TECHNICAL NOTE

WATER | ENVIRONMENT

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PROJECT	Rosary House Aerodrome Road, Bekesbourne	**CLIENT**	Woodchurch Property Developments	
TITLE	Outline SuDS Strategy	**REFERENCE**	21078-DNG-TN-01	C01

AUTHOR	**CHECKER**	**APPROVER**
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REV	**COMMENTS**	**DATE**	**AUTH**	**CHKR**	**APPR**
P01	First issue for comment	21/10/2021	FR	GE	TC
C01	Final	08/11/2021	FR	GE	TC

1 Introduction

1.1 This technical note provides an outline surface water drainage (SuDS) strategy for the proposed development to the eastern side of Aerodrome Road in Bekesbourne, Canterbury (Kent), CT4 5EX. Proposals include the erection of seven residential units and the demolition of a garage over an area of 0.53ha.

1.2 Canterbury City Council (CCC) fulfils the role of Local Planning Authority (LPA).

1.3 Although the proposed development does not constitute 'major development', Canterbury requires all development (except 'small-scale development') to complete their Surface Water Drainage Pro-forma, demonstrating that SuDS have been incorporated into the proposals.

2 Development description

2.1 The application site is located on the eastern side of Aerodrome Road, Bekesbourne (Canterbury) in Kent. Easting and northing coordinates are, respectively, 620115 and 155540. The site is bounded by the railway line (in a trench) to the north and by residential properties to the east, south and west.

2.2 The site comprises 0.31ha of reptile habitat and 0.22ha of existing house and gardens.

2.3 The proposal is a total of seven new dwellings (plots), consisting of a pair of bungalows with a barn hip roof (plots 6 and 7) to the front of the existing dwelling, Rosary House, and; three detached and a pair of semi-detached dwellings arranged in a cul-de-sac (plots 1, 2, 3, 4 and 5) behind Breckenridge, Lysander, The Haven, Sycamore Cottage and Rosary House (to the north of the site). Proposals also include the demolition of Rosary House garage. The total site is 0.53ha.

2.4 A topographical survey has been undertaken by Cad Surveys Ltd in June 2021 (included in Appendix). Ground levels gradually range from 46m Above Ordnance Datum (AOD) at the entrance of the site in

Aerodrome Road (to the south) to 43.8m AOD in the northern corner, adjacent to the sloping banks of the railway trench.

2.5 Finished floor levels of the proposed development have not been provided. Access road and cul-de-sac levels have been derived from the topographic survey levels and adjusted to fit SuDS elements, as specified in the following sections.

2.6 Figure 1 shows the site location and a model of the ground levels interpolated from the topographical survey. Drawings of the proposals are included in the Appendix.

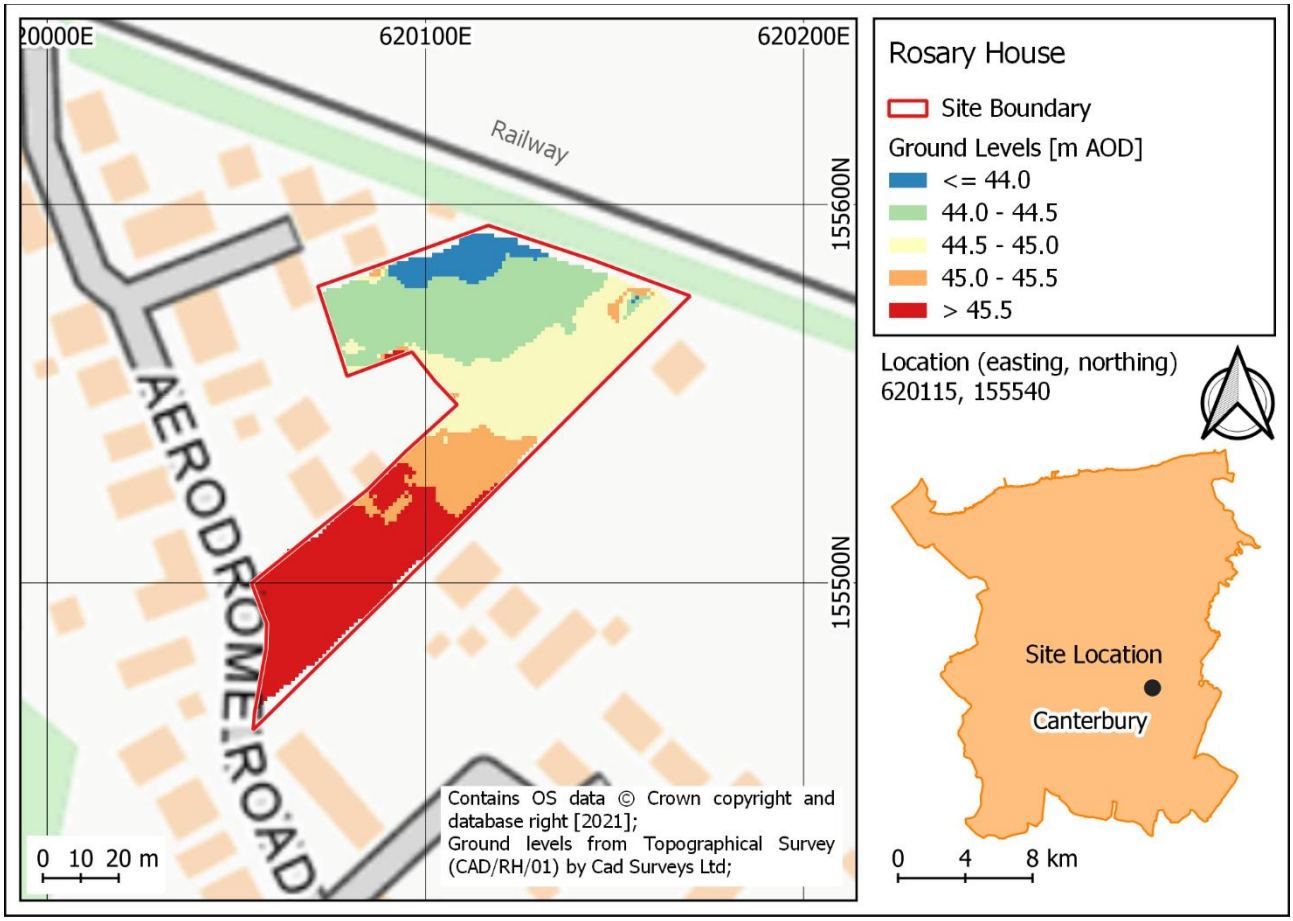


Figure 1 - Site location and ground levels

3 Surface Water Management

3.1 Policy (CC11) of the Local Plan[1] states that all applications for development should include a sustainable drainage system (SuDS).

3.2 As shown in Figure 1 above, the site slopes approximately 2m in a northerly direction (towards the proposed cul-de-sac). Therefore, any proposed impervious surface (roofs, driveways, car parks…) if not properly drained might result in surface water flooding to the proposed plots 1, 2, 3, 4 and 5.

3.3 This section will present the considerations around which the outline SuDS strategy has been prepared.

[1] Canterbury City Council, Canterbury District Local Plan, Adopted July 2017.

Ground Conditions

3.4 Ground conditions are important when considering whether infiltration measures for sustainable drainage are feasible for discharging surface water runoff post development.

3.5 The online 1:50k British Geology Society (BGS) map (Figure 2) indicates that the site is underlain by bedrock of Margate Chalk Formation outcrops in the area with no superficial deposits. According to the Department for Environment, Food and Rural Affairs (DEFRA) Magic Map[2] the site is not in a Source Protection Zone (SPZ); however the Margate Chalk Formation is classified as a principal aquifer, defined as layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage.

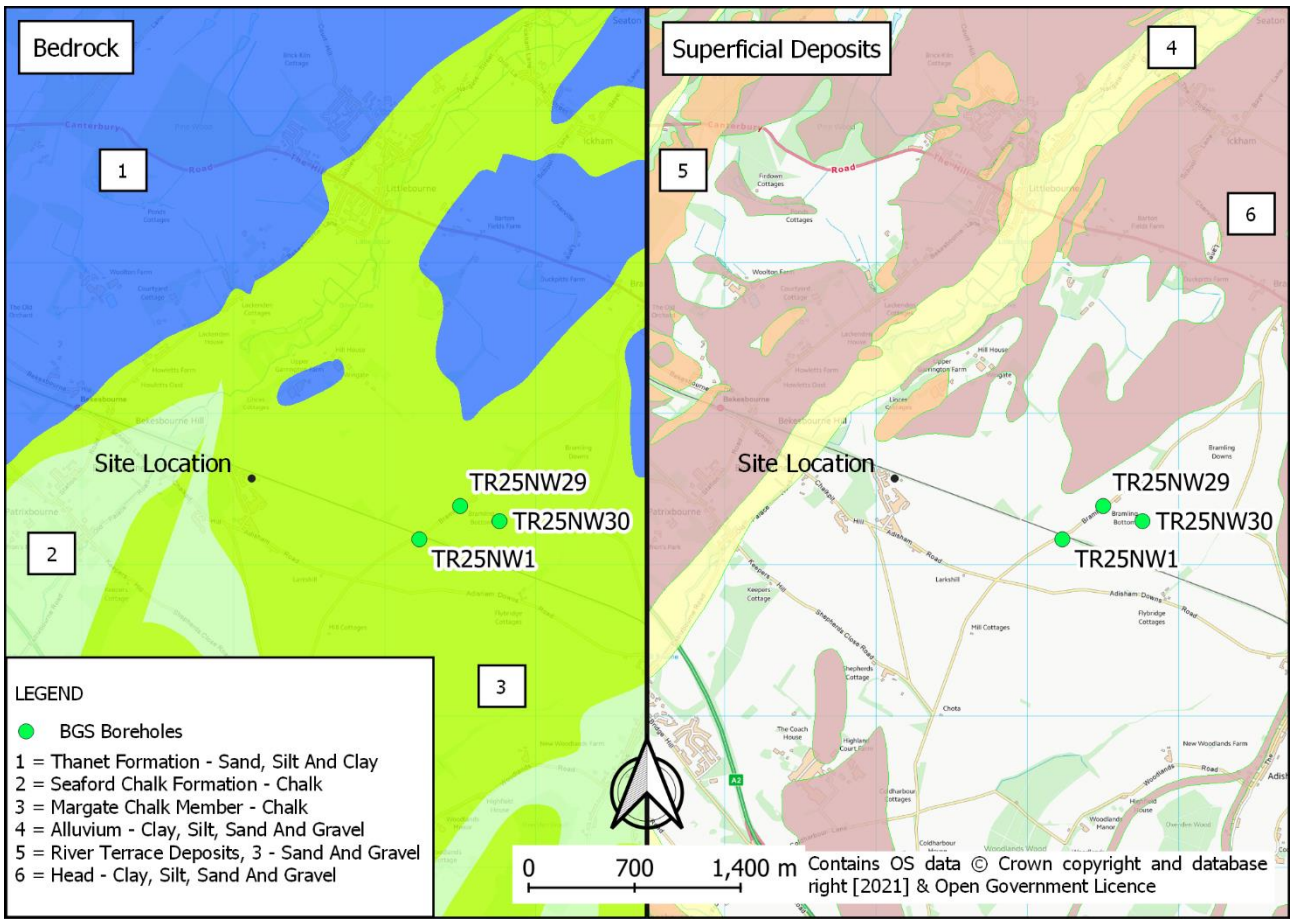


Figure 2 - 1:50k BGS bedrock and superficial deposits map

3.6 Three borehole logs in the vicinity of the site are available from the BGS website located in similar geological conditions. Boreholes TR25NW29 and TR25NW30 are wells and water levels have been recorded between 1900 and 1958. In both wells, water level is more than 17m below ground level (BGL), at around 14m AOD. Borehole TR25NW1 is 5.18m deep with no record of groundwater. The geology consists of a 1.08m layer of firm silty clay, chalk, flint and gravel over a 3.58m layer of firm white broken chalk, and brown clayey silt.

3.7 Chalk overall effective porosity is low, meaning that water can flow and infiltrate over a very small volume of rock, resulting in low infiltration rates. However, chalk can be fractured, and the transmissive capacity can be high, allowing for water to infiltrate at greater rates. In confirmation of this, in North Kent which is dominated by the White Chalk Subgroup – Chalk[3], is not uncommon to have single house developments

[2] Available at: https://magic.defra.gov.uk/MagicMap.aspx [Accessed on 15/10/2021]
[3] 1:625K bedrock geology description, available at: http://mapapps.bgs.ac.uk/geologyofbritain/home.html [Accessed 18/10/2021].

or highway schemes discharging to the ground[4]. In addition, Figure 2.4 of the Canterbury City Council Strategic Flood Risk Assessment[5] show that the soil characteristics at the site location are those of a 'Freely draining lime-rich loamy soils', indicating a soil that allows infiltration to groundwater.

3.8 The ground conditions suggest that it is possible to implement infiltration SuDS in the development, however groundwater monitoring and infiltration testing will be required to provide infiltration rates. At a strategic level, published infiltration rates[6] can be used when modelling the SuDS.

Existing Drainage

3.9 Southern Water (SW) sewer assets (see Appendix) show that the site at Rosary House is served by a 150mm foul water sewer that runs northerly along Aerodrome Road.

3.10 In the area surrounding Aerodrome Road there are no surface water nor combined sewers: this suggests that surface water from the residential properties is discharged to ground by infiltration, for example through the use of soakaways.

3.11 There are no main rivers or ordinary watercourses (including drainage ditches) in proximity of the site. This has been established via use of Ordnance Survey (OS) maps and published Environment Agency (EA) data.

Climate Change

3.12 The current best practice for climate change allowances is the National Planning Policy Framework (NPPF)[7], which defers to the PPG[8] to specify climate change allowances. The EA recommends an increase in river flows and rainfall intensity depending on which river basin district the site lies in and the type of development.

3.13 The range of allowances is based on percentiles. A percentile is a measure used in statistics to describe the proportion of possible scenarios that fall below an allowance level. The 50th percentile is the point at which half of the possible scenarios for peak flows fall below it and half fall above it. The central allowance is based on the 50th percentile, the higher central is based on the 70th percentile and the upper end is based on the 90th percentile.

3.14 In this context, the EA anticipated changes in extreme rainfall intensity in small and urban catchments, which are shown in Table 1:

Table 1 - Peak Rainfall intensity in small and urban catchments

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper End	10%	20%	40%
Central	5%	10%	20%

[4] Kent County Council, July 2000, The Soakaway Design Guide.
[5] Herrington Consulting Ltd – Canterbury City Council Engineering Services, Strategic Flood Risk Assessment, February 2019.
[6] CIRIA SuDS Manual 2015, Chapter 25 Infiltration: design methods, Table 25.1.
[7] Ministry of Housing, Communities and Local Government (July 2021), updated National Planning Policy Framework.
[8] Available at: https://www.gov.uk/guidance/flood-risk-and-coastal-change [Accessed on 12/10/2021].

3.15 The planned lifetime for the proposed development is assumed to be 100 years, in accordance with the PPG for Flood Risk and Coastal Change.

3.16 The proposed development is classified as 'More vulnerable' and therefore it is recommended that the 'Upper End' allowance should be used to assess the future impacts of climate change on peak rainfall intensity. A 40% increase in peak rainfall intensities has been adopted as the allowance for climate change in the design calculations, which is considered to be a precautionary approach.

Sustainable Drainage Principles

3.17 The aim of SuDS is to emulate natural drainage processes such that watercourses and storage areas receive the hydrological profiles under which they evolved, and that water quality in local ecosystems is protected or improved. The best practice guide[9] states that SuDS will:

- Reduce the impact of additional urbanisation on the frequency and size of floods;
- Protect or enhance river and groundwater quality;
- Be sympathetic to the needs of the local environment and community; and
- Encourage natural groundwater recharge.

3.18 Table 2 shows the hierarchy of SuDS techniques. The SuDS techniques that are proposed to manage surface water for the development will be discussed in relation to this hierarchy.

3.19 Living roofs are not feasible for the development due to the pitched roof construction. It may be possible to include bioretention or rain gardens in the garden areas on the site. However, this would be considered as part of a landscaping strategy at the detailed design stage.

3.20 Since the development includes garden areas, rainwater harvesting systems could be employed to collect roof-water both for irrigation and / or non-potable water supply. Although it is strongly recommended that source control systems are utilised in the final site design, in a conservative approach to runoff calculation, neither bioretention nor rainwater harvesting systems are considered within the calculations.

3.21 Lined basins, ponds, filter strips and swales are not suitable for use within the development due to a lack of communal available space.

3.22 Shallow infiltration devices, as well as soakaways, can be used at the proposed development in light of the considerations in Sections on "Ground Conditions" and "Existing Drainage" of this report. In the absence of a ground investigation, published infiltration rates can be used.

3.23 There is sufficient paved area on the site that it should be possible to store rainfall runoff, as well as filter rainwater to improve quality, within the porous sub-base and the permeable paving.

3.24 In addition, below ground storage systems will be considered to accompany any proposed sub-base and infiltration systems.

[9] CIRIA (2001), CIRIA C523: Sustainable Drainage Systems – Best practice.

Table 2 – SuDS Hierarchy

Most Sustainable	SUDS Technique	Flood Reduction	Pollution Reduction	Landscape & Wildlife
	Green roofs	✓	✓	✓
	Basins and ponds 1. Constructed wetlands 2. Balancing ponds 3. Detention basins 4. Retention ponds	✓	✓	✓
	Filter strips and swales	✓	✓	✓
	Infiltration devices 5. Soakaways 6. Infiltration trenches and basins	✓	✓	✓
	Permeable surfaces and filter drains 7. Gravelled areas 8. Solid paving blocks 9. Porous paviors	✓	✓	
Least Sustainable	**Tanked systems** 10. Over-sized pipes/tanks 11. Box storage systems	✓		

Proposed SuDS Strategy

3.25 In accordance with the discharge hierarchy, as required in Part H of the Building Regulations[10], and based on the assumed ground conditions discussed previously, the SuDS strategy has been designed to discharge all rainwater from the roofs and paved areas to infiltration systems.

3.26 For the strategic assessment, the following principles have been assumed:

- The proposed site layout is that shown on the drawing 20-0925-10 Rev C by OGS Architecture Ltd (refer to Appendix).
- The site existing levels are assumed to be those presented in the topographic survey completed by Cad Surveys Ltd in June 2021 (refer to Appendix).
- The infiltration rate[6] for the site is assumed to be $1x10^{-5}$m/s: this value corresponds the soil type 'loamy sand' and 'sandy loam', in accordance with the soil type at the site location shown in Figure 2.4 of the Canterbury City Council Strategic Flood Risk Assessment[5].
- The permeable and landscaped areas are not formally drained.

3.27 Based on these design principles and constraints, a SuDS strategy has been completed in line with the SuDS hierarchy. The following measures are included:

- Porous asphalt or permeable block paving, with an associated non-lined 450mm porous sub-base (30% void ratio), is suggested for use on the shared access road, footpath and parking areas on the site. The area for the suggested permeable paving is approximately 1,016m^2. The infiltration rate is assumed to be 1 x 10^{-5}m/s (0.036m/h), according to published values.

[10] The Building Regulations 2010 (SI 2010/2214)

- All surface water drainage from the proposed roof areas (except Plot 3), footpath, the shared access road and parking areas will be collected into the porous sub-base underneath the permeable paving or porous asphalt.
- The roof of Plot 3 will separately drain into an underground geocellular attenuation storage unit. For the purpose of this strategy, and to demonstrate feasibility, ACO Strombrixx[11] systems will be used, and surface water will be conveyed to 14 no. 0.914m x 1.2m x 1.2m (H x D x W) geocellular storage units, with a 95% void ratio. Infiltration is allowed through base and sides of the underground storage.

3.28 The proposed SuDS strategy can be seen within drawing 21078-DNG-DP-01-P01 included in the Appendix and in Figure 3 below.

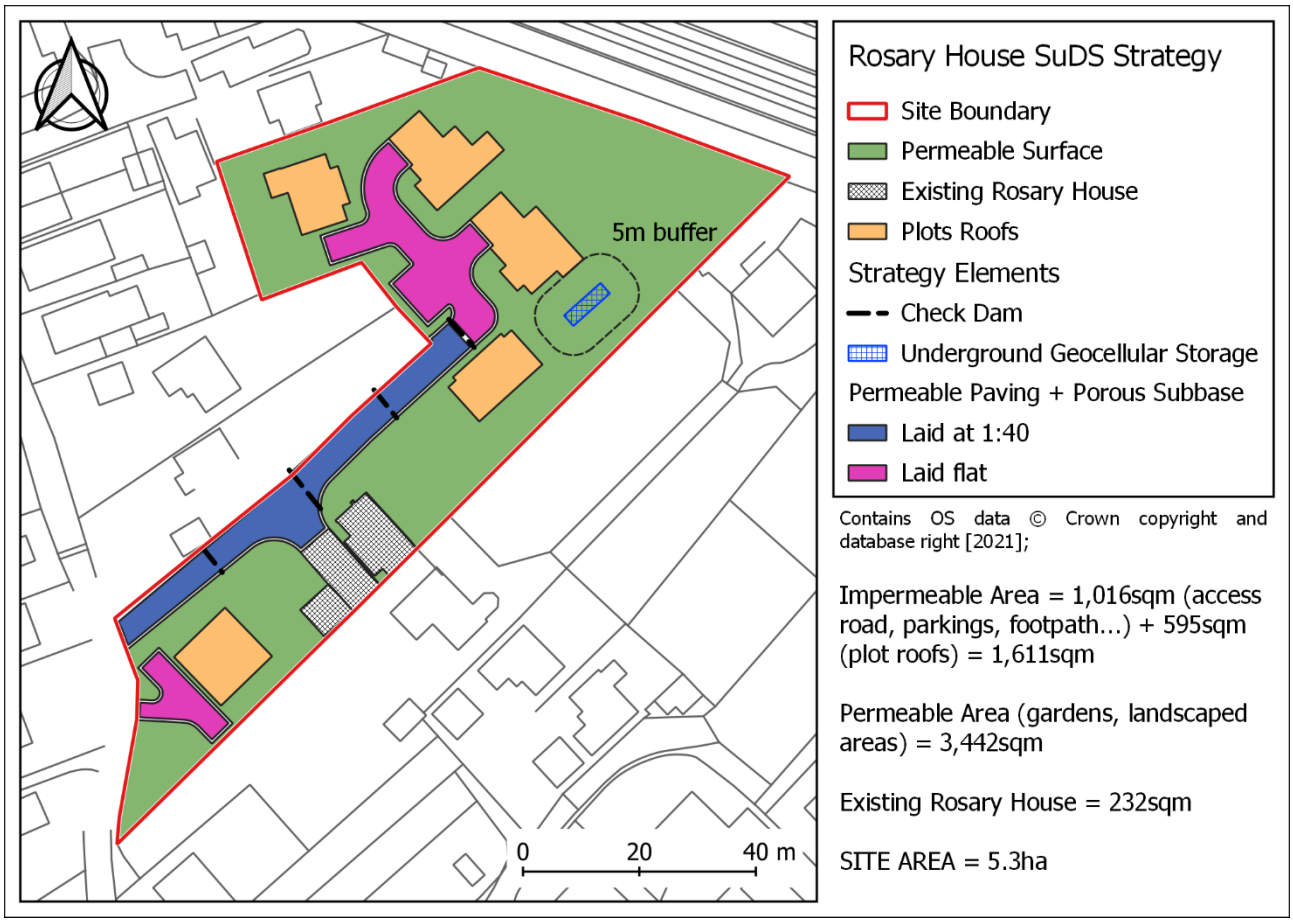


Figure 3 -Proposed SuDS Strategy

3.29 The site prior to development slopes approximately at 1:60 in a northerly direction, from the ingress of Aerodrome Road (46m AOD) to the north corner of the site (43.8m AOD). In order to maximise the volume stored in the porous sub-base, the levels at the cul-de-sac post development are set to be flat. The access road for the cul-de-sac (plots 1, 2, 3, 4 and 5) is set to be at 1:40.

3.30 The porous sub-base underneath the 1:40 access road will be split with check dams into four 20m long segments, so that the volume stored in the sloping sections is maximised.

3.31 Invert levels of the various elements of the SuDS strategy are shown in drawing 21078-DNG-DP-01-P01 (see Appendix). The underground geocellular storage serving Plot 3 has been designed to ensure the appropriate level of cover and sufficient self-cleansing gradients for the incoming pipe.

[11] ACO StormBrixx - Stormwater attenuation and infiltration system, Specification and technical data www.stormbrixx.co.uk

3.32 The strategy was tested using MicroDrainage, with a number of conservative assumptions. FEH rainfall specific to the site was obtained from the FEH Web-Service and used to set the 100-year rainfall profiles, including a 40% allowance for climate change and a factor of safety of 2 was applied to the infiltration rate. A runoff coefficient of 1 was applied for both summer and winter rainfall (drained area 100% impermeable).

3.33 A range of storm durations from 15 minutes to one week were simulated.

3.34 A MicroDrainage source control model has been developed for each of the following:

- Plot 3: roof area draining to underground geocellular storage, with infiltration through base and sides;
- Plot 6 & 7: roof area and the adjacent car park area draining to the porous sub-base underneath the car park, with base infiltration;
- Plot 1 & 2, Plot 4, Plot 5: roof area and the cul-de-sac area draining to the porous sub-base underneath the cul-de-sac, with base infiltration;
- Road: rain falling on the road will be drained within the road's porous sub-base, with base infiltration; only the bottom segment of the 1:40 access road (south of the cul-de-sac) has been modelled, and results can be extended to the remaining three segments.

3.35 Modelling results show that flooding does not occur in any modelled storm duration (see Appendix).

3.36 The layout is preliminary and demonstrates feasibility only; it should be revisited at detailed design stage to ensure all elements of the proposed scheme fall within the required design guidelines, in accordance with final levels.

3.37 At detailed design stage the groundwater level and infiltration rates must be confirmed through ground investigation.

4 Summary

4.1 The application site is located on the eastern side of Aerodrome Road, Bekesbourne (Canterbury) in Kent. It lies in Flood Zone 1, in an area that is not susceptible to surface water flooding. Proposals are for the construction of seven new dwellings and the demolition of Rosary House garage.

4.2 The site area is 0.53ha.

4.3 A SuDS strategy is not required for the proposed development, however it has been included to deal with surface water runoff and to promote best practices and sustainability, as well as providing benefits on water quality.

4.4 In the area surrounding the site in Aerodrome Road there are no surface water or combined sewers, nor an ordinary watercourse. This suggests that the existing developments along Aerodrome Road discharge the surface water runoff to ground (e.g. through soakaways). This is common in North Kent, dominated by chalk bedrock formations.

4.5 A SuDS strategy has been developed in line with the SuDS hierarchy, allowing for water to infiltrate to ground. Published values have been used to determine the filtration rates.

4.6 The elements of the strategy include permeable paving (or porous asphalt) over a 450mm deep, 30% void ratio porous sub-base allowing for infiltration through the base; underground geocellular storage with 95% void ratio allowing for infiltration through the base and sides; and check dams maximising the volume stored in the 1:40 section of the porous sub-base.

4.7 The strategy has been tested using the hydraulic modelling software MicroDrainage. A 40% climate change allowance has been applied to the 100-year rainfall event, and storm durations ranging from 15 minutes to one week have been simulated.

4.8 The modelling results show that flooding on-site does not occur. The layout is preliminary and demonstrates feasibility only; it should be revisited at detailed design stage to ensure all elements of the proposed scheme fall within the required design guidelines and final levels.

4.9 At detailed design stage the groundwater level and infiltration rates must be confirmed through ground investigation.

Appendix

- Topographic Survey, Drawing no T13/01/A (Cd Surveys Ltd).
- Proposed Plan, Drawing no. 20-0925-10 Rev C (OGS Architecture Ltd).
- Southern Water Sewer Assets Plan.
- Sustainable Drainage Strategy, Drawing no. 21078-DNG-DP-01-C01 (Water Environment Ltd).
- MicroDrainage Modelling Results.

LEGEND

STREET FURNITURE	
BB	BELISHA BEACON
Bin	LITTER BIN
BO	BOLLARD
BS	BUS STOP
CPO	CONCRETE POST
EP	ELECTRIC POLE
FHM	FIRE HYDRANT MARKER
FL	FLOOD LIGHT
FP	FLAG POLE
JB	JUNCTION BOX
GB	GRIT BOX
GPO	GATE POST
IBO	ILLUMINATED BOLLARD
LP	LAMP POST
LW	LIGHTWELL
MPO	METAL POST
PB	POST BOX
PM	PARKING METER
RS	ROAD SIGN
SI	SIGN
SL	SUNKEN LIGHT
STN	SURVEY STATION
Tap	ATTACHED TO WALL ETC
TP	TELEGRAPH POLE
TPO	TIMBER POST

PIPES	
DP	DOWN PIPE
GP	GAS PIPE
RWP	RAIN WATER PIPE
SP	STAND PIPE
SVP	SOIL VENT PIPE
VP	VENT PIPE
WP	WASTE PIPE

LEVELS	
A	APPROXIMATE
CL	COVER LEVEL
EL	EAVES LEVEL
FFL	FINISHED FLOOR LEVEL
FRL	FLAT ROOF LEVEL
ID	INVERT DEPTH
IL	INVERT LEVEL
PAL	PARAPET WALL LEVEL
RL	RIDGE LEVEL
TFL	TOP OF FENCE LEVEL
TWL	TOP OF WALL LEVEL

VEGETATION	
BSH	BUSH
FB	FLOWER/SHRUB BORDER
HDG	HEDGE
OVG	OVERGROWTH

TREE

TYPE
GIRTH / SPREAD (R)

WALLS & FENCES	
BW	BLOCK WALL
BRTW	BRICK RETAINING WALL
BRW	BRICK WALL
CBF	CLOSE BOARD FENCE
CCF	CHESTNUT CLEFT FENCE
CIF	CORRUGATED IRON FENCE
CLF	CHAIN LINK FENCE
CRW	CONCRETE RETAINING WALL
CW	CONCRETE WALL
DIL	DILAPIDATED
FPO	FENCE POST
HR	HAND RAIL
MF	MISCELLANEOUS FENCE
MRF	METAL RAILING FENCE
OBF	OPEN BOARD FENCE
PRF	POST & RAIL FENCE
RTW	RETAINING WALL
STW	STONE WALL
STRW	STONE RETAINING WALL
WMF	WIRE MESH FENCE

INSPECTION CHAMBERS	
AC	ACCESS COVER
EIC	ELECTRIC INSPECTION COVER
FH	FIRE HYDRANT
GIG	GAS INSPECTION COVER
GM	GAS METER
GY	GULLY
IC	INSPECTION COVER
SV	STOP VALVE
TIC	TELECOM COVER
UTL	UNABLE TO LIFT
WIC	WATER INSPECTION COVER

SURFACES	
ASPT	ASPHALT
BCP	BARK CHIPS
BPAV	BRICK PAVING
CONC	CONCRETE
CPAV	CONCRETE PAVING SLABS
CPS	CRAZY PAVING
FB	FLOWER/SHRUB BORDER
GRS	GRASS
GVL	GRAVEL
MPAV	MIXED PAVING
MRB	MARBLE STONES
SHG	SHINGLE
TLE	TILE
TMAC	TARMAC
TPAV	TACTILE PAVING
WDK	WOODEN DECKING

SINGLE GATE
DOUBLE GATE
BANKING
+0.00 LEVEL
SURVEY STATION

TREE LEGEND

ALD	ALDER	LAR	LARCH
ASH	ASH	LBM	LABURNUM
ASP	ASPEN	LCS	LOCUST
BCH	BEECH	LIM	LIME
BRC	BIRCH	LPN	LONDON PLANE
CED	CEDAR	MAG	MAGNOLIA
CHY	CHERRY	MPL	MAPLE
CON	CONIFEROUS	OAK	OAK
CYP	CYPRESS	PNE	PINE
DEC	DECIDUOUS	POP	POPLAR
DED	DEAD	RDN	RHODODENRONS
ELD	ELDERBERRY	RWN	ROWAN
ELM	ELM	SLW	SALLOW
EUC	EUCALYPTUS	SAP	SAPLING
FIR	FIR	SCH	SWEET CHESTNUT
FRT	FRUIT	SPR	SPRUCE
HAW	HAWTHORN	SYC	SYCAMORE
HZL	HAZEL	UNK	UNKNOWN SPECIES
HBM	HORNBEAM	WBM	WHITEBEAM
HCH	HORSE CHESTNUT	WLW	WILLOW
HLY	HOLLY	WNT	WALNUT
IBT	INDIAN BEAN TREE	YEW	YEW

NOTES

This survey has been carried out to an accuracy consistent with a presentation scale of
1:100; therefore interrogated dimensions will be within the tolerance associated with this scale. The same accuracies implied by the plotting scale are equally applicable to digital data supplied for CAD. The scale of this drawing should not be changed without permission.

Boundaries shown are not necessarily legal boundaries.

Building footprints edged with a solid line have been surveyed. Where the outline is merely hatched the footprint is indicative only.

All levels, heights, measurements and dimensions are in metres unless otherwise stated.

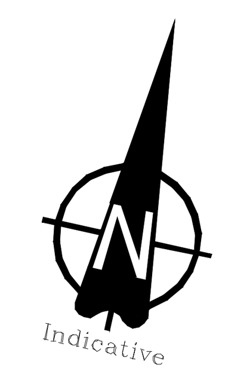
Eaves levels are generally surveyed as the end of the roof slate/tile/thatch. In cases where this is not possible the top of gutter is surveyed instead. Where underside of fascia or other features are surveyed these are recorded as such.

All below-ground features (including drainage, voids and services) have been identified from above ground and therefore all details relating to these (such as sizes, depth, pipe positions and alignments, description etc.) will be approximate only. Underground services have not been traced, but any visible surface features have been located. No allowance has been made for any sub-surface manholes or other chambers or voids below ground level. While every effort is made to identify all visible above-ground features, it should be noted that there may be features obscured at the time of survey.

Spot heights at edges of roads are road/gutter levels, not top of kerb unless otherwise stated.

Trees have been drawn diagrammatically (i.e. circular) showing average canopy spread.

Measurements to internal walls have been taken to the wall finishes at approximately 1m above floor level and assumed to be vertical.



0 1 2 3 4 5 10 15 20
SCALE (M)

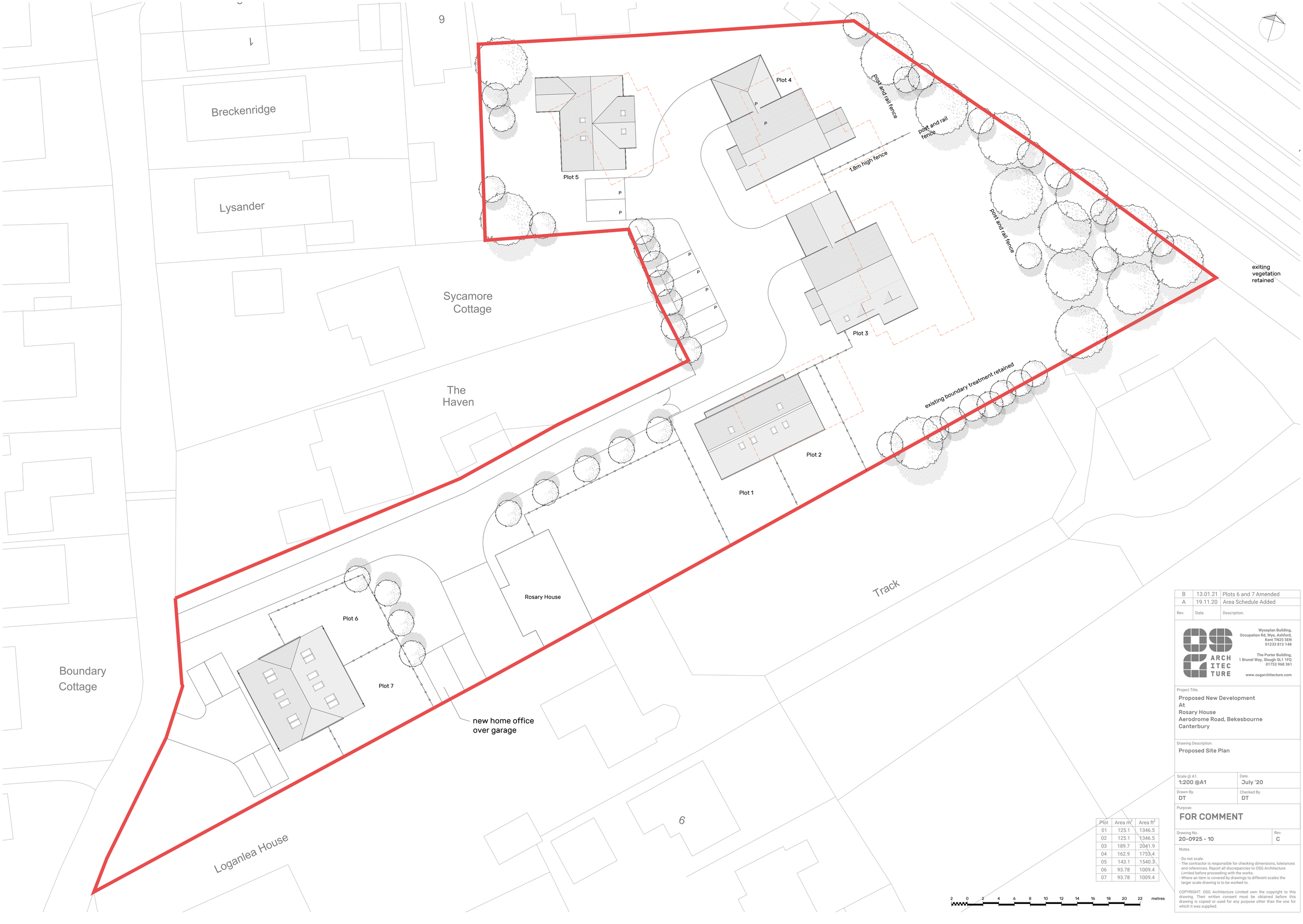
CAD Surveys Ltd.
Suite 2 KPC House
Canterbury Road
Willesborough
Ashford
TN24 0BP

www.cadsurveys.co.uk
01233 635089

Project :
ROSARY HOUSE
AERODROME ROAD, CANTERBURY
CT4 5EX

Drawing title :
TOPOGRAPHICAL SURVEY

Job No. :	Dwg No. :	Surveyed by :
CAD/RH/01	T13/01/A	D.R
Scale : 1:200 at A1	Date : JUN 2021	Drawn by : B.D



Rev.	Date.	Description.
B	13.01.21	Plots 6 and 7 Amended
A	19.11.20	Area Schedule Added

OS ARCHITECTURE

Wyseplan Building,
Occupation Rd, Wye, Ashford,
Kent TN25 5EN
01233 812 148

The Porter Building,
1 Brunel Way, Slough SL1 1FQ
01753 968 361

www.osgarchitecture.com

Project Title.

Proposed New Development
At
Rosary House
Aerodrome Road, Bekesbourne
Canterbury

Drawing Description.

Proposed Site Plan

Scale @ A1.	Date.
1:200 @A1	July '20
Drawn By. DT	Checked By. DT

Purpose.

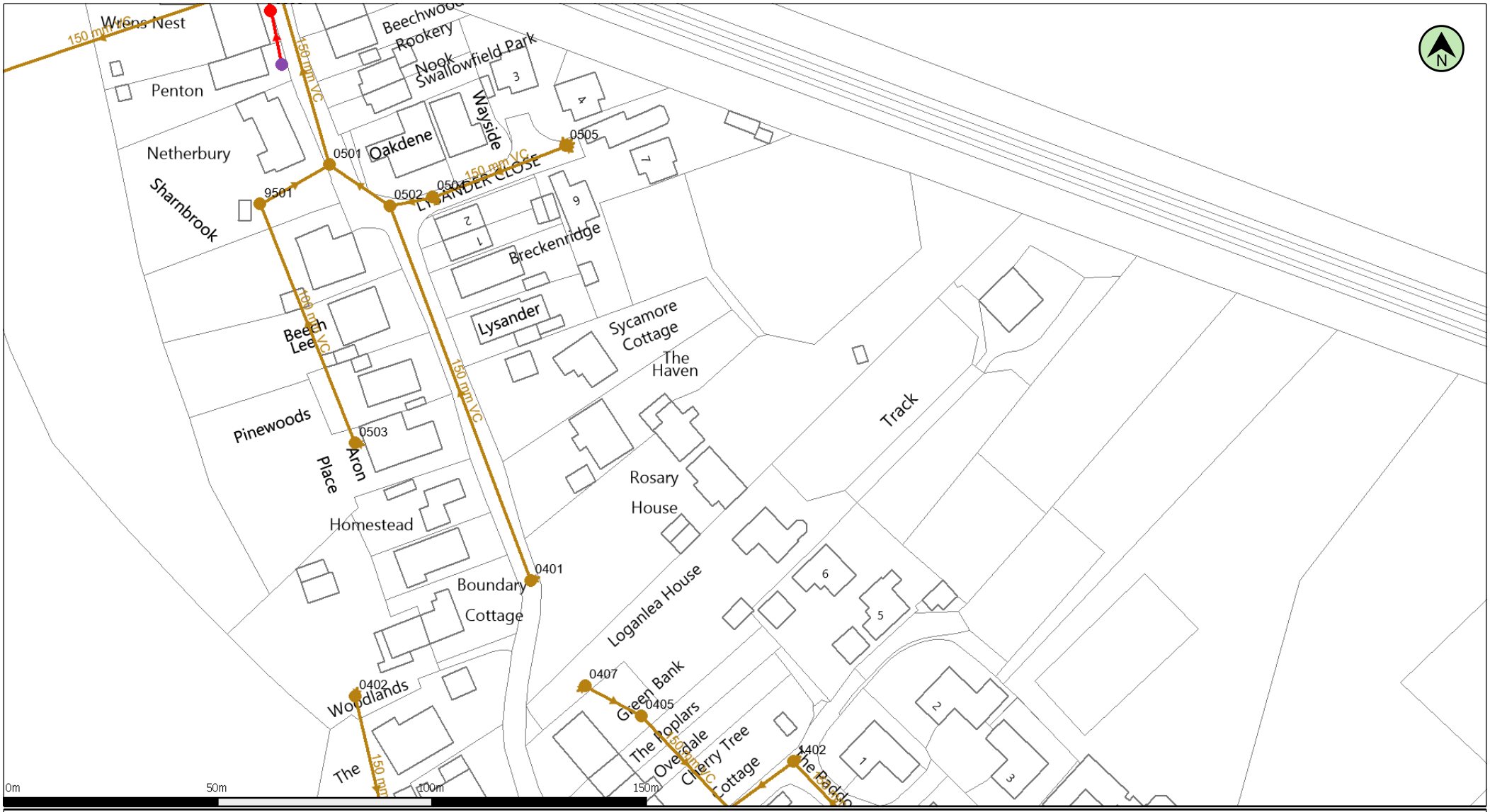
FOR COMMENT

Drawing No.	Rev.
20-0925 - 10	C

Plot	Area m^2	Area ft^2
01	125.1	1346.5
02	125.1	1346.5
03	189.7	2041.9
04	162.9	1753.4
05	143.1	1540.3
06	93.78	1009.4
07	93.78	1009.4

Notes.

- Do not scale.
- The contractor is responsible for checking dimensions, tolerances and references. Report all discrepancies to OSG Architecture Limited before proceeding with the works.
- Where an item is covered by drawings to different scales the larger scale drawing is to be worked to.



Date: 05/10/21 | Scale: 1:1250 | Map Centre: 620105,155532 | Data updated: 20/09/21 | Our Ref: 666702 - 1 | Wastewater Plan A4

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2021 Ordnance Survey 100031673 .This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.

Foul Gravity Sewer
Combined Gravity Sewer
Culverted Water Course or Treated Effluent
Surface Water Gravity Sewer
Rising Main, Vacuum or Syphon
Combined Outfall
Surface Water Outfall
Foul Outfall
Surface Water Inlet
Combined Pumping Station
Surface Water Pumping Station
Foul Pumping Station
Water Treatment Works
Section 104 Area
Building Over Agreement Area
Foul Manhole
Combined Manhole
Surface Water Manhole
Side Entry Manhole, Decarcation Chamber, Dummy Manhole or Surface Water Soakaway

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Rosary House

WATER for LIFE from Southern Water.

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
9603	C	0.00	0.00	-
0401	F	46.07	44.04	-
0402	F	45.64	44.49	-
0405	F	46.16	44.99	-
0407	F	46.20	45.52	-
0501	F	43.30	41.50	-
0502	F	43.78	41.92	-
0503	F	45.06	44.08	-
0504	F	43.76	42.04	-
0505	F	43.52	42.44	-
1402	F	46.52	44.71	-
9501	F	43.24	41.77	-

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

532m² permeable paving at 1:40 with 450mm porous subbase (30% void ratio);
Check dam at every 20m interval to maximise storage;
Infiltration rate at the base 1 x 10^{-5} m/s;
The 1:40 road has been approximated with no. 4 20m x 5m (L x W) segments;
Storage volume of each segment of road = 6.75m³ and surface drained by each segment of road = 530m²/4 = 133m²;
Infiltration rate at the base 1 x 10^{-5} m/s;
Minimum road storage volume = 6.75m³ x 4 = 27m³;

364m² flat permeable paving serving Plot 1, 2, 4 & 5 with 450mm and 30% void ratio porous subbase;
CL = 44.14m AOD;
IL = 43.47m AOD;
Infiltration rate at the base 1 x 10^{-5} m/s;
Total storage volume = 53.3m³;

IL = 45.70m AOD
IL = 45.20m AOD
IL = 44.70m AOD
IL = 44.20m AOD
5m
20m
20m
20m
20m

Plot 5 120m²
Plot 4 157m²
Plot 3 170m²
Plot 6 & 7 143m²
Plot 1 & 2 125m²

5m buffer from Plot 3

120m² flat permeable paving serving Plot 6 & 7 with 450mm and 30% void ratio porous subbase;
CL = 45.9m AOD;
IL = 45.23m AOD;
Infiltration rate at the base 1 x 10^{-5} m/s;
Total storage volume = 16.2m³;

Geocellular tank with infiltration serving Plot 3;
No. 14 crates;
IL = 43.08m AOD
0.914m x 1.2m x 1.2m (H x D x W)
95% void ratio;
Infiltration rate at the base and sides 1 x 10^{-5} m/s;
Total storage volume = 18.4m³;

Breckenridge
Avon Place
Homestead
Sycamore Cottage
The Haven
Boundary Cottage
Rosary House
Loganlea House
Green Bank
The Poplars
Overdale
existing boundary treatment retained
1.8m high fence
post and rail fence

Legend

- Application boundary
- Roof
- Permeable surface
- Flat permeable paving + porous subbase
- 1:40 permeable paving + porous subbase
- Check dam
- Surface water drainage element

N

Scale 1:500 (m)
0 5 10 20

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NOTES

1. Dimensions in metres and levels in m AOD unless otherwise stated. Do not scale.
2. Not for construction, for planning only.
3. To be read in conjunction with Outline SuDS Strategy technical note 21078-DNG-TN-01-P01 by Water Environment Ltd.
4. Based on Proposed Site Plan drawing no. 20-0925-10 Rev D by OGS Architecture Ltd.
5. Invert levels based on Topographic Survey T13/01/A by Cad Surveys Ltd.
6. Subject to confirmation of infiltration rate from ground investigation.

REV	DATE	AMENDMENTS	DR	AP
C01	08/11/21	Issue for planning	FR	TC
P01	21/10/21	Draft for client approval	FR	TC

CLIENT: Woodchurch Property Developments
PROJECT: Rosary House, Bekesbourne
DRAWING: Sustainable Drainage Strategy

SCALE @A3: 1:500
DATE: 21/10/2021
DRAWN: FR
CHECKED: GE
APPROVED: TC
DRAWING NO: 21078-DNG-DP-01
REVISION: C01

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 816 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Σ Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	43.382	0.302	0.1	0.0	0.0	0.1	5.7	O K
30 min Summer	43.478	0.398	0.1	0.0	0.0	0.1	7.6	O K
60 min Summer	43.572	0.492	0.1	0.0	0.0	0.1	9.4	O K
120 min Summer	43.665	0.585	0.2	0.0	0.0	0.2	11.1	O K
180 min Summer	43.722	0.642	0.2	0.0	0.0	0.2	12.2	O K
240 min Summer	43.765	0.685	0.2	0.0	0.0	0.2	13.0	O K
360 min Summer	43.829	0.749	0.2	0.0	0.0	0.2	14.2	O K
480 min Summer	43.879	0.799	0.2	0.0	0.0	0.2	15.2	O K
600 min Summer	43.914	0.834	0.2	0.0	0.0	0.2	15.9	O K
720 min Summer	43.940	0.860	0.2	0.0	0.0	0.2	16.3	O K
960 min Summer	43.974	0.894	0.2	0.0	0.0	0.2	17.0	O K
1440 min Summer	43.994	0.914	0.2	0.0	0.0	0.2	17.4	O K
2160 min Summer	43.971	0.891	0.2	0.0	0.0	0.2	16.9	O K
2880 min Summer	43.927	0.847	0.2	0.0	0.0	0.2	16.1	O K
4320 min Summer	43.831	0.751	0.2	0.0	0.0	0.2	14.3	O K
5760 min Summer	43.742	0.662	0.2	0.0	0.0	0.2	12.6	O K
7200 min Summer	43.662	0.582	0.2	0.0	0.0	0.2	11.1	O K
8640 min Summer	43.592	0.512	0.1	0.0	0.0	0.1	9.7	O K
10080 min Summer	43.530	0.450	0.1	0.0	0.0	0.1	8.5	O K
15 min Winter	43.382	0.302	0.1	0.0	0.0	0.1	5.7	O K
30 min Winter	43.478	0.398	0.1	0.0	0.0	0.1	7.6	O K
60 min Winter	43.573	0.493	0.1	0.0	0.0	0.1	9.4	O K
120 min Winter	43.666	0.586	0.2	0.0	0.0	0.2	11.1	O K
180 min Winter	43.724	0.644	0.2	0.0	0.0	0.2	12.2	O K
240 min Winter	43.768	0.688	0.2	0.0	0.0	0.2	13.1	O K
360 min Winter	43.833	0.753	0.2	0.0	0.0	0.2	14.3	O K
480 min Winter	43.885	0.805	0.2	0.0	0.0	0.2	15.3	O K
600 min Winter	43.922	0.842	0.2	0.0	0.0	0.2	16.0	O K
720 min Winter	43.950	0.870	0.2	0.0	0.0	0.2	16.5	O K
960 min Winter	43.980	0.900	0.2	0.0	0.0	0.2	17.1	O K
1440 min Winter	43.994	0.914	0.2	0.0	0.0	0.2	17.4	O K
2160 min Winter	43.957	0.877	0.2	0.0	0.0	0.2	16.7	O K
2880 min Winter	43.896	0.816	0.2	0.0	0.0	0.2	15.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	138.309	0.0	5.9	0.0	26
30 min Summer	91.602	0.0	7.7	0.0	41
60 min Summer	57.606	0.0	9.8	0.0	70
120 min Summer	35.219	0.0	12.0	0.0	128
180 min Summer	26.504	0.0	13.5	0.0	188
240 min Summer	21.751	0.0	14.8	0.0	246
360 min Summer	16.636	0.0	17.0	0.0	364
480 min Summer	13.894	0.0	18.9	0.0	482
600 min Summer	12.106	0.0	20.5	0.0	600
720 min Summer	10.819	0.0	21.9	0.0	688
960 min Summer	9.019	0.0	23.7	0.0	806
1440 min Summer	6.872	0.0	24.3	0.0	1032
2160 min Summer	5.108	0.0	31.3	0.0	1476
2880 min Summer	4.090	0.0	33.4	0.0	1900
4320 min Summer	2.948	0.0	36.1	0.0	2724
5760 min Summer	2.325	0.0	37.9	0.0	3520
7200 min Summer	1.930	0.0	39.4	0.0	4320
8640 min Summer	1.658	0.0	40.6	0.0	5096
10080 min Summer	1.458	0.0	41.6	0.0	5848
15 min Winter	138.309	0.0	5.9	0.0	26
30 min Winter	91.602	0.0	7.7	0.0	40
60 min Winter	57.606	0.0	9.8	0.0	70
120 min Winter	35.219	0.0	12.0	0.0	126
180 min Winter	26.504	0.0	13.5	0.0	184
240 min Winter	21.751	0.0	14.8	0.0	242
360 min Winter	16.636	0.0	17.0	0.0	356
480 min Winter	13.894	0.0	18.9	0.0	470
600 min Winter	12.106	0.0	20.5	0.0	580
720 min Winter	10.819	0.0	21.9	0.0	690
960 min Winter	9.019	0.0	23.6	0.0	888
1440 min Winter	6.872	0.0	24.2	0.0	1082
2160 min Winter	5.108	0.0	31.3	0.0	1580
2880 min Winter	4.090	0.0	33.4	0.0	2024

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Σ Max Outflow (l/s)	Max Volume (m³)	Status
4320 min Winter	43.764	0.684	0.2	0.0	0.0	0.2	13.0	O K
5760 min Winter	43.646	0.566	0.2	0.0	0.0	0.2	10.7	O K
7200 min Winter	43.543	0.463	0.1	0.0	0.0	0.1	8.8	O K
8640 min Winter	43.454	0.374	0.1	0.0	0.0	0.1	7.1	O K
10080 min Winter	43.379	0.299	0.1	0.0	0.0	0.1	5.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
4320 min Winter	2.948	0.0	36.1	0.0	2900
5760 min Winter	2.325	0.0	37.9	0.0	3744
7200 min Winter	1.930	0.0	39.4	0.0	4536
8640 min Winter	1.658	0.0	40.6	0.0	5280
10080 min Winter	1.458	0.0	41.7	0.0	6056

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
FEH Rainfall Version	2013	Cv (Winter)	1.000
Site Location	GB 620153 155483 TR 20153 55483	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.017

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.005	4	8	0.006	8	12	0.006

Model Details

Storage is Online Cover Level (m) 44.700

Cellular Storage Structure

Invert Level (m) 43.080 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.03600 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.03600

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	20.0	20.0	0.914	20.0	36.4	0.915	0.4	36.4

Weir Outflow Control

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 43.993

Weir Overflow Control

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 43.994

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 228 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Σ Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	45.446	0.216	0.6	0.0	0.0	0.6	7.8	O K
30 min Summer	45.517	0.287	0.6	0.0	0.0	0.6	10.3	O K
60 min Summer	45.580	0.350	0.6	0.0	0.0	0.6	12.6	O K
120 min Summer	45.626	0.396	0.6	0.0	0.0	0.6	14.3	Flood Risk
180 min Summer	45.645	0.415	0.6	0.0	0.0	0.6	14.9	Flood Risk
240 min Summer	45.653	0.423	0.6	0.0	0.0	0.6	15.2	Flood Risk
360 min Summer	45.664	0.434	0.6	0.0	0.0	0.6	15.6	Flood Risk
480 min Summer	45.674	0.444	0.6	0.0	0.0	0.6	16.0	Flood Risk
600 min Summer	45.679	0.449	0.6	0.0	0.0	0.6	16.2	Flood Risk
720 min Summer	45.686	0.456	0.6	0.0	0.0	0.6	16.2	Flood Risk
960 min Summer	45.673	0.443	0.6	0.0	0.0	0.6	16.0	Flood Risk
1440 min Summer	45.636	0.406	0.6	0.0	0.0	0.6	14.6	Flood Risk
2160 min Summer	45.555	0.325	0.6	0.0	0.0	0.6	11.7	O K
2880 min Summer	45.475	0.245	0.6	0.0	0.0	0.6	8.8	O K
4320 min Summer	45.352	0.122	0.6	0.0	0.0	0.6	4.4	O K
5760 min Summer	45.289	0.059	0.6	0.0	0.0	0.6	2.1	O K
7200 min Summer	45.275	0.045	0.5	0.0	0.0	0.5	1.6	O K
8640 min Summer	45.269	0.039	0.5	0.0	0.0	0.5	1.4	O K
10080 min Summer	45.264	0.034	0.4	0.0	0.0	0.4	1.2	O K
15 min Winter	45.446	0.216	0.6	0.0	0.0	0.6	7.8	O K
30 min Winter	45.517	0.287	0.6	0.0	0.0	0.6	10.3	O K
60 min Winter	45.581	0.351	0.6	0.0	0.0	0.6	12.6	O K
120 min Winter	45.628	0.398	0.6	0.0	0.0	0.6	14.3	Flood Risk
180 min Winter	45.647	0.417	0.6	0.0	0.0	0.6	15.0	Flood Risk
240 min Winter	45.655	0.425	0.6	0.0	0.0	0.6	15.3	Flood Risk
360 min Winter	45.662	0.432	0.6	0.0	0.0	0.6	15.5	Flood Risk
480 min Winter	45.666	0.436	0.6	0.0	0.0	0.6	15.7	Flood Risk
600 min Winter	45.665	0.435	0.6	0.0	0.0	0.6	15.7	Flood Risk
720 min Winter	45.659	0.429	0.6	0.0	0.0	0.6	15.4	Flood Risk
960 min Winter	45.636	0.406	0.6	0.0	0.0	0.6	14.6	Flood Risk
1440 min Winter	45.566	0.336	0.6	0.0	0.0	0.6	12.1	O K
2160 min Winter	45.444	0.214	0.6	0.0	0.0	0.6	7.7	O K
2880 min Winter	45.343	0.113	0.6	0.0	0.0	0.6	4.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	138.309	0.0	8.4	0.0	25
30 min Summer	91.602	0.0	11.3	0.0	39
60 min Summer	57.606	0.0	14.3	0.0	66
120 min Summer	35.219	0.0	17.7	0.0	124
180 min Summer	26.504	0.0	20.0	0.0	180
240 min Summer	21.751	0.0	21.9	0.0	216
360 min Summer	16.636	0.0	25.2	0.0	282
480 min Summer	13.894	0.0	28.2	0.0	350
600 min Summer	12.106	0.0	30.7	0.0	422
720 min Summer	10.819	0.0	33.0	0.0	492
960 min Summer	9.019	0.0	36.7	0.0	632
1440 min Summer	6.872	0.0	41.9	0.0	908
2160 min Summer	5.108	0.0	46.7	0.0	1300
2880 min Summer	4.090	0.0	49.7	0.0	1672
4320 min Summer	2.948	0.0	53.5	0.0	2340
5760 min Summer	2.325	0.0	56.0	0.0	2952
7200 min Summer	1.930	0.0	57.8	0.0	3672
8640 min Summer	1.658	0.0	59.3	0.0	4408
10080 min Summer	1.458	0.0	60.6	0.0	5120
15 min Winter	138.309	0.0	8.4	0.0	25
30 min Winter	91.602	0.0	11.3	0.0	38
60 min Winter	57.606	0.0	14.3	0.0	66
120 min Winter	35.219	0.0	17.7	0.0	122
180 min Winter	26.504	0.0	20.0	0.0	178
240 min Winter	21.751	0.0	21.9	0.0	230
360 min Winter	16.636	0.0	25.2	0.0	290
480 min Winter	13.894	0.0	28.2	0.0	368
600 min Winter	12.106	0.0	30.7	0.0	448
720 min Winter	10.819	0.0	33.0	0.0	526
960 min Winter	9.019	0.0	36.7	0.0	676
1440 min Winter	6.872	0.0	41.9	0.0	960
2160 min Winter	5.108	0.0	46.7	0.0	1344
2880 min Winter	4.090	0.0	49.7	0.0	1672

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Σ Max Outflow (l/s)	Max Volume (m³)	Status
4320 min Winter	45.274	0.044	0.5	0.0	0.0	0.5	1.6	O K
5760 min Winter	45.265	0.035	0.4	0.0	0.0	0.4	1.3	O K
7200 min Winter	45.259	0.029	0.4	0.0	0.0	0.4	1.0	O K
8640 min Winter	45.255	0.025	0.3	0.0	0.0	0.3	0.9	O K
10080 min Winter	45.252	0.022	0.3	0.0	0.0	0.3	0.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
4320 min Winter	2.948	0.0	53.5	0.0	2208
5760 min Winter	2.325	0.0	56.0	0.0	2936
7200 min Winter	1.930	0.0	57.8	0.0	3664
8640 min Winter	1.658	0.0	59.3	0.0	4408
10080 min Winter	1.458	0.0	60.6	0.0	5144

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
FEH Rainfall Version	2013	Cv (Winter)	1.000
Site Location	GB 620153 155483 TR 20153 55483	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.026

Time From: (mins)	To:	Area (ha)	Time From: (mins)	To:	Area (ha)	Time From: (mins)	To:	Area (ha)
0	4	0.009	4	8	0.009	8	12	0.008

Model Details

Storage is Online Cover Level (m) 45.900

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.03600	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	12.0
Max Percolation (l/s)	33.3	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	45.230	Cap Volume Depth (m)	0.450

Weir Outflow Control

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 45.690

Weir Overflow Control

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 45.700

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 219 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Σ Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	43.680	0.210	1.8	0.0	0.0	1.8	22.9	O K
30 min Summer	43.749	0.279	1.8	0.0	0.0	1.8	30.5	O K
60 min Summer	43.811	0.341	1.8	0.0	0.0	1.8	37.2	O K
120 min Summer	43.855	0.385	1.8	0.0	0.0	1.8	42.0	Flood Risk
180 min Summer	43.872	0.402	1.8	0.0	0.0	1.8	43.9	Flood Risk
240 min Summer	43.880	0.410	1.8	0.0	0.0	1.8	44.7	Flood Risk
360 min Summer	43.891	0.421	1.8	0.0	0.0	1.8	45.9	Flood Risk
480 min Summer	43.899	0.429	1.8	0.0	0.0	1.8	46.9	Flood Risk
600 min Summer	43.903	0.433	1.8	0.0	0.0	1.8	47.3	Flood Risk
720 min Summer	43.904	0.434	1.8	0.0	0.0	1.8	47.4	Flood Risk
960 min Summer	43.897	0.427	1.8	0.0	0.0	1.8	46.6	Flood Risk
1440 min Summer	43.859	0.389	1.8	0.0	0.0	1.8	42.5	Flood Risk
2160 min Summer	43.779	0.309	1.8	0.0	0.0	1.8	33.7	O K
2880 min Summer	43.700	0.230	1.8	0.0	0.0	1.8	25.1	O K
4320 min Summer	43.581	0.111	1.8	0.0	0.0	1.8	12.2	O K
5760 min Summer	43.525	0.055	1.8	0.0	0.0	1.8	6.0	O K
7200 min Summer	43.514	0.044	1.6	0.0	0.0	1.6	4.8	O K
8640 min Summer	43.508	0.038	1.4	0.0	0.0	1.4	4.1	O K
10080 min Summer	43.503	0.033	1.2	0.0	0.0	1.2	3.6	O K
15 min Winter	43.680	0.210	1.8	0.0	0.0	1.8	22.9	O K
30 min Winter	43.749	0.279	1.8	0.0	0.0	1.8	30.5	O K
60 min Winter	43.811	0.341	1.8	0.0	0.0	1.8	37.2	O K
120 min Winter	43.856	0.386	1.8	0.0	0.0	1.8	42.2	Flood Risk
180 min Winter	43.874	0.404	1.8	0.0	0.0	1.8	44.1	Flood Risk
240 min Winter	43.881	0.411	1.8	0.0	0.0	1.8	44.9	Flood Risk
360 min Winter	43.887	0.417	1.8	0.0	0.0	1.8	45.5	Flood Risk
480 min Winter	43.891	0.421	1.8	0.0	0.0	1.8	45.9	Flood Risk
600 min Winter	43.889	0.419	1.8	0.0	0.0	1.8	45.7	Flood Risk
720 min Winter	43.882	0.412	1.8	0.0	0.0	1.8	45.0	Flood Risk
960 min Winter	43.858	0.388	1.8	0.0	0.0	1.8	42.4	Flood Risk
1440 min Winter	43.788	0.318	1.8	0.0	0.0	1.8	34.7	O K
2160 min Winter	43.668	0.198	1.8	0.0	0.0	1.8	21.6	O K
2880 min Winter	43.571	0.101	1.8	0.0	0.0	1.8	11.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	138.309	0.0	24.7	0.0	25
30 min Summer	91.602	0.0	33.4	0.0	39
60 min Summer	57.606	0.0	42.4	0.0	66
120 min Summer	35.219	0.0	52.3	0.0	124
180 min Summer	26.504	0.0	59.2	0.0	180
240 min Summer	21.751	0.0	64.9	0.0	212
360 min Summer	16.636	0.0	74.7	0.0	280
480 min Summer	13.894	0.0	83.3	0.0	348
600 min Summer	12.106	0.0	90.9	0.0	420
720 min Summer	10.819	0.0	97.5	0.0	490
960 min Summer	9.019	0.0	108.5	0.0	630
1440 min Summer	6.872	0.0	124.0	0.0	904
2160 min Summer	5.108	0.0	138.1	0.0	1296
2880 min Summer	4.090	0.0	147.1	0.0	1652
4320 min Summer	2.948	0.0	158.3	0.0	2336
5760 min Summer	2.325	0.0	165.6	0.0	2944
7200 min Summer	1.930	0.0	171.0	0.0	3672
8640 min Summer	1.658	0.0	175.4	0.0	4400
10080 min Summer	1.458	0.0	179.1	0.0	5072
15 min Winter	138.309	0.0	24.7	0.0	25
30 min Winter	91.602	0.0	33.4	0.0	38
60 min Winter	57.606	0.0	42.4	0.0	66
120 min Winter	35.219	0.0	52.3	0.0	122
180 min Winter	26.504	0.0	59.2	0.0	176
240 min Winter	21.751	0.0	64.9	0.0	230
360 min Winter	16.636	0.0	74.7	0.0	288
480 min Winter	13.894	0.0	83.3	0.0	368
600 min Winter	12.106	0.0	90.9	0.0	446
720 min Winter	10.819	0.0	97.5	0.0	524
960 min Winter	9.019	0.0	108.5	0.0	674
1440 min Winter	6.872	0.0	124.0	0.0	956
2160 min Winter	5.108	0.0	138.1	0.0	1336
2880 min Winter	4.090	0.0	147.1	0.0	1652

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Σ Max Outflow (l/s)	Max Volume (m³)	Status
4320 min Winter	43.513	0.043	1.6	0.0	0.0	1.6	4.7	O K
5760 min Winter	43.504	0.034	1.2	0.0	0.0	1.2	3.7	O K
7200 min Winter	43.498	0.028	1.0	0.0	0.0	1.0	3.1	O K
8640 min Winter	43.494	0.024	0.9	0.0	0.0	0.9	2.6	O K
10080 min Winter	43.491	0.021	0.8	0.0	0.0	0.8	2.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
4320 min Winter	2.948	0.0	158.3	0.0	2208
5760 min Winter	2.325	0.0	165.6	0.0	2896
7200 min Winter	1.930	0.0	171.0	0.0	3672
8640 min Winter	1.658	0.0	175.4	0.0	4408
10080 min Winter	1.458	0.0	179.2	0.0	5144

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
FEH Rainfall Version	2013	Cv (Winter)	1.000
Site Location	GB 620153 155483 TR 20153 55483	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.077

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.026	4	8	0.026	8	12	0.025

Model Details

Storage is Online Cover Level (m) 44.140

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.03600	Width (m)	13.0
Membrane Percolation (mm/hr)	1000	Length (m)	28.0
Max Percolation (l/s)	101.1	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	43.470	Cap Volume Depth (m)	0.450

Weir Outflow Control

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 43.930

Weir Overflow Control

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 43.940

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 150 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Σ Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	43.881	0.351	0.4	0.0	0.0	0.4	3.7	O K
30 min Summer	43.935	0.405	0.4	0.0	0.0	0.4	4.9	Flood Risk
60 min Summer	43.976	0.446	0.4	0.0	0.0	0.4	6.0	Flood Risk
120 min Summer	43.999	0.469	0.5	0.0	0.0	0.5	6.6	Flood Risk
180 min Summer	44.009	0.479	0.5	0.0	0.0	0.5	6.9	Flood Risk
240 min Summer	44.015	0.485	0.5	0.0	0.0	0.5	7.1	Flood Risk
360 min Summer	44.023	0.493	0.5	0.0	0.0	0.5	7.3	Flood Risk
480 min Summer	44.027	0.497	0.5	0.0	0.0	0.5	7.4	Flood Risk
600 min Summer	44.028	0.498	0.5	0.0	0.0	0.5	7.4	Flood Risk
720 min Summer	44.027	0.497	0.5	0.0	0.0	0.5	7.4	Flood Risk
960 min Summer	44.019	0.489	0.5	0.0	0.0	0.5	7.2	Flood Risk
1440 min Summer	43.994	0.464	0.5	0.0	0.0	0.5	6.5	Flood Risk
2160 min Summer	43.952	0.422	0.4	0.0	0.0	0.4	5.3	Flood Risk
2880 min Summer	43.913	0.383	0.4	0.0	0.0	0.4	4.4	Flood Risk
4320 min Summer	43.851	0.321	0.3	0.0	0.0	0.3	3.1	O K
5760 min Summer	43.804	0.274	0.3	0.0	0.0	0.3	2.3	O K
7200 min Summer	43.770	0.240	0.2	0.0	0.0	0.2	1.7	O K
8640 min Summer	43.742	0.212	0.2	0.0	0.0	0.2	1.4	O K
10080 min Summer	43.722	0.192	0.2	0.0	0.0	0.2	1.1	O K
15 min Winter	43.881	0.351	0.4	0.0	0.0	0.4	3.7	O K
30 min Winter	43.935	0.405	0.4	0.0	0.0	0.4	4.9	Flood Risk
60 min Winter	43.977	0.447	0.4	0.0	0.0	0.4	6.0	Flood Risk
120 min Winter	44.000	0.470	0.5	0.0	0.0	0.5	6.6	Flood Risk
180 min Winter	44.008	0.478	0.5	0.0	0.0	0.5	6.9	Flood Risk
240 min Winter	44.013	0.483	0.5	0.0	0.0	0.5	7.0	Flood Risk
360 min Winter	44.016	0.486	0.5	0.0	0.0	0.5	7.1	Flood Risk
480 min Winter	44.015	0.485	0.5	0.0	0.0	0.5	7.1	Flood Risk
600 min Winter	44.011	0.481	0.5	0.0	0.0	0.5	6.9	Flood Risk
720 min Winter	44.005	0.475	0.5	0.0	0.0	0.5	6.8	Flood Risk
960 min Winter	43.989	0.459	0.5	0.0	0.0	0.5	6.3	Flood Risk
1440 min Winter	43.951	0.421	0.4	0.0	0.0	0.4	5.3	Flood Risk
2160 min Winter	43.895	0.365	0.4	0.0	0.0	0.4	4.0	O K
2880 min Winter	43.847	0.317	0.3	0.0	0.0	0.3	3.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	138.309	0.0	4.0	0.0	24
30 min Summer	91.602	0.0	5.4	0.0	38
60 min Summer	57.606	0.0	7.0	0.0	64
120 min Summer	35.219	0.0	8.6	0.0	114
180 min Summer	26.504	0.0	9.8	0.0	144
240 min Summer	21.751	0.0	10.8	0.0	176
360 min Summer	16.636	0.0	12.4	0.0	246
480 min Summer	13.894	0.0	13.8	0.0	316
600 min Summer	12.106	0.0	15.1	0.0	384
720 min Summer	10.819	0.0	16.2	0.0	454
960 min Summer	9.019	0.0	18.1	0.0	588
1440 min Summer	6.872	0.0	20.6	0.0	848
2160 min Summer	5.108	0.0	23.0	0.0	1220
2880 min Summer	4.090	0.0	24.4	0.0	1588
4320 min Summer	2.948	0.0	26.2	0.0	2300
5760 min Summer	2.325	0.0	27.3	0.0	3008
7200 min Summer	1.930	0.0	28.1	0.0	3744
8640 min Summer	1.658	0.0	28.7	0.0	4424
10080 min Summer	1.458	0.0	29.3	0.0	5152
15 min Winter	138.309	0.0	4.0	0.0	24
30 min Winter	91.602	0.0	5.4	0.0	37
60 min Winter	57.606	0.0	7.0	0.0	64
120 min Winter	35.219	0.0	8.6	0.0	118
180 min Winter	26.504	0.0	9.8	0.0	148
240 min Winter	21.751	0.0	10.8	0.0	186
360 min Winter	16.636	0.0	12.4	0.0	264
480 min Winter	13.894	0.0	13.8	0.0	338
600 min Winter	12.106	0.0	15.1	0.0	412
720 min Winter	10.819	0.0	16.2	0.0	482
960 min Winter	9.019	0.0	18.1	0.0	622
1440 min Winter	6.872	0.0	20.6	0.0	886
2160 min Winter	5.108	0.0	23.0	0.0	1260
2880 min Winter	4.090	0.0	24.4	0.0	1624

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Σ Max Outflow (l/s)	Max Volume (m³)	Status
4320 min Winter	43.777	0.247	0.2	0.0	0.0	0.2	1.8	O K
5760 min Winter	43.731	0.201	0.2	0.0	0.0	0.2	1.2	O K
7200 min Winter	43.699	0.169	0.2	0.0	0.0	0.2	0.9	O K
8640 min Winter	43.676	0.146	0.1	0.0	0.0	0.1	0.6	O K
10080 min Winter	43.659	0.129	0.1	0.0	0.0	0.1	0.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
4320 min Winter	2.948	0.0	26.2	0.0	2340
5760 min Winter	2.325	0.0	27.3	0.0	3056
7200 min Winter	1.930	0.0	28.1	0.0	3744
8640 min Winter	1.658	0.0	28.7	0.0	4416
10080 min Winter	1.458	0.0	29.3	0.0	5144

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
FEH Rainfall Version	2013	Cv (Winter)	1.000
Site Location	GB 620153 155483 TR 20153 55483	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.013

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.005	4	8	0.004	8	12	0.004

Model Details

Storage is Online Cover Level (m) 44.200

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.03600	Width (m)	5.0
Membrane Percolation (mm/hr)	1000	Length (m)	20.0
Max Percolation (l/s)	27.8	Slope (1:X)	40.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	43.530	Cap Volume Depth (m)	0.450

Weir Outflow Control

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 44.180

Weir Overflow Control

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 44.190