WOLDINGHAM HOMES

FORMER COAL YARD, 119-121 SILVERDALE ROAD
TUNBRIDGE WELLS, KENT, TN4 9HX

Flood Risk, Foul and Surface Water Drainage Assessment

January 2017
(Revised November 2018)

eas ltd
Environmental Assessment Services Ltd

REPORT DATA SHEET

Requirement	**Data**
Report Reference	Woldingham/SilverdaleRoad/FRFSWDA
Date	January 2017
Client	Woldingham Homes
Report type	Flood Risk, Foul and Surface Water Drainage Assessment
Purpose	Planning
Revisions	April 2018, July 2018, November 2018 revised maximum flow
Preparted by	Eur Ing Malcolm McKemey BSc (Hons), CEng, CEnv, MICE, MIEAust, MCIWEM, MIEnvSc Signed 

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CONTENTS

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Flood Risk, Foul and Surface Water Drainage Assessment

January 2017
(Revised November 2018)

1. BACKGROUND, EXISTING SITE & PROPOSED DEVELOPMENT

1.1 The site comprises a former coal yard, located on the north side of Silverdale Road. The site includes the existing chalet bungalow (No. 121 Silverdale Road) plus a number of dilapidated outbuildings/garages. The site lies some 2 km NNE of the centre of the town of Tunbridge Wells, Kent. Access to the site is presently via a metal gate on the east side of No. 121.

1.2 The site area is approximately 0.17 ha. The Ordnance Survey (OS) map reference for the site is TQ 5892 4107. The site elevation is approximately +81 m OD. See Appendix A: Figure 1 for Site Location Plan and Figure 2 for the Existing Topographic Site Plan.

1.3 It is proposed to redevelop the site, to include removal of the existing chalet bungalow and outbuildings/garages, and replacement with 5 No. two-bed houses, 6 No. three-bed houses, 1 No. two-bed flat and 1 No. three-bed flat with gardens, access, parking and landscaping. See Appendix A: Figure 3 for the Proposed Site Layout. The site is presently considered to be Brownfield, having had a former commercial use as a coal distribution depot.

1.4 The site lies within a depression in a valley with a slow fall to the east. The site is accessed via a driveway descending from Silverdale Road at the south east corner of the site towards the centre of the site. Houses and gardens surrounding the site are generally at a higher elevation than the site. In particular, the northern site boundary comprises retaining structures bordering the rear gardens of houses to the north (on Merrion Way). Other site boundaries do not appear to be retained and are fenced or vegetated, bordering adjacent gardens/residences.

1.5 A Flood Risk, Foul and Surface Water Drainage Assessment has been requested to assess the flood risk at the site and investigate the existing drainage features. This report details the findings of the abovementioned assessments, including the methodology and results of percolation testing carried out at the site. The findings are used to inform recommendations for drainage features and structural/design considerations to be included in the redeveloped site. This report has been revised to take into account the revised redevelopment proposal.

2. FLOOD RISK ASSESSMENT

2.1 According to the Environment Agency (EA) flood mapping, the site lies within Flood Zone 1 - low risk of flooding from fluvial sources. The nearest Flood Zones 2 and 3 lie more than 500 m distant to the east and north east of the site. However, online EA mapping shows parts of the site appear to be at medium to high risk of surface water flooding. See Appendix B for EA map extracts.

2.2 The nearest watercourse is a tributary of the River Medway, which lies some 1 km to the northeast of the site at its nearest point.

2.3 Although EA mapping shows the site to lie within a zone at medium to high risk of surface water flooding, Kent County Council has advised that there are no records of surface water flooding in the vicinity of the site. However, the Council states that there have been a number of queries relating to basement inundation and groundwater emergence, suggesting that groundwater levels within the area are high. Online EA mapping shows the site to lie on a minor aquifer of high leaching potential (Lower Tunbridge Wells Sand). See Appendix B for EA map extracts.

2.4 The Tunbridge Wells Borough Council Level 2 Strategic Flood Risk Assessment (dated 2009) indicates that the site does not lie within a critical drainage area.

2.5 The site is under 1 ha in area, within Flood Zone 1 and not within a critical drainage area. The proposed residential land use is appropriate for Flood Zone 1 and the Sequential Test is considered to be satisfied. However, there is some concern regarding surface water flood risk at the site, which is addressed in the following sections.

3. EXISTING SURFACE WATER DRAINAGE

3.1 The site was originally visited on 5 October 2015 and the existing drainage was examined.

3.2 The site was previously used as a coal yard, however the majority of the site was overgrown with grass and dense foliage. Broken concrete was visible along the driveway from Silverdale Road, but this area is substantially covered with grass and moss. The central area is paved with brick, but has also been substantially overgrown with grass.

3.3 The site lies within a depression, with surrounding buildings at higher elevations. The site topography descends towards the middle of the site, and the lowest point of the site lies towards the north east corner. Although plans indicate a drainage system, some pooling of rainwater was evident in the central area of the site. See Appendix A: Figure 2 for Topographic Site Plan.

3.4 Southern Water Sewer Plans are provided in Appendix D. The plans show a large diameter (900 mm) surface water sewer crossing the west of the site, from the south western boundary towards the northern boundary, before continuing eastwards along the northern boundary. This sewer then turns south east to join a smaller (600 mm) sewer east of the site in Silverdale Road, which flows to the east. A chamber (905D) is shown towards the south western site boundary, and two are marked towards and along the northern site boundary. It was not possible to locate these chambers during the initial site visit; further investigation to locate these chambers should be carried out during site clearance.

3.5 In addition to features identified from the Sewer Plans, a gulley is included on the Topographic Site Plan (Figure 2). The gulley is located within the north western area of the site, south of the western manhole along the northern boundary (identified on sewer plans). It is considered likely that surface water at the site partly drains to this gulley (and hence to the surface water sewer shown on the sewer plans). However, the central area of the site does not appear to fully drain to the gulley, resulting in ponding.

3.6 The proposed location of some of the houses lies over the existing surface water sewer in the western section of the site. The cover over the crown of the sewer is only around 1 m and it will probably be necessary to divert this sewer, permission should be sought from Southern Water. An indicative diversion arrangement is shown in Figure 4: Drainage Options.

4. PERCOLATION TESTING

4.1 The proposed redevelopment of the site would require installation of a new drainage system. Tunbridge Wells Surface Water Management Plan (2013) states that new development should seek to incorporate Sustainable Drainage Systems (SuDS) where feasible and appropriate to the scale and size of the development. Drainage to soakaway would be the preferred Sustainable Drainage System (SuDS) solution, however percolation testing would be required to investigate the practicality of soakaway as a method of disposal of surface water.,

4.2 The site was revisited on 10 November 2016 to undertake percolation testing, which included the excavation of three trial pits within the site. The location of the trial pits were informed by the findings of the initial site visit in October 2015, including the published geology of the site and the proposed site layout. TP1 is located to the north west of the site, TP2 to the east of TP1, and TP3 towards the south east of the site. The location of the trial pits are shown in Figure 2 in Appendix A.

4.3 **Site Geology**

4.3.1 According to the British Geological Survey, the majority of the site lies on Cretaceous Lower Tunbridge Wells Sand, apart from, the eastern area of the site, which lies on an outcrop of Wadhurst Clay.

4.3.2 The Lower Tunbridge Wells Sand could potentially be a suitable medium for soakaway, however the low permeability of the Wadhurst Clay would not facilitate soakaway drainage.

4.3.3 Environment Agency (EA) online mapping shows the majority of the site to lie on secondary aquifer (associated with the Lower Tunbridge Wells Sand). The site does not lie within a groundwater source protection zone.

4.3.4 Excavation of the three trial pits at the site revealed a variable depth of made ground over clay. Trial pit logs are provided in Appendix E. A ground investigation, undertaken as part of a Quantitative Ground Contamination Risk Assessment by Ashdown Investigation Limited in November 2015, also revealed the presence of a significant depth of made ground across the site. The 2015 investigation encountered Lower Tunbridge Wells Sand at the south eastern edge of the site only.

4.3.5 Groundwater was encountered within TP1 (to the north west of the site) at 1.03 m. Groundwater was not encountered within the other trial pits.

4.4 **Percolation Testing Method & Results**

4.4.1 Percolation testing was not undertaken in TP1 as the high groundwater levels (1.03 m BGL) made it immediately apparent that soakaway would not be practicable in this location. Although groundwater was not encountered in TP2 or TP3, the natural ground (clay) revealed beneath the made ground indicated that infiltration rates would likely be low in these locations. Percolation testing was carried out in TP2 to confirm these assumptions.

4.4.2 The trial pit (TP2) was filled with water and the water level drop relative to the time was recorded. The results of the percolation test are given in Appendix F.

4.4.3 BRE Digest 365 'Soakaway Design' states that soakaway should discharge from full to half-volume within 24 hours. The water level in TP2 dropped by 8 mm over 45 minutes, and then remained at this level for a further 1 hour 15 minutes, after which time it was apparent that the water level was unlikely to fall further. The percolation test revealed that infiltration rates are too low for soakaway to be practical at this site.

5. PROPOSED SURFACE WATER DRAINAGE

5.1 As percolation testing confirmed that surface water at the site cannot be adequately managed by drainage to soakaway, it will be necessary to attenuate surface water on-site, with discharge to the existing public surface water sewer limited to the Greenfield runoff rate.

5.2 The Greenfield runoff rate for the site has been estimated using the UK Sustainable Drainage (UKSUDS) Greenfield Runoff Estimation Tool. The rates are given for scenarios up to (and including) the 1 in 100 year storm event are summarised in Table 5.1, and provided in Appendix G.

TABLE 5.1
GREENFIELD RUNOFF RATES

Return period	Actual rates (l/s)	Assumed rates (l/s)
Qbar	1.04	1.04
1 in 1 year	0.88	2.00*
1 in 30 year	2.39	2.00*
1 in 100 year	3.32	2.00*

* 2 l/s is the assumed maximum flow rate as this is the lowest flow that can be achieved using a vortex control device. 5 l/s is the lowest practicable flow using an orifice plate.

5.3 The proposed redevelopment will increase the impermeable area of the site, thus increasing the peak flow following a rainfall event.

5.4 The attenuation storage requirements for the site (also provided by UKSUDS) have been calculated for the 1 in 100 year return event. In accordance with current EA guidance, the calculations should include a 20% and a 40% allowance for climate change. The required storage volumes for both climate change scenarios are summarised in Table 5.2 and provided in Appendix G.

TABLE 5.2
REQUIRED STORAGE VOLUMES

Climate Change Allowance Factor (%)	Total Required Storage (m^3)
20	65
40	79

5.5 Considering the proposed site layout, the most suitable option for attenuation storage would be underground. A proposed location for the attenuation storage at the site (using the greater storage volume of 79 m^3) is provided in Appendix A: Figure 4.

5.6 To reduce the chance of damage or blockages affecting the correct function of the attenuation storage system, regular and routine maintenance of the system should be undertaken to ensure all channels and pipes remain clear and free flowing.

5.7 In addition to attenuation storage, additional surface water drainage options for the site include the use of permeable paving. This would be laid over drainage blankets of no-fines stone wrapped in geotextile, which would drain via the attenuation storage system (and also provide some of the storage volume).

5.8 Rainwater harvesting could be used for supplying toilet cisterns or irrigation of gardens and soft landscaping areas. In either case, the most suitable water will be from roofs. Surface water from the paved areas is more likely to be polluted and would need to be treated and pumped to a height suitable for use.

5.9 Green roofs may also be an option at the site to reduce surface water runoff. These features can be integrated into building structures, including the roofs of proposed residential blocks, plus the roofs of any other proposed structures such as refuse and cycle stores.

5.10 The inclusion of all or a combination of the additional drainage options outlined above would ensure that there would be no discharge from the site for rainfall up to 5 mm. The additional drainage options for the site are also shown in Appendix A: Figure 4.

5.11 Extreme Event

5.11.1 If an extreme storm overwhelmed the surface water drainage system at the site, and/or if the drainage system were to fail, ground levels would indicate that surface water could accumulate within the site. In this case, topographical mapping for the site and surrounding area indicates that surface water would accumulate to a maximum depth of approximately 0.56 m within the site (81.5 m AOD), before discharging through the garden fence of No. 125 Silverdale Road (on the eastern site boundary) and then down the valley to the east.

5.11.2 The above scenario would be considered an unlikely event. However, it is recommended that finished floor levels are at least 300 mm above the potential flood level (a finished level of 81.8 m AOD), with flood resilient measures considered for inclusion within the design of the proposed accommodation, up to at least 300 mm above the finished floor levels.

5.12 Surface Water Sewer Diversion

5.12.1 The proposed site layout will require the diversion of the surface water sewer presently crossing the site, subject to consent from Southern Water. See Figures 3 and 4. The chamber levels and pipe size for the proposed diversion arrangement have been calculated. See Appendix C.

6. FOUL SEWERAGE

6.1 Sewer Plans obtained for the site are contained in Appendix D. The site would appear to have foul sewerage connections via the existing chalet bungalow, which appears to drain to the public foul sewer in Silverdale Road. The preferred option for draining foul sewage from the proposed redevelopment would be to connect to this existing public foul sewer. Existing foul sewerage at the site was examined during the site visit in November 2016.

6.2 The nearest point of connection into the public foul sewer is located within Silverdale Road, ~5 m south east of the site entrance, identified as Southern Water Chamber No. 9002 (See Appendix D). The cover level for this chamber is given as 83.31 m AOD. Site measurements of the chamber reveal the invert level to be 79.81 m AOD. In this case, it would be possible for foul sewerage from the redeveloped site to discharge to this chamber via a gravity fed connection, and a pumping station will not be required.

6.3 For a connection to be made from the redeveloped site to Chamber No. 9002, it is recommended that a capacity check is requested from Southern Water.

6.4 According to the WRc publication "Sewers for Adoption" (7th Edition), the design (peak) flow from the proposed redevelopment should be assumed to be 4000 l/dwelling/day. The proposed redevelopment includes a total of 18 units, therefore the foul sewage design flow for the site is calculated as 0.83 l/s.

7. SUMMARY & CONCLUSIONS

7.1 The site is a former coal yard located on the north side of Silverdale Road, Tunbridge Wells. It is proposed to redevelop the site for residential use, comprising 5 No. two-bed houses, 6 No. three-bed houses, 1 No. two-bed flat and 1 No. three-bed flat with gardens, access, parking and landscaping. The proposed redevelopment would result in a small increase in the impermeable area of the site.

7.2 According to the Environment Agency (EA) flood mapping, the site lies within Flood Zone 1 - low risk of flooding from fluvial sources. The nearest Flood Zones 2 and 3 lie more than 500 m distant to the east and northeast of the site. However, parts of the site appear to be at medium to high risk of surface water flooding. The proposed residential land use is appropriate for Flood Zone 1 and the Sequential Test is considered to be satisfied.

7.3 EA mapping shows the site to lie within a zone at medium to high risk of surface water flooding. Kent County Council has advised that there are no records of surface water flooding in the vicinity of the site.

7.4 The site was visited in October 2015 to undertake an initial assessment of existing drainage features at the site. Existing surface water drainage appears to drain only part of the site. Some pooling was noted towards the centre of the site.

7.5 The proposed redevelopment of the site would require installation of a new drainage system with the incorporation of Sustainable Drainage Systems (SuDS). The preferred SuDS surface water drainage solution for the site would be drainage to soakaway, however percolation testing undertaken at the site in November 2016 confirmed that infiltration rates were too low for soakaway drainage to be practicable at the site. Recommendations for site drainage features and design considerations for the redeveloped site are contained in the following section.

8 RECOMMENDATIONS

8.1 As soakaway is not feasible at this site, the proposed redevelopment would require installation of attenuation storage, with the peak discharge rate from the site limited to the assumed Greenfield runoff rate of 2 l/s.

8.2 The required attenuation storage for the site for the 1 in 100 year return event (plus a 40% allowance for climate change) is calculated as 79 m^3, see Appendix A: Figure 4. The attenuation storage would discharge to the existing surface water sewer at the site via a flow control chamber.

8.3 Additional SuDS options recommended for consideration as supplementary methods for attenuating surface water run-off and reducing peak discharge flows from the site include permeable paving, rainwater harvesting, and green roofs. The recommended principal drainage options for the site are contained within Appendix A: Figure 4. Suggested invert levels for the new chambers are given in Table 8.1 below. It should be noted that the invert levels of the existing sewer chamber 905D should be checked before the final setting out of the new chambers.

TABLE 8.1
SUGGESTED SURFACE WATER CHAMBER DETAILS

Chamber No./Description	Invert Level (+ m OD)	Cover Level (+ m OD)	Pipe size (mm dia)	Chamber type
Southern Water 905D	79.95*	81.85	900	Existing
SW1 (new chamber)	79.80*	GL	1200	B18
FC (flow control chamber)	80.70	GL	100	B23
SW2 (new chamber)	79.64*	GL	1200	B18
SW3 (new chamber)	79.60*	GL	1200	B19
SW4 (new chamber)	79.58*	GL	1200	B19
Southern Water 9051	79.34	81.90	900	Existing

* Subject to confirmation

8.4 An extreme pluvial event and overwhelming of the drainage system could result in pooling in the site to a depth of approximately 0.56 m before running off down the valley to the east. Topographic plans would suggest that this flood level would be approximately 81.5 m AOD. Although this event would be unlikely, it is recommended that finished floor levels are at least 300 mm above the potential flood level (81.8 m AOD), with flood resilient measures considered for inclusion within the design of the proposed accommodation, up to at least 300 mm above the finished floor levels.

8.5 The recommended option for the disposal of foul sewage from the proposed redevelopment would be to connect to the public foul sewer in Silverdale Road (chamber 9002). Inspection of the chamber on 10 November 2016 revealed the invert level to lie at a sufficient depth that a pumping station would not be required, and foul sewage can be discharged from the site via a gravity fed connection.

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APPENDIX A: FIGURES

Figure 1: Site Location Plan
Figure 2: Existing Topographic Site Plan and Trial Pit Locations
Figure 3: Proposed Site Layout
Figure 4: Drainage Options

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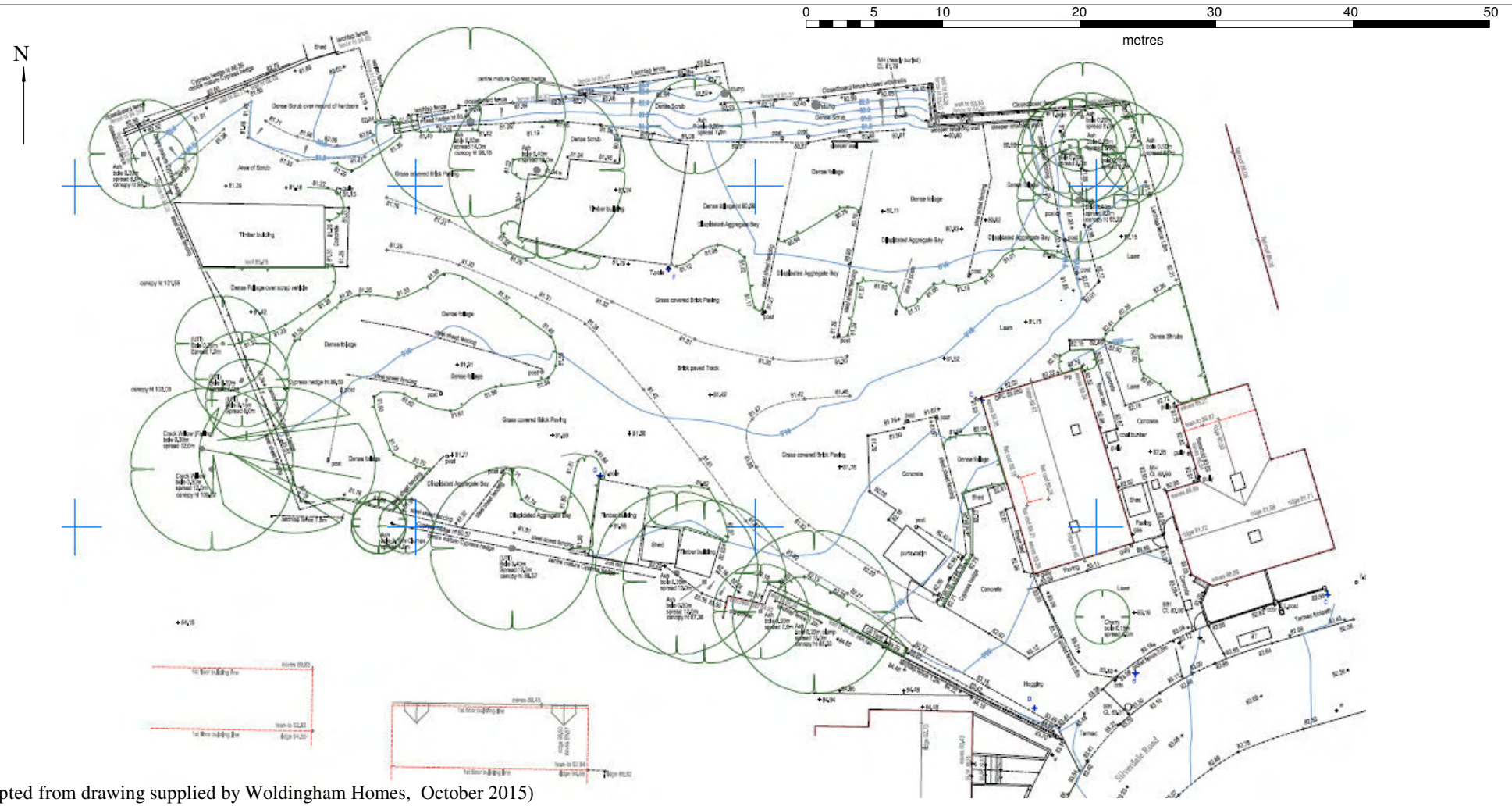
Scale 1:25000

FORMER COAL YARD, SILVERDALE ROAD,
TUNBRIDGE WELLS, KENT, TN4 9HX

Figure 1: Site Location

July 2016



(adapted from drawing supplied by Woldingham Homes, October 2015)

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FORMER COAL YARD, SILVERDALE ROAD,

TUNBRIDGE WELLS, KENT, TN4 9HX

Figure 2: Exisitng Topographic Site Plan

Scale as shown

July 2016

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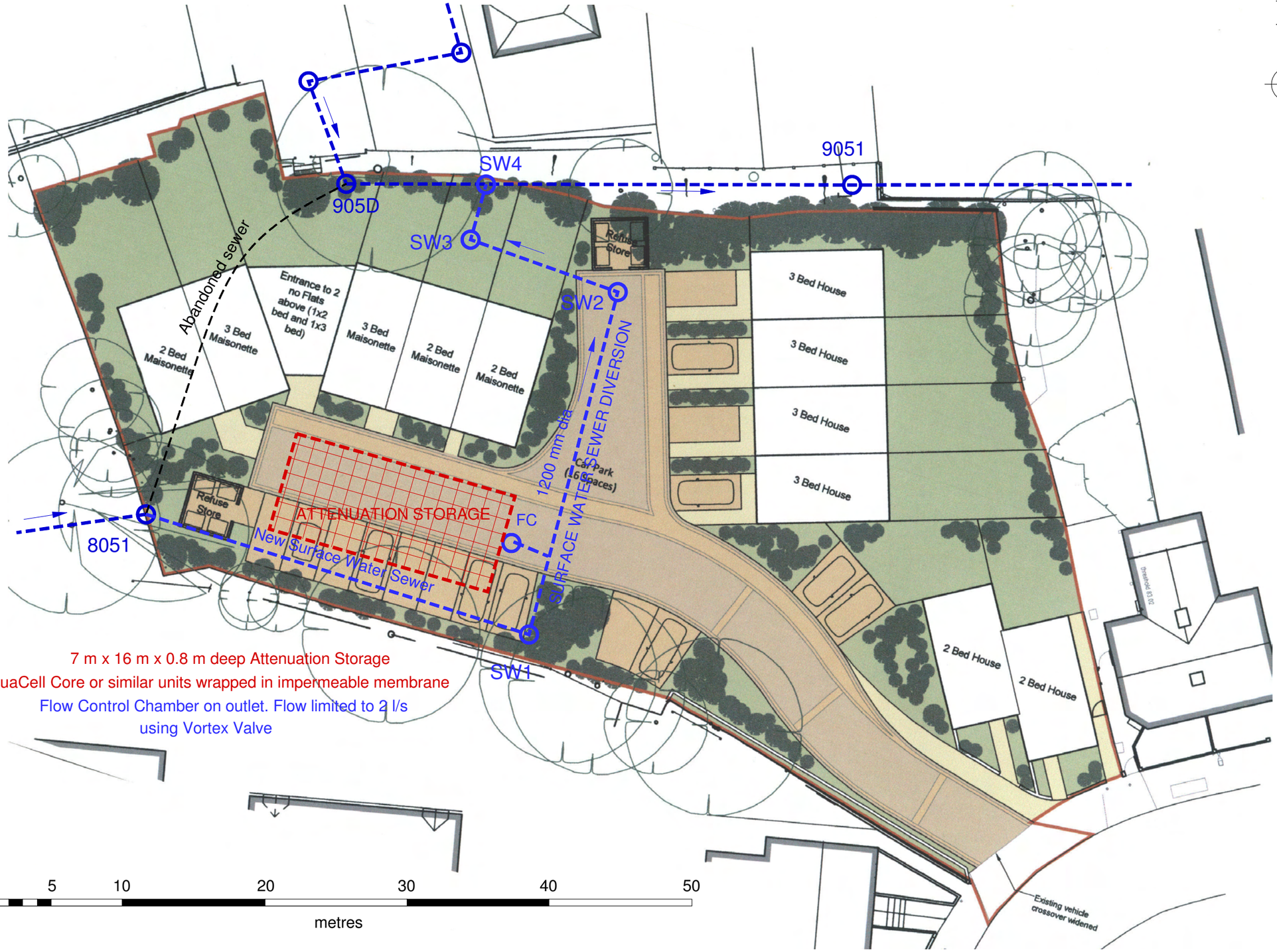
FORMER COAL YARD, SILVERDALE ROAD, TUNBRIDGE WELLS, KENT TN4 9HX

Figure 3: Proposed Site Layout

Scale as shown

April 2018



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FORMER COAL YARD, SILVERDALE ROAD, TUNBRIDGE WELLS, KENT TN4 9HX

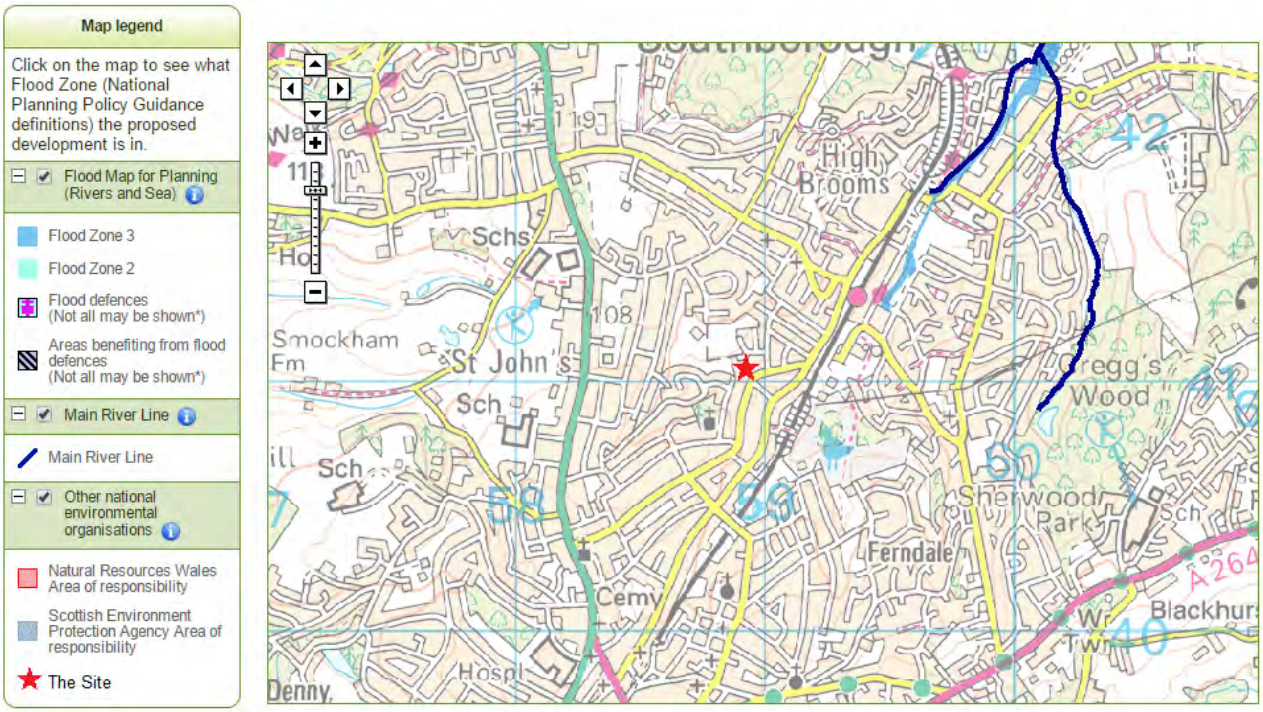
Figure 4: Drainage Options

Scale as shown

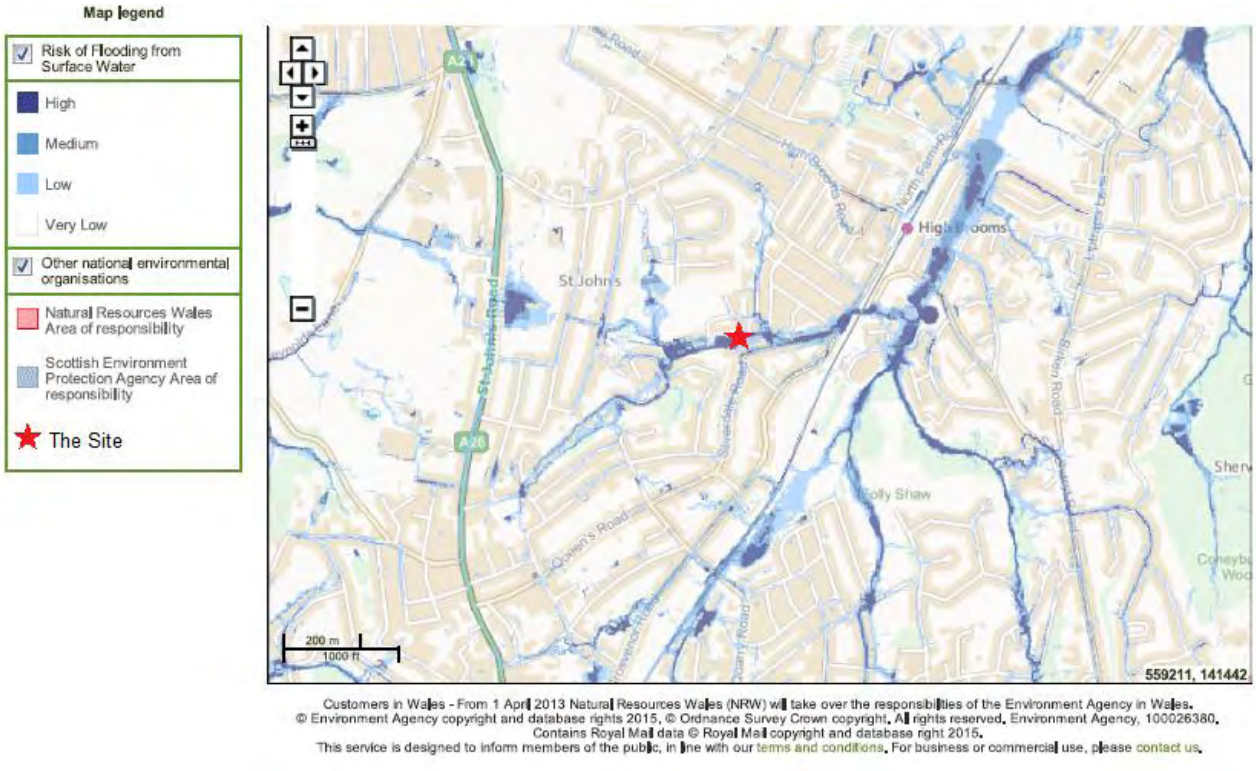
November 2018

APPENDIX B

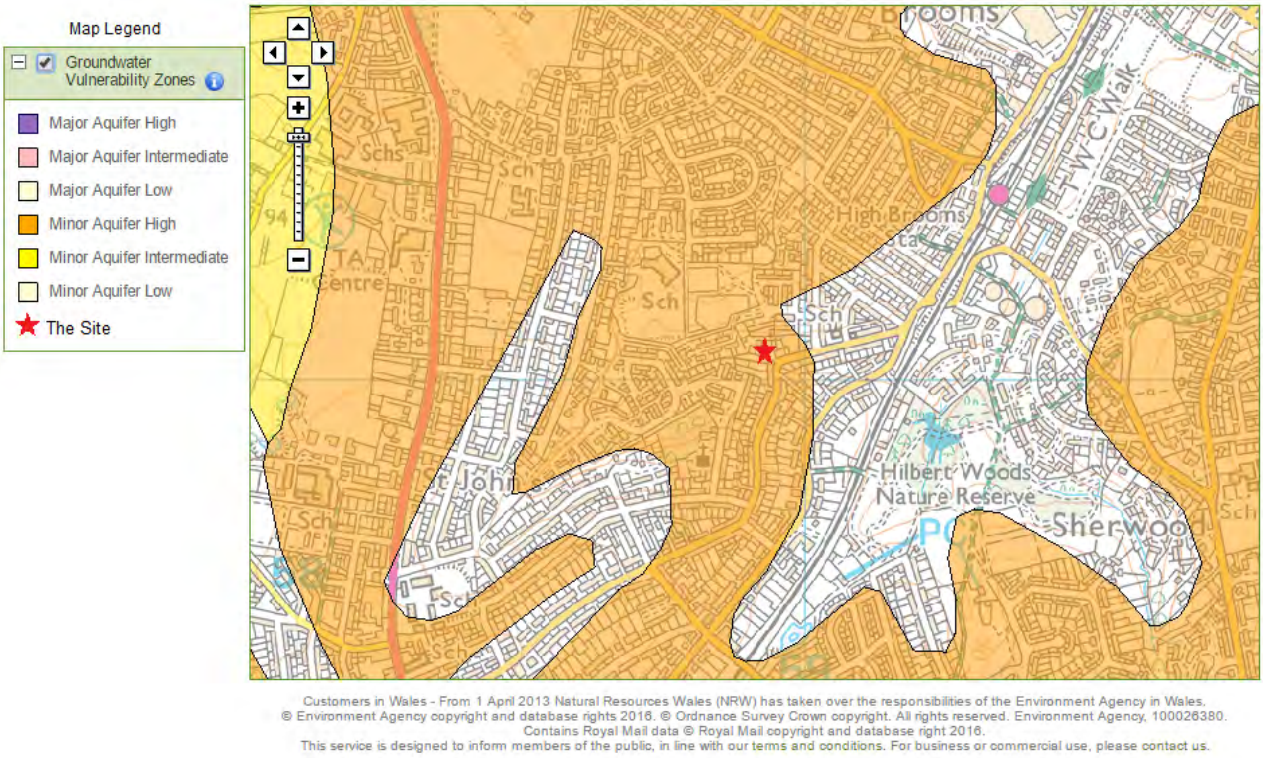
EA ONLINE MAP EXTRACTS



Flood Map for Planning (Rivers and Sea)



Risk of Flooding from Surface Water



Groundwater Vulnerability Zones

APPENDIX C

SURFACE WATER SEWER DIVERSION CALCULATIONS

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FORMER COAL YARD, 119-121, SILVERDALE ROAD
TUNBRIDGE WELLS
KENT, TN4 9HX

Surface Water Sewer Diversion Capacity

August 2018

1. BACKGROUND, EXISTING SITE & PROPOSED REDEVELOPMENT

1.1 The site comprises a former coal yard, located on the north side of Silverdale Road. The site includes the existing chalet bungalow (No. 121 Silverdale Road) plus a number of dilapidated outbuildings/garages. The site lies some 2 km NNE of the centre of the town of Tunbridge Wells, Kent.

1.2 The site area is approximately 0.17 ha. The Ordnance Survey (OS) map reference for the site is TQ 5892 4107. The site elevation is approximately +81 m OD.

1.3 The proposed redevelopment layout will require the diversion of the existing surface water sewer beneath the west end of the site between chambers 8051 and 9051. See Drawing No. A4457-1500 (attached) for details.

2. SEWER CAPACITY

2.1 The proposed diversion will increase the length of the sewer compared with the existing and introduce two 90^{o} bends compared with the existing single 114^{o} bend at chamber 905D, although the sharpness of the bend at chamber 8051 will be lessened to 151^{o}, compared with the existing 119^{o}.

2.2 The existing capacity of the sewer is uncertain, and an estimate of the capacity can only be based on the existing sections of the sewer in the vicinity of the proposed diversion. It will be necessary to demonstrate that the proposed diversion does not result in a reduction in the capacity of the sewer as existing.

2.3 Capacity can be calculated from the existing sewer diameter and fall of the existing sewer between chambers. The information regarding the existing sewer was obtained from Southern Water and does not provide invert level data for all of the chambers in the vicinity of the site. See Table 2.1 below:

TABLE 2.1

Chamber No,	Distance between chambers (m)	Invert level (+m OD)	Sewer diameter (mm)
7059		Not known	
	62.36		900
8050		80.701	
	33.01		900
8051		80.335	
	25.68		900
905D		Not known	
	32.10		900
9051		79.341	
	55.02		900
9052		Not known	
	48.60		600
005D		Not known	

2.4 From the above, the capacity of the sewer between chambers 8050 - 8051, and 8051 - 9051 may be calculated:

2.5 Assuming a roughness (k) for the existing pipes of 3 mm (to allow for deterioration, deposition and rough internal joints), the minimum capacity, which can be calculated, occurs on the 8050 - 8051 section (hydraulic gradient 1.35%).

Capacity = 1.8 m^3/s, with a velocity of 2.83 m/s.

2.6 For the proposed sewer diversion, the hydraulic gradient would be fall of 0.553 m/pipe route distance 0f 55.29 m, however, this will be further reduced by head losses at the 90^o bends. It will be necessary to use a larger diameter pipe.

A 1200 mm diameter pipe with a flow of 1.8 m^3/s would give a velocity (V) of 1.59 m/s. The head losses at the two 90^o bends will be:

$\frac{2 \times kV^2}{2g}$ For a 90^o short bend, constant k = 1

Head loss in the bends will be 0.258 m. This will reduce the effective hydraulic gradient of the diversion to (0.553 - 0.258)/55.29 = 0.53%.

Capacity of the 1200 mm diameter pipe in the sewer diversion will be 2.5 m^3/s (> 1.8 m^3/s).

Note: a 1000 mm diameter pipe on the line of the proposed sewer diversion will only provide a capacity of 0.8 m^3/s, due to increased head loss in the 90^o bends at the resultant higher velocity.

3. SUMMARY & CONCLUSIONS

3.1 The pipe diversion route, as given in Drawing No. A4457-1500 will require a pipe diameter of 1200 mm to avoid causing a risk of a reduction in capacity within the surface water sewer.

3.2 In all cases, pipe inverts should be continuous throughout the sewer, although crown heights may vary.

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APPENDIX A

Drawing No. A4457-1500

APPENDIX D

SOUTHERN WATER SEWER PLANS

Environmental Assessment Services Ltd
London Road
Hickstead
Haywards Heath
West Sussex
RH17 5LZ

Your Ref	WH/Broardlands/SilverDale/FR&DA
Our Ref	203059
Date	28 September 2015
Contact	searches@southernwater.co.uk Fax 01634 844514 DX:400450 Chatham 5

Attention: Hannah Biggs

Dear Sirs

Provision of Public Sewer Main Record Extracts – VAT Receipt
123 Silverdale Road, Tunbridge Wells, Kent, TN4 9HX

Further to your recent enquiry regarding the provision of Southern Water apparatus record extracts for the above location.

Please be aware that there are areas within our region in which there are neither sewers nor water mains. Similarly, whilst the enclosed extract may indicate the approximate location of our apparatus in the area of interest, it should not be relied upon as showing that further infrastructure does not exist and may subsequently be found following site investigation. Therefore actual positions of the disclosed (and any undisclosed) infrastructure should be determined on site, because Southern Water does not accept any responsibility for inaccuracy or omission regarding the enclosed plan and accordingly it should not be considered to be a definitive document.

I confirm payment of the appropriate fee in the sum of £ **49.92**

The breakdown of costs is as follows: -

- Provision of record extracts £ 41.60
- VAT @ 20.0% £ 8.32

VAT Registration Number 813 0378 56

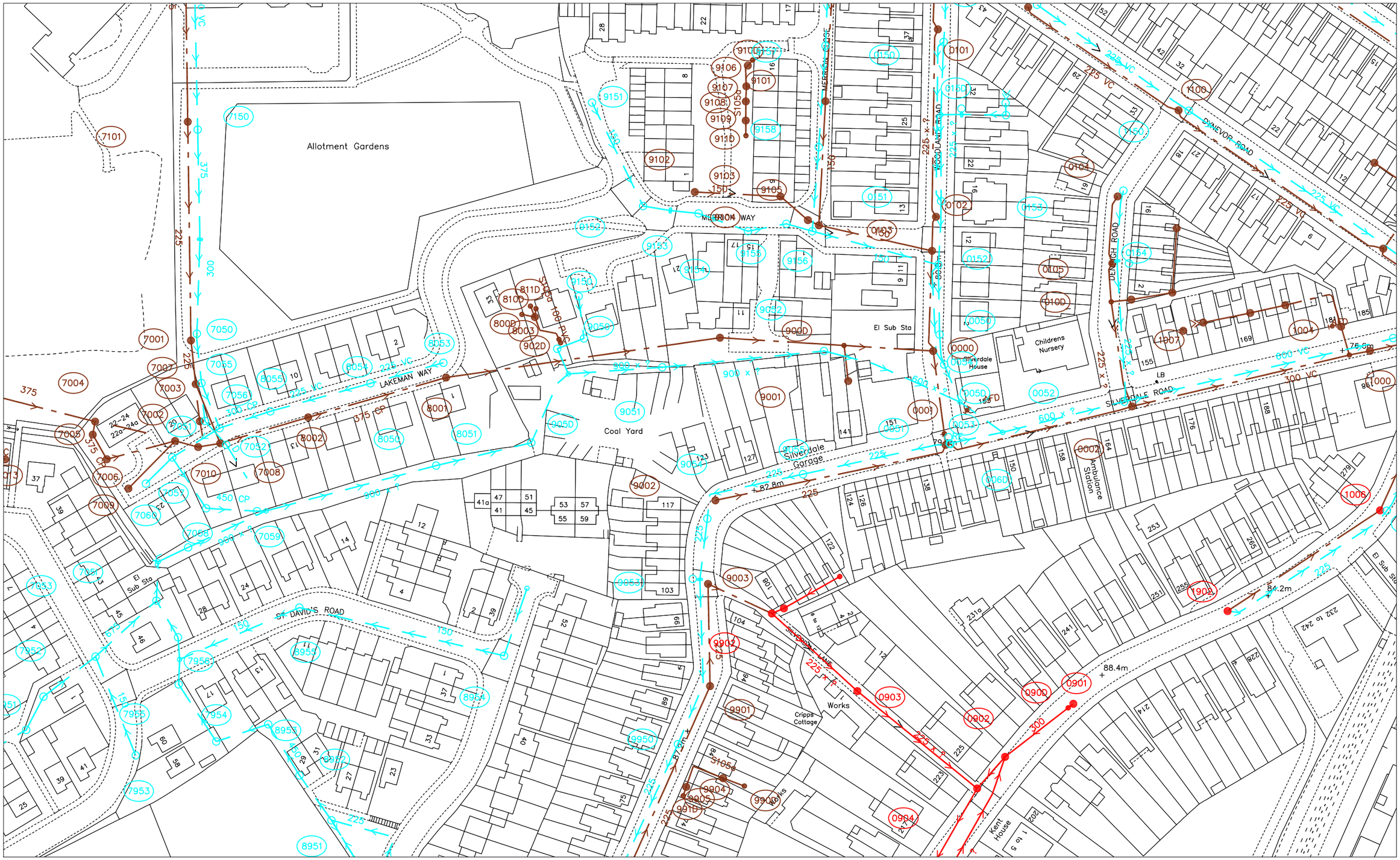
Should you require any additional information regarding this matter please contact this office at the address given at the foot of this letter.

Yours faithfully

Land Search Department

SEWER RECORDS PAGE 1 OF 2

141203



140915

558712

559183

O.S. REF. TQ5841SE	Drawn by: spaceyk	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 determnined on site. WARNING: BAC pipes are constructed of Bonded Asbestos Cement WARNING: Unknown (UNK) materials may Include Bonded Asbestos Cement	N
	Scale: 1:1250		Southern Water
Title: 203059_123 Silverdale Road	Date: 28/09/2015	Based upon Ordnance Survey Digital Data with the permission of the controller of H.M.S.O. Crown Copyright Reserved Licence No. WU 298530.	

SEWER RECORDS PAGE 2 OF 2

Node	Cover	Invert	Size	Material	Shape	
0000X	78.644		300	UNK	UNK	
0001X	79.141		225	UNK	CIRC	
0002Y	76.862	75.162	300	VC	CIRC	
0004X			UNK	VC	CIRC	
000DX			300	UNK	UNK	
0050X	78.592	77.076	225	UNK	UNK	
0052X	76.953		600	VC	CIRC	
0053X	78.524	76.45	225	UNK	UNK	*
0053Y	78.524		300	UNK	UNK	*
0054X	78.462	76.322	225	UNK	UNK	
005DX			225	UNK	UNK	
006DX			600	UNK	UNK	
0101X	90.627	86.627	225	UNK	UNK	
0102X	82.779	79.199	225	UNK	UNK	
0103X	81.725		225	UNK	UNK	
0104X	83.518	79.518	225	UNK	UNK	
0105X	80.879		225	UNK	UNK	
0106X			UNK	UNK	CIRC	
010DX			225	VC	UNK	
0150X	89.605	87.455	225	UNK	UNK	*
0150Y	89.605	88.366	300	VC	CIRC	*
0151X	83.081	80.861	375	CO	CIRC	
0152Y	80.976		300	VC	CIRC	*
0152X	80.976	79.276	225	UNK	UNK	*
0153X	83.321	81.161	225	UNK	UNK	
0155X			UNK	UNK	CIRC	
0157X			UNK	UNK	CIRC	
015DX			225	UNK	UNK	
015ZX			UNK	UNK	CIRC	
016ZX			225	UNK	UNK	
0203X	92.655	88.955	225	VC	CIRC	
0253X	92.417	90.057	225	VC	CIRC	
0901X	89.182	81.772	300	UNK	CIRC	
0902X	90.892	88.092	300	UNK	UNK	
0903X	90.107	88.782	225	UNK	UNK	
0904X	91.377	81.337	300	UNK	UNK	
090DX			300	UNK	CIRC	
1000Y	76.59	74.71	300	VC	CIRC	
1003X			UNK	UNK	CIRC	
1004X			UNK	UNK	CIRC	
1005X			UNK	UNK	CIRC	
1006X	81.175	77.465	225	UNK	UNK	
100DX			300	VC	CIRC	
1050X	76.742		600	VC	UNK	
1051X	81.026	78.816	225	UNK	UNK	
1100Y	88.194		225	VC	CIRC	
1101X	78.297		225	VC	CIRC	
1104X			UNK	UNK	CIRC	
1107X			150	UNK	CIRC	
1108X			UNK	UNK	CIRC	
1109X			UNK	UNK	CIRC	
1150X	88	85.75	225	VC	CIRC	
1902X	84.848	82.688	225	UNK	CIRC	*
1902Y	84.848	81.158	125	UNK	CIRC	*
7001X	88.022	85.212	225	UNK	CIRC	
7002X	84.44	80.29	375	CP	CIRC	
7004X	85.15	81.85	375	CP	CIRC	
7005X	84.3	81.765	375	CP	CIRC	
7006X	84.14	81.59	375	CP	CIRC	
7007X	85	83.5	375	CP	CIRC	
7008X	84.41	79.64	375	CP	CIRC	
7009X	84.09	80.47	225	VC	CIRC	
7010X	84.34	79.79	375	CP	CIRC	
7050X	88.022	85.37	300	UNK	CIRC	
7053X			675	UNK	CIRC	
7054X	83.87		900	UNK	UNK	
7055X	85	83.8	450	CP	CIRC	
7056X	84.39	82.85	225	VC	CIRC	
7057X	84.23	82.688	450	CP	CIRC	
7058X	83.5	82.57	450	CP	CIRC	
7059X	83		450	CP	CIRC	
705DX			900	UNK	UNK	
705IX	84.344	83.224	UNK	UNK	CIRC	
7060X	84.1	82.95	225	VC	CIRC	
7101X	93.781	91.141	225	UNK	CIRC	
7150X	93.419	90.919	375	UNK	CIRC	
715ZX			300	UNK	CIRC	
7950X	87.599	84.709	675	UNK	CIRC	
7951X	87.21	84.32	675	UNK	CIRC	
7952X	86.219		675	UNK	CIRC	
7953X	87.32	85.89	150	UNK	CIRC	
7954X	89.34	87.642	450	UNK	CIRC	
7955X	87.496	85.676	450	UNK	CIRC	
7956X	87.113	84.513	450	UNK	CIRC	
795DX			450	UNK	CIRC	
8001X	84.92		UNK	UNK	CIRC	
8002X	84.73	79.01	375	CP	CIRC	
8003X			100	PVC	CIRC	
800DX			100	PVC	CIRC	
8050X	82.191	80.781	900	UNK	UNK	
8051X	81.845	80.335	900	UNK	UNK	
8052X	82.879	81.109	150	UNK	CIRC	
8053X	84.89	83.42	225	VC	CIRC	
8054X	84.52	83.25	225	VC	CIRC	
8055X	84.59	83.07	300	CP	CIRC	
805DX			150	UNK	CIRC	
806DX			900	UNK	UNK	
810DX			100	PVC	CIRC	
811DX			100	PVC	CIRC	
8951X	92.973	91.873	450	UNK	CIRC	
8952X	91.645	89.645	450	UNK	CIRC	
8953X	90.111	88.351	450	UNK	CIRC	
8954X	91.204		150	UNK	CIRC	
8955X	88.829	87.209	150	UNK	CIRC	
9001X			UNK	UNK	CIRC	
9002X			225	UNK	CIRC	
9003X			225	BRC	CIRC	
9004X			UNK	UNK	CIRC	
900DX			UNK	UNK	CIRC	
901DX			UNK	UNK	CIRC	
9050X	85.754	83.824	150	UNK	CIRC	
9051X	81.891	79.341	900	UNK	UNK	
9052X	81.731		600	UNK	UNK	
9054X	82.26	81.05	225	UNK	CIRC	
9055X	81.131	79.151	225	UNK	CIRC	
905DX			900	UNK	UNK	
905ZY			225	UNK	CIRC	
9101X	83.43	82.25	150	UNK	CIRC	
9102X	88.039	87.129	150	UNK	CIRC	
9103X	84.638	83.608	150	UNK	CIRC	
9104X	82.47	80.76	150	UNK	CIRC	
9105X	82.171		150	UNK	CIRC	
9106X			UNK	UNK	CIRC	
9107X			UNK	UNK	CIRC	
9108X			UNK	UNK	CIRC	
9109X			UNK	UNK	CIRC	
910DX			UNK	UNK	CIRC	
9150X	86.72	86.17	150	UNK	CIRC	
9151X	89.518	88.148	150	UNK	CIRC	
9152X	88.558	87.188	150	UNK	CIRC	
9153X	87.089		150	UNK	CIRC	
9154X	85.187	83.677	150	UNK	CIRC	
9155X	83.762	82.232	150	UNK	CIRC	
9156X	82.254		150	UNK	CIRC	
9157X	85.583	83.753	150	UNK	CIRC	
9158X	82.779	81.559	150	UNK	CIRC	
915ZX			100	UNK	CIRC	
9901X	86.33	84.12	225	UNK	CIRC	
9902X	85.847		225	UNK	UNK	
9903X			UNK	UNK	CIRC	
9904X			UNK	UNK	CIRC	
9905X			UNK	UNK	CIRC	
990DX			UNK	UNK	CIRC	
9950X	86.646	85.25	225	UNK	CIRC	

Node	Cover	Invert	Size	Material	Shape

LINE STYLES / COLOURS

- Brown — Foul
- Foul Syphon Sewer
- Foul Vacuum Main
- Foul Rising Main
- Red — Combined
- Combined Syphon Sewer
- Combined Rising Main
- Lateral Drain
- Orange — Building Over Agreement Area
- Dark Blue — Treated Effluent
- Purple — Sludge
- Sewer Catchment
- Section 104 Area
- Light Blue — Surface Water
- Surface Water Rising Main
- Yellow — Private
- Green — Access Shaft
- Decommissioned

MATERIALS

AK	Alkathene
BAC	Bonded Asbestos Cement
BRC	Brick (Common)
BRE	Brick (Engineering)
CC	Concrete Box Culvert
CI	Cast Iron
CO	Concrete (In-Situ)
CP	Concrete (Pre-Cast)
CSB	Concrete Segments (bolted)
CSU	Concrete Segments (unbolted)
DI	Ductile Iron
GRC	Glass Reinforced Concrete
GRP	Glass Reinforced Plastic
MAC	Masonry in regular Courses
MAR	Masonry in random Courses
PE	Polyethylene
PF	Pitch Fibre
PP	Polypropylene
PVC	Polyvinyl Chloride
RPM	Reinforced Plastic Matrix
SI	Spun Iron
ST	Steel
VC	Vitrified Clay
XXX	Other
ZZZ	Unknown

LEGEND - SEWERS

- Manhole (SW)
- Manhole (F&C)
- Lamp hole (SW)
- Lamp hole (F&C)
- Pumping Station (SW)
- Pumping Station (F&C)
- Side entry manhole (SW)
- Side entry Manhole (F&C)
- Blind shaft (SW)
- Blind shaft (F&C)
- Ejector station (SW)
- Ejector station (F&C)
- Watertight door (SW)
- Watertight door (F&C)
- Flushing ch. Mn-e (SW)
- Flushing ch. Mn-e (F&C)
- Flushing ch. No-e (SW)
- Flushing ch. No-e (F&C)
- Demarcation Chamber
- Washout (SW)
- Washout (F&C)
- Rodding Eye (SW)
- Rodding Eye (F&C)
- Gauging point (SW)
- Gauging point (F&C)
- Intercept chamber (SW)
- Intercept chamber (F&C)
- Storm Tank (SW)
- Storm Tank (F&C)
- Vortex chamber (SW)
- Vortex chamber (F&C)
- Label ellipse
- Dummy/S24 manhole
- Outfall
- Penstock chamber
- Damboards
- Storm Overflow
- Backdrop manhole
- Other (s)
- Other
- Change in sewer (s)
- Change in sewer
- Reflux valve
- Flap valve
- Cascade
- Anode
- Valve
- Closed Valve
- Air Valve
- Hatch box (SW)
- Hatch box (F&C)
- Direction arrow
- Emptying valve
- Catchpit
- Soakaway
- Inlet
- Balancing Pond
- Wastewater treatment works
- Marine treatment works
- Outfall headworks
- Vent
- Vent column
- Tidal storage tank
- Blank end
- Head of Public Sewer
- Micro Pumping Station

SHAPES (S)

A	Arched	R	Rectangular
B	Barrel	S	Square
C	Circular	T	Trapezoidal
E	Egg	U	U Shape
H	Horseshoe	X	Other

NODE REFERENCING SYSTEM

- 1st digit: hundred metre easting identifier
- 2nd digit: hundred metre northing identifier
- 3rd digit: sewer type identifier
  - 0-4 = Foul/Combined
  - 5-9 = Surface Water
- 4th digit: next sequential node

Drawn by:	spaceyk
Title:	203059_123 Silverdale Road
Date:	28/09/2015

Southern Water

APPENDIX E

TRIAL PIT LOGS

Environmental Assessment Services Limited

Site: Silverdale Road, Tunbridge Wells

Date: 10 Nov. 2016

Standpipe	Sampling: Type	Sampling: Depths From	Sampling: Depths To	Strata: Legend	Strata: Depth bgl	Strata: Strata Description
						Topsoil with roots.
					0.2 m	MADE GROUND including soil, pieces of brick, concrete, metal pipe and plastic pipe, sand and gravel.
					0.7 m	MADE GROUND comprising weak concrete on hardcore.
					0.8 m	Slightly silty, soft, grey CLAY.
					1.03 m	
					1.8 m	END

Remarks:
Groundwater encountered @ 1.03 m

Method	Trial Pit
Dimensions Dia	
Made by	AK
Borehole or Trial Pit No.	TP1
Job No.	Woldingham/SilverdaleRoad/Percolation

Environmental Assessment Services Limited

Site: Silverdale Road, Tunbridge Wells

Date: 10 Nov. 2016

Standpipe	Sampling: Type	Sampling: Depths From	Sampling: Depths To	Strata: Legend	Strata: Depth bgl	Strata: R L	Strata: Strata Description
							MADE GROUND comprising tarmac and weak concrete.
					0.3 m		MADE GROUND including soil, pieces of brick, concrete and steel, coal and gravel.
					1.1 m		Light grey, silty CLAY
					1.2 m		Soft, dark grey CLAY
					1.9 m		END

Remarks

Method	Trial Pit
Dimensions Dia	
Made by	AK
Borehole or Trial Pit No.	TP2
Job No.	Woldingham/SilverdaleRoad/Percolation

Environmental Assessment Services Limited

Site: Silverdale Road, Tunbridge Wells

Date: 10 Nov. 2016

Standpipe	Sampling: Type	Sampling: Depths From	Sampling: Depths To	Strata: Legend	Strata: Depth bgl	Strata: Strata Description
					0.12 m	MADE GROUND comprising brick paving and topsoil.
						MADE GROUND with pieces of brick.
					0.43 m	Stiff to hard, silty, green/grey/orange CLAY with pieces of sandstone.
					0.83 m	END

Remarks

Method	Trial Pit
Dimensions Dia	
Made by	AK
Borehole or Trial Pit No.	TP3

Job No. Woldingham/SilverdaleRoad/Percolation

Environmental Assessment Services Limited

Site:

Date:

Standpipe	Sampling: Type	Sampling: Depths From	Sampling: Depths To	Strata: Legend	Strata: Depth bgl	Strata: R L	Strata: Strata Description

Remarks

Method	
Dimensions Dia	
Made by	
Borehole or Trial Pit No.	

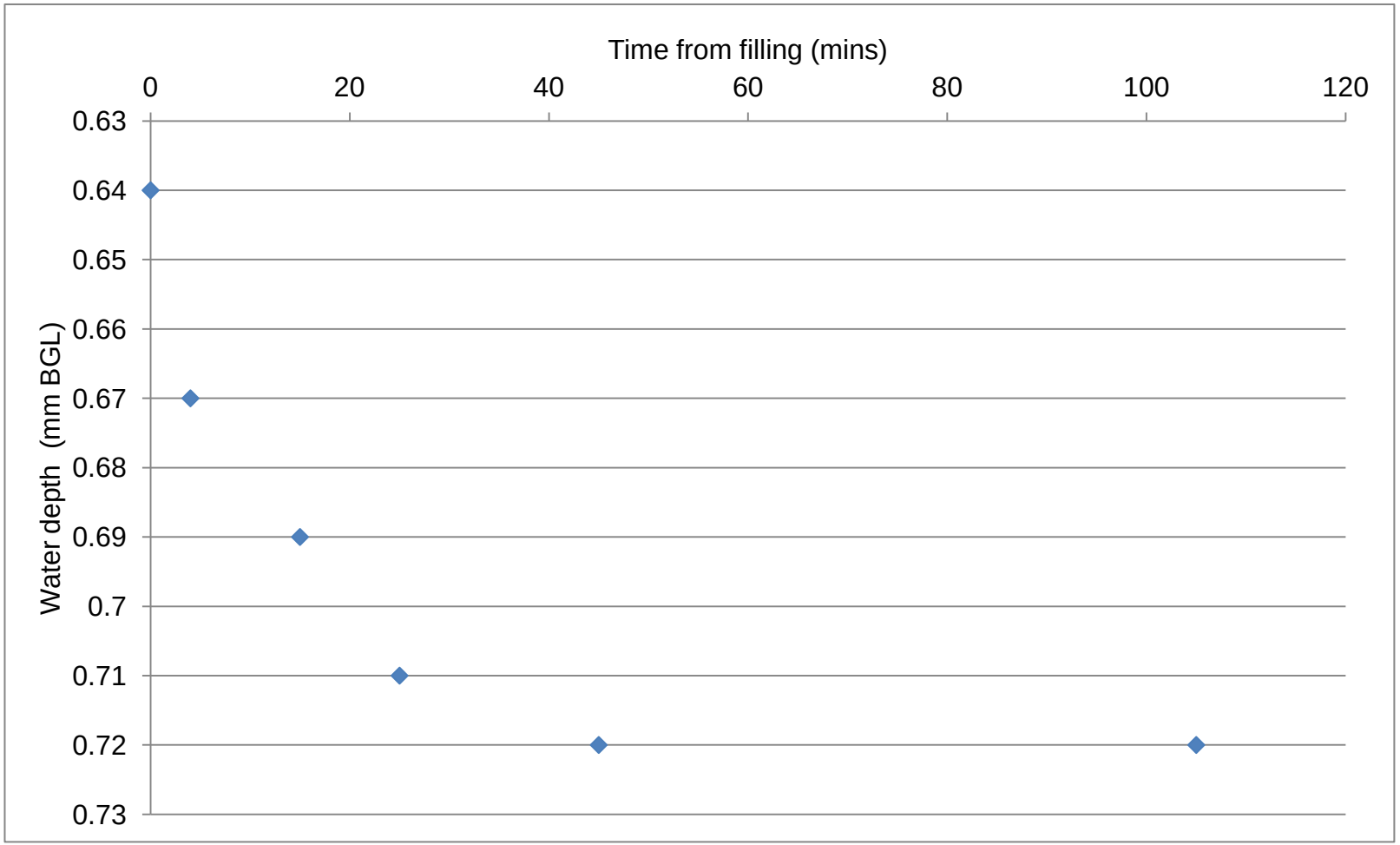
Job No.

APPENDIX F

PERCOLATION TESTING RESULTS

TP2	
Length (m)	1.3
Width (m)	0.5
Depth (m)	1.9
Volume (cubic m)	1.235

Depth (m BGL)	Time (hh:mm)	Time from filling (mins)
0.64	12:00	0
0.67	12:06	4
0.69	12:15	15
0.71	12:25	25
0.72	12:45	45
0.72	13:45	105



APPENDIX G

HR WALLINGFORD CALCULATIONS (GREENFIELD RUNOFF RATE AND REQUIRED STORAGE VOLUMES)

HR Wallingford
Working with water

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Malcolm McKemey
Site name:	119 - 121 Silveradale Road
Site location:	Tunbridge Wells

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the drainage scheme.

Site coordinates

Latitude:	51.14661° N
Longitude:	0.27067° E

Reference:	6488464
Date:	2018-11-05T11:32:16

Methodology	IH124

Site characteristics

Total site area (ha)	0.17
Significant public open space (ha)	0
Area positively drained (ha)	0.17
Pervious area contribution (%)	30
Impermeable area (ha)	0.1
Percentage of drained area that is impermeable (%)	59
Impervious area drained via infiltration (ha)	0
Return period for infiltration system design (year)	100
Impervious area drained to rainwater harvesting systems (ha)	0
Return period for rainwater harvesting system design (year)	100
Compliance factor for rainwater harvesting system design (%)	66
Net site area for storage volume design (ha)	0.17
Net impermeable area for storage volume design (ha)	0.11

* Where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50 % of the 'area positively drained', the 'net site area' and the estimates of Qbar and other flow rates will have been reduced accordingly.

Design criteria

Volume control approach	Use long term storage

	Default	Edited
Climate change allowance factor	1.4	1.4
Urban creep allowance factor	1.1	1.1
Interception rainfall depth (mm)	5	5
Minimum flow rate (l/s)	2	2

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
Qbar total site area (l/s)	0.93	--
SOIL type	4	4
HOST class	N/A	N/A
SPR	0.47	0.47

Hydrology

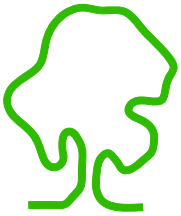
	Default	Edited
SAAR (mm)	780	780
M5-60 Rainfall Depth (mm)	20	20
'r' Ratio M5-60/M5-2 day	0.3	0.3
Rainfall 100 yrs 6 hrs	70	
Rainfall 100 yrs 12 hrs	99.12	
FEH/FSR conversion factor	1.18	1.18
Hydrological region	7	
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 10 year	1.62	1.62
Growth curve factor: 30 year	2.3	2.13
Growth curve factor: 100 year	3.19	3.19

Site discharge rates

	Default	Edited
Qbar total site area (l/s)	0.93	0.93
Qbar net site area (l/s)	0.93	0.93
1 in 1 year (l/s)	2	2
1 in 30 years (l/s)	2.1	2
1 in 100 years (l/s)	3	3

Estimated storage volumes

	Default	Edited
Interception storage (m^3)	4	4
Attenuation storage (m^3)	59	75
Long term storage (m^3)	0	0
Treatment storage (m^3)	12	12
Total storage *(excluding treatment)* (m^3)	63	79



eas ltd
Environmental Assessment Services Ltd
London Road, Hickstead, Haywards Heath, West Sussex RH17 5LZ UK
Phone : +44 (0) 1444 882 552 Fax : +44 (0) 1444 882 553
email : info@easltd.co.uk web site : www.easltd.co.uk