# Drainage Statement

| | |
|---|---|
| ***Site:*** | ***Land off Wildfell Close, Walderslade Woods, Kent ME5 9RU*** |
| Developer: | Gen$^2$ Property Limited |
| Prepared by: | DHA Environment<br>Eclipse House<br>Eclipse Park<br>Sittingbourne Road<br>Maidstone ME14 3EN |
| Date: | 1st August 2017 |

## 1.1 Introduction

1.1.1 DHA Environment have been engaged by Gen$^2$ Property Limited to prepare a statement relating to surface water drainage to accompany a detailed planning application for the provision of 12 residential dwellings on land off Wildfell Close Walderslade Woods Kent.

1.1.2 The detailed planning application reference 15/507909/Full was originally submitted in November 2015 to which KCC in their role as Lead Local Flood Authority raised a holding objection based on insufficient detail relating to the disposal of surface water. The purpose of this report is to demonstrate a suitable method for the disposal of surface water and remove KCC's objection.

## 1.2 Summary of existing development

<u>Location</u>

1.2.1 The site is located on land off Wildfell Close, Walderslade Woods, Kent and is centred on approximate grid reference 576987, 161730. The site occupies an area of 0.32 hectares and currently consists entirely of greenspace/woodland.

<u>Existing Site</u>

1.2.2 A topographical survey of the site is shown on drawings 9486/TS/01 contained within **Appendix 1**. The area of the site to be developed site is generally rectangular in shape and falls from a high point of 163.0m AOD in the South East corner to a low point of 162.1m AOD in the North West corner. The site has the following boundary conditions:

- South – Walderslade Woods Road, elevated 4m above the site.
- East – Wildfell Close with Beechen Hall Beyond.
- North East –Residential development off Sandstone Rise.
- North – Woodland falling away from the site.
- West – Woodland, elevated 3m above the development area.

Existing Drainage

1.2.3 Based on the existing topography, the site can be seen to drain overland from South to North with any runoff soaking into the ground.

1.2.4 Southern Water asset plans are shown in **Appendix 2** and indicate the location of public foul and surface water sewers in the area. These records do not indicate any private drainage that may be present.

1.2.5 In October 2011 the ownership of any private sewer serving more than one property was automatically transferred to the Water Authority, although many of these sewers are yet to be recorded on the asset plans. Known existing drainage can be summarised as follows.

***Surface Water***

1.2.6 Southern Water asset plans show there to be no public surface water sewers within the development site or surrounding area.

***Foul Water***

1.2.7 Southern Water asset plans show there to be no public foul sewers within the development site.

1.2.8 Southern Water asset plans show there to be a 150mm diameter sewer running South to North along Sandstone Rise.

Geology and Hydrogeology

1.2.9 Site specific investigation was initially carried by CET Infrastructure on the 20th June 2017. Four number trial pits were excavated at depths between 0.6 and 2.7m below ground. These trial pits showed the ground conditions to comprise of stiff gravelly clay with a high cobble content of flint. Soakage testing was carried out in all four trial pits to BRE 365 and provided Infiltration rates of between $2.1 \times 10^{-7}$ and $8.1 \times 10^{-7}$ m/s.

1.2.10 Given the very low infiltration rates achieved, it was recommended that the use of porous paving and traditional shallow soakaways would not be suitable as the method for the disposal of surface water. The report also recommended that further investigation should be carried out at depth, within the Nodular Chalk Formation in the form of cable percussion boreholes. A copy of the Site investigation is included in **Appendix 3.0**.

1.2.11 Based on the recommendations a single borehole soakaway was drilled, tested and installed on the 27th July 2017 by CET Infrastructure. The boreholes encountered strata described as “brown clay with small to large flints” considered most likely to be Clay-with-Flints beneath a mantle of topsoil and extending to a depth of 9.2m below ground level. Chalk described as “clean white chalk” was penetrated from the base of the Clay-with-Flints to a depth of 20m at which the borehole was terminated.

1.2.12 The borehole was tested by pumping nominally 1000 litres of water into the borehole for 8 minutes and 10 seconds and subsequently monitoring the fall in head of the water in the borehole. Pumping water into the borehole at a rate of approximately 2 litres/second only raised the water level to about 14m below ground level. By extrapolating the driving head to a depth of say 4m, the typical depth of a soakaway chamber, this would equate to an unfactored soakage rate of about 5 litres/second. A factor of safety of 2 was applied to the test rate which in this case would give a design rate of 2.5l/s.

1.2.13 Following testing, the borehole was installed with a 150mm diameter soakaway liner with the bottom 6m perforated and surrounded by pea gravel. The pea gravel from 20m to 10m bgl. Bentonite was placed around the plain pipe from 10m bgl to ground level. A copy of the site investigation is included in **Appendix 3.0.**

1.2.14 Groundwater was not found during the site investigation. Reference has been made to borehole records from the BGS website to ascertain levels of ground water in the area. The nearest borehole is located on Westfield Sole Road approximately 480m to the South East of the proposed site. This borehole encountered groundwater at a level of 48m below ground (127m AOD which can be seen to be 15m below the bottom of the soakaway.

## 1.3 Proposed Development

1.3.1 The proposals consist of the provision of up to 12 residential development units and associated roads and hardstanding on greenfield site located off Wildfell Close, Walderslade Woods, Kent. The proposed masterplan is indicated on drawing 07.10.2 contained in **Appendix 4.0**.

<u>Proposed Surface Water Drainage Strategy</u>

1.3.2 The proposed site has an overall area of 0.32 hectares of which 0.151 hectares will comprise of roads roofs and hardstanding. The remaining part of the site will comprise of gardens and communal green space. The proposed contributing areas are shown on drawing 9484/D/01 contained in **Appendix 5**.

1.3.3 The principles of the proposed drainage are shown on drawing 9486/D/02 contained in **Appendix 5**. Sustainable Urban Drainage (SUDs) techniques will be used to deal with the surface water drainage generated by the development. This will replicate the existing drainage regime by dealing with the surface water at source, so as not to increase the risk of downstream flooding.

1.3.4 The surface water is to drain to a network of surface water sewers via gullies, rainwater pipes and channel drains before discharging into a new cellular attenuation tank located in the communal area of open space. Catchpit manholes will be provided to intercept any silt before discharging into the attenuation tank.

1.3.5 Flows from the attenuation tank will drain into a deep bored soakaway. As described section 1.2.12 a 20m deep borehole was drilled tested and installed as part of the site investigation which provided a factored discharged rate of 2.5 l/s.

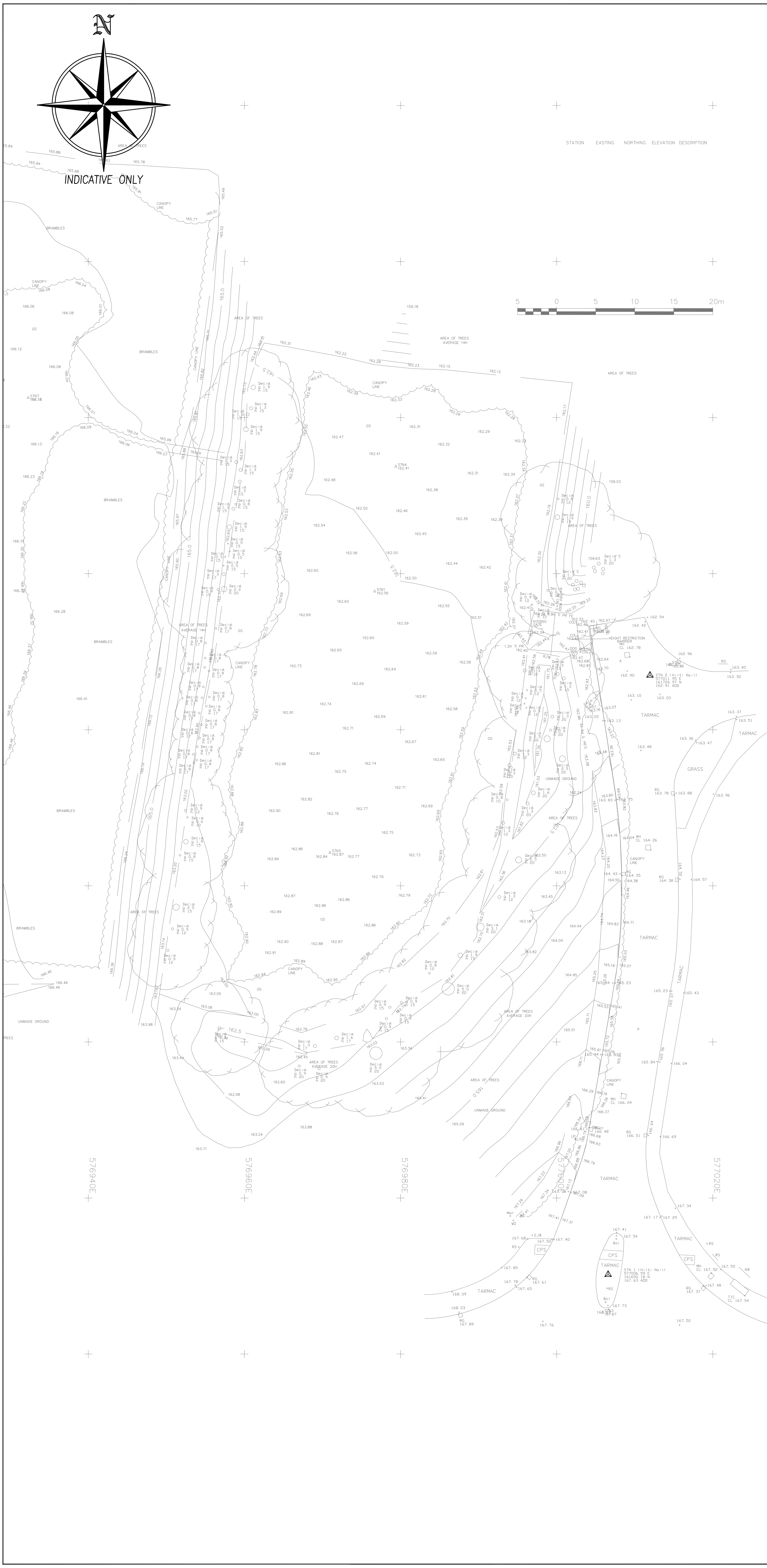
1.3.6 The drainage system has been designed in Windes and has been designed to accommodate all storms up to and including the 1 in 100 year rainfall event without flooding. The 1 in 100 year plus a 30% allowance for climate change.

## 1.4 Conclusions

1.4.1 The proposal site has an overall area of 0.32 hectares of which 0.151 hectares is to be developed with 12 residential units with associated roads and hardstanding.

1.4.2 A Sustainable Urban Drainage system incorporating an underground cellular attenuation tank with a discharge into a deep bored soakaway will be used to accommodate the 1 in 100 year rainfall event with a 30% allowance for climate change.

## APPENDIX 1 - TOPOGRAPHICAL SURVEY




DO NOT SCALE

| REV | DATE | BY | DESCRIPTION | CHK | APD |
|---|---|---|---|---|---|
| P1 | 04/08/17 | CS | First Issue | CS | CS |

client

GEN2 PROPERTY LIMITED

project

LAND OFF WILDFELL CLOSE
WALDERSLADE WOODS, KENT

title

TOPOGRAPHICAL SURVEY

| project | drwg | rev |
|---|---|---|
| 9486 | TS-01 | P1 |

| Drawn | Checked | Approved | scale @ A3 | date |
|---|---|---|---|---|
| CS | CS | CS | 1:500 | 03.08.17 |

status

FOR INFORMATION

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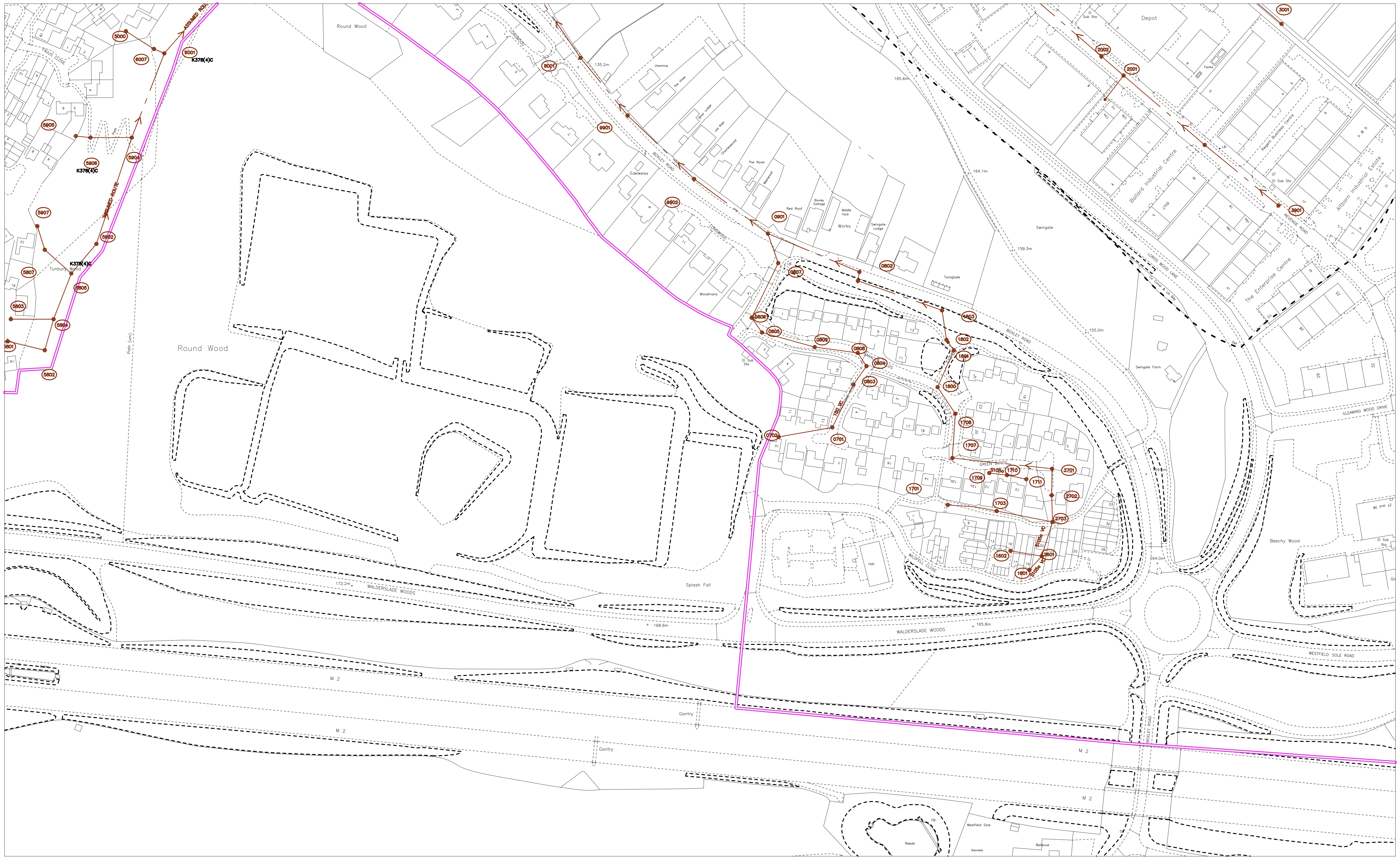
CAD Reference:

A3

## APPENDIX 2 – SOUTHERN WATER ASSET PLANS

# SEWER RECORDS PAGE 1 OF 2

162065




161487

576500

577446

| O.S. REF. | Drawn by: kumaria | 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 |
|---|---|---|
| TQ7661NE | Scale: 1:2500 | |
| Title: 256225_Land to the west of Wil | Date: 09/08/2017 | Based upon Ordnance Survey Digital Data with the permission of the controller of H.M.S.O. Crown Copyright Reserved Licence No. WU 298530. |

N

Southern Water

# SEWER RECORDS PAGE 2 OF 2

| Node | Cover | Invert | Size | Material | Shape |
|---|---|---|---|---|---|
| 0701X | | | 150 | VC | CIRC |
| 0702X | | | UNK | UNK | CIRC |
| 0801X | 146.5 | 145 | 150 | VC | CIRC |
| 0802X | 146.1 | 144.88 | 150 | VC | CIRC |
| 0803X | | | 150 | VC | CIRC |
| 0804X | | | 150 | VC | CIRC |
| 0805X | 149.59 | | 150 | VC | CIRC |
| 0806X | 148.23 | 146.17 | 150 | VC | CIRC |
| 0807X | 144.23 | 142.21 | 150 | VC | CIRC |
| 0808X | | | 150 | VC | CIRC |
| 0809X | | | 150 | VC | CIRC |
| 0901X | 143.13 | 141.64 | 150 | VC | CIRC |
| 1601X | | | UNK | VC | CIRC |
| 1602X | | | UNK | VC | CIRC |
| 1701X | | | 150 | VC | CIRC |
| 1703X | | | 150 | VC | CIRC |
| 1707X | 164.27 | 162.51 | 150 | VC | CIRC |
| 1708X | 161.72 | 160.02 | 150 | VC | CIRC |
| 1710X | | | UNK | OTHER | CIRC |
| 1711X | | | UNK | OTHER | CIRC |
| 1800X | 159.08 | 157.46 | 150 | VC | CIRC |
| 1801X | 155.76 | 152.96 | 150 | VC | CIRC |
| 1802X | 155.05 | 150.06 | 150 | VC | CIRC |
| 1803X | 150.56 | 148.74 | 150 | VC | CIRC |
| 2001X | 165.6 | 164 | 150 | VC | CIRC |
| 2002X | 165.42 | 163.79 | 150 | VC | CIRC |
| 2601X | | | UNK | VC | CIRC |
| 2701X | 164.82 | 163.17 | 150 | VC | CIRC |
| 2702X | 165.75 | 163.63 | 150 | VC | CIRC |
| 2703X | | | 150 | VC | CIRC |
| 290DX | | | 100 | UNK | CIRC |
| 3001X | 164.85 | 163.18 | 150 | VC | CIRC |
| 3901X | 167.13 | 165.69 | 150 | VC | CIRC |
| 3902X | 166.44 | 164.96 | 150 | VC | CIRC |
| 5000X | 149.2 | 147.76 | 150 | VC | CIRC |
| 5801X | | | 150 | VC | CIRC |
| 5802X | | | 150 | VC | CIRC |
| 5803X | | | 150 | VC | CIRC |
| 5804X | | | 150 | VC | CIRC |
| 5805X | 156.74 | 155.64 | 150 | VC | CIRC |
| 5807X | 161.86 | 160.84 | 150 | VC | CIRC |
| 5902X | | | 150 | VC | CIRC |
| 5904X | 149.48 | | 150 | VC | CIRC |
| 5905X | 162.26 | 158.59 | 150 | VC | CIRC |
| 5906X | 155.91 | 154.97 | 150 | VC | CIRC |
| 5907X | 165.05 | 162.52 | 150 | VC | CIRC |
| 6001X | 144.2 | 142.99 | 375 | VC | CIRC |
| 6007X | 146.08 | 145.08 | 150 | VC | CIRC |
| 8001X | 131.43 | 129.69 | 150 | VC | CIRC |
| 9901X | 137.89 | 136.45 | 150 | VC | CIRC |
| 9902X | 140.63 | 138.98 | 150 | VC | CIRC |

| Node | Cover | Invert | Size | Material | Shape |
|---|---|---|---|---|---|

| Node | Cover | Invert | Size | Material | Shape |
|---|---|---|---|---|---|

| 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)
- LH Lamp hole (SW)
- LH Lamp hole (F&C)
- Pumping Station (SW)
- Pumping Station (F&C)
- WD Side entry manhole (SW)
- WD Side entry Manhole (F&C)
- BS Blind shaft (SW)
- BS Blind shaft (F&C)
- EJ Ejector station (SW)
- EJ Ejector station (F&C)
- WD Watertight door (SW)
- WD Watertight door (F&C)
- FC Flushing ch. Mn-e (SW)
- FC Flushing ch. Mn-e (F&C)
- FC Flushing ch. No-e (SW)
- FC Flushing ch. No-e (F&C)
- DC Demarcation Chamber
- WO Washout (SW)
- WO Washout (F&C)
- RE Rodding Eye (SW)
- RE Rodding Eye (F&C)
- GP Gauging point (SW)
- GP Gauging point (F&C)
- IC Intercept chamber (SW)
- IC Intercept chamber (F&C)
- ST Storm Tank (SW)
- ST Storm Tank (F&C)
- VC Vortex chamber (SW)
- VC Vortex chamber (F&C)
- 4301 Label ellipse
- Dummy/S24 manhole
- Outfall
- PK Penstock chamber
- DB Damboards
- SO Storm Overflow
- Backdrop manhole
- ? Other (s)
- ? Other
- Change in sewer (s)
- Change in sewer
- Reflux valve
- Flap valve
- CC Cascade
- AN Anode
- Valve
- Closed Valve
- Air Valve
- HB Hatch box (SW)
- HB Hatch box (F&C)
- Direction arrow
- EM Emptying valve
- CP Catchpit
- S Soakaway
- Inlet
- BP Balancing Pond
- WTW Wastewater treatment works
- MTW Marine treatment works
- Outfall headworks
- VT Vent
- VE Vent column
- TST Tidal storage tank
- B Blank end
- Head of Public Sewer
- MPS 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<br>0-4 = Foul/Combined<br>5-9 = Surface Water
- 4th digit: next sequential node

| | |
|---|---|
| Drawn by: | kumaria |
| Title: | 256225_Land to the west of Wil |
| Date: | 09/08/2017 |

Southern Water

**APPENDIX 3 – SITE INVESTIGATION**

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GEN$^2$ Property Ltd.
Property and Infrastructure Support
Kent County Council
Sessions House
County Road
Maidstone
Kent
ME14 1XQ

For the attention of Henry Clark

## Geotechnical Department

Our ref: 351932

26th June 2017

Dear Sirs,

# RE: WILDFELL CLOSE – SOAKAGE TESTING

### BACKGROUND

CET Infrastructure (CET) was instructed by GEN$^2$ to undertake a total of four infiltration tests at nominated locations across the land located to the west of Wildfell Close, Chatham, Kent. The works were undertaken by a CET engineer and technician on the 20th June 2017.

At the time of investigation the area of investigation comprised open land that was locally covered with vegetation. The perimeter of the site was surrounded by trees of various heights and species. Access to the site was available through two gates located at the top of Wildfell Close.

### SITE LOCATION

The study site comprises an approximately rectangular shaped area situated to the west of Wildfell Close, Chatham. The site is centred on National Grid Reference TQ 769 617 as shown in Figure 1. The area surveyed and the positions of each of the trial pits are shown on Figure 2.

Reference to the publications of the British Geological Survey indicates that the site is underlain by deposits of the Lewes Nodular Chalk Formation which is mantled by superficial deposits of the Clay with Flints Formation. In addition, Head material is mapped in the vicinity of the site. The aforementioned geological formations are described in BGS publications as:

| | |
|---|---|
| Head | *Comprises gravel, sand and clay depending on upslope source and distance from source. Poorly sorted and poorly stratified deposits formed mostly by solifluction and/or hillwash and soil creep. Essentially comprises sand and gravel, locally with lenses of silt, clay or peat and organic material.* |
| Clay with Flints | *The Clay-with-Flints Formation is a residual deposit formed from the dissolution, decalcification and cryoturbation of bedrock strata of the Chalk Group. It is unbedded and heterogenous. The dominant lithology is orange-brown and red-brown sandy clay with abundant nodules and rounded pebbles of flint. Angular flints are derived from the Chalk.* |
| Lewes Nodular Chalk Formation | *Composed of hard to very hard nodular chalks and with interbedded soft to medium hard chalks (some grainy) and marls. The softer chalks become more abundant towards the top. Nodular chalks are typically lumpy and first regular seams of nodular flint, some large, commence near the base and continue throughout.* |

Both Head deposits and Clay with Flints Formation were encountered during the course of the site investigation. The Lewes Nodular Chalk Formation was not proven.

## FIELDWORK

In total four trial pits were excavated for the purposes of carrying out soakage testing. Two of the pits, INF1 and INF2, were excavated to depths of 2.6m and 2.7m below ground level, respectively, with the use of a mechanical excavator. The pits were filled with water using a trucked 2000 gallon water tanker. The other two pits, INF3 and INF4, were hand excavated to depths of 0.6m below ground level and were filled using portable 25 litre containers. Pit dimensions and monitoring details for each of the infiltration pits are presented in the table below:

| Trial Pit | Depth (m) | Length (m) | Width (m) | Diameter (m) | Initial Water Level (mbgl) | Final Water Level (mbgl) | Total Monitoring Period (hrs) |
|---|---|---|---|---|---|---|---|
| INF1 | 2.6 | 2.1 | 0.55 | N/A | 0.15 | 0.21 | 6.5 |
| INF2 | 2.7 | 2.3 | 0.6 | N/A | 0.08 | 0.17 | 6.5 |
| INF3 | 0.6 | N/A | N/A | 0.25 | 0 | 0.17 | 5.5 |
| INF4 | 0.6 | N/A | N/A | 0.25 | 0 | 0.15 | 5.5 |

Each pit was logged by the CET geotechnical engineer and samples were recovered from each exploratory hole. The engineer's logs are attached to back of this report. Head material was encountered from ground level in INF2, INF3 and INF4 as gravelly CLAY with the gravel comprising flint and chalk. The Head material was encountered to a maximum depth of 0.8m below ground level in INF2. INF3 and INF4 terminated within the Head at depths of 0.6m below ground level.

From ground level in INF1 and beneath the overlying Head stratum in INF2 deposits of the Clay with Flints Formation were encountered as stiff, gravelly CLAY with a high cobble content of flint. The gravel also comprised flint. The Clay with Flints Formation was encountered to 2.6m and 2.7m below ground level in INF1 and INF2, respectively, at which depths the trial pits terminated.

The trial pits remained dry prior to commencing soakage tests however the pits were only open for a short period prior to filling with water and the duration may not have been sufficient for ingress to have been observed in the excavations.

Soakage tests were carried out essentially in accordance with the procedure in BRE Digest 365 except that the pits were filled only once and monitored for no longer than 6.5 hours. The results of these tests produced the following infiltration rates:

| INFILTRATION TEST RESULTS | | |
|---|---|---|
| **Trial Pit** | **Infiltration Rate (m/s)** | **Comment** |
| INF1 | $2.1 \times 10^{-7}$ | Trial pit did not empty to 25% full during test duration. Analysis based on full duration of test and initial and final water level. Actual rate likely to be lower after third filling and if test emptied. |
| INF2 | $3.3 \times 10^{-7}$ | Trial pit did not empty to 25% full during test duration. Analysis based on full duration of test and initial and final water level. Actual rate likely to be lower after third filling and if test emptied. |
| INF3 | $5.8 \times 10^{-7}$ | Trial pit did not empty to 25% full during test duration. Analysis based on full duration of test and initial and final water level. Actual rate likely to be lower after third filling and if test emptied. |
| INF4 | $8.1 \times 10^{-7}$ | Trial pit did not empty to 25% full during test duration. Analysis based on full duration of test and initial and final water level. Actual rate likely to be lower after third filling and if test emptied. |

## INTERPRETATION OF RESULTS

Based upon the low infiltration rates observed in all four soakage pits and the type of material encountered during the ground investigation the near surface strata of Head material and Clay with Flints Formation are considered unsuitable for the direct discharge of surface water.

Although the Lewes Nodular Chalk Formation was not encountered during the course of the investigation it may be possible to discharge to these strata if they are encountered.  It should be noted that the permeability of the chalk will be almost entirely dependent on secondary porosity, i.e. fracture flow, and further investigation in the form of cable of percussion boreholes would need to be undertaken to identify the depth to the chalk and to ascertain the existing groundwater conditions.

Consideration could be given to utilising a deep borehole soakaway discharging into the Lewes Nodular Chalk Formation, however further field investigation would need to be undertaken in the form of a borehole soakage test to ensure that the permeability of the Lewes Nodular Chalk Formation is sufficient to accommodate the discharge of surface water runoff. Furthermore, the relevant permissions would have to be sought from the Local Authority and Environment Agency.

It is not uncommon for the near surface zone of the chalk to be characterised by the presence of irregular hollows that are termed pipes, swallow holes or dissolution features.  These have resulted from the dissolution of the chalk due to percolation of slightly acidic rain/groundwater and they are particularly common at the margins and the base of any overlying deposits. These features may be infilled with material similar to the overlying deposits (Head etc.), or loose debris that has collapsed into a void, or alternatively any overlying relatively competent material may be arching over a void.  In addition, man-made cavities, shafts and tunnels may also be present within the chalk.  Any changes in stress as may be brought about by changes in groundwater regime or leaking sewers and drains may initiate collapse settlements of any loose void infill or of competent material arching over the void.  Therefore, great care must be taken to ensure that discharge to the chalk is within the competent rock strata and not into any of the features mentioned above.

Should further ground investigation conclude that surface water discharge to the chalk is unlikely to be feasible then consideration could be given to utilising some form of SUDS scheme, rainwater collection, harvesting etc.  In addition, it may be possible to utilise any existing drainage networks on or around the site however permissions would have to be sought from the relevant authorities.

We trust that the above meets your requirements however please do not hesitate to contact us should you have any questions or queries.

Yours Faithfully,

Gary Clarke *BSc MSc*
**Geotechnical Engineer**

For and on behalf of CET Infrastructure

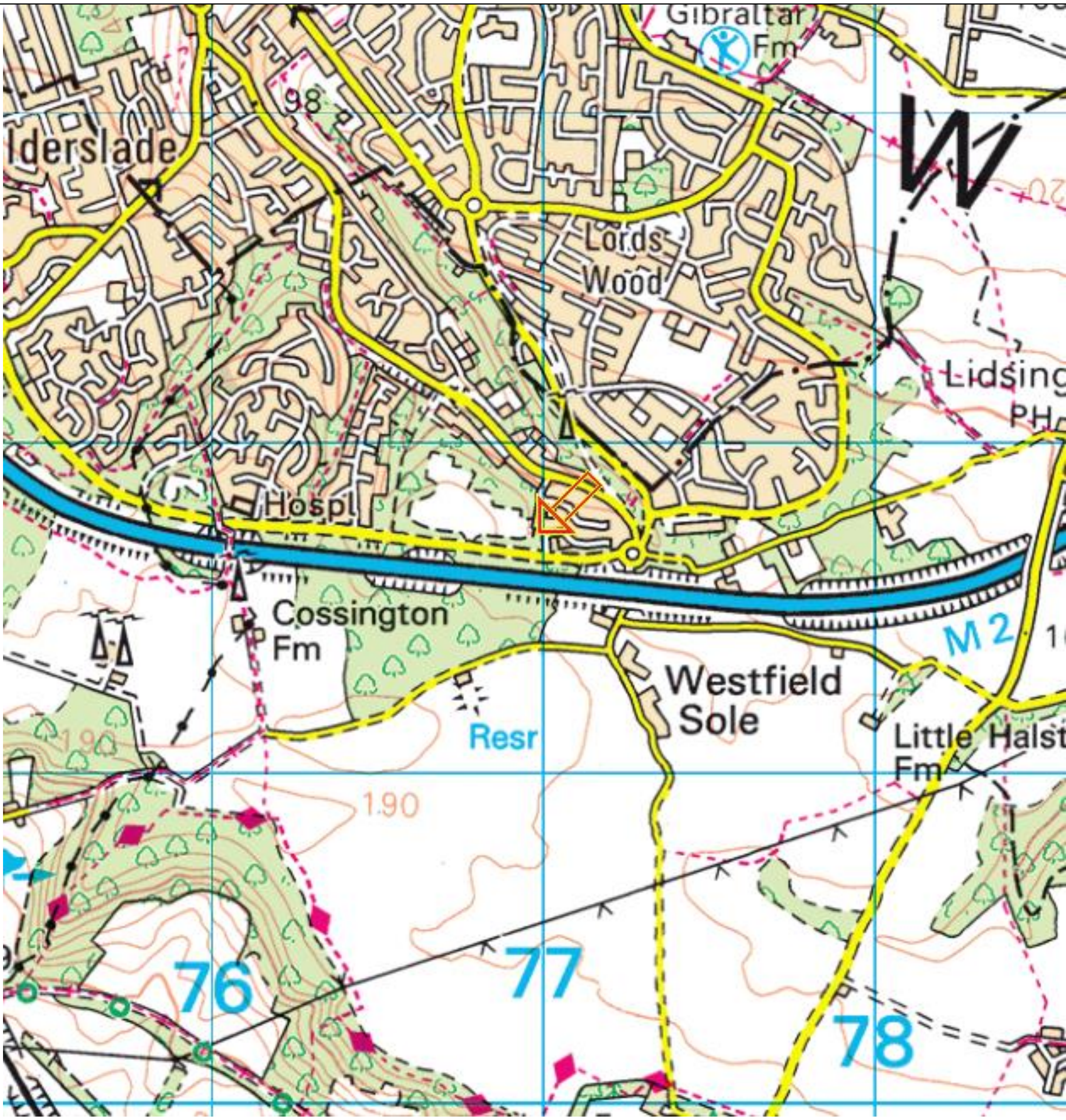
Figure 1 - Site Location Plan

Figure 2 - Approximate Trial Pit Positions

INFRASTRUCTURE
Giving our all

N

# FIGURE 1
## SITE LOCATION PLAN
Wildfell Close
351932



# FIGURE 2

## APPROXIMATE EXPLORATORY HOLE LOCATION PLAN

Wildfell Close

351932

| Client: **GEN²** | | Depth (m) 2.60 | Plant used:JCB | TRIAL PIT NUMBER **INF1** Sheet 1 of 1 |
|---|---|---|---|---|
| Width (m) 0.55 | Length (m) 2.10 | Method of Excavation : Mechanical Excavator | Shoring: None | |
| Co-ordinates E N | Ground Level (mAOD) | | Date Started :20/06/2017 | |

| Samples/In Situ Tests | | | Change of Strata | | | |
|---|---|---|---|---|---|---|
| Depth (m) | Type | Test/Field Records | Reduced Level (mAOD) | Depth & *(Thickness)* (m) | Description of Strata | Legend |
| | | | | *(2.60)* | Stiff, brownish orange, mottled red, slightly gravelly CLAY with a high cobble content of flint. Gravel is very angular to sub-angular, fine to coarse, white, grey and black flint. (Clay with Flints) | |
| 1.50 | D | | | | | |
| | | | | 2.60 | *End of Trial Pit at 2.60 m* | |

General Remarks:
1. Trial pit noted to be stable during soakage testing.
2. Roots noted to the base of the trial pit.

| Ref: | 351932 | TRIAL PIT RECORD Scale 1:25 Symbols and abbreviations in accoradance with AGS | CET INFRASTRUCTURE Giving our all |
|---|---|---|---|
| Logged: | GC | | |
| Check'd: | | **Wildfell Close** | **FIG A1** |
| Appr'd: | | | |

| Client: **GEN²** | | Depth (m) 2.70 | Plant used:JCB | TRIAL PIT NUMBER **INF2** Sheet 1 of 1 |
|---|---|---|---|---|
| Width (m) 0.60 | Length (m) 2.30 | Method of Excavation : Mechanical Excavator | Shoring: None | |
| Co-ordinates E N | Ground Level (mAOD) | | Date Started :20/06/2017 | |

| Samples/In Situ Tests | | | Change of Strata | | Description of Strata | Legend |
|---|---|---|---|---|---|---|
| Depth (m) | Type | Test/Field Records | Reduced Level (mAOD) | Depth & *(Thickness)* (m) | | |
| 0.30 | D | | | *(0.80)* | Stiff, white and brownish orange, mottled red, slightly gravelly CLAY. Gravel is angular to sub-rounded, fine to coarse, chalk and flint. (Head) | |
| | | | | 0.80 | | |
| 1.50 | D | | | *(1.80)* | Very stiff, brownish orange, mottled red, slightly gravelly CLAY with a high cobble content of flint. Gravel is very angular to sub-angular, fine to coarse, white, grey and black flint. (Clay with Flints) | |
| | | | | 2.60 | *End of Trial Pit at 2.70 m* | |

General Remarks:
1. Trial pit noted to be stable during soakage testing.
2. Roots noted to the base of the trial pit.

| Ref: | 351932 | TRIAL PIT RECORD<br>Scale 1:25<br>Symbols and abbreviations in accoradance with AGS | CET INFRASTRUCTURE Giving our all |
|---|---|---|---|
| Logged: | GC | | |
| Check'd: | | **Wildfell Close** | **FIG A2** |
| Appr'd: | | | |

| Client: **GEN²** | | Depth (m) 0.60 | Plant used: None | TRIAL PIT NUMBER **INF3** Sheet 1 of 1 |
|---|---|---|---|---|
| Width (m) | Length (m) | Method of Excavation : Hand Excavated | Shoring: None | |
| Co-ordinates E N | Ground Level (mAOD) | | Date Started :20/06/2017 | |

| Samples/In Situ Tests | | | Change of Strata | | | |
|---|---|---|---|---|---|---|
| Depth (m) | Type | Test/Field Records | Reduced Level (mAOD) | Depth & *(Thickness)* (m) | Description of Strata | Legend |
| 0.30 | D | | | *(0.60)* | Stiff, white and brownish orange, mottled red, slightly gravelly CLAY. Gravel is angular to sub-rounded, fine to coarse, chalk and flint. (Head) | |
| | | | | 0.60 | *End of Trial Pit at 0.60 m* | |

General Remarks:
1. Diameter of cylindrical trial pit = 0.25m.
2. Trial pit noted to be stable during soakage testing.
3. Roots noted to the base of the trial pit.

| | | | |
|---|---|---|---|
| Ref: | 351932 | TRIAL PIT RECORD<br>Scale 1:25<br>Symbols and abbreviations in accoradance with AGS | CET INFRASTRUCTURE Giving our all |
| Logged: | GC | | |
| Check'd: | | **Wildfell Close** | **FIG A3** |
| Appr'd: | | | |

| Client: **GEN²** | | Depth (m) 0.60 | Plant used: None | TRIAL PIT NUMBER **INF4** Sheet 1 of 1 |
|---|---|---|---|---|
| Width (m) | Length (m) | Method of Excavation : Hand Excavated | Shoring: None | |
| Co-ordinates E N | Ground Level (mAOD) | | Date Started :20/06/2017 | |

| Samples/In Situ Tests | | | Change of Strata | | | |
|---|---|---|---|---|---|---|
| Depth (m) | Type | Test/Field Records | Reduced Level (mAOD) | Depth & *(Thickness)* (m) | Description of Strata | Legend |
| 0.30 | D | | | *(0.60)* | Stiff, brownish orange, mottled red, slightly gravelly CLAY. Gravel is angular to sub-rounded, fine to coarse, flint. Rare, sub-rounded, fine and medium gravel of chalk. (Head) | |
| | | | | 0.60 | *End of Trial Pit at 0.60 m* | |

General Remarks:
1. Diameter of cylindrical trial pit = 0.25m.
2. Trial pit noted to be stable during soakage testing.
3. Roots noted to the base of the trial pit.

| Ref: | 351932 | TRIAL PIT RECORD Scale 1:25 Symbols and abbreviations in accoradance with AGS | CET INFRASTRUCTURE Giving our all |
|---|---|---|---|
| Logged: | GC | | |
| Check'd: | | **Wildfell Close** | **FIG A4** |
| Appr'd: | | | |

## Chris Smoker

| | |
|---|---|
| **From:** | Phil West <phil.west@cet-uk.com> |
| **Sent:** | 02 August 2017 14:58 |
| **To:** | Chris Smoker |
| **Subject:** | RE: Wildfell Close |

Hi Chris

The borehole soakaway was drilled, tested and installed at the above site on 27 July 2017. The below presents a summary of the ground conditions encountered, the results if the soakage test and details of the installation.

GROUND CONDITIONS

The boreholes encountered strata described as "brown clay with small to large flints" considered most likely to be Clay-with-Flints beneath a mantle of topsoil and extending to a depth of 9.2m below ground level. Chalk described by the driller as "clean white chalk" was penetrated from the base of the Clay-with-Flints to a depth of 20m at which the borehole was terminated.

SOAKAGE TEST

The borehole was tested by pumping nominally 1000 litres of water into the borehole in 8 minutes and 10 seconds and subsequently monitoring the fall in head of the water in the borehole. Pumping water into the borehole at a rate of approximately 2 litres/second only raised the water level to about 14m below ground level. By extrapolating the driving head to a depth of say 4m, the typical depth of a soakaway chamber, this would equate to an unfactored soakage rate of about 5 litres/second. Typically a factor of safety of 2 is applied to the test rate which in this case would give a design rate of 2.5l/s.

INSTALLATION

Following testing the borehole was installed with a 150mm diameter soakaway liner with the bottom 6m perforated and surrounded by pea gravel. The pea gravel from 20m to 10m bgl. Bentonite was placed around the plain pipe from 10m bgl to ground level. A weir head has been used to cap the borehole and when the liner has been cut down to the correct level within the chamber this should be reinstalled at the top of the pipe to prevent floating debris entering the pipe.

I trust that this meets with your requirements and that if you have any queries you will not hesitate to contact me.

Regards

Phil


Phillip J West *BSc MSc CEng MICE*
Consultancy Manager

Giving our all

**T**: 01622 858545 | **M**: 07951 297404 | **E**: phil.west@cet-uk.com
**W**: www.cet-uk.com
Northdown House, Ashford Road, Harrietsham, Nr Maidstone, Kent, ME17 1QW

**APPENDIX 4 – PROPOSED MASTERPLAN**


DETAILED SITE PLAN @ 1:200

# PROPOSED RESIDENTIAL DEVELOPMENT: Walderslade Round Wood Site, Boxley

PROPOSED SITE PLAN



All dimensions are to be checked on site prior to fabrication and the Architect should be notified of any discrepancy

0 1 5 10 20

Revisions

| | | |
|---|---|---|
| A. | Turning head added to address Fire Service comments/ adjustments in response to Kent Police comments | 22.07.08 |
| B. | General Amdts. | 23.12.09 |
| C. | General Amdts. | 21.01.10 |
| D. | Site Location Plan removed, red line boundary removed. | 06.10.15 |

Project
Proposed Residential Development, Walderslade Round Wood Site, Boxley

Client
KCC

Title
PROPOSED SITE PLAN

| Scale | Date | Drawn | Chk'd |
|---|---|---|---|
| 1:1250 & 1:200 | June 2007 | dbw&ag | |


guy hollaway ARCHITECTS

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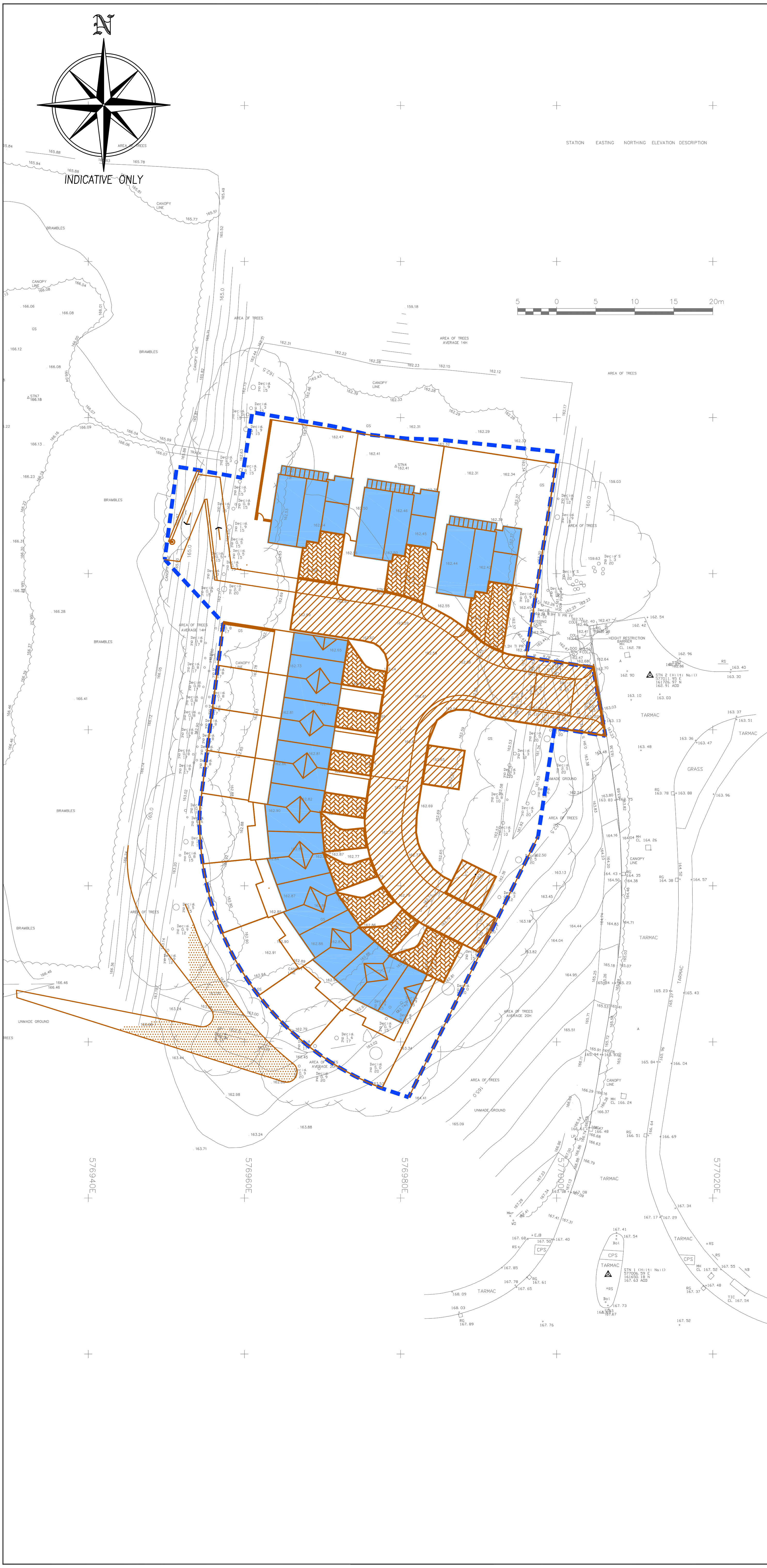
Drawing Number
**07.10.02**

Revision
**D**

# APPENDIX 5 – PROPOSED DRAINAGE




DO NOT SCALE

5 0 5 10 15 20 25
Metres (1:500)

Key

| | | |
|---|---|---|
| | Communal hardstanding | - 582m² |
| | Private hardstanding | - 299m² |
| | Roof Areas | - 626m² |
| | Total area | - 1507m² |
| | Catchment Boundaries | |

| REV | DATE | BY | DESCRIPTION | CHK | APD |
|---|---|---|---|---|---|
| P1 | 04/08/17 | CS | First Issue | CS | CS |

client
GEN2 PROPERTY LIMITED

project
LAND OFF WILDFELL CLOSE
WALDERSLADE WOODS, KENT

title
CATCHMENT AREAS PLAN

| project | drwg | rev |
|---|---|---|
| 9486 | D-01 | P1 |

| Drawn | Checked | Approved | scale @ A3 | date |
|---|---|---|---|---|
| CS | CS | CS | 1:500 | 03.08.17 |

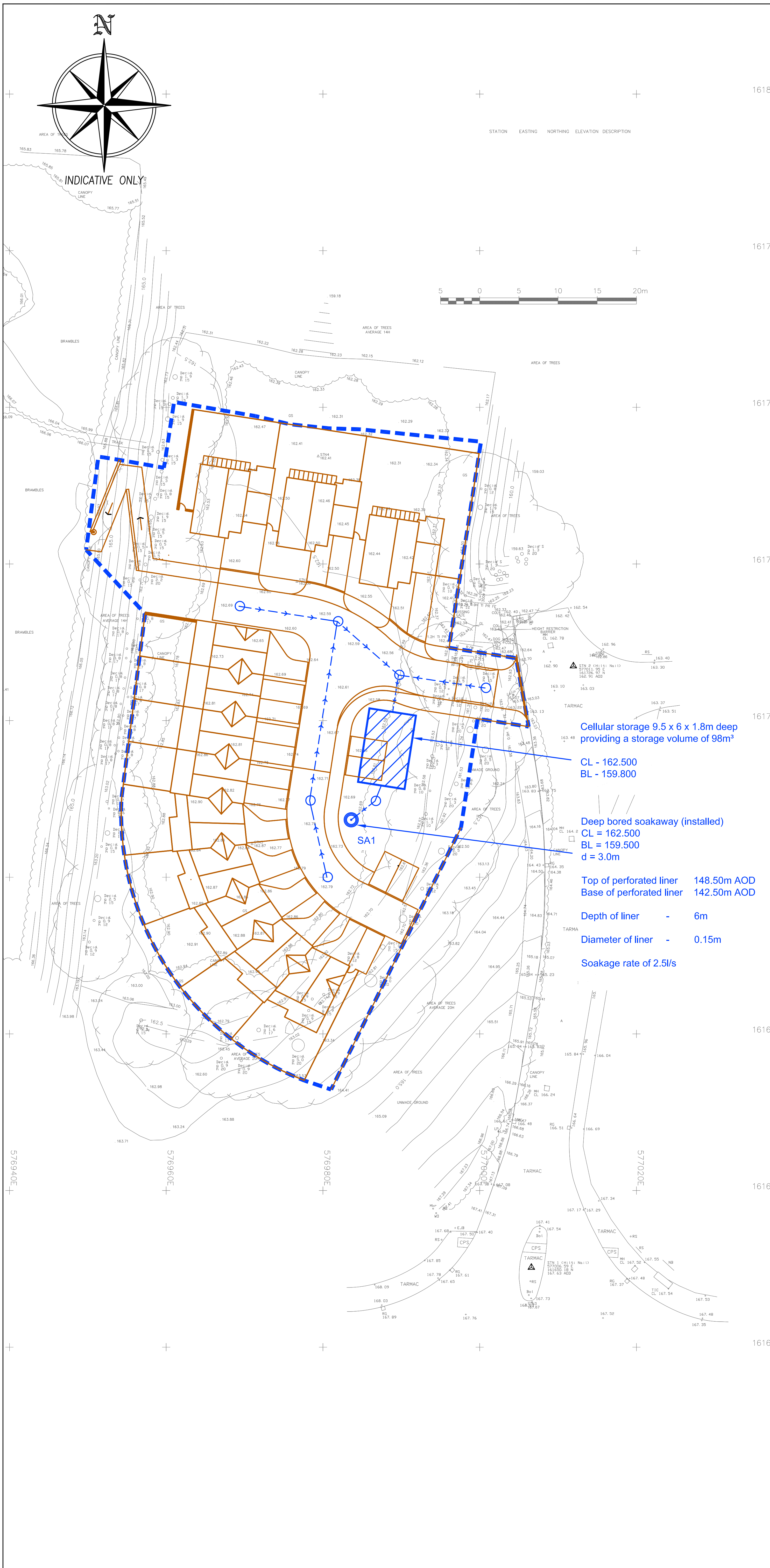
status
FOR INFORMATION

dha transport

Eclipse House, Eclipse Park, Sittingbourne Road
Maidstone, Kent. ME14 3EN
t: 01622 776226 f: 01622 776227
e: info@dhaplanning.co.uk w: www.dhatransport.co.uk

CAD Reference:

A3




DO NOT SCALE

5 0 5 10 15 20 25

Metres (1:500)

Key

Proposed surface water sewer

Proposed cellular storage

SA1 Deep bored soakaway

Catchment Boundaries

| REV | DATE | BY | DESCRIPTION | CHK | APD |
|---|---|---|---|---|---|
| P1 | 04/08/17 | CS | First Issue | CS | CS |

client
GEN2 PROPERTY LIMITED

project
LAND OFF WILDFELL CLOSE
WALDERSLADE WOODS, KENT

title
CATCHMENT AREAS PLAN

| project | drwg | rev |
|---|---|---|
| 9486 | D-01 | P1 |

| Drawn | Checked | Approved | scale @ A3 | date |
|---|---|---|---|---|
| CS | CS | CS | 1:500 | 03.08.17 |

status
FOR INFORMATION

dha transport

Eclipse House, Eclipse Park, Sittingbourne Road
Maidstone, Kent. ME14 3EN
t: 01622 776226 f: 01622 776227
e: info@dhaplanning.co.uk w: www.dhatransport.co.uk

CAD Reference:

A3

## Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 325 minutes.

| Storm Event | Max Level (m) | Max Depth (m) | Max Infiltration (l/s) | Max Control (l/s) | Max Σ Outflow (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|---|---|
| 15 min Summer | 160.675 | 0.875 | 0.0 | 2.5 | 2.5 | 47.4 | O K |
| 30 min Summer | 160.922 | 1.122 | 0.0 | 2.5 | 2.5 | 60.7 | O K |
| 60 min Summer | 161.138 | 1.338 | 0.0 | 2.5 | 2.5 | 72.4 | O K |
| 120 min Summer | 161.293 | 1.493 | 0.0 | 2.5 | 2.5 | 80.9 | O K |
| 180 min Summer | 161.351 | 1.551 | 0.0 | 2.5 | 2.5 | 84.0 | O K |
| 240 min Summer | 161.366 | 1.566 | 0.0 | 2.5 | 2.5 | 84.8 | O K |
| 360 min Summer | 161.365 | 1.565 | 0.0 | 2.5 | 2.5 | 84.8 | O K |
| 480 min Summer | 161.348 | 1.548 | 0.0 | 2.5 | 2.5 | 83.8 | O K |
| 600 min Summer | 161.320 | 1.520 | 0.0 | 2.5 | 2.5 | 82.3 | O K |
| 720 min Summer | 161.284 | 1.484 | 0.0 | 2.5 | 2.5 | 80.3 | O K |
| 960 min Summer | 161.196 | 1.396 | 0.0 | 2.5 | 2.5 | 75.6 | O K |
| 1440 min Summer | 161.003 | 1.203 | 0.0 | 2.5 | 2.5 | 65.2 | O K |
| 2160 min Summer | 160.744 | 0.944 | 0.0 | 2.5 | 2.5 | 51.1 | O K |
| 2880 min Summer | 160.546 | 0.746 | 0.0 | 2.5 | 2.5 | 40.4 | O K |
| 4320 min Summer | 160.329 | 0.529 | 0.0 | 2.5 | 2.5 | 28.7 | O K |
| 5760 min Summer | 160.288 | 0.488 | 0.0 | 2.2 | 2.2 | 26.4 | O K |
| 7200 min Summer | 160.274 | 0.474 | 0.0 | 1.8 | 1.8 | 25.6 | O K |
| 8640 min Summer | 160.264 | 0.464 | 0.0 | 1.6 | 1.6 | 25.1 | O K |
| 10080 min Summer | 160.256 | 0.456 | 0.0 | 1.4 | 1.4 | 24.7 | O K |
| 15 min Winter | 160.783 | 0.983 | 0.0 | 2.5 | 2.5 | 53.2 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) |
|---|---|---|---|---|
| 15 min Summer | 172.371 | 0.0 | 27.1 | 18 |
| 30 min Summer | 111.955 | 0.0 | 41.7 | 33 |
| 60 min Summer | 68.611 | 0.0 | 56.0 | 62 |
| 120 min Summer | 40.367 | 0.0 | 69.8 | 122 |
| 180 min Summer | 29.441 | 0.0 | 78.4 | 180 |
| 240 min Summer | 23.480 | 0.0 | 84.7 | 234 |
| 360 min Summer | 17.026 | 0.0 | 94.0 | 288 |
| 480 min Summer | 13.532 | 0.0 | 100.9 | 348 |
| 600 min Summer | 11.315 | 0.0 | 106.5 | 416 |
| 720 min Summer | 9.772 | 0.0 | 111.1 | 484 |
| 960 min Summer | 7.746 | 0.0 | 118.7 | 618 |
| 1440 min Summer | 5.574 | 0.0 | 129.9 | 880 |
| 2160 min Summer | 4.004 | 0.0 | 141.6 | 1256 |
| 2880 min Summer | 3.163 | 0.0 | 150.3 | 1588 |
| 4320 min Summer | 2.268 | 0.0 | 163.2 | 2248 |
| 5760 min Summer | 1.793 | 0.0 | 173.2 | 2936 |
| 7200 min Summer | 1.494 | 0.0 | 181.4 | 3664 |
| 8640 min Summer | 1.287 | 0.0 | 188.3 | 4392 |
| 10080 min Summer | 1.135 | 0.0 | 194.3 | 5088 |
| 15 min Winter | 172.371 | 0.0 | 33.0 | 18 |

## Summary of Results for 100 year Return Period (+30%)

| Storm Event | Max Level (m) | Max Depth (m) | Max Infiltration (l/s) | Max Control (l/s) | Max Σ Outflow (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|---|---|
| 30 min Winter | 161.060 | 1.260 | 0.0 | 2.5 | 2.5 | 68.3 | O K |
| 60 min Winter | 161.306 | 1.506 | 0.0 | 2.5 | 2.5 | 81.5 | O K |
| 120 min Winter | 161.487 | 1.687 | 0.0 | 2.5 | 2.5 | 91.3 | O K |
| 180 min Winter | 161.559 | 1.759 | 0.0 | 2.5 | 2.5 | 95.3 | O K |
| 240 min Winter | 161.585 | 1.785 | 0.0 | 2.5 | 2.5 | 96.6 | O K |
| 360 min Winter | 161.569 | 1.769 | 0.0 | 2.5 | 2.5 | 95.8 | O K |
| 480 min Winter | 161.532 | 1.732 | 0.0 | 2.5 | 2.5 | 93.8 | O K |
| 600 min Winter | 161.486 | 1.686 | 0.0 | 2.5 | 2.5 | 91.3 | O K |
| 720 min Winter | 161.427 | 1.627 | 0.0 | 2.5 | 2.5 | 88.1 | O K |
| 960 min Winter | 161.292 | 1.492 | 0.0 | 2.5 | 2.5 | 80.8 | O K |
| 1440 min Winter | 161.000 | 1.200 | 0.0 | 2.5 | 2.5 | 65.0 | O K |
| 2160 min Winter | 160.619 | 0.819 | 0.0 | 2.5 | 2.5 | 44.3 | O K |
| 2880 min Winter | 160.366 | 0.566 | 0.0 | 2.5 | 2.5 | 30.7 | O K |
| 4320 min Winter | 160.281 | 0.481 | 0.0 | 2.0 | 2.0 | 26.0 | O K |
| 5760 min Winter | 160.264 | 0.464 | 0.0 | 1.6 | 1.6 | 25.1 | O K |
| 7200 min Winter | 160.253 | 0.453 | 0.0 | 1.3 | 1.3 | 24.5 | O K |
| 8640 min Winter | 160.246 | 0.446 | 0.0 | 1.1 | 1.1 | 24.2 | O K |
| 10080 min Winter | 160.241 | 0.441 | 0.0 | 1.0 | 1.0 | 23.9 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) |
|---|---|---|---|---|
| 30 min Winter | 111.955 | 0.0 | 49.3 | 33 |
| 60 min Winter | 68.611 | 0.0 | 65.4 | 62 |
| 120 min Winter | 40.367 | 0.0 | 80.7 | 120 |
| 180 min Winter | 29.441 | 0.0 | 90.4 | 176 |
| 240 min Winter | 23.480 | 0.0 | 97.5 | 232 |
| 360 min Winter | 17.026 | 0.0 | 107.9 | 334 |
| 480 min Winter | 13.532 | 0.0 | 115.7 | 376 |
| 600 min Winter | 11.315 | 0.0 | 121.9 | 452 |
| 720 min Winter | 9.772 | 0.0 | 127.1 | 528 |
| 960 min Winter | 7.746 | 0.0 | 135.5 | 674 |
| 1440 min Winter | 5.574 | 0.0 | 148.0 | 952 |
| 2160 min Winter | 4.004 | 0.0 | 161.2 | 1316 |
| 2880 min Winter | 3.163 | 0.0 | 170.9 | 1588 |
| 4320 min Winter | 2.268 | 0.0 | 185.4 | 2200 |
| 5760 min Winter | 1.793 | 0.0 | 196.6 | 2936 |
| 7200 min Winter | 1.494 | 0.0 | 205.7 | 3584 |
| 8640 min Winter | 1.287 | 0.0 | 213.5 | 4408 |
| 10080 min Winter | 1.135 | 0.0 | 220.2 | 5048 |

## Rainfall Details

| | | | |
|---|---|---|---|
| Rainfall Model | FSR | Winter Storms | Yes |
| Return Period (years) | 100 | Cv (Summer) | 0.750 |
| Region | England and Wales | Cv (Winter) | 0.840 |
| M5-60 (mm) | 26.250 | Shortest Storm (mins) | 15 |
| Ratio R | 0.400 | Longest Storm (mins) | 10080 |
| Summer Storms | Yes | Climate Change % | +30 |

## Time Area Diagram

Total Area (ha) 0.151

| Time From: | (mins) To: | Area (ha) |
|---|---|---|
| 0 | 4 | 0.151 |

## Model Details

Storage is Online Cover Level (m) 162.500

## Cellular Storage Structure

Invert Level (m) 159.800 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

| Depth (m) | Area (m²) | Inf. Area (m²) | Depth (m) | Area (m²) | Inf. Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 57.0 | 0.0 | 1.300 | 57.0 | 0.0 |
| 0.100 | 57.0 | 0.0 | 1.400 | 57.0 | 0.0 |
| 0.200 | 57.0 | 0.0 | 1.500 | 57.0 | 0.0 |
| 0.300 | 57.0 | 0.0 | 1.600 | 57.0 | 0.0 |
| 0.400 | 57.0 | 0.0 | 1.700 | 57.0 | 0.0 |
| 0.500 | 57.0 | 0.0 | 1.800 | 57.0 | 0.0 |
| 0.600 | 57.0 | 0.0 | 1.900 | 0.0 | 0.0 |
| 0.700 | 57.0 | 0.0 | 2.000 | 0.0 | 0.0 |
| 0.800 | 57.0 | 0.0 | 2.100 | 0.0 | 0.0 |
| 0.900 | 57.0 | 0.0 | 2.200 | 0.0 | 0.0 |
| 1.000 | 57.0 | 0.0 | 2.300 | 0.0 | 0.0 |
| 1.100 | 57.0 | 0.0 | 2.400 | 0.0 | 0.0 |
| 1.200 | 57.0 | 0.0 | 2.500 | 0.0 | 0.0 |

## Depth/Flow Relationship Outflow Control

Invert Level (m) 160.200

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|---|---|---|---|
| 0.100 | 2.5000 | 0.900 | 2.5000 | 1.700 | 2.5000 | 2.500 | 0.0000 |
| 0.200 | 2.5000 | 1.000 | 2.5000 | 1.800 | 2.5000 | 2.600 | 0.0000 |
| 0.300 | 2.5000 | 1.100 | 2.5000 | 1.900 | 0.0000 | 2.700 | 0.0000 |
| 0.400 | 2.5000 | 1.200 | 2.5000 | 2.000 | 0.0000 | 2.800 | 0.0000 |
| 0.500 | 2.5000 | 1.300 | 2.5000 | 2.100 | 0.0000 | 2.900 | 0.0000 |
| 0.600 | 2.5000 | 1.400 | 2.5000 | 2.200 | 0.0000 | 3.000 | 0.0000 |
| 0.700 | 2.5000 | 1.500 | 2.5000 | 2.300 | 0.0000 | | |
| 0.800 | 2.5000 | 1.600 | 2.5000 | 2.400 | 0.0000 | | |