE~~ AVAILABLE	
If discharge to a sewerage asset is proposed, has evidence been provided that the design criteria have been agreed with the sewerage undertaker and that an appropriate connection detail has been agreed?			✓	TO BE UNDERTAKEN AT DETAILED DESIGN. BETTERMENT TO BE OFFERED TO SEWERAGE PROVIDER.	
Have adequate and appropriate exceedance routes been provided and are they protected from future development?		✓		EXTENSIVE PROTECTED GARDENS AND GREEN AREAS.	
INTERCEPTION					
Does the scheme design demonstrate on-site retention of approximately the first 5mm of runoff from impermeable surfaces for most events? How is Interception to be delivered (e.g. infiltration, green roofs, permeable pavements, vegetated surfaces, bespoke design - provide details)?		✓		POROUS PAVEMENT AND INFILTRATION TRENCHES.	
PEAK FLOW RATE CONTROL					
Does the design demonstrate control of the 1 year, critical duration site event to the equivalent 1 year greenfield peak flow rate or below?		✓		INFILTRATION OF SMALLER STORM EVENTS.	
Does the design demonstrate control of the 100 year, critical duration site event to the equivalent 100 year greenfield peak flow rate or below?		✓		RESTRICTED DISCHARGE TO 5 l/s	
Do the design calculations take account of future development (urban creep) and climate change?		✓		40% CC INCLUDED	
VOLUMETRIC CONTROL (FOR THE 100 YEAR, 6 HOUR EVENT)					
Does the design demonstrate that, for the 100 year 6 hour event: *Either:* The discharged site runoff volume is not greater than the equivalent greenfield runoff volume? *Or:* The discharged site runoff volume over and above the equivalent greenfield runoff volume (i.e. the Long Term Storage Volume) is discharged at a rate < 2 l/s/ha (or another rate that is considered acceptable in not negatively impacting flood risk of the receiving water body) *Or*: Peak flow rates from the site are restricted to 2 l/s/ha or Qbar, whichever is the greater ha (or another rate that is considered acceptable in not negatively impacting flood risk of the receiving water body).		✓		PEAK FLOW RATES ARE RESTRICTED TO 5 l/s, MINIMUM PRACTICAL CONTROL RATE. ADDITIONALLY INFILTRATION PROVIDES ADDITIONAL VOLUME AND FLOW CONTROL IN EXCESS OF ATTENUATION PROVIDED. OUTLINE DESIGN IS CONSERVATIVE.	
WATER QUALITY TREATMENT					
Is the receiving water body (surface or groundwater) environmentally sensitive (E.g. Groundwater Source Protection Zone? What is its designation? Are any implications for drainage design clearly defined?		✓		NO SPZ. MINOR AQUIFER OF HIGH VULNERABILITY PRESENT.	

	SuDS Manual Page Ref*	Y	N	Summary of details	Comments / Remedial actions
Does the design include an appropriate treatment strategy that ensures: 1. Sediment is trapped and retained on site in accessible and maintainable areas? 2. Has a sufficient number of drainage components been provided in series prior to discharge? 3. Suitable pollution removal capability e.g. % TSS removal (where this is a requirement of the SAB)		✓		SEDIMENT LEFT ON SURFACE OF POROUS PAVING (TO BE SWEPT) OR IN CATCHPITS. FILTRATION OFFERS SUITABLE TREATMENT CAPACITY.	
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?		✓		WELL USED STANDARD PRODUCTS PROPOSED	
Are all parts of the SuDS system outside any areas of flood risk? If not, provide justification and evidence that performance will not be adversely affected.		✓		NO FLOOD RISK AREAS ON SITE	
Is pumping a requirement for operation of the system? If yes, provide justification and set out operation and maintenance/adoption arrangements.			✓	GRAVITY SYSTEM.	
Has runoff and flooding from all sources (both on and off site) been considered and taken into account in the design?		✓		NO SIGNIFICANT OFFSITE FLOWS EXPECTED	
Are 1 in 30 year flows fully conveyed within the SuD system ?		✓			
Are 1 in 100 year flows contained or stored on-site within safe exceedance storage areas and flow paths? Note some approving authorities may require greater return periods.		✓		STORED BELOW GROUND	
CONSTRUCTABILITY					
Has an acceptable construction method statement been submitted and approved?			✓	TO BE COMPLETED AT DETAILED DESIGN	
MAINTAINABILITY					
Has an acceptable Maintenance Plan been submitted and approved?			✓	TO BE COMPLETED AT DETAILED DESIGN	
INFORMATION PROVISION					
Do the design proposals include sufficient provision for community engagement and awareness raising?		✓			

(*) to be added on completion of SuDS Manual update

SYSTEM DESIGN ACCEPTABILITY	Summary details including any changes required	Acceptable (Y/N)	Date changes made
Acceptable: Minor changes required: Major changes required / re-design:	ADDITIONAL INFORMATION TO BE PROVIDED AT DETAILED DESIGN.		

ACCEPTABLE AT OUTLINE DESIGN.

TO BE CONDITIONED IF NECESSARY.

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- Building Surveying
- CDM Consultants