

LAND AT TORTINGTON, ARUNDEL (OUTLINE PLANNING)

FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY

REPORT REF. 173483-01

PROJECT NO. 173483

NOVEMBER 2020

HEAD OFFICE: 3rd Floor, The Hallmark Building, 52-56 Leadenhall Street, London, EC3M 5JE T [REDACTED] 8
ESSEX: 1 - 2 Crescent Court, Billericay, Essex, CM12 9AQ [REDACTED]
KENT: Suite 10, Building 40, Churchill Business Centre, Kings Hill, Kent, ME19 4YU [REDACTED]
MIDLANDS: Office 3, The Garage Studios, 41-43 St Mary's Gate, Nottingham, NG1 1PU [REDACTED] 940
SOUTH WEST: City Point, Temple Gate, Bristol, BS1 6PL T [REDACTED]
SUFFOLK: Suite 110, Suffolk Enterprise Centre, 44 Felaw Street, Ipswich, IP2 8SJ [REDACTED]

CONTENTS

	Page
1.0 INTRODUCTION	1
2.0 BASELINE PARAMETERS	2
Site location	2
Hydrology	3
Ground Conditions	3
Topography	5
Existing Sewer Infrastructure	5
Development Proposals	6
3.0 POLICY CONTEXT	7
National Planning Policy Framework (July 2018)	7
Sustainable Drainage Systems - Non-statutory technical standards for sustainable drainage systems March 2015	8
Regional & Local Planning Policy	9
4.0 FLOOD RISK ASSESSMENT AND SURFACE WATER MANAGEMENT	10
Fluvial/ Tidal Flood Risk	10
Pluvial Flooding	12
Sewer Flooding	14
Groundwater Flooding	14
Artificial sources	14
Summary of Flood Risk Assessment	14
5.0 SUSTAINABLE DRAINAGE STRATEGY	15
Existing Surface Water Drainage Regime	15
Proposed Sustainable Drainage Systems (SuDS)	15
Proposed surface water runoff rates	18
Long Term Storage	19
Overland Flow Routes	20
Water Quality	20
Maintenance and Management of System	20
Foul Drainage	20
6.0 SUMMARY & RECOMMENDATIONS	22

APPENDICES

- A. Proposed Development Plans
- B. Topographical Survey
- C. Southern Water Asset Location Maps
- D. Environment Agency Flood Data (Product 4)
- E. Correspondence with LLFA and Arun Council
- F. Proposed Foul and Surface Water Drainage Strategy Plans
- G. Proposed Surface Water Drainage Strategy Hydraulic Calculations
- H. Foul Loading Calculations

FIGURES

Figure 2-1: Site Location Plan I.....	2
Figure 2-2 BGS Online Bedrock Geology Mapping- Bedrock Geology (1:50,000)	4
Figure 2-3 BGS Online Bedrock Geology Mapping- Superficial deposits (1:50,000)	4
Figure 2-4 Southern Water sewer records	6
Figure 4-1: EA Flood Map for Planning.....	10
Figure 4-2: Modelled Fluvial Flood Outline.....	11
Figure 4-3: Modelled Tidal Flood Outline.....	12
Figure 4-4: Environment Agency Flood Map for Surface Water	13

TABLES

Table 1-1: Sources of Information	1
Table 5-1: C753 SuDS Management Train, Site Assessment	17
Table 5-2: Greenfield Discharge rates	18

DOCUMENT CONTROL SHEET

REV	ISSUE PURPOSE	AUTHOR	CHECKED	APPROVED	DATE
-	Draft for review	VL	CC	DRAFT	28.10.2020
-	For Planning	VL	CC 	BC 	26.11.2020

DISTRIBUTION

This report has been prepared for the exclusive use of Savills Ltd and the Norfolk Estate. It should not be reproduced in whole or in part, or relied upon by third parties, without the express written authority of Ardent Consulting Engineers.

1.0 INTRODUCTION

- 1.1 Ardent Consulting Engineers has been appointed by Savills Ltd and the Norfolk Estate to prepare a site-specific Flood Risk Assessment (FRA) and Drainage Strategy to support the proposed residential development of the site known as "Land at Tortington, Arundel".
- 1.2 It is proposed to develop the site to provide a new neighbourhood at Tortington, consisting of a wide range of housing types and ancillary access roads and landscaped amenity areas. A development masterplan is included in **Appendix A**.
- 1.3 This FRA has been prepared with specific reference to the requirements of National Planning Policy Framework (NPPF) released in February 2019 and the Planning Practice Guidance (PPG), which superseded the Technical Guidance to the NPPF, in March 2014. The report aims to demonstrate to the Local Planning Authority and Statutory Consultees that the site can be suitably redeveloped whilst complying with the requirements of the NPPF in terms of flood risk.
- 1.4 Key reports/documents reviewed as part of this study are listed in

Table 1-1 below:

Title	Author	Date
Arun District Council Level 1 Strategic Flood Risk Assessment	JBA	August 2016
Arun District Council Level 2 Strategic Flood Risk Assessment	JBA	November 2016
Environment Agency's online flood maps	Environment Agency	January 2020
Environment Agency Site Specific Flood Risk Data (Product 4)	Environment Agency	Feb 2020
British Geological Survey (BGS) Mapping and Borehole Records	BGS Web Portal	October 2020
Topographical Survey	M. J. Zara Associates	January 2020

Table 1-1: Sources of Information

2.0 BASELINE PARAMETERS

Site location

- 1.1. The site is located approximately 1km to the southwest of the centre of Arundel, centred at Ordnance Survey grid co-ordinates 500591mE, 106269mN, with the nearest postcode of BN18 9EX.
- 2.1 The site lies within the administrative boundaries of Arun District Council (ADC, the Local Planning Authority) and West Sussex County Council (WSCC, the Lead Local Flood Authority).
- 2.2 The area within the redline boundary equates to approximately 9.81 ha, currently greenfield land in agricultural use. The site is bound by Ford Road to the southeast; Priory Lane to the southwest and west; and the rear boundaries of existing residential properties fronting onto Stewards Rise and Dalloway Road to the north and northeast. A Site location is illustrated in **Figure 2-1** below:

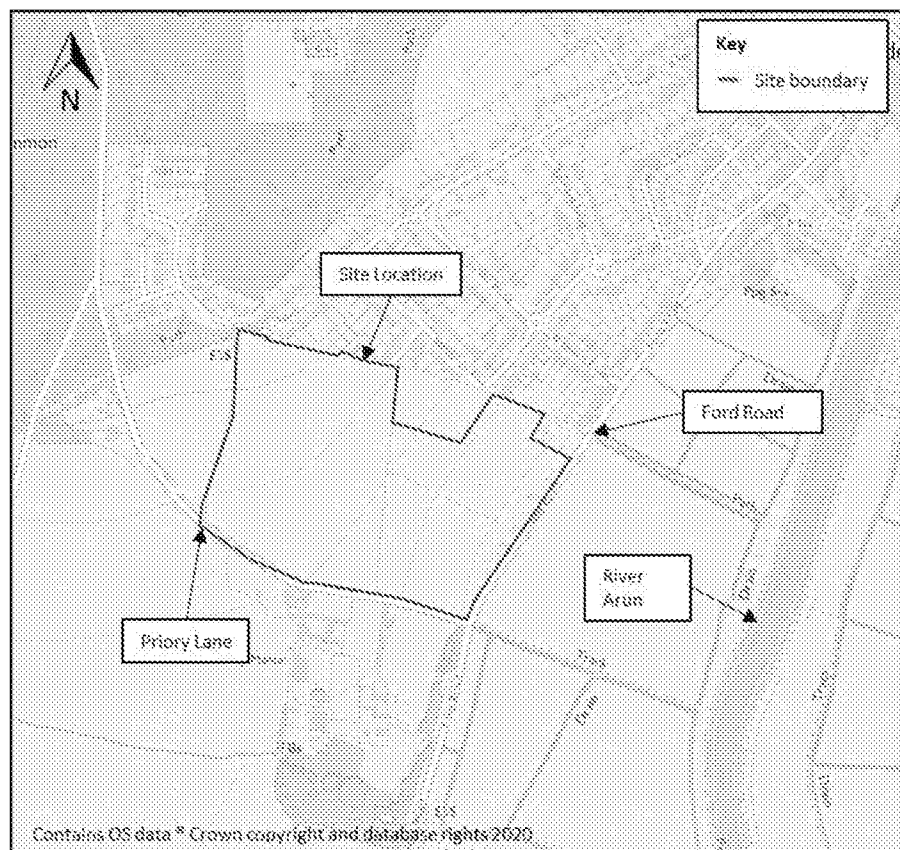


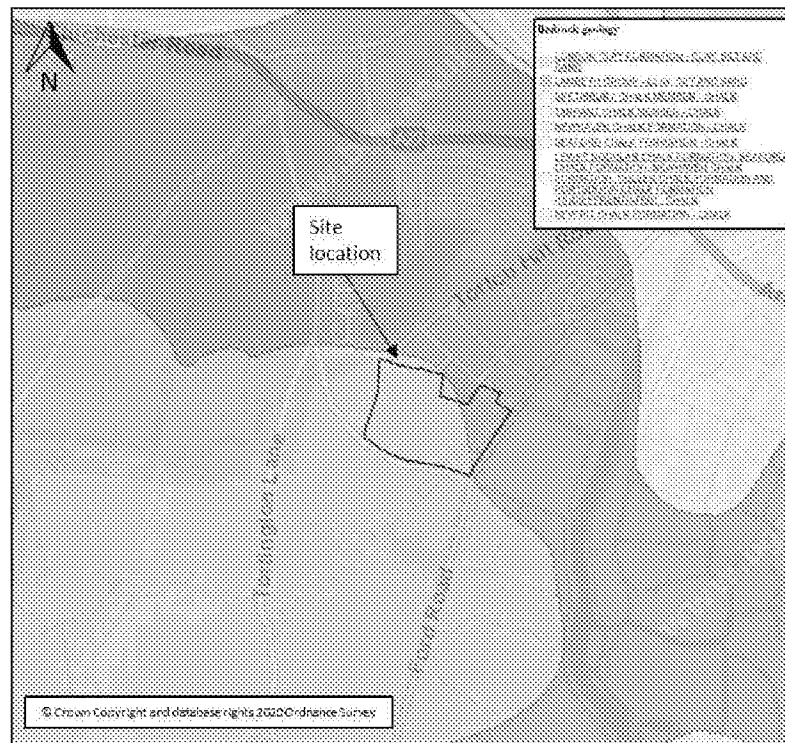
Figure 2-1: Site Location Plan

Hydrology

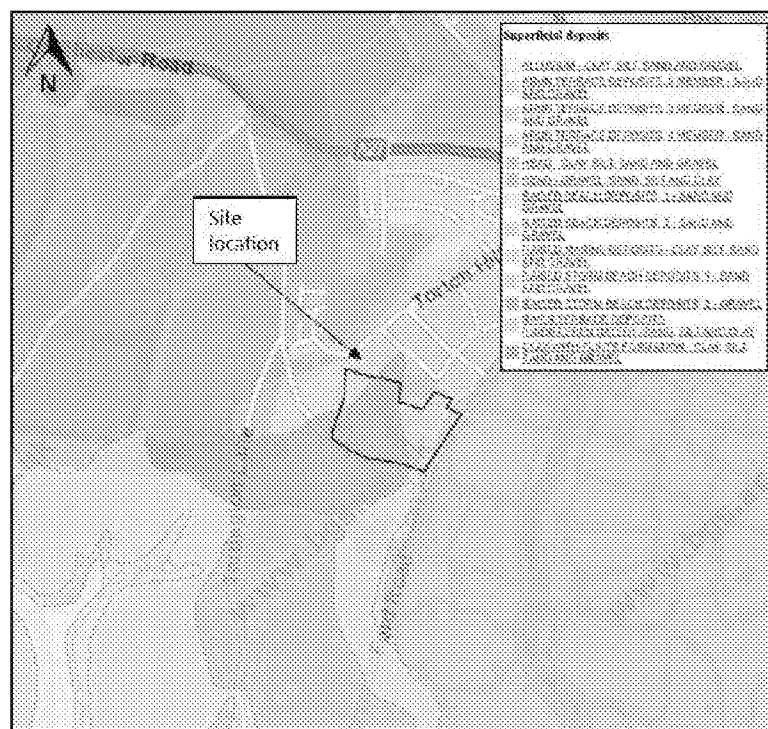
- 2.3 The River Arun runs 350m to the east of the site's eastern boundary. A network of ordinary watercourses drain the fields between Ford Road and the Arun, and eventually discharge into this River.
- 2.4 A surface water ditch crosses the middle of the site from north to south until reaching Priory Lane, where it turns east and follows the side of the road towards Ford Road. This watercourse dissects the site into a western and eastern field.
- 2.5 Another ditch runs in a southerly direction immediately outside the western site boundary.

Ground Conditions

- 2.6 A review of British Geological Survey (BGS) mapping indicates the bedrock geology of the site consists of Clay, Silt and Sand, of the London Clay and Lambeth Group Formations. A central portion of the site is overlain by Head superficial deposits formed of Clay, Silt, Sand and Gravel while a small fringe on the eastern portion of the site is overlain by Raised Marine Deposits (Clay, Silt, Sand and Gravel) Refer to **Figure 2-2** and **Figure 2-2 2-3** below.



**Figure 2-2 BGS Online Bedrock Geology Mapping- Bedrock Geology
(1:50,000)**



**Figure 2-3 BGS Online Bedrock Geology Mapping- Superficial deposits
(1:50,000)**

- 2.7 The Department for the Environment, Food and Rural Affairs (Defra) mapping indicates the Site is not located within a Source Protection Zone.

Topography

- 2.8 A topographical survey was undertaken by M. J. Zara Associates in January 2020 and is included in **Appendix B**.
- 2.9 Site elevations strongly vary from east to west, ranging from 2-4mAOD up to 27m AOD. The western field slopes from the north west corner (27.1mAOD) to the south east corner (12.0mAOD) at a constant gradient of circa 1 in 20. The field in the eastern part of the site slopes more steeply from west to east, down to Ford Road from a point of 14m AOD to 2m AOD.

Existing Sewer Infrastructure

- 2.10 Southern Water sewer records included in **Appendix C** show there are no foul or surface water sewers serving the site. The nearest public foul sewers are those serving residential properties immediately to the north of the site. Refer to Southern Water asset maps in **Appendix C** and **Figure 2-4** below.



2.11 It is proposed to develop the site to provide a new neighbourhood at Tortington consisting of 90 new residential units and ancillary access roads and landscaped amenity areas. A development masterplan is included in **Appendix A**.

3.0 POLICY CONTEXT

National Planning Policy Framework (July 2018)

- 3.1 The National Planning Policy Framework (NPPF) was introduced on 27 March 2012. This document was revised in July 2018 and again in February 2019 where paragraphs 155 to 169 inclusive, establish the Planning Policy relating to flood risk management. The Technical Guide to the NPPF was superseded by the Planning Practice Guidance (PPG) in March 2014.
- 3.2 The main focus of the policy is to direct development towards areas of the lowest practicable flood risk and to ensure that all development is safe, without increasing flood risk elsewhere. The main considerations are:
- a) applying the sequential test and then, if necessary, the exception test as set out below;
 - b) safeguarding land from development that is required, or is likely to be required, for current or future flood management;
 - c) using opportunities provided by new development to reduce the causes and impacts of flooding (where appropriate through the use of natural flood management techniques); and
 - d) where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to relocate development including housing, to more sustainable locations."
- 3.3 The NPPF states that a Flood Risk Assessment is required "*for proposals of 1 hectare or greater in Flood Zone 1; all proposals for new development (including minor development and change of use) in Flood Zones 2 and 3, or in an area within Flood Zone 1 where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.*"
- 3.4 The Site is located in Flood Zone 1, 2 and 3 associated with tidal flooding (Refer to the Environment Agency's Flood Map for Planning

in Section 4). As part of the proposed development, all residential dwellings would be located in Flood Zone 1 following a sequential approach. According to NPPF, the proposed use for the site is classified as 'More vulnerable', which is compatible with development in Flood Zone 1 without having to undergo the Sequential and Exception Tests. However, given that part of the site is within Flood Zones 2 and 3, the requirement for undergoing the Sequential and Exception tests should be confirmed with the LPA

Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	×	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	×	×	×

Key: ✓ Development is appropriate.
* Development should not be permitted.

Figure 3-1 Extract of NPPF Table 3 Flood Risk Vulnerability

Sustainable Drainage Systems - Non-statutory technical standards for sustainable drainage systems March 2015

- 3.5 The Non-statutory technical standards for sustainable drainage systems were published in March 2015. This document sets out non-statutory technical standards for sustainable drainage systems. They should be used in conjunction with the Planning Practice Guidance (PPG).

-
- 3.6 The Local Planning Authority (LPA) may set local requirements for planning permission that have the effect of more stringent requirements than these non-statutory technical standards.
- 3.7 In addition, SuDS should be designed in accordance with CIRIA 753 SuDS Manual, which represents current best practice.
- 3.8 The Non-Statutory Technical Standards for Sustainable Drainage Systems: Best Practice Guidance was published by Local Authority SuDS Officer Organisation (LASOO) in July 2015 to provide an interpretation of the technical standard.

Regional & Local Planning Policy

- 3.9 In the preparation of this report, reference is made to the following regional and local planning documents pertinent to flood risk:
- Arun District Council Level 1 Strategic Flood Risk Assessment (SFRA), JBA, August 2016;
 - Arun District Council Level 1 Strategic Flood Risk Assessment (SFRA), JBA, November 2016;
 - West Sussex LLFA Policy for the Management of Surface Water, West Sussex County Council, November 2018;
 - Arun Strategic Surface Water Management Study, Mott MacDonald, October 2016.
- 3.10 West Sussex County Council as Lead Local Flood Authority is responsible for managing local flood risk which can be defined as flood risk mainly originating from surface runoff, groundwater and ordinary watercourses.

4.0 FLOOD RISK ASSESSMENT AND SURFACE WATER MANAGEMENT

Fluvial/ Tidal Flood Risk

4.1 According to the Environment Agency's indicative flood map for planning, as illustrated in **Figure 4-1** below, the Site is mainly located within Flood Zone 1, defined as having a low risk of flooding and being suitable for any type of development.

4.2 An eastern portion of the site is located within Flood Zones 2 and 3.

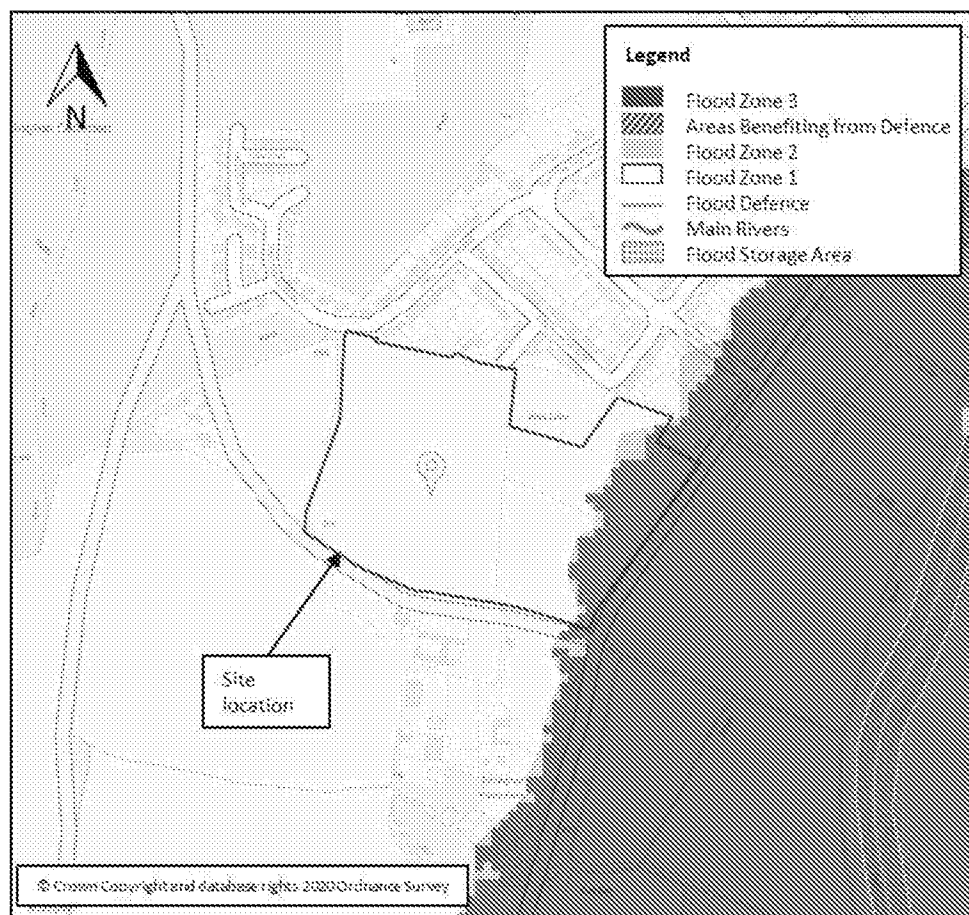


Figure 4-1: EA Flood Map for Planning

4.3 Site-specific Detailed Flood Risk Assessment Maps (Product 4) were requested from the Environment Agency; the maps are included in **Appendix D**. The information provided does not however comply with

the latest climate change (CC) allowances, which came into force in February 2016.

4.4 Following consultation with the Environment Agency (EA), it was requested that the latest 100 year climate change requirements for the South East River Basin, which came into force on the 29th February 2016, were run. The details of this modelling exercise are set out in ACE's Hydraulic Modelling Note (report no. 173483-03). The results obtained are summarised below:

4.5 **Figure 4-2** below shows the predicted flood outlines for the defended 1 in 100yr+50%CC and the 1 in 100yr+105%CC including a Mean Water Spring Tide (MHWS)+CC tidal boundary. The same figure also includes the defended 100yr and 1000yr event including a MHWS tidal boundary as received from the EA.

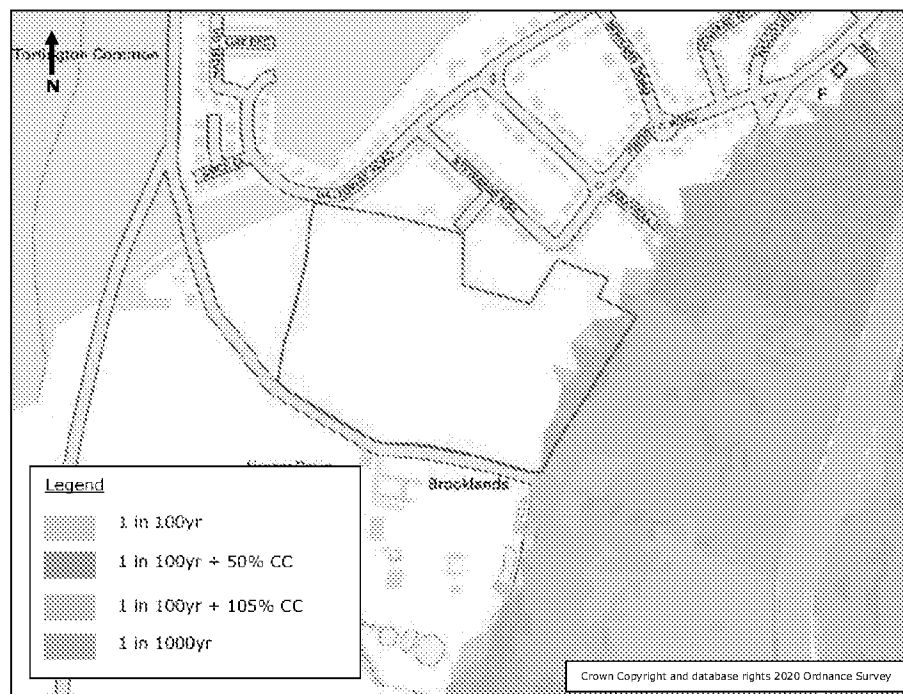


Figure 4-2: Modelled Fluvial Flood Outline

4.6 **Figure 4-3** below shows the predicted flood outlines for the defended mean winter fluvial flow including a 200yr+CC tidal boundary.

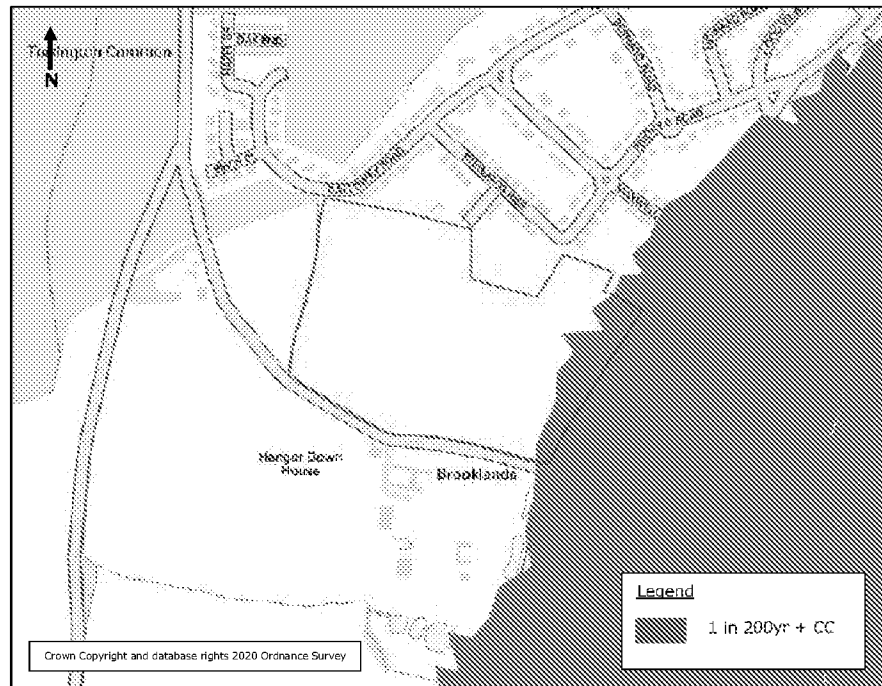


Figure 4-3: Modelled Tidal Flood Outline

- 4.7 It is proposed that all residential development is located outside the 100 year +50% flood outline and Finished Floor Levels are set 300mm above the tidal 200year+CC predicted flood level (i.e. they will be set at 4.368m AOD or above).
- 4.8 Safe access and egress in the event of flooding will be available at all times via Priory Lane heading west and subsequently north away from the tidal floodplain.
- 4.9 Considering the above, it is concluded that the proposed development is at low risk of fluvial/tidal flooding.

Pluvial Flooding

- 4.10 The Environment Agency's surface water flood map shows the site is predominantly at 'Very Low' risk of surface water flooding (**Figure 4-4**).
- 4.11 However, the eastern edge of the site adjacent to Ford Road lies within a "Medium" to "High" risk of surface water flooding, which is

classified as having an annual probability of surface water flooding of greater than 3.3% (1 in 30 year return period) and 1% (1 in 100 year return period) respectively. This represents localised flood risk which is correlated with topographic low points within the site and a lack of formal drainage. The predicted flooding is confined to this area of the site only. The surrounding roads are mainly at "Low" risk of surface water flooding.

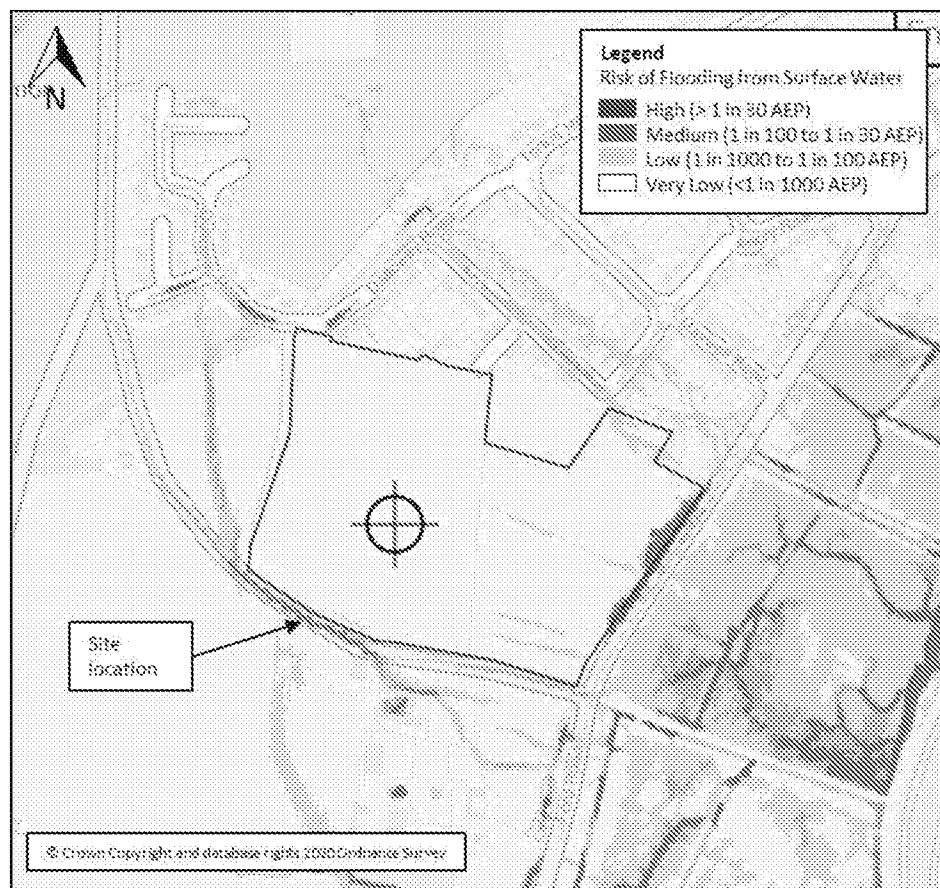


Figure 4-4: Environment Agency Flood Map for Surface Water

4.12 The areas shown to be at 'Medium' or 'High' risk of pluvial flooding are to remain open space and are to be enhanced to provide biodiversity and ecology benefits. The proposed sustainable drainage system for the Site (as described in **Section 5** of this report) will improve the overall drainage of the site, mitigating any risk of pluvial flooding.

4.13 Based on the above, the risk of surface water flooding to the site, or

from the development to offsite areas, is considered low.

Sewer Flooding

- 4.14 There are no recorded sewer flooding incidents within close proximity to the site.
- 4.15 The site is considered to be at very low risk of sewer flooding.

Groundwater Flooding

- 4.1 The 'Susceptibility to Groundwater Flooding' map included in the SFRA shows the site in an area with a low associated susceptibility to groundwater flooding (less than 25%).
- 4.2 Therefore, the site is assessed as being at low risk of groundwater flooding.

Artificial sources

- 4.3 According to the Environment Agency's Flood risk from reservoirs map, the Site is not in an area at risk of flooding from a reservoir breach. There are no other artificial sources (e.g. canals) within the vicinity of the development. The site is therefore considered to be at negligible risk of flooding from artificial sources.

Summary of Flood Risk Assessment

- 4.4 In view of this assessment, it is concluded that the development site is at low risk of flooding from any source including fluvial, tidal, a breach of any nearby reservoir, sewer flooding, groundwater or surface water flooding.

5.0 SUSTAINABLE DRAINAGE STRATEGY

Existing Surface Water Drainage Regime

- 5.1 An ordinary watercourse crosses the centre of the site from north to south, dissecting it into a western and an eastern parcel. The western parcel is circa 5.95ha in area, whilst the eastern parcel has an area of 3.86ha. The total planning redline boundary equates to approximately 9.81ha of greenfield land.
- 5.2 Greenfield runoff generated on the western parcel currently flows into this ditch, which connects into another watercourse running eastward along Priory Lane.
- 5.3 The Lead Local Flood Authority has confirmed this ditch is then culverted under Ford Road and discharges into the network of ordinary watercourses between Ford Road and the Arun.
- 5.4 Greenfield runoff from the eastern parcel follows an east-west topography and drains towards Ford Road. There is a ditch alongside Ford Road which takes runoff from this portion of the site, although water appears to also pond onsite in the low-lying area adjoining Ford Road.
- 5.5 There are no known public foul or surface water sewers in close proximity to the Site.

Proposed Sustainable Drainage Systems (SuDS)

- 5.6 In accordance with the NPPF Planning Practice Guidance, surface water runoff should be disposed of according to the following hierarchy:
1. Store rainwater for later use;
 2. Use infiltration techniques, such as porous surfaces in non-clay areas;
 3. Attenuate rainwater in ponds or open water features for gradual release;
 4. Attenuate rainwater by storing in tanks or sealed water features for gradual release;
 5. Discharge rainwater direct to a watercourse;

6. Discharge rainwater to a surface water sewer/drain; and
7. Discharge rainwater to the combined sewer.

- 5.7 As discussed in **Section 2**, BGS data indicates that the majority of the Site is underlain by a combination of Clay, Silt and Sand, of the London Clay Formation. In addition, there are several watercourses in the area, including those crossing the site and in the immediate vicinity, which has lead us to conclude that surface water drains through superficial deposits into these watercourses.
- 5.8 Consequently, based on the characteristics of the site and its surroundings, we consider that the infiltration potential of the underlying soil will not be sufficient for a drainage strategy based on infiltration. It is therefore proposed to discharge surface water runoff at a controlled greenfield runoff rates into the onsite watercourse and into the watercourse running along Priory Lane.
- 5.9 The infiltration potential of the underlying soil should nonetheless be fully investigated by soakage testing to BRE365. Should testing confirm the viability of using infiltration systems, a solution combining attenuation and infiltration systems prior to discharge into the onsite watercourses will be explored. For the purpose of this Outline Application, a worst-case scenario has been assumed whereby infiltration systems are not feasible. This approach has been discussed and approved in principle by Arun District Council (refer to correspondence with ADC Drainage Engineer in **Appendix E**)
- 5.10 The constraints and opportunities for the use of SuDS techniques are appraised using the Management Train approach outlined in CIRIA C753 'The SuDS Manual' in **Table 5-1** below.

Table 5-1: C753 SuDS Management Train, Site Assessment

Type:	Infiltration Devices (Source Control)
Constraints:	Ground conditions onsite are variable and may be dominated by impermeable clays.
Opportunities:	Should testing confirm the viability of using infiltration systems, a solution combining attenuation and infiltration could be explored.
Type:	Lined Permeable Paving (Source Control)
Constraints:	The use of permeable paving in individual driveways is not advised as its correct functioning would be reliant on good maintenance, which cannot be enforced or controlled at an individual level.
Opportunities:	Permeable paving could be used in shared car parking areas of the site in order to provide additional water attenuation and a stage of treatment before discharging into the drainage system.
Type:	Rainwater Harvesting (Source Control)
Constraints:	The benefits of rainwater harvesting on a specific design storm event cannot be quantified, due to the seasonal availability of storage within the structure.
Opportunities:	Opportunities in amenity areas to provide harvesting features such as raised planters and water butts exist. It would be difficult to quantify storage contribution, and therefore these features are not included within calculations as part of this surface water management strategy.
Type:	Swales, etc. (Permeable Conveyance)
Constraints:	In order to provide practicable attenuation benefits 1:3 side-slope swales tend to require a significant land requirement.
Opportunities:	A swale is proposed as part of the drainage strategy for conveyance and to improve water quality.
Type:	Attenuation Basin/Ponds (end of pipe treatment)
Constraints:	Significant land take.
Opportunities:	There are opportunities to provide attenuation basins in the proposed public open spaces.
Type:	Attenuation Tanks (end of pipe treatment)
Constraints:	None.
Opportunities:	Should additional attenuation be required this could be achieved by use of oversized sewers or geo-cellular storage attenuation.
Type:	Proprietary SuDS – Downstream Defender (end of pipe system)
Constraints:	None.
Opportunities:	Could be used to improve the quality of surface water discharge offsite if required.

5.11 After consideration of the CIRIA C753 SuDS Management Train approach, the most viable SuDS option for this site are conveyance swales and attenuation basins prior to discharge to existing ordinary watercourses at controlled greenfield runoff rates via a complex flow control system. Permeable paving is proposed in a small number of

areas in order to provide additional water attenuation and a stage of treatment before discharging into the drainage system. Please refer to the proposed drainage strategy plans (**Drawings 173483-004 and 173483-005**) in **Appendix F**.

Proposed surface water runoff rates

- 5.12 The surface water drainage strategy separates the Site into two sub-catchments (eastern and western parcels) based on the Site's natural topography and site characteristics. Surface water runoff from each plot will be conveyed via a piped drainage network into conveyance swales leading to strategic attenuation basins/ponds prior to discharging at controlled rates, equivalent to calculated greenfield runoff rates for the 1, 30 and 100 year.
- 5.13 The existing greenfield runoff rates from the eastern and western parcels have been determined using the ICP SuDS Mean Annual Flow Method. The catchment sizes have been based upon the proposed developable areas, thereby excluding any large areas proposed for open green space which will continue to drain at greenfield rate. Peak Greenfield Runoff rates are presented in **Table 5-2** below. Full calculations can be found in **Appendix G**.

Table 5-2: Greenfield Discharge rates

Catchment	Size (Ha)	Proposed Greenfield Run-off rate (l/s)			
		1 in 1 year	1 in 30 year	1 in 100 year	1 in 100 year + Climate Change
West	3.80	6.7	17.9	25.1	25.1
East	1.0	1.8	4.7	6.6	6.6

- 5.14 Surface water runoff in excess of the proposed discharge rate for all storm events (up to and including the 100 year plus 40% allowance for climate change) will be attenuated onsite. Please refer to the

proposed drainage strategy plans (**Drawings 173483-004 and 173483-005**) in **Appendix F**.

- 5.15 MicroDrainage modelling results show there is no flooding on the Site for the 1 in 100 year including 40% climate change rainfall event. MicroDrainage modelling results are included in **Appendix G**.

Long Term Storage

- 5.16 It is proposed that the site will be restricted to variable Greenfield rates for up to the 1 in 100-year event plus 40% climate change. As such, Long Term Storage (LTS) will need to be provided based on discharge rates of 2 l/s/ha. The LTS for each development parcel has been calculated in accordance with CIRIA C753 and is indicated in **Table 5-3** below (refer to **Appendix G** for LTS calculation sheets). This volumes will be provided within the proposed attenuation basins.

Table 5-3: Long Term Storage Requirements

Parcel	Developable Area (ha)	LTS Discharge Rate (l/s)	LTS Requirements (m ³)
West	3.80 ha	7.60	513
East	1.0 ha	2.0	124

Urban creep

- 5.17 In line with BS 8582 'Code of practice for surface water management for development sites' and the Non-Statutory Technical Standards for Sustainable Drainage – Best Practice Guidance, a 10% allowance has been factored into the drainage design to take into account the possible increase in impermeable area over the lifetime of the development due to its residential use. A 10% increase in impermeable areas has been added to the proposed housing areas.

Overland Flow Routes

- 5.18 The surface water drainage strategy has been designed to ensure no flooding occurs as a result of the 1 in 100-year rainfall event (including an allowance for climate change).
- 5.19 Site levels will be designed to ensure that exceedance flows are directed towards the proposed surface water basins where capacity will exist within the 0.3m freeboard. Site levels will also be designed to ensure surface runoff falls away from residential dwellings.

Water Quality

- 5.20 Development proposals are for residential use, property driveways and low traffic roads. Based on Ciria753 Simple Index Treatment Method, the development would have an associated pollution hazard level of 'Very low'. The recommended stages of will be provided through the aforementioned conveyance swales and attenuation basins.

Maintenance and Management of System

- 5.21 In accordance with the recently published Code for Adoptions, the drainage network will be offered to Southern Water for adoption, including the proposed swales and detention basins.
- 5.22 A management company will be appointed to maintain the permeable paving as this is not covered within the updated adoption regimes. In the event that Southern Water do not adopt the surface water network, the management company will also attain responsibility for the maintenance of the remaining features associated with the development. Funding of the maintenance regime will likely to be via the yearly maintenance fees from the development if not adopted.
- 5.23 All maintenance will be in accord with the best practices and the CIRIA Manual C753.

Foul Drainage

- 5.24 It is proposed that foul flows generated from the development will be collected by a gravity network and directed to a pumping station on

the eastern portion of the site. A rising main will then take flows to a proposed discharge point (Southern Water Manhole No. 9305) located circa 150m north along Ford Road.

- 5.25 Based on rates from *British Water Flows and Loads -4* and 90 residential units, the proposed development site will generate a peak foul flow rate of 5.15l/s. Please refer to the foul loading calculation sheet within **Appendix H**.

6.0 SUMMARY & RECOMMENDATIONS

- 6.1 Ardent Consulting Engineers has been appointed by Savills Ltd and the Norfolk Estate to prepare a site-specific Flood Risk Assessment (FRA) and Drainage Strategy to support the proposed residential development of the site known as "Land at Tortington, Arundel".
- 6.2 It is proposed to develop the site to provide a new neighbourhood at Tortington consisting of 90 new residential units and ancillary access roads and landscaped amenity areas.
- 6.3 The Site is mainly located within Flood Zone 1, defined as being at a low risk of tidal/fluviial flooding. The proposed use for the site is classified as 'More vulnerable', which is compatible with development in Flood Zone 1 without having to undergo the Sequential and Exception Tests. However, a portion of the site is located within Flood Zones 2 and 3. As such, the need for the sequential and exception tests will need to be confirmed by the LPA.
- 6.4 Ardent carried out hydraulic modelling in consultation with the Environment Agency in order to obtain modelled flooding extents in accordance with the latest climate change requirements. The details of this modelling exercise are set out in Ardent's Hydraulic Modelling Note (report no. 173483-03); the obtained results have been summarised in Section 4 of this report. All residential development will be located outside the 100 year +50% flood outline and Finished Floor Levels will be set a minimum of 300mm above the tidal 200year+CC predicted flood level.
- 6.5 The Environment Agency's surface water flood map shows the site is predominantly at 'Very Low' risk of surface water flooding.
- 6.6 After consideration of the CIRIA C753 SuDS Management Train approach, it is proposed that surface water runoff from the development site will be conveyed via a piped drainage network into conveyance swales leading to strategic attenuation basins/ponds prior to discharging at controlled greenfield runoff rates, equivalent to

calculated greenfield runoff rates for the 1, 30 and 100 year, into onsite and adjacent watercourses.

6.7 MicroDrainage modelling results show there is no flooding on the Site for the 1 in 100 year including 40% climate change rainfall event.

6.8 In conclusion, this FRA demonstrated that the development site is at low risk of flooding from all sources of flooding, including fluvial, tidal, sewer, infrastructure (reservoir) , groundwater or surface water. The report concludes that:

- i. The development scheme and its occupants will not be at an increased risk of flooding;
- ii. The development scheme will not increase the risk of flooding elsewhere;
- iii. The proposals are consistent with the aims of the NPPF and PPG.

Appendix A



Quantum of Development:

	Area (ha)
Net Developable Area	3.82
SuDs	0.67
Allotments	0.10
Green (inc. LEAP)	0.21
Primary Tree Lined Road	0.42
Green Infrastructure	4.96
Site Area	10.18

Developable Area: 3.82 ha

Number of Units: 90

(Affordable Units: 27)

Density: 24dph

- Existing Built Form
- Existing Vegetation
- Proposed Planting
- Primary Tree Lined Road
- SuDS - Sustainable Drainage System
- Allotments
- LEAP - Local Equipped Area for Play
- 1m Contours
- Site Boundary
- Emergency Site Access Only
- Public Right of Way
- Pedestrian Access
- Proposed Footpath (Hoggin Surface)
- Mown path
- Vehicle Access (new junction)

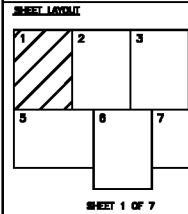
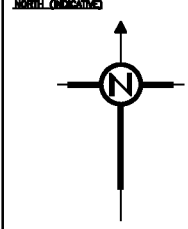
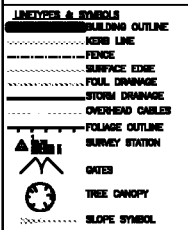
Illustrative Masterplan

Land at Ford Road, Arundel

Reproduced from the Ordnance Survey Map with the permission of the Controller of H.M. Stationery Office Crown copyright licence number 100024244 Savills (UK) Ltd. Published for the purposes of identification only and although believed to be correct accuracy is not guaranteed. C:\Users\coraluker\Box\UK Urban Design Projects\North Essex\SNUD400667\Land at Ford Road\Drawings\DDM\03 Illustrative Masterplan\2000@A3\IM03 Illustrative Masterplan_2000@A3\2011/20

drawing no.	IM003	drawing	Illustrative Masterplan
revision	1	scale	2000@A3
drawn by	CO	checked by	CO
date	20.11.2020	job no.	SNUD 400667

Appendix B



LAND & MINERAL RIGHTS SURVEYING

U. J. ZARA ASSOCIATES

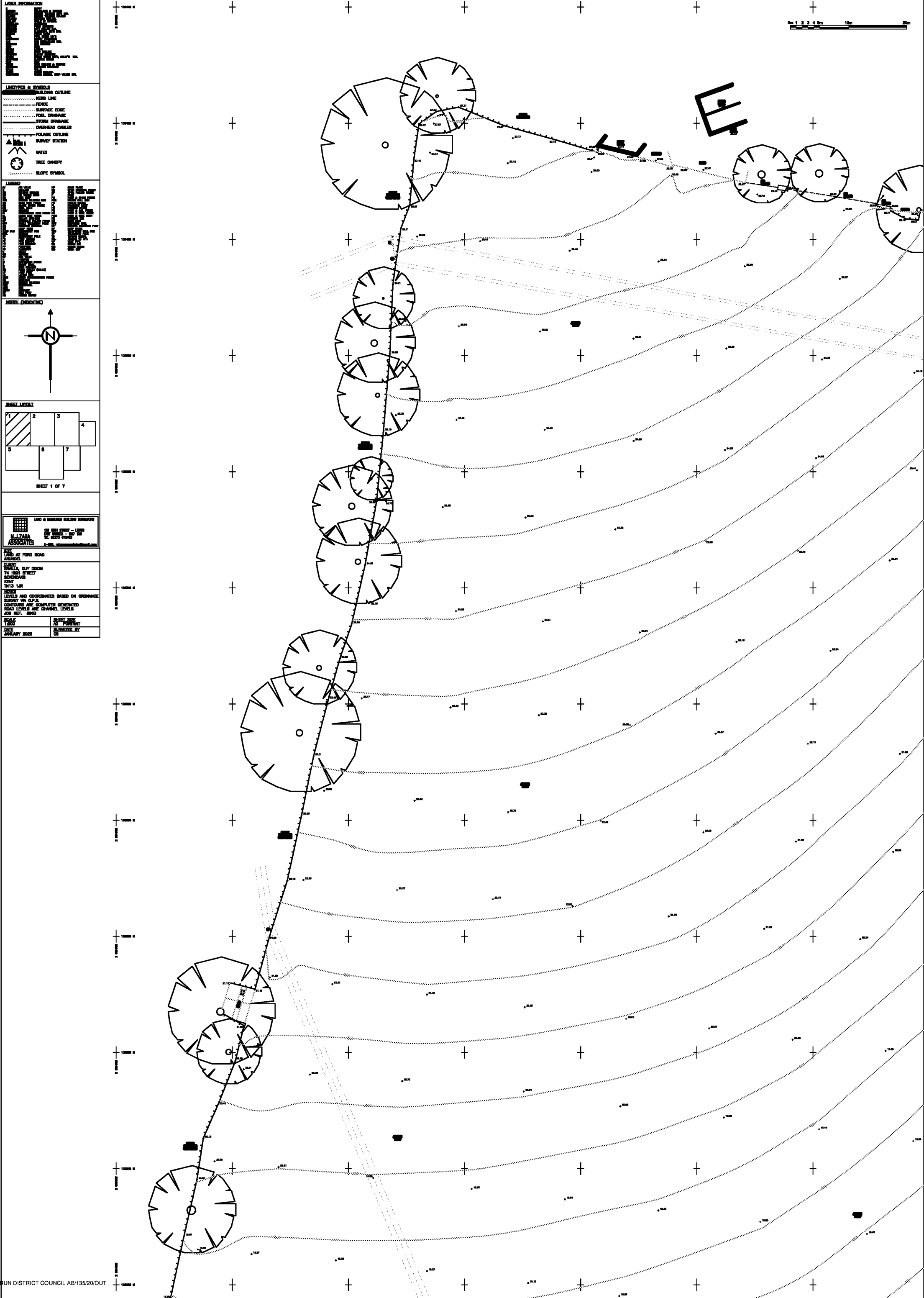
130 HIGH STREET - 1000
SUITE 1000 - 1000
SUITE 1000 - 1000
SUITE 1000 - 1000

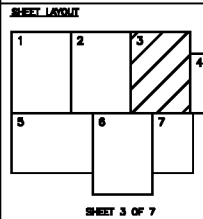
PROJECT
LAND AT FORD ROAD
ARUNDEL

CLIENT
SHELLS, GUY DEON
74 HIGH STREET
SEVENOAKS
SE17 1JN

SCOPE
LEVELS AND COORDINATES BASED ON ORDNANCE
SURVEY VIA GPS
CONTIGUOUS ARE COMPUTER GENERATED
ROAD LEVELS ARE CHANNEL LEVELS
AND NOT TO BE USED

SCALE 1:200	SHEET SIZE A0 PORTRAIT
DATE JANUARY 2020	DRAWN BY CJ



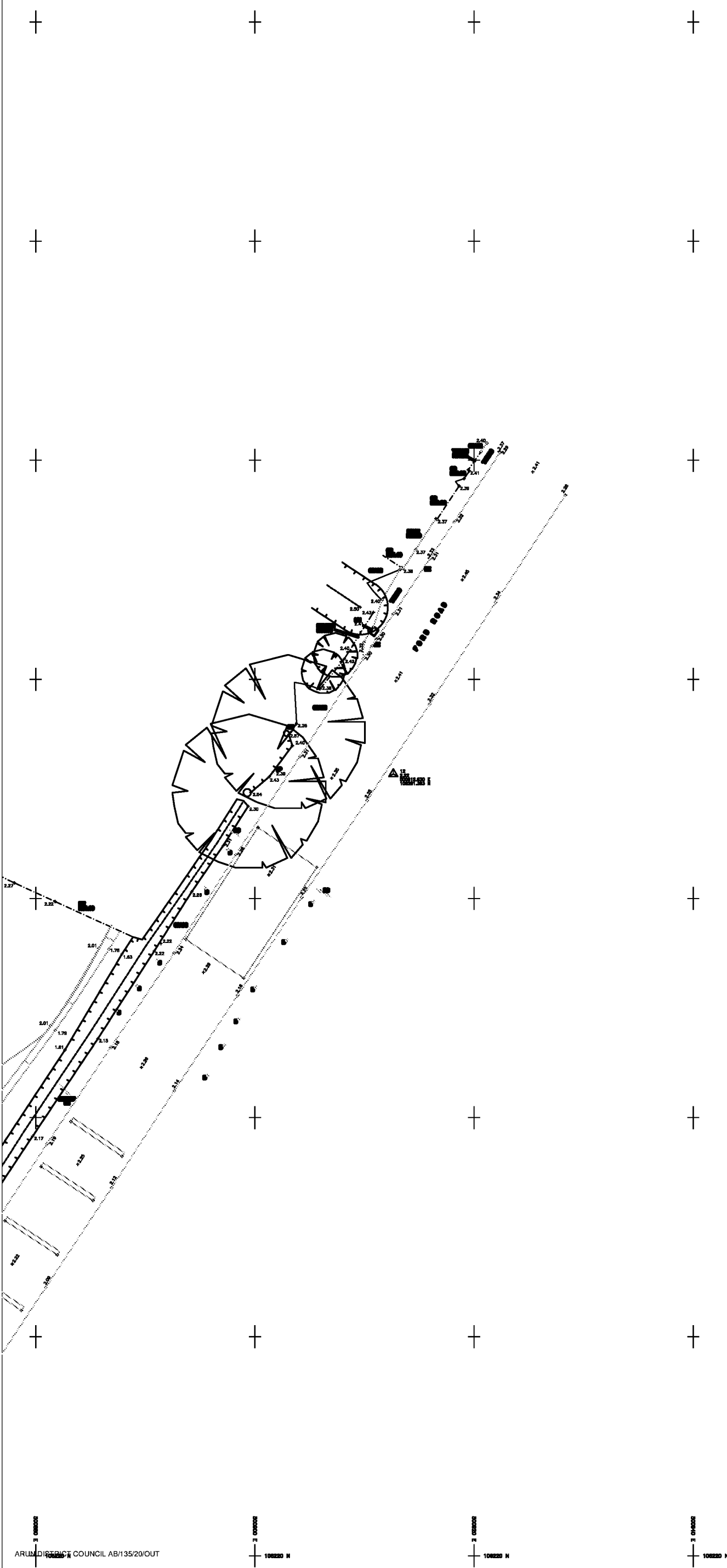


SITE
LAND AT FORD ROAD
ARUNDEL

CLIENT
SAMUEL, GUY DOON
74 HIGH STREET
SEVENOAKS
KENT
TN13 1JR

SCALE 1:2000	SHEET SIZE A0 PORTRAIT
DATE JANUARY 2020	SURVEYED BY CS



[illegible]

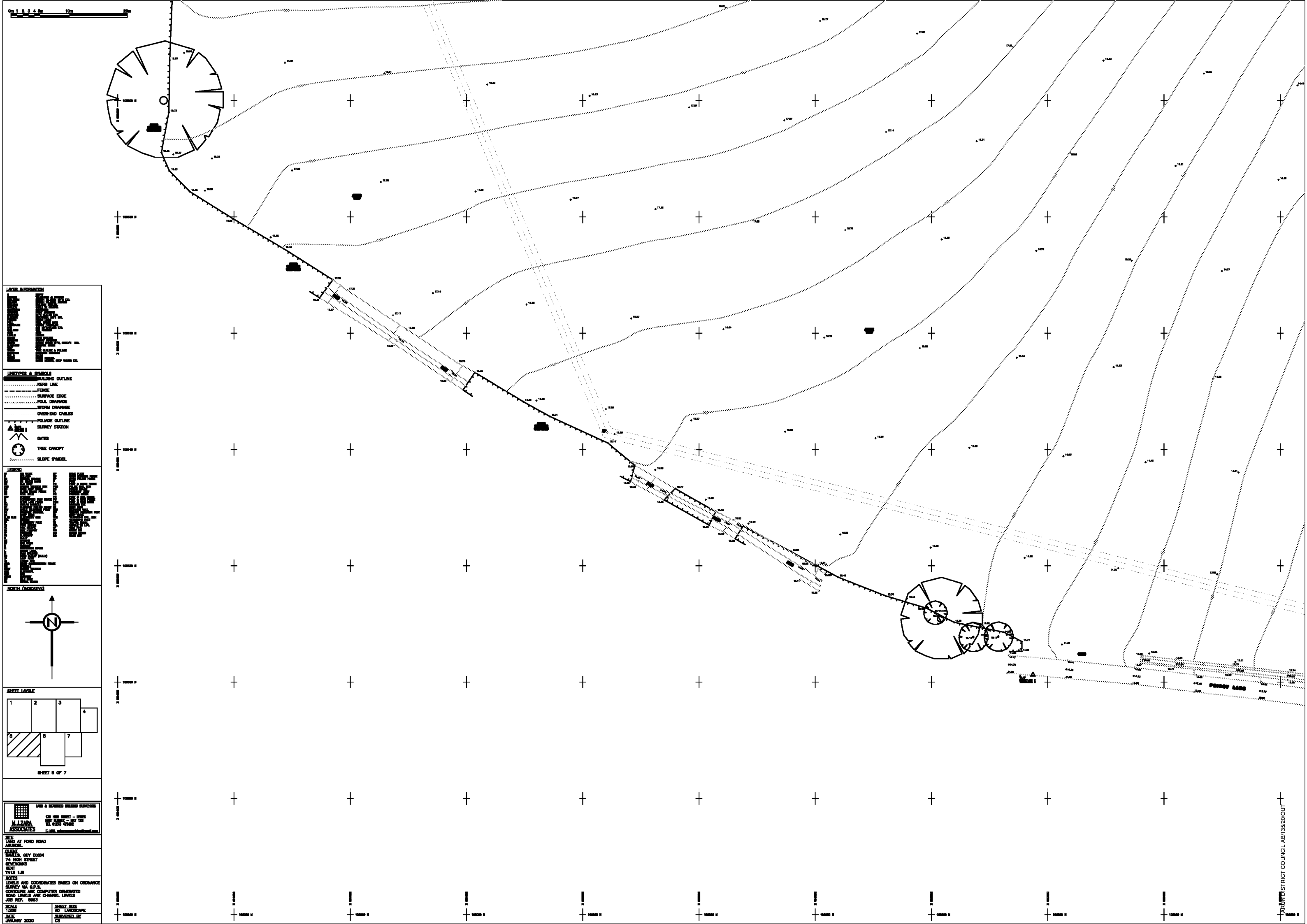
	BUILDING OUTLINE
	KERB LINE
	FENCE
	SURFACE EDGE
	FOUL DRAINAGE
	STORM DRAINAGE
	OVERHEAD CABLES
	FOLIAGE OUTLINE
	SURVEY STATION
	GATES
	TREE CANOPY
	SLOPE SYMBOL

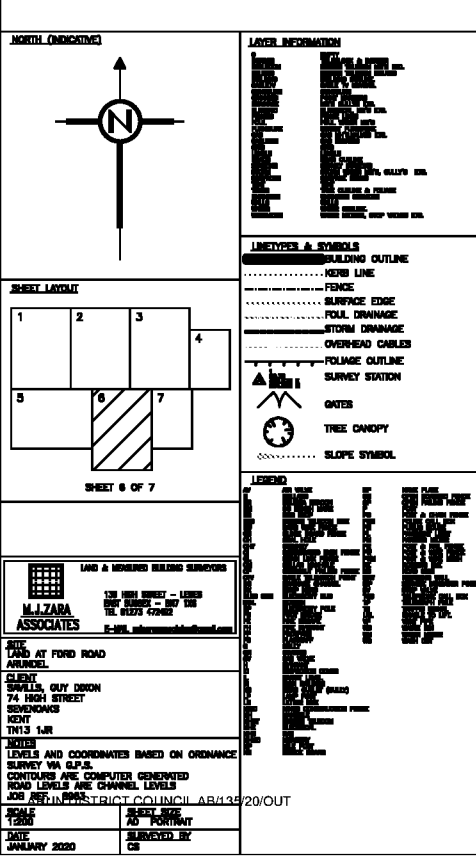
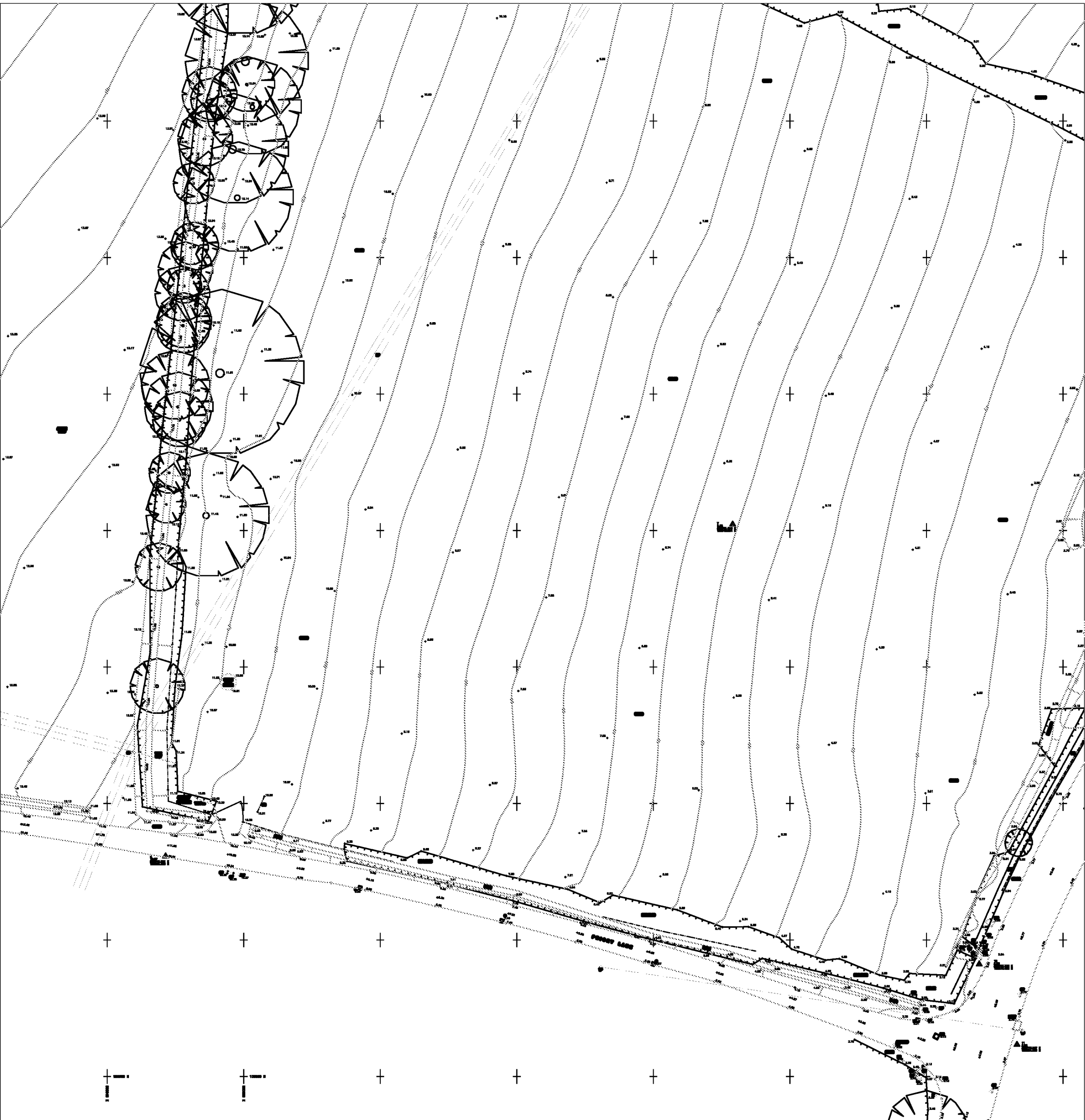
[illegible]

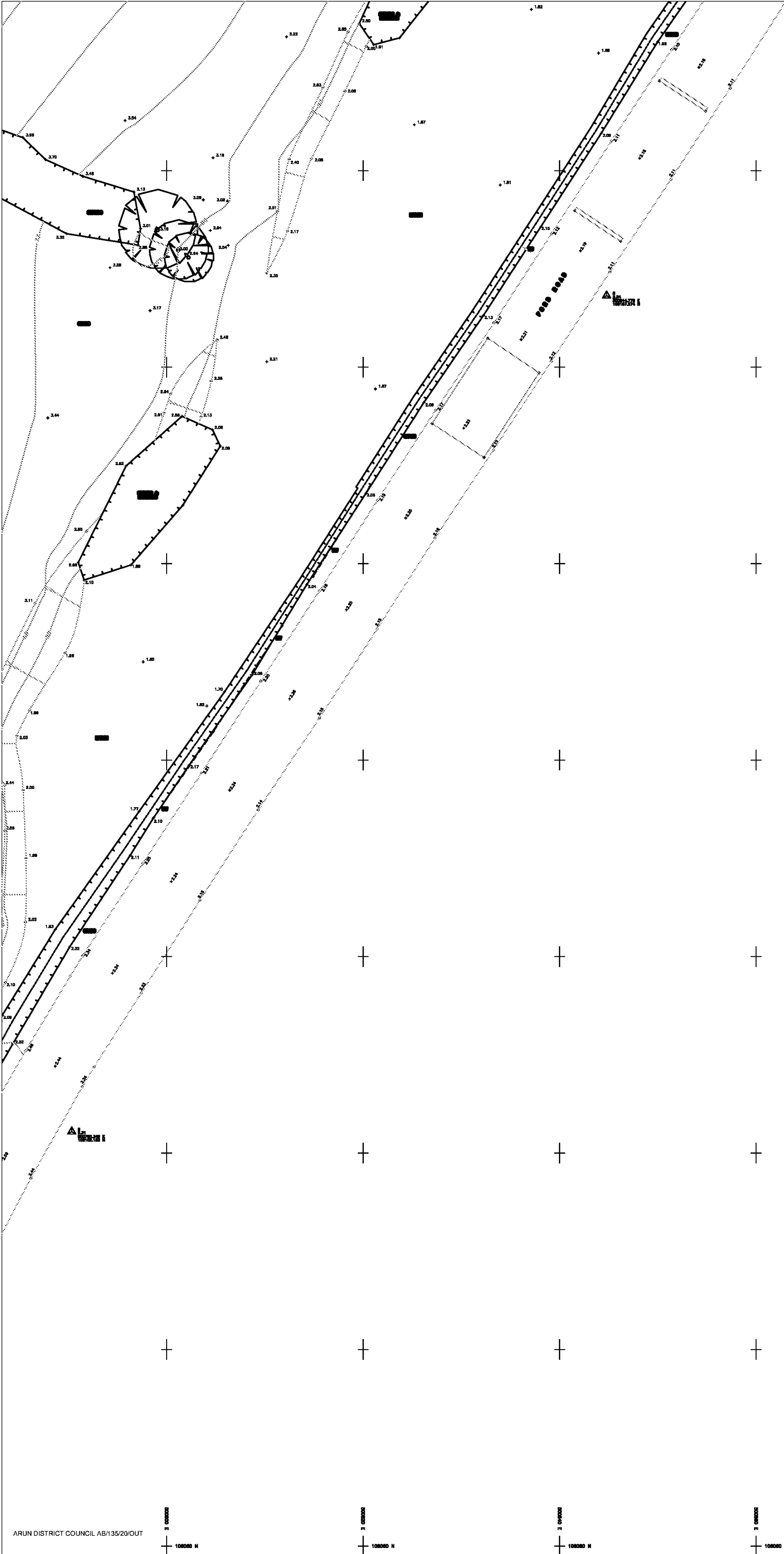
SHEET 4 OF 7

SITE LAND AT FORD ROAD ARUNDEL
CLIENT SAVILLS, GUY DIXON 74 HIGH STREET SEVENOAKS KENT TN13 1JR
NOTES LEVELS AND COORDINATES BASED ON ORDNANCE SURVEY VIA G.P.S. CONTOURS ARE COMPUTER GENERATED ROAD LEVELS ARE CHANNEL LEVELS JOB REF. 8963

<u>SCALE</u> 1:200	<u>SHEET SIZE</u> A1 PORTRAIT
<u>DATE</u> JANUARY 2020	<u>SURVEYED BY</u> CS







LAYER INFORMATION

[illegible]

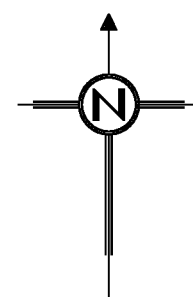
LINETYPES & SYMBOLS

LINE TYPES & SYMBOLS	
	BUILDING OUTLINE
	KERB LINE
	FENCE
	SURFACE EDGE
	FOUL DRAINAGE
	STORM DRAINAGE
	OVERHEAD CABLES
	FOLIAGE OUTLINE
	SURVEY STATION
	GATES
	TREE CANOPY
	SLOPE SYMBOL

LEGEND

[illegible]

NORTH (INDICATIVE)



SHEET LAYOUT

A 2x3 grid of rectangles. The top row contains rectangles labeled 1, 2, and 3. The bottom row contains rectangles labeled 5, 6, and 7. Rectangle 7 is shaded with diagonal lines. Rectangle 4 is a small rectangle to the right of rectangle 3.

SHEET 7 OF 7



LAND & MEASURED BUILDING CLEMENTS

130 HIGH STREET - LEWES
EAST SUSSEX - BN7 1XS
TEL 01273 472482

E-MAIL m.barnes@clinton.com

SITE

**SITE
LAND AT FORD ROAD
ARUNDEL**

CLIENT

CLIENT
SAVILLS, GUY DIXON
74 HIGH STREET
SEVENOAKS
KENT
TN13 1JR

NOTES

NOTES
LEVELS AND COORDINATES BASED ON ORDNANCE
SURVEY VIA G.P.S.
CONTOURS ARE COMPUTER GENERATED
ROAD LEVELS ARE CHANNEL LEVELS
JOB REF. 8963

SCALE
1:200

DATE
JANUARY 2020

<u>SHEET SIZE</u>
A1 PORTRAIT
<u>SURVEYED BY</u>
CS

Appendix C



(c) Crown copyright and database rights 2020 Ordnance Survey 100031673 Date: 27/01/20 Scale: 1:1250 Map Centre: 500558.106232 Data updated: 18/12/19 Our Ref: 365108 - 1 Wastewater Plan A1

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 2020 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.

 Road Gravity Sewer	 Constrained Gravity Sewer	 Culverted Sewer	 Surface Water	 Rising Main	 Manhole
 Constrained Outfall	 Road Outfall	 Surface Water Outfall	 Surface Water Inlet	 Sewerage Treatment Works	 Sewerage Treatment Works

 Sewerage Treatment Works	 Sewerage Treatment Works	 Sewerage Treatment Works	 Sewerage Treatment Works	 Sewerage Treatment Works	 Sewerage Treatment Works
 Sewerage Treatment Works	 Sewerage Treatment Works	 Sewerage Treatment Works	 Sewerage Treatment Works	 Sewerage Treatment Works	 Sewerage Treatment Works



Wastewater Plan A1

Appendix D

Charlie Cooper
Ardent
Third Floor
The Hallmark Building
52-56 Leadenhall Street
London
EC3M 5JE

Our ref: SSD157494
Date: 30/01/2020

Dear Charlie Cooper,

Enquiry Regarding Product 4 for Flood Risk Assessment for Land At Ford Road, Arundel, BN18 9ES.

Thank you for your enquiry which was received on 16th January 2020.

We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004. The information is attached.

The information on Flood Zones in the area relating to this address is as follows:

The site is in an area located within Flood Zone 1, 2 & 3 as shown on our Flood Map for Planning (Rivers and Sea).

Note - This information relates to the area that the above named property is in and is not specific to the property itself as it is influenced by factors such as the height of door steps, air bricks or the height of surrounding walls. We do not have access to this information and is not currently used in our flood modelling.

Flood Zone definitions can be found at www.gov.uk/guidance/flood-risk-and-coastal-change#Table-1-Flood-Zones

Flood Defences

There are flood defences in the form of an embankment, with an estimated standard of protection of 1 in 200 years (0.5% AEP). This asset is maintained by Environment Agency.

Model Information

The model used was the Lower Tidal River Arun Strategy which was completed by Atkins in 2010.

Flood History

We hold no record of previous flooding events affecting this site.

Please note our records are not comprehensive and may not include all events. I recommend contacting the Lead Local Flood Authority, **West Sussex County Council** or the Local Authority, **Arun District Council** for a more comprehensive flood history check.

FRA advisory text

Name	Product 4
Description	Detailed Flood Risk Assessment Map for Land At Ford Road, Arundel, BN18 9ES.
Licence	<u>Open Government Licence</u>
Information Warnings	Climate Change allowances for the fluvial model only show the superseded 20% increase in flows. The current allowances should be checked here: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances. The tidal flood risk data provided is based on existing EA hydraulic models for existing 0.5% annual probability events with an allowance for climate change. Please note the climate change allowances provided are not up to date. These were updated on 17 December 2019. You should refer to https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances for the most up to date allowances. You will need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence.
Information Warning - OS background mapping	<i>The mapping of features provided as a background in this product is © Ordnance Survey. It is provided to give context to this product. The Open Government Licence does not apply to this background mapping. You are granted a non-exclusive, royalty free, revocable licence solely to view the Licensed Data for non-commercial purposes for the period during which the Environment Agency makes it available. You are not permitted to copy, sub-license, distribute, sell or otherwise make available the Licensed Data to third parties in any form. Third party rights to enforce the terms of this licence shall be reserved to OS.</i>
Attribution	Contains Environment Agency information © Environment Agency and/or database rights. Contains Ordnance Survey data © Crown copyright 2020 Ordnance Survey 100024198.

Data Available Online

Many of our flood datasets are available online:

- Flood Map For Planning ([Flood Zone 2](#), [Flood Zone 3](#), [Flood Storage Areas](#), [Flood Defences](#), [Areas Benefiting from Defences](#))
- [Risk of Flooding from Rivers and Sea](#)
- [Historic Flood Map](#)
- [Current Flood Warnings](#)

Please get in touch if you have any further queries or contact us within two months if you'd like us to review the information we have sent.

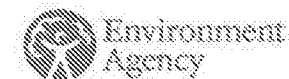
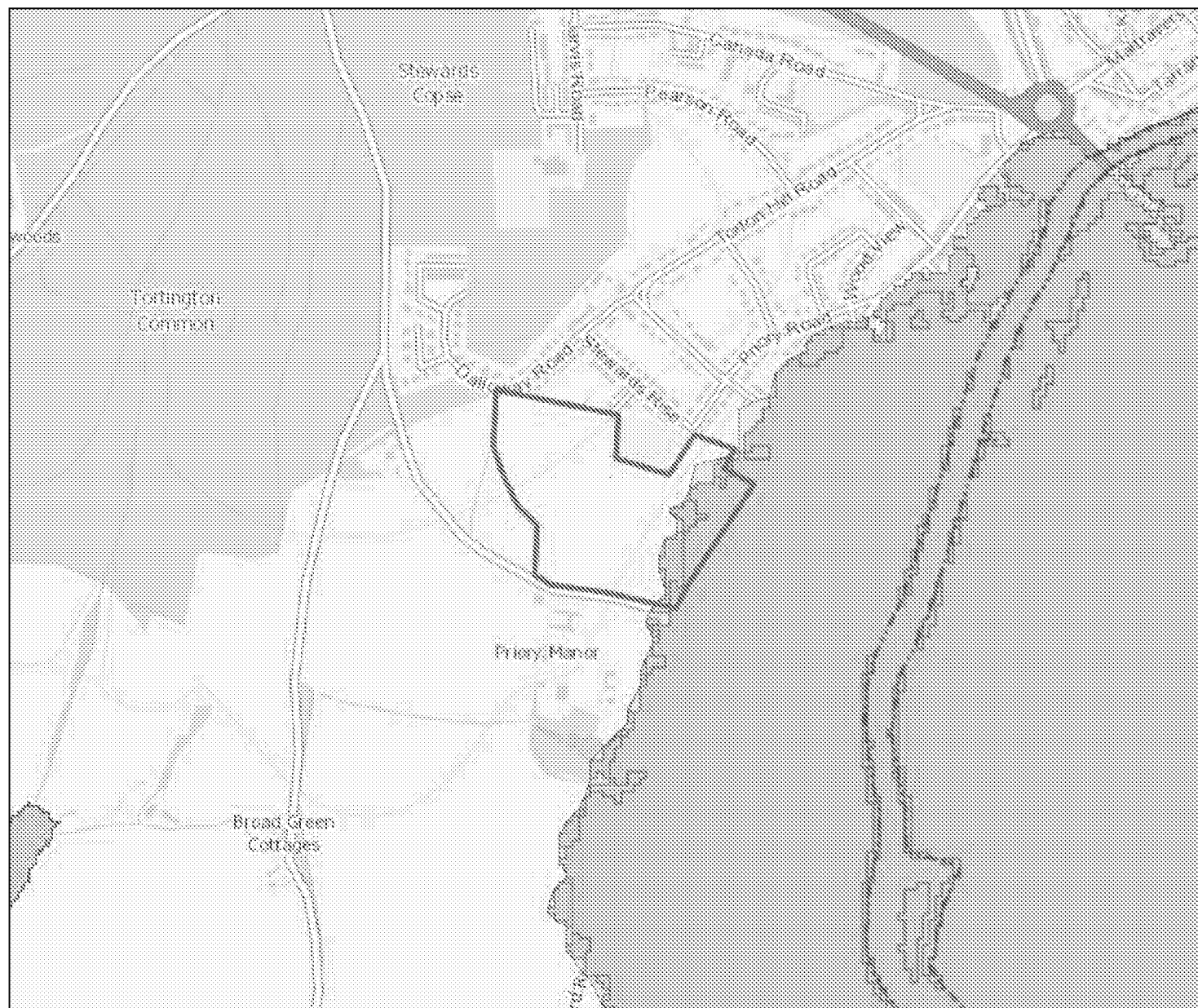
Yours sincerely,

Tom Lamboo

FCRM Officer, Partnership & Strategic Overview West Sussex, Solent and South Downs

Environment Agency, Guildbourne House, Chatsworth Road, Worthing, West Sussex, BN11 1LD

Flood Map for Planning (Rivers and Sea). Centred BN18 9ES. Created 29/01/2020.



1: 10,000

0 Metres 250



Flood Map for Planning (Rivers & Sea)

- Defences
- Flood Storage Areas
- Areas benefiting from flood defences
- Flood Zone 3
- Flood Zone 2

Flood Map Areas (assuming no defences)

Flood Zone 3 shows the area that could be affected by flooding:

- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

Legend

Please see page 2 for asset
symbolology



1: 10,000

0 250

Metres



Structures

-  Control Gate
-  Draw Off Tower
-  Fish Pass
-  Hydrobrake
-  In Channel Stoplogs
-  Inspection Chamber
-  Jetty
-  Outfall
-  Screen
-  Spillway
-  Stilling Basin
-  Weir

Beach Structures

-  Breakwater
-  Ramp
-  Slipway
-  Steps
-  Groyne

Instruments

-  Active Monitoring
-  Passive Monitoring

Channel Crossings

-  Bridge
-  Utility Services

Aids to Navigation

-  Beacon
-  Buoy
-  Dolphin
-  Signage
-  Signal

Building Assets

-  Pump House

Major Civils

-  Abutment
-  Central Pier

Defences

-  Embankment
-  Wall
-  Flood Gate
-  Demountable defence
-  Bridge abutment
-  High Ground
-  Beach
-  Barrier Beach
-  Promenade
-  Quay
-  Cliff
-  Dunes

Channels

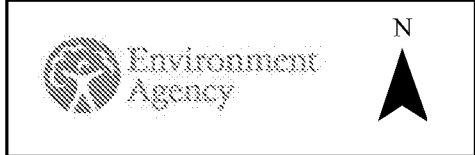
-  Open channel
-  Simple culvert
-  Complex culvert

Land

-  Mudflats
-  Saltmarsh
-  Washland

Sites

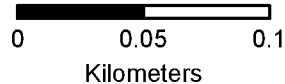
-  Amenity
-  Control Structure
-  Erosion Protection
-  General
-  Harbour
-  Monitoring
-  Navigation Lock
-  Pumping Station
-  Reservoir
-  Tidal Barrier



Legend

- Site_Nodes
- Site_Boundary

Scale: 1:3,000



Product 4 Flood Risk Data Requested by: Ardent
Site: Land at Ford Road, Arundel, BN18 9ES

Table 1: Water Levels: Fluvial Undefended

Node Ref	NGR		Modelled Flood Levels in Metres AOD			
	Eastings	Northings	Undefended Annual Exceedance Probability			
			5%	1%	1% +CC*	0.1%
1	500745	106135	-	-	3.33	-
2	500825	106275	-	-	3.33	2.62
3	500623	106263	-	-	-	-

Table 2: Water Levels: Fluvial Defended

Node Ref	NGR		Modelled Flood Levels in Metres AOD			
	Eastings	Northings	Defended Annual Exceedance Probability			
			5%	1%	1% +CC*	0.1%
1	500745	106135	-	-	-	-
2	500825	106275	-	-	-	-
3	500623	106263	-	-	-	-

Table 3: Water Levels: Tidal Undefended

Node Ref	NGR		Modelled Flood Levels in Metres AOD		
	Eastings	Northings	Undefended Annual Exceedance Probability		
			0.5%	0.5% (2110)**	0.1%
1	500745	106135	-	3.64	3.09
2	500825	106275	-	3.64	3.09
3	500623	106263	-	-	-

Table 4: Water Levels: Tidal Defended

Node Ref	NGR		Modelled Flood Levels in Metres AOD		
	Eastings	Northings	Defended Annual Exceedance Probability		
			0.5%	0.5% (2115)**	0.1%
1	500745	106135	-	4.03	2.86
2	500825	106275	-	4.03	2.86
3	500623	106263	-	-	-

Office Address: Guildbourne House, Chatsworth Road, Worthing BN11 1LD.

Table 5: Water Depths: Fluvial Undefended

Node Ref	NGR		Modelled Flood Depths in Metres			
			Undefended Annual Exceedance Probability			
	Eastings	Northings	5%	1%	1% +CC*	0.1%
1	500745	106135	-	-	0.53	-
2	500825	106275	-	-	0.25	0.31
3	500623	106263	-	-	-	-

Table 6: Water Depths: Fluvial Defended

Node Ref	NGR		Modelled Flood Depths in Metres			
			Defended Annual Exceedance Probability			
	Eastings	Northings	5%	1%	1% +CC*	0.1%
1	500745	106135	-	-	-	-
2	500825	106275	-	-	-	-
3	500623	106263	-	-	-	-

Table 7: Water Depths: Tidal Undefended

Node Ref	NGR		Modelled Flood Depths in Metres		
			Undefended Annual Exceedance Probability		
	Eastings	Northings	0.5%	0.5% (2110)**	0.1%
1	500745	106135	-	1.24	0.29
2	500825	106275	-	1.72	0.77
3	500623	106263	-	-	-

Table 8: Water Depths: Tidal Defended

Node Ref	NGR		Modelled Flood Depths in Metres		
			Defended Annual Exceedance Probability		
	Eastings	Northings	0.5%	0.5% (2115)**	0.1%
1	500745	106135	-	0.84	0.06
2	500825	106275	-	0.56	0.06
3	500623	106263	-	-	-

All levels taken from: Lower Tidal River Arun Strategy

Produced on: 30/01/2020

*** Climate Change allowances for this model only show the superseded 20% increase in fluvial flows. The current allowances should be checked here: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>.**

Office Address: Guildbourne House, Chatsworth Road, Worthing BN11 1LD.

**** The tidal flood risk data provided is based on existing EA hydraulic models for existing 0.5% annual probability events with an allowance for climate change. Please note the climate change allowances provided are not up to date. These were updated on 17 December 2019.**

You should refer to <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances> for the most up to date allowances. You will need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence.

There is no additional information or health warnings for these levels/depths or the model from which they have been produced.



Environment
Agency



N

Legend

- Site_Boundary
- 5% AEP (Defended Fluvial)
- 1% AEP (Defended Fluvial)
- 1% AEP Plus Climate Change (Defended Fluvial)
- 0.1% AEP (Defended Fluvial)

Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occurring in any given year.

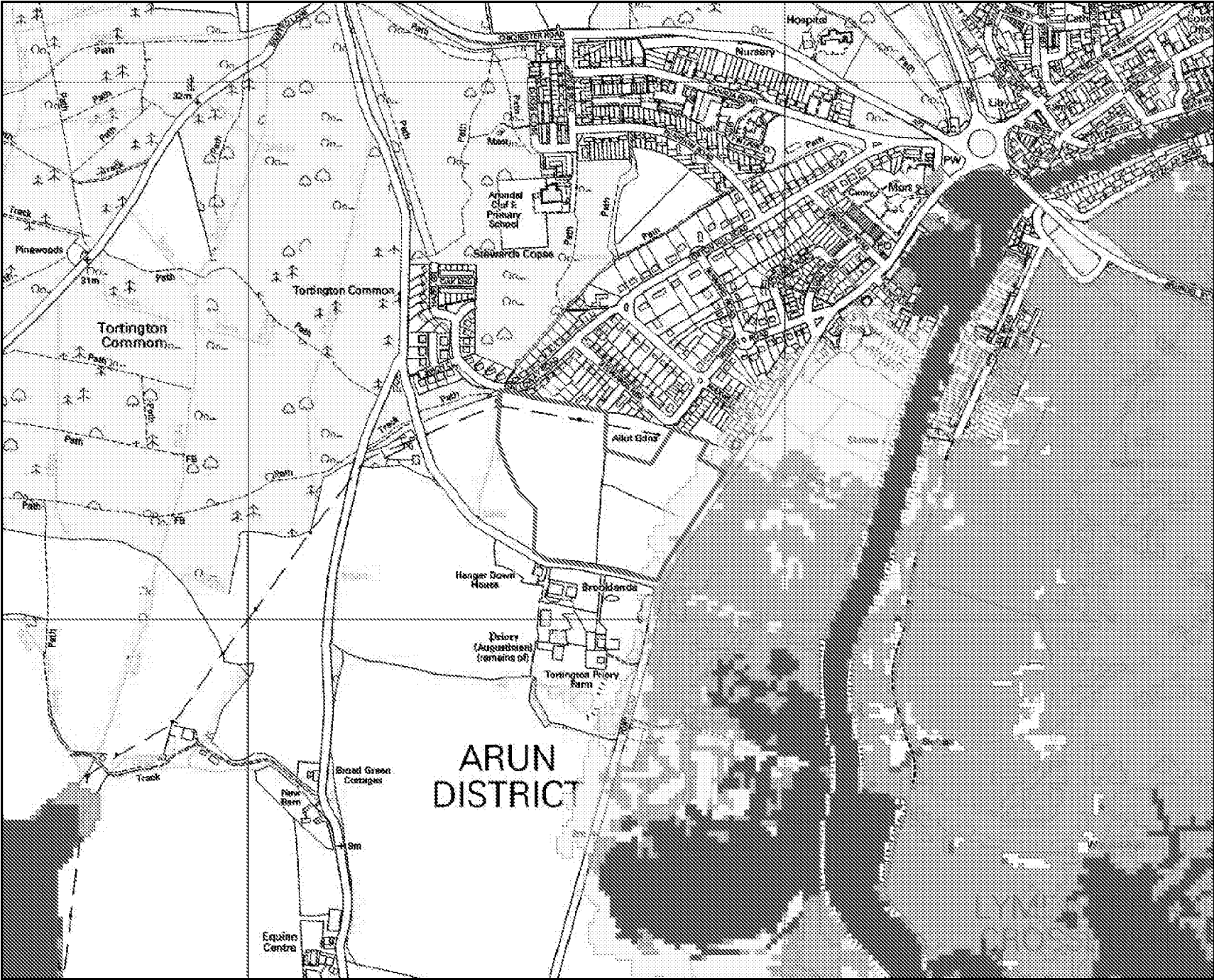
Scale: 1:10,000

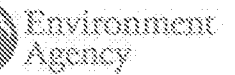
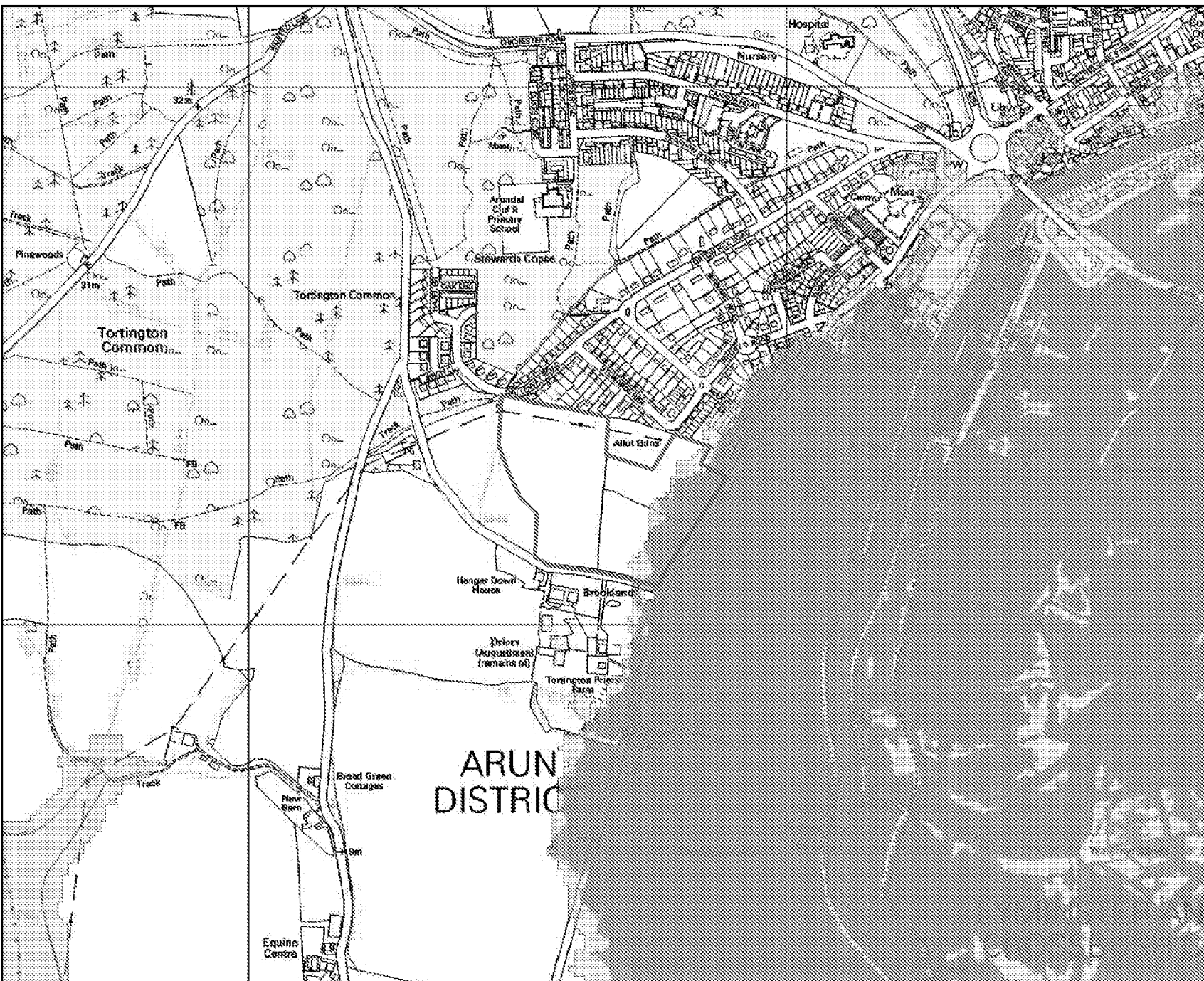
0

0.225

0.45

Kilometers



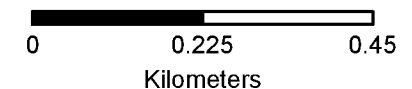


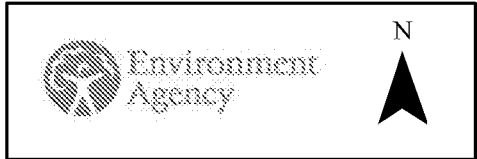
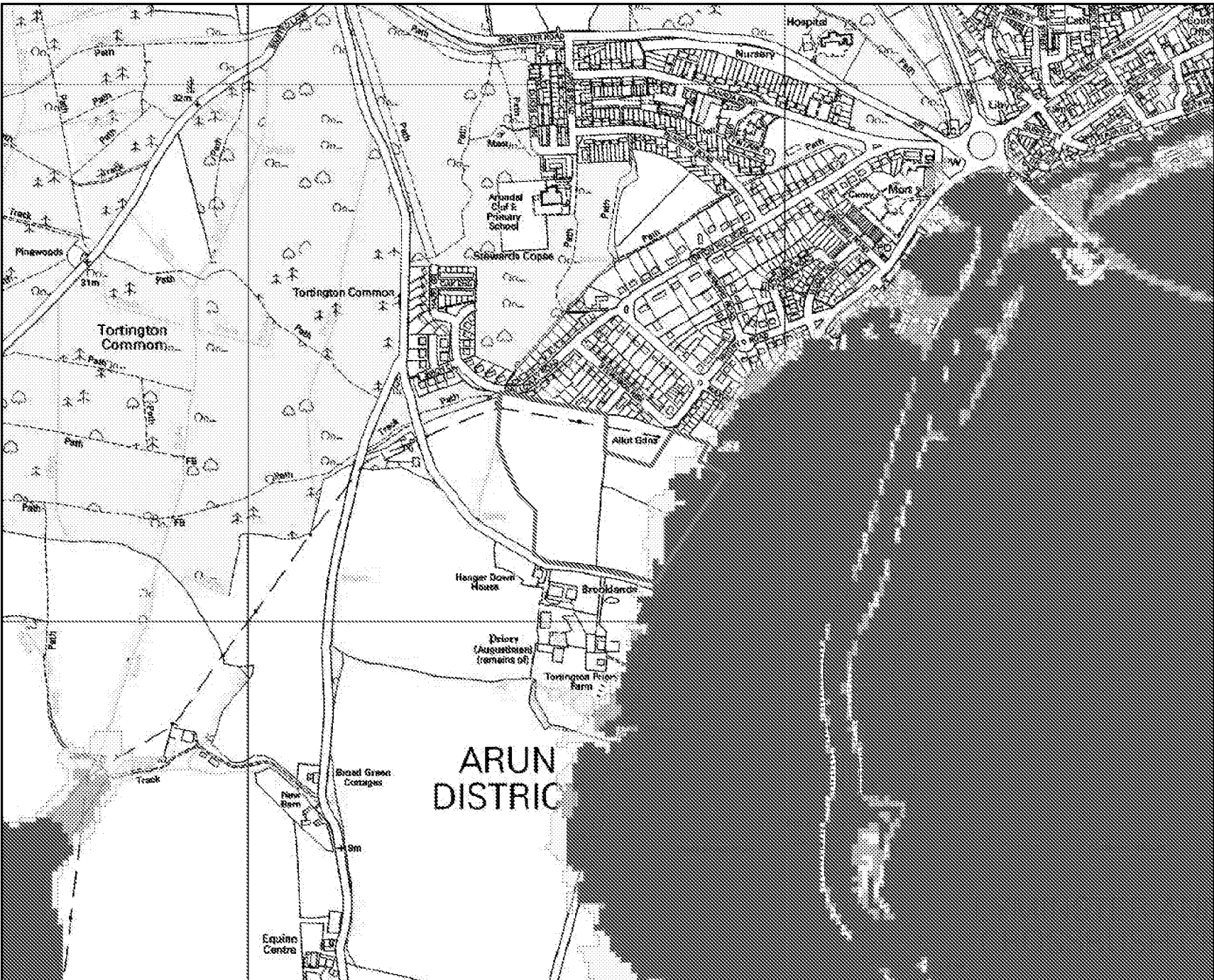
Legend

-  Site_Boundary
 0.5% AEP (Defended Tidal)
 0.5% AEP (2110) (Defended Tidal)
 0.1% AEP (Defended Tidal)

Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occurring in any given year.

Scale: 1:10,000



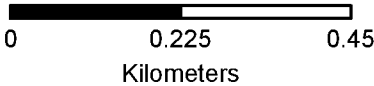


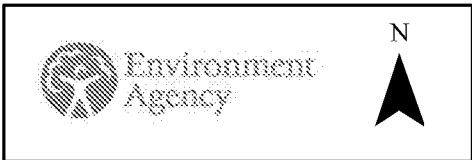
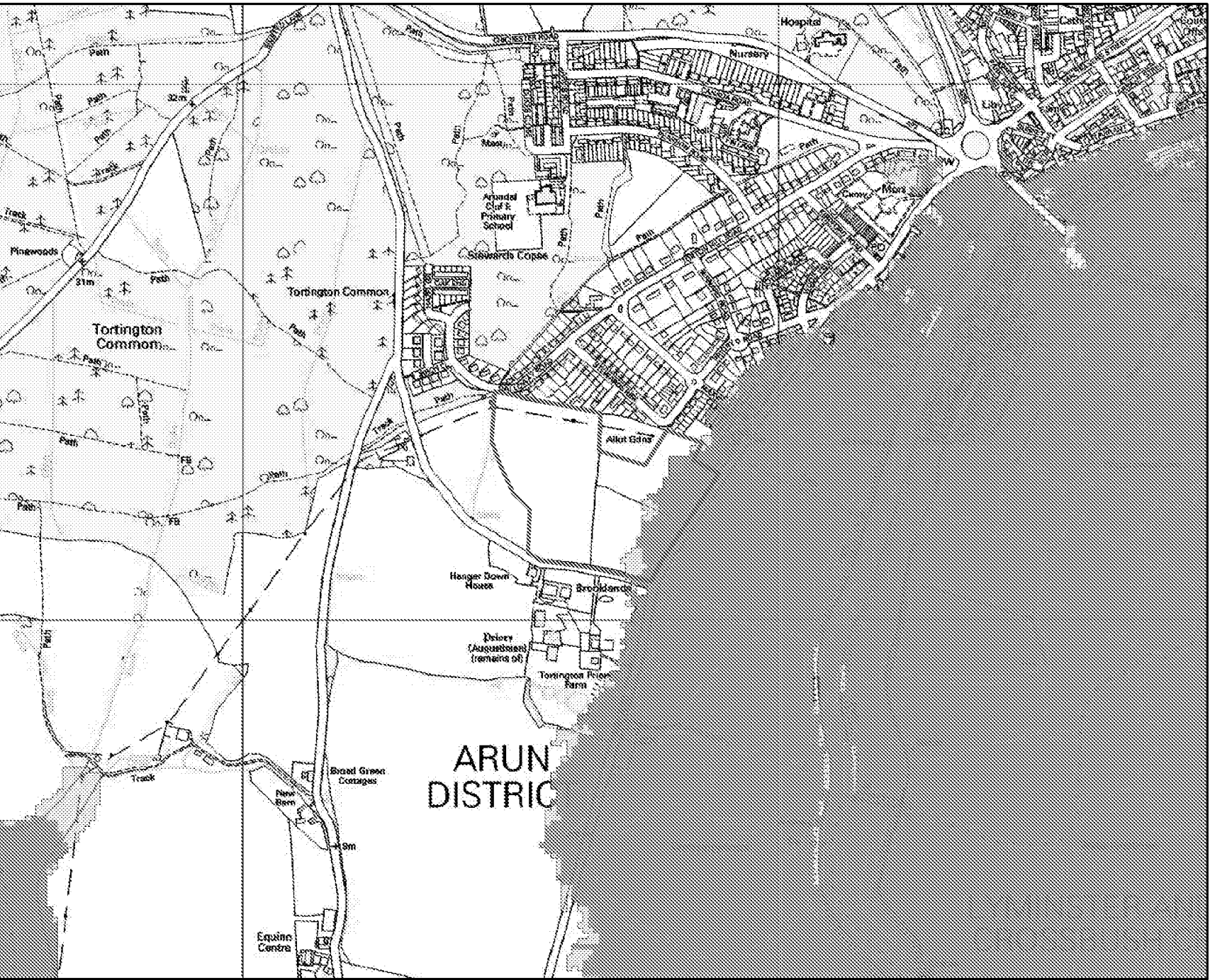
Legend

- Site_Boundary
- 5% AEP (Un defended Fluvial)
- 1% AEP (Un defended Fluvial)
- 1% AEP Plus Climate Change (Un defended Fluvial)
- 0.1% AEP (Un defended Fluvial)

Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occurring in any given year.

Scale: 1:10,000



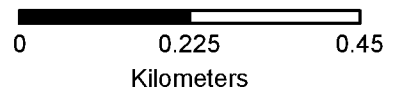


Legend

- Site_Boundary
- 0.5% AEP (Undefended Tidal)
- 0.5% AEP (2110) (Undefended Tidal)
- 0.1% AEP (Undefended Tidal)

Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occurring in any given year.

Scale: 1:10,000



Risk of flooding from Surface Water. Centred BN18 9ES. Created 29/01/2020.



Environmental
Agency

1: 10,000

0 Metres 250



Likelihood of flooding from Surface Water

 High ($v=3.3\%$)
 Medium ($3.3\% - 1\%$)
 Low ($1\% - 0.1\%$)
 Very Low

Likelihood of flooding from Surface Water

High:	Greater than or equal to 3.3% (1 in 30) chance in any given year
Medium:	Less than 3.3% (1 in 30) but greater than or equal to 1% (1 in 100) chance in any given year
Low:	Less than 1% (1 in 100) but greater than or equal to 0.1% (1 in 1,000) chance in any given year
Very Low:	Less than 0.1% (1 in 1,000) chance in any given year

This information is shown on the Risk of Flooding from Surface Water map on GOV.UK.

© Crown Copyright and database rights 2020 Ordnance Survey 100024198

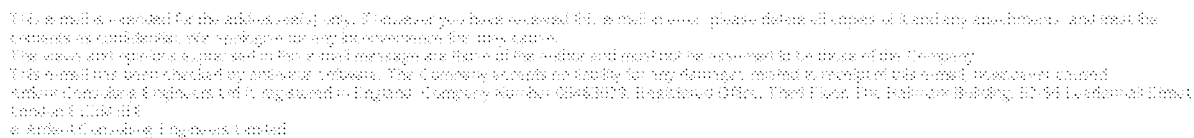
Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). E-mail: enquires@environment-agency.gov.uk

Appendix E

From: Paul Cann <Paul.Cann@arun.gov.uk>
Sent: 07 August 2020 13:59
To: Victoria Lander
Subject: RE: Enquiry related to Land at Tortington, Ford Road, Arundel (500591mE, 106269mN) nearest postcode BN18 9EX



ARUN DISTRICT COUNCIL AB/135/20/OUT



Victoria,

Could you sent me a plan showing your site boundary and your proposed point of discharge.

Regards,

Kevin

Kevin Macknay
Flood Risk Management - Team Leader
Highways, Transport and Planning
Place Services
West Sussex County Council



Location: Western Area Office, Drayton Lane, Nr. Chichester, West Sussex, PO20 2AJ.

Contact: Internal: 26429 | External: +44 (0)330 222 6429 | Mobile: +44 (0)7540 641819

E-mail: kevin.macknav@westsussex.gov.uk

Report a problem with a road or pavement or raise a highways related enquiry

Follow us at [@WS_Highways](https://twitter.com/WS_Highways)

From: Victoria Lander [mailto:vlander@ardent-ce.co.uk]

Sent: 03 April 2020 18:02

To: Kevin Macknay

Cc: Mat Jackson; Charlie Cooper

Subject: RE: Enquiry related to Land at Tortington, Ford Road, Arundel (500591mE, 106269mN) nearest postcode BN18 9EX

5T4↑YT↑GIE

[illegible][illegible]

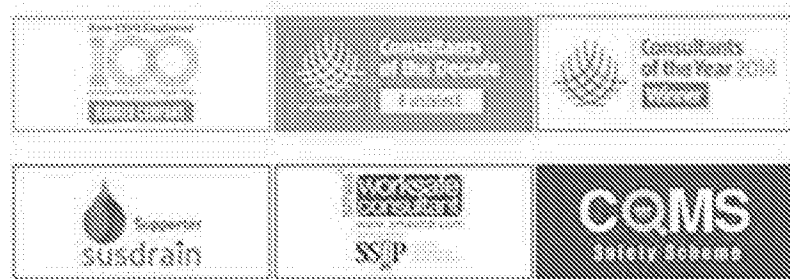
Victoria Lander
Engineer



Third Floor, The Hallmark Building, 52-56 Leadenhall Street, London EC3M 5J E

T 020 7600 4055

www.arden-cc.co.uk



This e-mail is intended for the individual(s) only. If however you have received this e-mail in error, please delete all copies of it and any attachments, and email for confirmation to info@arden-cc.co.uk. Any e-mails sent to any other email address are those of the author and must not be used to the detriment of the Company. The e-mail has been checked by anti-virus software. The Company accepts no liability for any damages related to receipt of this e-mail. It is hereby agreed that Arden Consulting Engineers Ltd is registered in England, Company Number 0641096. Registered Office: Third Floor, The Hallmark Building, 52-56 Leadenhall Street, London EC3M 5J E.
© Arden Consulting Engineers Limited

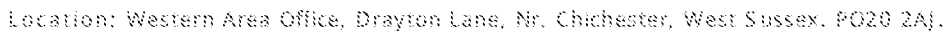
CTIXI 0YT ↑QPa Qd AUC=JA ↑QIB↑Qd AUC=JA ↑T↑EL↑P↑O↑J↑
{T ↑P↑QPa Qd AUC=JA ↑T↑EL↑P↑O↑J↑
0IX0 Qd AUC=JA ↑T↑EL↑P↑O↑J↑
/d0a Qd AUC=JA ↑T↑EL↑P↑O↑J↑ /IXX↑↑ Qd AUC=JA ↑T↑EL↑P↑O↑J↑
{ Qd AUC=JA ↑T↑EL↑P↑O↑J↑ Qd AUC=JA ↑T↑EL↑P↑O↑J↑ Qd AUC=JA ↑T↑EL↑P↑O↑J↑
. b 35 9AE

Victoria,

Please find attached:

- ¿ Site Location Plan - showing the existing drainage for the area. The ditch alongside Priory Lane, at the Ford Road end, has been piped at some point in the past. This culverted ditch outfalls under Ford Road into the ditch system which then outfalls to the River Arun.
- ¿ Flood Maps for the area - flood maps for the area show the eastern side of the site to be at risk from the River Arun. Sections of Priory Lane are also shown to be at risk of surface water flooding.
- ¿ Historical flooding issues - As this is agricultural land, we (as LLFA) are not aware of any significant flooding issues in the area. However, you may wish to check with Arun DC's Land Drainage Engineer - Paul Cann (Paul.Cann@arun.gov.uk).

Kevin Macknay
Flood Risk Management " Team Leader
Highways, Transport and Planning
Place Services
West Sussex County Council



Contact: Internal: 26429 | External: +44 (0)330 222 6429 | Mobile: +44 (0)7540 641819

E-mail: kevin.macknay@westsussex.gov.uk

[Report a problem with a road or pavement or raise a highways related enquiry](#)

Follow us at [@WS_Highways](https://twitter.com/WS_Highways)

From: Victoria Lander [mailto:viander@ardent-ce.co.uk]

Sent: 27 March 2020 09:23

To: Kevin Macknav

Cc: Mat Jackson; Charlie Cooper

Subject: FW: Enquiry related to Land at Tortington, Ford Road, Arundel (500591mE, 106269mN) nearest postcode BN18 9FX

~~DIX~~ ~~IIX~~ ~~IIIE~~ ➡

⁰ IX⁶ ↑IX↑IX↑ Q↑D ↑↑I↑↑↑% ↑X↑↑↑ It →Q, I→T% ←↑↑IX↑MIL↑→

YGLB ↑T_{CEL}↑O↑

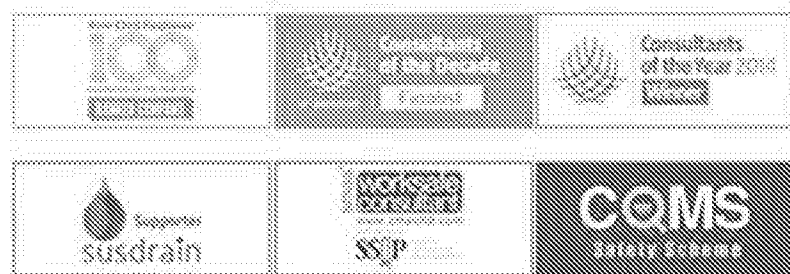
Victoria Lander
Engineer



Third Floor, The Hallmark Building, 52-56 Leadenhall Street, London EC3M 5JF

T 020 7680 4088

www.ardent-ce.co.uk



If this e-mail is e-forwarded for the addressee's use, if indicated you have received this e-mail in error, please delete all copies of it and any attachments, and notify the sender at info@bbs.com. We appreciate your report and advise you of this action.

The views and opinions expressed in this e-mail message are those of the sender and should not be ascribed to the House of the Commons.

This e-mail has been checked for malware viruses. The Company accepts no liability for any damage caused or receipt of this e-mail message or content. Any computer equipment not registered in England Company number 08683073, Registered Office, Third Floor, The Harbour Building, 10-14, London Street, London E1 6BE.

© 2008 Cityscape Limited. All Rights Reserved.

{ 5 "f d c" 9 k - q = t % p o i x l b b l f i x p e i x e c x o w x p s t u b t % 3 1 9 3 6 左 I b 、 I r l n t j x x g d x t . b z 9 4

DIXX T ↑↓ ICH E YT ↑ QH 

[illegible]

t 1/2 ↓ T oIX ↓ Ix ↓ Dp ↓ C ↓ Lp ↑ Ix ↑ ET ↑ C ↑ Ix ↓ Dp ↑ Ix o C ↓ C ↑

a $\text{LII} \rightarrow \text{DII} \rightarrow \text{LII}$

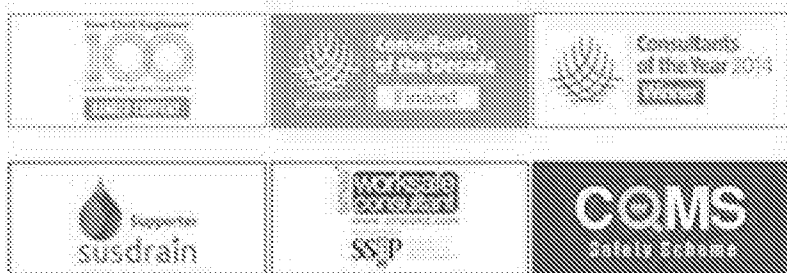
Victoria Lander
Engineer

ARDENT
CONSULTING ENGINEERS

Third Floor, The Hallmark Building, 52-56 Leadenhall Street, London EC3M 5J E

T 020 7680 4088

www.ardent-ce.co.uk



This e-mail is intended for the addressee(s) only. If however you have received this e-mail in error, please delete all copies of it and any attachments, and notify the contents as confidential. We apologise for any inconvenience this may cause.

{ 5 7 d x ° 9 I k - 0 = 1 % p r o f i x l i b l f = i x x t e n i e c i x o w x p e f ↑ 1 b t ½ 数 据 流 3 I 9 = 字 符 在 I b 、 I f l i t ↑ i x x t i x o t . b 3 5 9 f

DIXX IIX↑ICLIE

[illegible]

□ → D_p ↑ T ↑ D_p O ⊞ D_p IX ↑ Y ⊞ IX →

□.ЩЕ=Д□↑IX□□1/4BXOЩЕ □□G↑ L↑IX□□ ↑D↑ J□↑

[illegible]

a

YOUT ↑ T_{CE} ↓ O ↓

Victoria Lander
Engineer

ARDENT
CONSULTING ENGINEERS

Third Floor, The Hallmark Building, 52-56 Leadenhall Street, London EC3M 5J E

T 020 7680 4088

www.ardent-ce.co.uk

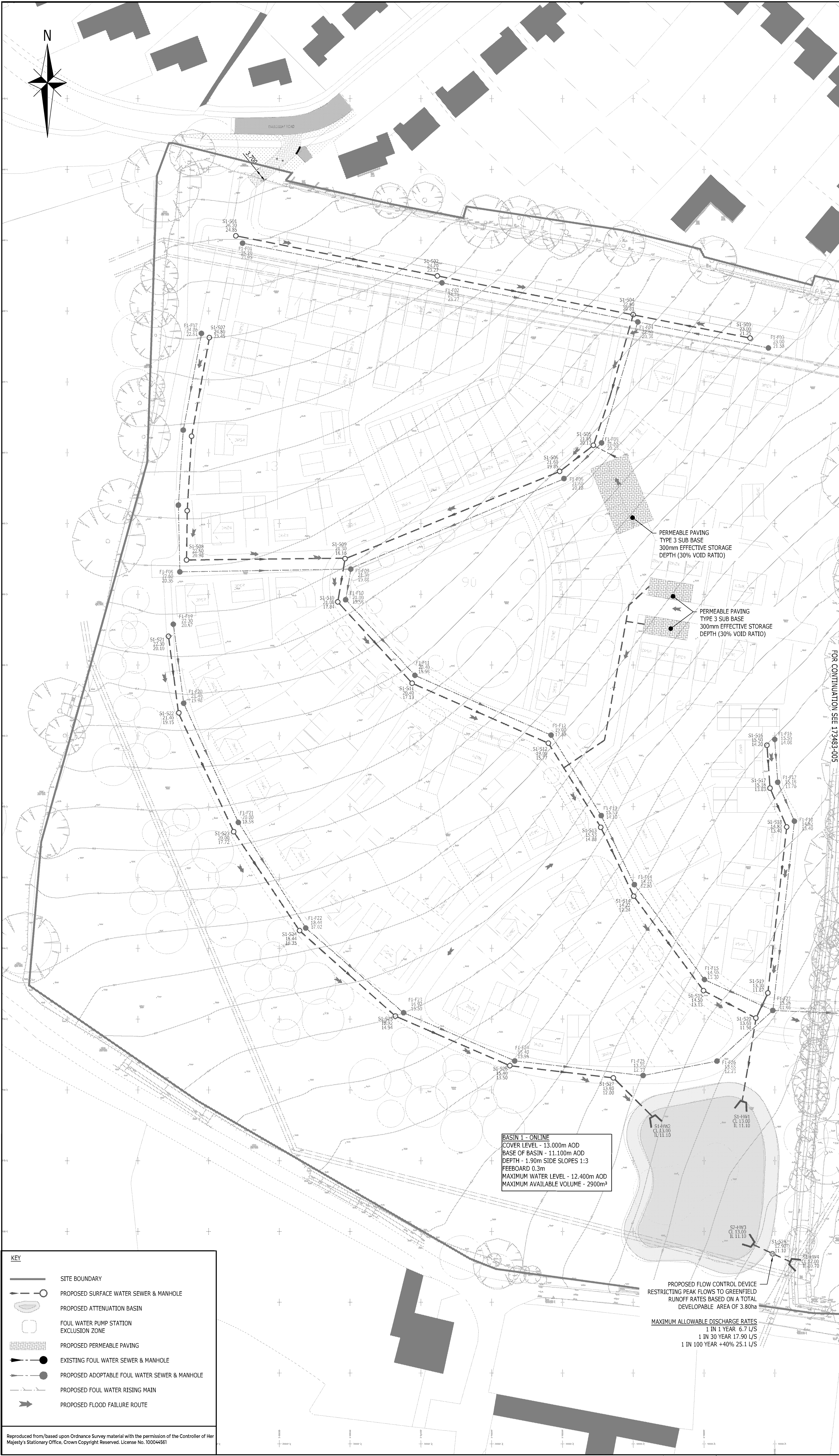


This document is intended for the addressee only. If however you have received this e-mail in error, please delete all copies of it and notify the sender, and avoid the further use of e-mail. No apologies or compensation may be claimed. The views and opinions expressed in this e-mail are those of the author and must not be assumed to be those of the Company. The e-mail has been checked for virus and worms. The Company accepts no liability for any damages caused to users of the e-mail, however caused. Andrew Cossington Engineering Ltd is registered in England, Company Number 05304166. Registered Office: Tired Place, The Bookmark Building, 36-38, Lombard Street, London, EC3N 3HT. A company of 05304166 Engineering Limited

[9D! [5k/[! la 9w

[illegible]

Appendix F



- NOTES:**
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE RELEVANT SPECIFICATION AND ALL OTHER RELATED DRAWINGS ISSUED BY THE ENGINEER.
 - DO NOT SCALE FROM THIS DRAWING. WORK FROM FIGURED DIMENSIONS ONLY.
 - ALL DIMENSIONS SHOWN ON THIS DRAWING ARE IN METRES UNLESS OTHERWISE STATED.
 - ALL DIMENSIONS, LEVELS AND SURVEY GRID CO-ORDINATES ARE TO BE CHECKED ON SITE AND THE ENGINEER NOTIFIED IMMEDIATELY OF ANY DISCREPANCIES PRIOR TO THE COMMENCEMENT OF THE WORKS. LEVELS ARE SUBJECT TO DETAILED EARTHWORKS AND LEVELS DESIGN.
 - ALL ADOPTABLE DRAINAGE WORKS SUBJECT TO SOUTHERN WATER'S APPROVAL.
 - THIS DRAWING HAS BEEN BASED ON DRAWING No. IM003 REVISION 01 BY URBAN DESIGN STUDIO ARCHITECTS.
 - EXISTING DRAINAGE AND UTILITIES TO BE CONFIRMED IN-SITU BY THE CONTRACTOR, PRIOR TO STARTING WORKS. EXISTING DRAINAGE SHOWN INDICATIVELY.
 - THE DRAINAGE STRATEGY IS INDICATIVE ONLY, TO DEMONSTRATE DESIGN INTENT AND REQUIREMENTS. DESIGN SUBJECT TO CHANGE AND DESIGN TEAM COORDINATION. DESIGN SUBJECT TO CHANGE BASED ON CCTV DRAINAGE SURVEY.
 - FEASIBILITY TO CONNECT TO THE EXITING SOUTHERN WATER NETWORK HAS BEEN ASSUMED. SOUTHERN WATER TO CONFIRM SUITABILITY OF OUTFALL AND NETWORK CAPACITY.

- CDM NOTES**
- THE ATTENTION OF THE CLIENT, PRINCIPAL DESIGNER, PRINCIPAL CONTRACTOR, DESIGNERS AND CONTRACTORS IS DRAWN TO THE FOLLOWING POTENTIAL RISKS IN CONJUNCTION WITH THE PROPOSED ON-SITE AND OFF-SITE WORKS AS DESIGNED FOR THIS PROJECT:
- WORKS IN THE VICINITY OF LIVE SERVICES INCLUDING GAS, ELECTRICITY AND BT WILL BE NECESSARY AND THE ADVICE OF ALL STATUTORY SERVICE COMPANIES MUST BE SOUGHT BEFORE ANY WORKS COMMENCE.
 - WORKS WITHIN AND ABUTTING THE EXISTING HIGHWAY WILL ENTAIL TRAFFIC HAZARDS AND ALL APPROPRIATE SAFETY MEASURES INCLUDING BARRIERS, SIGNS AND LIGHTING MUST BE UNDERTAKEN TO THE APPROVAL OF THE LOCAL AUTHORITY, THE HIGHWAY AUTHORITY AND THE POLICE DEPARTMENT.
 - HAZARDOUS MATERIALS INCLUDING CEMENT AND BITUMINOUS MATERIALS ARE SPECIFIED AND THE MANUFACTURERS ADVICE ON SAFE HANDLING PROCEDURES MUST BE OBTAINED AND MADE CLEAR TO ALL OPERATIVES.
 - THE CONTRACTOR WILL BE RESPONSIBLE FOR LOCATING ALL EXISTING SERVICES WITHIN THE VICINITY OF THE WORKS HAND DUG AND ENSURE THESE ARE PROTECTED THROUGHOUT THE DURATION OF THE WORKS. ALL UTILITY PLANT SHOULD BE CLEARLY MARKED ON THE GROUND PRIOR TO COMMENCEMENT OF THE WORKS.
 - THE CONTRACTOR MUST ENSURE ALL WORKING AREAS ARE FULLY SECURE.

PRELIMINARY

NOT FOR CONSTRUCTION

Rev	Description	Drn	Chk	App	Date
-----	-------------	-----	-----	-----	------

ARDENT CONSULTING ENGINEERS

Third Floor
The Hallmark Building
52-56 Leadenhall Street
London
EC3M 5JE

Tel: 020 7680 4088
Web: www.ardent-ce.co.uk
E-mail: enquiries@ardent-ce.co.uk

Client
NORFOLK ESTATE LTD

Project Title:
LAND AT TORTINGTON, ARUNDEL

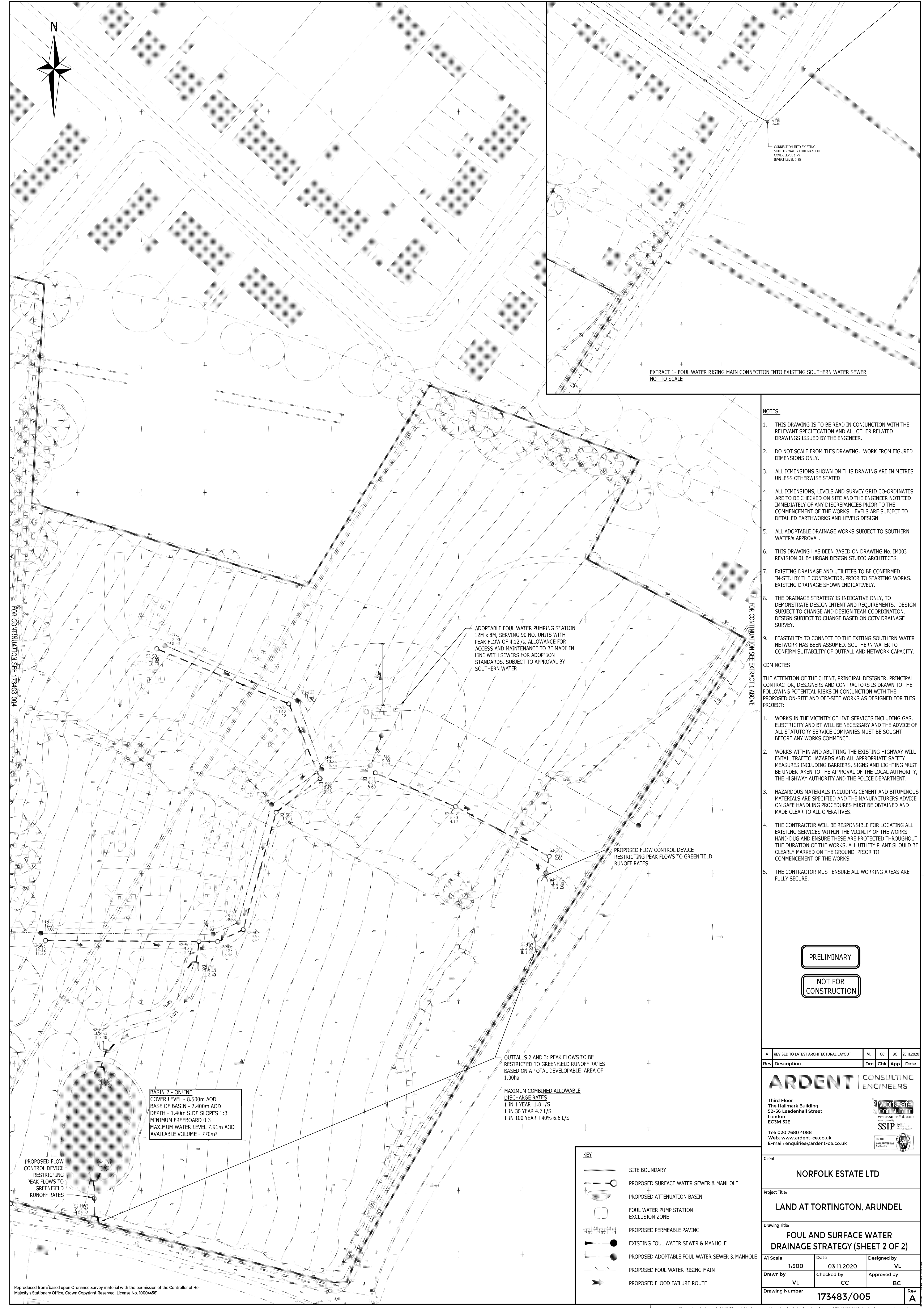
Drawing Title:
FOUL AND SURFACE WATER DRAINAGE STRATEGY (SHEET 1 OF 2)

A1 Scale	Date	Designed by
1:500	03.11.2020	VL
Drawn by	Checked by	Approved by
VL	CC	BC

Drawing Number
173483/004

Rev
A

FOR CONTINUATION SEE 173483-005



NOTES:

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE RELEVANT SPECIFICATION AND ALL OTHER RELATED DRAWINGS ISSUED BY THE ENGINEER.
2. DO NOT SCALE FROM THIS DRAWING. WORK FROM FIGURED DIMENSIONS ONLY.
3. ALL DIMENSIONS SHOWN ON THIS DRAWING ARE IN METRES UNLESS OTHERWISE STATED.
4. ALL DIMENSIONS, LEVELS AND SURVEY GRID CO-ORDINATES ARE TO BE CHECKED ON SITE AND THE ENGINEER NOTIFIED IMMEDIATELY OF ANY DISCREPANCIES PRIOR TO THE COMMENCEMENT OF THE WORKS. LEVELS ARE SUBJECT TO DETAILED EARTHWORKS AND LEVELS DESIGN.
5. ALL ADAPTABLE DRAINAGE WORKS SUBJECT TO SOUTHERN WATER'S APPROVAL.
6. THIS DRAWING HAS BEEN BASED ON DRAWING NO. IM003 REVISION 01 BY URBAN DESIGN STUDIO ARCHITECTS.
7. EXISTING DRAINAGE AND UTILITIES TO BE CONFIRMED IN-SITU BY THE CONTRACTOR, PRIOR TO STARTING WORKS. EXISTING DRAINAGE SHOWN INDICATIVELY.
8. THE DRAINAGE STRATEGY IS INDICATIVE ONLY, TO DEMONSTRATE DESIGN INTENT AND REQUIREMENTS. DESIGN SUBJECT TO CHANGE AND DESIGN TEAM COORDINATION. DESIGN SUBJECT TO CHANGE BASED ON CCTV DRAINAGE SURVEY.
9. FEASIBILITY TO CONNECT TO THE EXISTING SOUTHERN WATER NETWORK HAS BEEN ASSUMED. SOUTHERN WATER TO CONFIRM SUITABILITY OF OUTFALL AND NETWORK CAPACITY.

CDM NOTES

THE ATTENTION OF THE CLIENT, PRINCIPAL DESIGNER, PRINCIPAL CONTRACTOR, DESIGNERS AND CONTRACTORS IS DRAWN TO THE FOLLOWING POTENTIAL RISKS IN CONJUNCTION WITH THE PROPOSED ON-SITE AND OFF-SITE WORKS AS DESIGNED FOR THIS PROJECT:

1. WORKS IN THE VICINITY OF LIVE SERVICES INCLUDING GAS, ELECTRICITY AND BT WILL BE NECESSARY AND THE ADVICE OF ALL STATUTORY SERVICE COMPANIES MUST BE SOUGHT BEFORE ANY WORKS COMMENCE.
2. WORKS WITHIN AND ABUTTING THE EXISTING HIGHWAY WILL ENTAIL TRAFFIC HAZARDS AND ALL APPROPRIATE SAFETY MEASURES INCLUDING BARRIERS, SIGNS AND LIGHTING MUST BE UNDERTAKEN TO THE APPROVAL OF THE LOCAL AUTHORITY, THE HIGHWAY AUTHORITY AND THE POLICE DEPARTMENT.
3. HAZARDOUS MATERIALS INCLUDING CEMENT AND BITUMINOUS MATERIALS ARE SPECIFIED AND THE MANUFACTURERS ADVICE ON SAFE HANDLING PROCEDURES MUST BE OBTAINED AND MADE CLEAR TO ALL OPERATIVES.
4. THE CONTRACTOR WILL BE RESPONSIBLE FOR LOCATING ALL EXISTING SERVICES WITHIN THE VICINITY OF THE WORKS HAND DIG AND ENSURE THESE ARE PROTECTED THROUGHOUT THE DURATION OF THE WORKS. ALL UTILITY PLANT SHOULD BE CLEARLY MARKED ON THE GROUND PRIOR TO COMMENCEMENT OF THE WORKS.
5. THE CONTRACTOR MUST ENSURE ALL WORKING AREAS ARE FULLY SECURE.

PRELIMINARY

NOT FOR
CONSTRUCTION

A	REVISED TO LATEST ARCHITECTURAL LAYOUT	VL	CC	BC	26.11.20
Rev	Description	Drn	Chk	App	Date

ARDENT CONSULTING
ENGINEERS

Third Floor
The Hallmark Building
52-56 Leadenhall Street
London
EC3M 5JE

Tel: 020 7680 4088
Web: www.ardent-ce.co.uk
E-mail: enquiries@ardent-ce.co.uk

smas
worksafe
consultant
www.smasitd.com
as recognized by
SSIP SAFETY
SPECIALIST



ISO 9001
BUREAU VERITAS
Certification

1928

Client	
--------	--

NORFOLK ESTATE LTD

Project Title:	
----------------	--

LAND AT TORTINGTON, ARUNDEL

Drawing Title:

FOUL AND SURFACE WATER
DRAINAGE STRATEGY (SHEET 2 OF 2)

A1 Scale 1:500	Date 03.11.2020	Designed by VL
Drawn by VL	Checked by CC	Approved by BC

173483/005

A

Reproduced from/based upon Ordnance Survey material with the permission of the Controller of Her Majesty's Stationary Office. Crown Copyright Reserved. License No. 100044561

Appendix G

Ardent		Page 1
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE	1734483 Land at Tortington, Arundel Western Parcel	
Date 01/10/2020	Designed by vlander	
File 173483- SW NETWORK 1.MDX	Checked by	
Innovyze	Network 2020.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.500	Add Flow / Climate Change (%)	0
Ratio R	0.332	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	1.727	4-8	0.812

Total Area Contributing (ha) = 2.539

Total Pipe Volume (m³) = 70.160

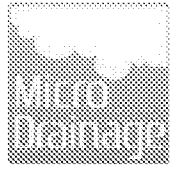
Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	56.900	1.423	40.0	0.168	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	55.200	1.380	40.0	0.123	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	32.500	0.361	90.0	0.136	5.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.46	24.856	0.168	0.0	0.0	0.0	2.07	82.5	22.7
1.001	50.00	5.90	23.427	0.291	0.0	0.0	0.0	2.07	82.5	39.4
2.000	50.00	5.39	21.256	0.136	0.0	0.0	0.0	1.38	54.8	18.4

©1982-2020 Innovyze

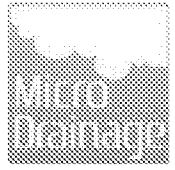
Ardent		Page 2
3rd Floor, The Hallmark Building 52-56 Leadenhall Street London, EC3M 5JE	1734483 Land at Tortington, Arundel Western Parcel	
Date 01/10/2020 File 173483- SW NETWORK 1.MDX	Designed by vlander Checked by	
Innovyze	Network 2020.1	

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.002	25.500	0.638	40.0	0.052	0.00	0.0	0.600	o	300	Pipe/Conduit	🔍
1.003	10.200	0.255	40.0	0.176	0.00	0.0	0.600	o	300	Pipe/Conduit	🔍
1.004	64.300	1.608	40.0	0.133	0.00	0.0	0.600	o	375	Pipe/Conduit	🔍
3.000	59.900	2.396	25.0	0.112	5.00	0.0	0.600	o	225	Pipe/Conduit	🔍
3.001	30.700	1.228	25.0	0.288	0.00	0.0	0.600	o	300	Pipe/Conduit	🔍
1.005	11.200	0.280	40.0	0.020	0.00	0.0	0.600	o	450	Pipe/Conduit	🔍
1.006	29.900	0.748	40.0	0.067	0.00	0.0	0.600	o	450	Pipe/Conduit	🔍
1.007	40.900	1.363	30.0	0.178	0.00	0.0	0.600	o	450	Pipe/Conduit	🔍
1.008	26.800	0.893	30.0	0.163	0.00	0.0	0.600	o	450	Pipe/Conduit	🔍
1.009	20.400	0.680	30.0	0.061	0.00	0.0	0.600	o	450	Pipe/Conduit	🔍
1.010	32.000	1.067	30.0	0.109	0.00	0.0	0.600	o	450	Pipe/Conduit	🔍
1.011	15.500	0.517	30.0	0.032	0.00	0.0	0.600	o	450	Pipe/Conduit	🔍
4.000	10.900	0.320	34.1	0.029	5.00	0.0	0.600	o	100	Pipe/Conduit	🔍
4.001	10.800	0.432	25.0	0.017	0.00	0.0	0.600	o	150	Pipe/Conduit	🔍
4.002	46.000	1.448	31.8	0.050	0.00	0.0	0.600	o	150	Pipe/Conduit	🔍
4.003	6.700	0.068	98.5	0.025	0.00	0.0	0.600	o	225	Pipe/Conduit	🔍

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.002	50.00	6.07	20.814	0.479	0.0	0.0	0.0	2.49	176.2	64.9
1.003	50.00	6.14	20.177	0.655	0.0	0.0	0.0	2.49	176.2	88.7
1.004	50.00	6.51	19.847	0.788	0.0	0.0	0.0	2.87	317.2	106.7
3.000	50.00	5.38	23.450	0.112	0.0	0.0	0.0	2.63	104.5	15.2
3.001	50.00	5.54	20.979	0.400	0.0	0.0	0.0	3.16	223.2	54.2
1.005	50.00	6.57	18.164	1.208	0.0	0.0	0.0	3.22	512.5	163.6
1.006	50.00	6.72	17.884	1.275	0.0	0.0	0.0	3.22	512.5	172.7
1.007	50.00	6.91	17.137	1.453	0.0	0.0	0.0	3.72	592.1	196.8
1.008	50.00	7.03	15.773	1.616	0.0	0.0	0.0	3.72	592.1	218.8
1.009	50.00	7.12	14.880	1.677	0.0	0.0	0.0	3.72	592.1	227.1
1.010	50.00	7.26	14.200	1.786	0.0	0.0	0.0	3.72	592.1	241.8
1.011	50.00	7.33	13.133	1.818	0.0	0.0	0.0	3.72	592.3	246.2
4.000	50.00	5.14	14.200	0.029	0.0	0.0	0.0	1.33	10.4	3.9
4.001	50.00	5.23	13.830	0.046	0.0	0.0	0.0	2.02	35.7	6.2
4.002	50.00	5.65	13.398	0.096	0.0	0.0	0.0	1.79	31.7	13.0
4.003	50.00	5.74	11.875	0.121	0.0	0.0	0.0	1.32	52.4	16.4

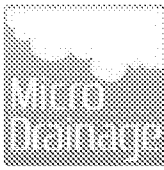
Ardent		Page 3
3rd Floor, The Hallmark Building 52-56 Leadenhall Street London, EC3M 5JE	1734483 Land at Tortington, Arundel Western Parcel	
Date 01/10/2020 File 173483- SW NETWORK 1.MDX	Designed by vlander Checked by	
Innovyze	Network 2020.1	

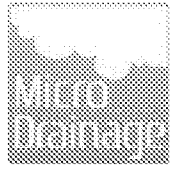
Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.012	21.800	0.482	45.2	0.025	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.000	20.600	0.824	25.0	0.054	5.00	0.0	0.600	o	100	Pipe/Conduit	
5.001	35.800	1.432	25.0	0.065	0.00	0.0	0.600	o	225	Pipe/Conduit	
5.002	32.400	1.296	25.0	0.115	0.00	0.0	0.600	o	225	Pipe/Conduit	
5.003	35.100	1.404	25.0	0.064	0.00	0.0	0.600	o	300	Pipe/Conduit	
5.004	34.100	1.364	25.0	0.198	0.00	0.0	0.600	o	300	Pipe/Conduit	
5.005	37.600	1.504	25.0	0.079	0.00	0.0	0.600	o	375	Pipe/Conduit	
5.006	20.000	0.900	22.2	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.013	20.000	0.325	61.5	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	I.Area (ha)	Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.012	50.00	7.45	11.582	1.964	0.0	0.0	0.0	3.03	481.8	266.0
5.000	50.00	5.22	20.100	0.054	0.0	0.0	0.0	1.55	12.2	7.3
5.001	50.00	5.45	19.151	0.119	0.0	0.0	0.0	2.63	104.5	16.1
5.002	50.00	5.65	17.719	0.234	0.0	0.0	0.0	2.63	104.5	31.7
5.003	50.00	5.84	16.348	0.298	0.0	0.0	0.0	3.16	223.2	40.4
5.004	50.00	6.02	14.944	0.496	0.0	0.0	0.0	3.16	223.2	67.2
5.005	50.00	6.19	13.505	0.575	0.0	0.0	0.0	3.64	401.7	77.9
5.006	50.00	6.28	12.001	0.575	0.0	0.0	0.0	3.86	426.1	77.9
1.013	50.00	7.58	11.026	2.539	0.0	0.0	0.0	2.60	412.8	343.8

Ardent			Page 6																
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE		1734483 Land at Tortington, Arundel Western Parcel																	
Date 01/10/2020		Designed by vlander																	
File 173483- SW NETWORK 1.MDX		Checked by																	
Innovyze		Network 2020.1																	
<u>Free Flowing Outfall Details for Storm</u> <table><tr><th>Outfall Pipe Number</th><th>Outfall Name</th><th>C. Level (m)</th><th>I. Level (m)</th><th>Min I. Level (m)</th><th>D,L (mm)</th><th>W (mm)</th></tr><tr><td>1.013</td><td>Outfall 1</td><td>12.130</td><td>10.701</td><td>10.800</td><td>0</td><td>0</td></tr></table>						Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)	1.013	Outfall 1	12.130	10.701	10.800	0	0
Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)													
1.013	Outfall 1	12.130	10.701	10.800	0	0													
©1982-2020 Innovyze																			

Ardent		Page 7
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE	1734483 Land at Tortington, Arundel Western Parcel	
Date 01/10/2020 File 173483- SW NETWORK 1.MDX	Designed by vlander Checked by	
Innovyze	Network 2020.1	

Online Controls for Storm

Complex Manhole: S1-S28, DS/PN: 1.013, Volume (m³): 8.1

Orifice

Diameter (m) 0.073 Discharge Coefficient 0.600 Invert Level (m) 11.100

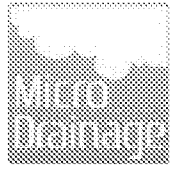
Hydro-Brake® Optimum

Unit Reference	MD-SHE-0147-1400-2500-1400
Design Head (m)	2.500
Design Flow (l/s)	14.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	147
Invert Level (m)	11.980
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.500	14.0	Kick-Flo®	1.315	10.3
Flush-Flo™	0.638	13.2	Mean Flow over Head Range	-	11.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.3	1.200	11.5	3.000	15.3	7.000	22.9
0.200	10.7	1.400	10.6	3.500	16.4	7.500	23.7
0.300	12.0	1.600	11.3	4.000	17.5	8.000	24.4
0.400	12.7	1.800	12.0	4.500	18.5	8.500	25.1
0.500	13.0	2.000	12.6	5.000	19.5	9.000	25.8
0.600	13.1	2.200	13.2	5.500	20.4	9.500	26.5
0.800	13.0	2.400	13.7	6.000	21.3		
1.000	12.5	2.600	14.3	6.500	22.1		

Ardent		Page 9
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE	1734483 Land at Tortington, Arundel Western Parcel	
Date 01/10/2020 File 173483- SW NETWORK 1.MDX	Designed by vlander Checked by	
Innovyze	Network 2020.1	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 1 Number of Storage Structures 4 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.332
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 19.500 Cv (Winter) 0.840

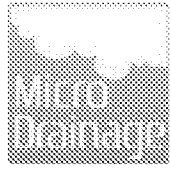
Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status OFF
 Inertia Status OFF

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 40

WARNING: Half Drain Time has not been calculated as the structure is too full.

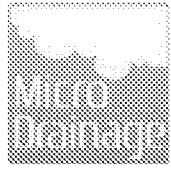
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S1-S01	15 Winter	1	+0%	100/15 Summer				24.930
1.001	S1-S02	30 Winter	1	+0%	100/15 Winter				23.495
2.000	S1-S03	15 Winter	1	+0%	100/15 Summer				21.340
1.002	S1-S04	30 Winter	1	+0%	100/15 Summer				20.901
1.003	S1-S05	15 Winter	1	+0%	100/15 Summer				20.302
1.004	S1-S06	15 Winter	1	+0%	100/15 Summer				19.961
3.000	S1-S07	15 Winter	1	+0%					23.506
3.001	S1-S08	15 Winter	1	+0%	100/15 Summer				21.075
1.005	S1-S09	15 Winter	1	+0%	100/15 Summer				18.349
1.006	S1-S10	15 Winter	1	+0%	100/15 Summer				18.038
1.007	S1-S11	15 Winter	1	+0%	100/15 Summer				17.288
1.008	S1-S12	15 Winter	1	+0%	100/15 Summer				15.948

©1982-2020 Innovyze

Ardent		Page 10
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE	1734483 Land at Tortington, Arundel Western Parcel	
Date 01/10/2020 File 173483- SW NETWORK 1.MDX	Designed by vlander Checked by	
Innovyze	Network 2020.1	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

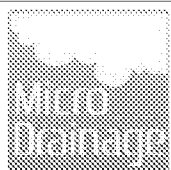
PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Half Drain	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)	Cap.	(l/s)	Time (mins)	Flow (l/s)		
1.000	S1-S01	-0.145	0.000	0.26			21.0	OK	
1.001	S1-S02	-0.157	0.000	0.20		17	15.7	OK	
2.000	S1-S03	-0.135	0.000	0.33			17.1	OK	
1.002	S1-S04	-0.213	0.000	0.18			29.1	OK	
1.003	S1-S05	-0.174	0.000	0.36		9	45.6	OK	
1.004	S1-S06	-0.261	0.000	0.20			59.1	OK	
3.000	S1-S07	-0.169	0.000	0.14			14.1	OK	
3.001	S1-S08	-0.204	0.000	0.22			45.0	OK	
1.005	S1-S09	-0.265	0.000	0.35			105.7	OK	
1.006	S1-S10	-0.296	0.000	0.26			112.4	OK	
1.007	S1-S11	-0.298	0.000	0.25			130.7	OK	
1.008	S1-S12	-0.276	0.000	0.29			147.2	OK	

Ardent		Page 11
3rd Floor, The Hallmark Building 52-56 Leadenhall Street London, EC3M 5JE	1734483 Land at Tortington, Arundel Western Parcel	
Date 01/10/2020 File 173483- SW NETWORK 1.MDX	Designed by vlander Checked by	
Innovyze	Network 2020.1	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) SurchARGE	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.009	S1-S13	15 Winter	1	+0%	100/15 Summer				15.059
1.010	S1-S14	15 Summer	1	+0%	100/15 Summer				14.385
1.011	S1-S15	15 Winter	1	+0%	30/15 Summer				13.341
4.000	S1-S16	15 Winter	1	+0%	100/15 Summer				14.243
4.001	S1-S17	15 Winter	1	+0%	100/15 Summer				13.872
4.002	S1-S18	15 Winter	1	+0%	30/15 Summer				13.460
4.003	S1-S19	15 Winter	1	+0%	30/15 Summer				11.970
1.012	S1-S20	15 Winter	1	+0%	30/15 Summer				11.808
5.000	S1-S21	15 Winter	1	+0%	30/15 Summer				20.156
5.001	S1-S22	15 Winter	1	+0%					19.207
5.002	S1-S23	15 Winter	1	+0%	100/15 Summer				17.799
5.003	S1-S24	15 Winter	1	+0%	100/15 Summer				16.429
5.004	S1-S25	15 Winter	1	+0%	100/15 Summer				15.050
5.005	S1-S26	15 Winter	1	+0%					13.610
5.006	S1-S27	15 Winter	1	+0%					12.107
1.013	S1-S28	1440 Winter	1	+0%	1/960 Winter				11.490

PN	US/MH Name	Depth (m)	Surcharged Volume (m³)	Flooded Flow / Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.009	S1-S13	-0.271	0.000	0.33		153.0	OK	
1.010	S1-S14	-0.265	0.000	0.30		154.6	OK	
1.011	S1-S15	-0.242	0.000	0.41		168.2	OK	
4.000	S1-S16	-0.057	0.000	0.38		3.7	OK	
4.001	S1-S17	-0.108	0.000	0.17		5.5	OK	
4.002	S1-S18	-0.088	0.000	0.35		10.9	OK	
4.003	S1-S19	-0.130	0.000	0.37		13.6	OK	
1.012	S1-S20	-0.224	0.000	0.47		184.0	OK	
5.000	S1-S21	-0.044	0.000	0.58		6.9	OK	
5.001	S1-S22	-0.169	0.000	0.14		13.8	OK	
5.002	S1-S23	-0.145	0.000	0.27		26.1	OK	
5.003	S1-S24	-0.219	0.000	0.16		33.1	OK	
5.004	S1-S25	-0.194	0.000	0.27		54.4	OK	
5.005	S1-S26	-0.270	0.000	0.17		63.1	OK	
5.006	S1-S27	-0.269	0.000	0.18		63.2	OK	
1.013	S1-S28	0.014	0.000	0.02		6.6	SURCHARGED	

Ardent		Page 12
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE	1734483 Land at Tortington, Arundel Western Parcel	
Date 01/10/2020 File 173483- SW NETWORK 1.MDX	Designed by vlander Checked by	
Innovyze Network 2020.1		

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 1 Number of Storage Structures 4 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.332
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 19.500 Cv (Winter) 0.840

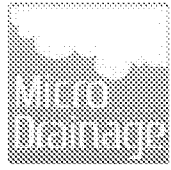
Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status OFF
 Inertia Status OFF

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 40

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S1-S01	15 Winter	30	+0%	100/15 Summer				24.985
1.001	S1-S02	30 Winter	30	+0%	100/15 Winter				23.561
2.000	S1-S03	15 Winter	30	+0%	100/15 Summer				21.408
1.002	S1-S04	15 Winter	30	+0%	100/15 Summer				20.984
1.003	S1-S05	15 Winter	30	+0%	100/15 Summer				20.435
1.004	S1-S06	15 Winter	30	+0%	100/15 Summer				20.049
3.000	S1-S07	15 Winter	30	+0%					23.542
3.001	S1-S08	15 Winter	30	+0%	100/15 Summer				21.155
1.005	S1-S09	15 Winter	30	+0%	100/15 Summer				18.538
1.006	S1-S10	15 Winter	30	+0%	100/15 Summer				18.170
1.007	S1-S11	15 Winter	30	+0%	100/15 Summer				17.420
1.008	S1-S12	15 Winter	30	+0%	100/15 Summer				16.095

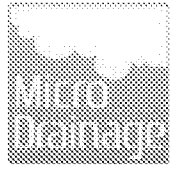
©1982-2020 Innovyze

Ardent		Page 13
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE	1734483 Land at Tortington, Arundel Western Parcel	
Date 01/10/2020 File 173483- SW NETWORK 1.MDX	Designed by vlander Checked by	
Innovyze	Network 2020.1	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

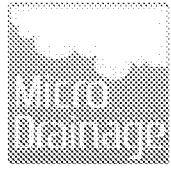
PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Half Drain	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)	Cap.	(l/s)	Time (mins)	Flow (l/s)		
1.000	S1-S01	-0.090	0.000	0.65			51.4	OK	
1.001	S1-S02	-0.091	0.000	0.66		13	52.3	OK	
2.000	S1-S03	-0.067	0.000	0.81			41.6	OK	
1.002	S1-S04	-0.130	0.000	0.59			93.6	OK	
1.003	S1-S05	-0.042	0.000	1.00		3	126.5	OK	
1.004	S1-S06	-0.173	0.000	0.55			164.9	OK	
3.000	S1-S07	-0.133	0.000	0.34			34.4	OK	
3.001	S1-S08	-0.124	0.000	0.64			130.2	OK	
1.005	S1-S09	-0.076	0.000	0.99			294.7	OK	
1.006	S1-S10	-0.164	0.000	0.72			316.4	OK	
1.007	S1-S11	-0.167	0.000	0.70			369.9	OK	
1.008	S1-S12	-0.128	0.000	0.84			419.5	OK	

Ardent								Page 14																																																																																																																																																																																				
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE				1734483 Land at Tortington, Arundel Western Parcel																																																																																																																																																																																								
Date 01/10/2020 File 173483- SW NETWORK 1.MDX				Designed by vlander Checked by																																																																																																																																																																																								
Innovyze				Network 2020.1																																																																																																																																																																																								
<u>30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)</u> <u>for Storm</u>																																																																																																																																																																																												
<table><tr><th colspan="2">US/MH</th><th rowspan="2">Storm</th><th rowspan="2">Return Period</th><th rowspan="2">Climate Change</th><th rowspan="2">First (X) Surcharge</th><th rowspan="2">First (Y) Flood</th><th rowspan="2">First (Z) Overflow</th><th rowspan="2">Overflow Act.</th><th>Water Level</th></tr><tr><th>PN</th><th>Name</th><th>(m)</th></tr><tr><td>1.009</td><td>S1-S13</td><td>15 Winter</td><td>30</td><td>+0%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>15.232</td></tr><tr><td>1.010</td><td>S1-S14</td><td>15 Winter</td><td>30</td><td>+0%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>14.640</td></tr><tr><td>1.011</td><td>S1-S15</td><td>15 Winter</td><td>30</td><td>+0%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>13.759</td></tr><tr><td>4.000</td><td>S1-S16</td><td>15 Winter</td><td>30</td><td>+0%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>14.277</td></tr><tr><td>4.001</td><td>S1-S17</td><td>15 Winter</td><td>30</td><td>+0%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>13.902</td></tr><tr><td>4.002</td><td>S1-S18</td><td>15 Winter</td><td>30</td><td>+0%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>13.596</td></tr><tr><td>4.003</td><td>S1-S19</td><td>15 Winter</td><td>30</td><td>+0%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>12.429</td></tr><tr><td>1.012</td><td>S1-S20</td><td>15 Winter</td><td>30</td><td>+0%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>12.370</td></tr><tr><td>5.000</td><td>S1-S21</td><td>15 Winter</td><td>30</td><td>+0%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>20.566</td></tr><tr><td>5.001</td><td>S1-S22</td><td>15 Winter</td><td>30</td><td>+0%</td><td></td><td></td><td></td><td></td><td>19.244</td></tr><tr><td>5.002</td><td>S1-S23</td><td>15 Winter</td><td>30</td><td>+0%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>17.865</td></tr><tr><td>5.003</td><td>S1-S24</td><td>15 Winter</td><td>30</td><td>+0%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>16.491</td></tr><tr><td>5.004</td><td>S1-S25</td><td>15 Summer</td><td>30</td><td>+0%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>15.145</td></tr><tr><td>5.005</td><td>S1-S26</td><td>15 Winter</td><td>30</td><td>+0%</td><td></td><td></td><td></td><td></td><td>13.696</td></tr><tr><td>5.006</td><td>S1-S27</td><td>15 Winter</td><td>30</td><td>+0%</td><td></td><td></td><td></td><td></td><td>12.194</td></tr><tr><td>1.013</td><td>S1-S28</td><td>1440 Winter</td><td>30</td><td>+0%</td><td>1/960 Winter</td><td></td><td></td><td></td><td>11.905</td></tr></table>										US/MH		Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level	PN	Name	(m)	1.009	S1-S13	15 Winter	30	+0%	100/15 Summer				15.232	1.010	S1-S14	15 Winter	30	+0%	100/15 Summer				14.640	1.011	S1-S15	15 Winter	30	+0%	30/15 Summer				13.759	4.000	S1-S16	15 Winter	30	+0%	100/15 Summer				14.277	4.001	S1-S17	15 Winter	30	+0%	100/15 Summer				13.902	4.002	S1-S18	15 Winter	30	+0%	30/15 Summer				13.596	4.003	S1-S19	15 Winter	30	+0%	30/15 Summer				12.429	1.012	S1-S20	15 Winter	30	+0%	30/15 Summer				12.370	5.000	S1-S21	15 Winter	30	+0%	30/15 Summer				20.566	5.001	S1-S22	15 Winter	30	+0%					19.244	5.002	S1-S23	15 Winter	30	+0%	100/15 Summer				17.865	5.003	S1-S24	15 Winter	30	+0%	100/15 Summer				16.491	5.004	S1-S25	15 Summer	30	+0%	100/15 Summer				15.145	5.005	S1-S26	15 Winter	30	+0%					13.696	5.006	S1-S27	15 Winter	30	+0%					12.194	1.013	S1-S28	1440 Winter	30	+0%	1/960 Winter				11.905						
US/MH		Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level																																																																																																																																																																																			
PN	Name								(m)																																																																																																																																																																																			
1.009	S1-S13	15 Winter	30	+0%	100/15 Summer				15.232																																																																																																																																																																																			
1.010	S1-S14	15 Winter	30	+0%	100/15 Summer				14.640																																																																																																																																																																																			
1.011	S1-S15	15 Winter	30	+0%	30/15 Summer				13.759																																																																																																																																																																																			
4.000	S1-S16	15 Winter	30	+0%	100/15 Summer				14.277																																																																																																																																																																																			
4.001	S1-S17	15 Winter	30	+0%	100/15 Summer				13.902																																																																																																																																																																																			
4.002	S1-S18	15 Winter	30	+0%	30/15 Summer				13.596																																																																																																																																																																																			
4.003	S1-S19	15 Winter	30	+0%	30/15 Summer				12.429																																																																																																																																																																																			
1.012	S1-S20	15 Winter	30	+0%	30/15 Summer				12.370																																																																																																																																																																																			
5.000	S1-S21	15 Winter	30	+0%	30/15 Summer				20.566																																																																																																																																																																																			
5.001	S1-S22	15 Winter	30	+0%					19.244																																																																																																																																																																																			
5.002	S1-S23	15 Winter	30	+0%	100/15 Summer				17.865																																																																																																																																																																																			
5.003	S1-S24	15 Winter	30	+0%	100/15 Summer				16.491																																																																																																																																																																																			
5.004	S1-S25	15 Summer	30	+0%	100/15 Summer				15.145																																																																																																																																																																																			
5.005	S1-S26	15 Winter	30	+0%					13.696																																																																																																																																																																																			
5.006	S1-S27	15 Winter	30	+0%					12.194																																																																																																																																																																																			
1.013	S1-S28	1440 Winter	30	+0%	1/960 Winter				11.905																																																																																																																																																																																			
<table><tr><th colspan="2"></th><th colspan="2">Surcharged Flooded</th><th colspan="2">Half Drain</th><th>Pipe</th><th colspan="2"></th></tr><tr><th>PN</th><th>US/MH Name</th><th>Depth (m)</th><th>Volume (m³)</th><th>Flow / Cap.</th><th>Overflow (l/s)</th><th>Time (mins)</th><th>Flow (l/s)</th><th>Status</th><th>Level Exceeded</th></tr><tr><td>1.009</td><td>S1-S13</td><td>-0.098</td><td>0.000</td><td>0.94</td><td></td><td></td><td>438.8</td><td>OK</td><td></td></tr><tr><td>1.010</td><td>S1-S14</td><td>-0.009</td><td>0.000</td><td>0.91</td><td></td><td></td><td>465.8</td><td>OK</td><td></td></tr><tr><td>1.011</td><td>S1-S15</td><td>-0.176</td><td>0.000</td><td>1.17</td><td></td><td></td><td>472.8</td><td>SURCHARGED</td><td></td></tr><tr><td>4.000</td><td>S1-S16</td><td>-0.023</td><td>0.000</td><td>0.92</td><td></td><td></td><td>9.0</td><td>OK</td><td></td></tr><tr><td>4.001</td><td>S1-S17</td><td>-0.078</td><td>0.000</td><td>0.46</td><td></td><td></td><td>14.6</td><td>OK</td><td></td></tr><tr><td>4.002</td><td>S1-S18</td><td>0.048</td><td>0.000</td><td>0.95</td><td></td><td></td><td>29.2</td><td>SURCHARGED</td><td></td></tr><tr><td>4.003</td><td>S1-S19</td><td>0.329</td><td>0.000</td><td>0.95</td><td></td><td></td><td>34.7</td><td>SURCHARGED</td><td></td></tr><tr><td>1.012</td><td>S1-S20</td><td>0.338</td><td>0.000</td><td>1.21</td><td></td><td></td><td>514.1</td><td>SURCHARGED</td><td></td></tr><tr><td>5.000</td><td>S1-S21</td><td>0.366</td><td>0.000</td><td>1.20</td><td></td><td></td><td>14.1</td><td>SURCHARGED</td><td></td></tr><tr><td>5.001</td><td>S1-S22</td><td>-0.132</td><td>0.000</td><td>0.35</td><td></td><td></td><td>34.7</td><td>OK</td><td></td></tr><tr><td>5.002</td><td>S1-S23</td><td>-0.079</td><td>0.000</td><td>0.74</td><td></td><td></td><td>73.0</td><td>OK</td><td></td></tr><tr><td>5.003</td><td>S1-S24</td><td>-0.157</td><td>0.000</td><td>0.46</td><td></td><td></td><td>94.3</td><td>OK</td><td></td></tr><tr><td>5.004</td><td>S1-S25</td><td>-0.099</td><td>0.000</td><td>0.78</td><td></td><td></td><td>160.2</td><td>OK</td><td></td></tr><tr><td>5.005</td><td>S1-S26</td><td>-0.184</td><td>0.000</td><td>0.51</td><td></td><td></td><td>186.4</td><td>OK</td><td></td></tr><tr><td>5.006</td><td>S1-S27</td><td>-0.182</td><td>0.000</td><td>0.52</td><td></td><td></td><td>185.7</td><td>OK</td><td></td></tr><tr><td>1.013</td><td>S1-S28</td><td>0.429</td><td>0.000</td><td>0.03</td><td></td><td></td><td>9.8</td><td>SURCHARGED</td><td></td></tr></table>												Surcharged Flooded		Half Drain		Pipe			PN	US/MH Name	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)	Status	Level Exceeded	1.009	S1-S13	-0.098	0.000	0.94			438.8	OK		1.010	S1-S14	-0.009	0.000	0.91			465.8	OK		1.011	S1-S15	-0.176	0.000	1.17			472.8	SURCHARGED		4.000	S1-S16	-0.023	0.000	0.92			9.0	OK		4.001	S1-S17	-0.078	0.000	0.46			14.6	OK		4.002	S1-S18	0.048	0.000	0.95			29.2	SURCHARGED		4.003	S1-S19	0.329	0.000	0.95			34.7	SURCHARGED		1.012	S1-S20	0.338	0.000	1.21			514.1	SURCHARGED		5.000	S1-S21	0.366	0.000	1.20			14.1	SURCHARGED		5.001	S1-S22	-0.132	0.000	0.35			34.7	OK		5.002	S1-S23	-0.079	0.000	0.74			73.0	OK		5.003	S1-S24	-0.157	0.000	0.46			94.3	OK		5.004	S1-S25	-0.099	0.000	0.78			160.2	OK		5.005	S1-S26	-0.184	0.000	0.51			186.4	OK		5.006	S1-S27	-0.182	0.000	0.52			185.7	OK		1.013	S1-S28	0.429	0.000	0.03			9.8	SURCHARGED	
		Surcharged Flooded		Half Drain		Pipe																																																																																																																																																																																						
PN	US/MH Name	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)	Status	Level Exceeded																																																																																																																																																																																			
1.009	S1-S13	-0.098	0.000	0.94			438.8	OK																																																																																																																																																																																				
1.010	S1-S14	-0.009	0.000	0.91			465.8	OK																																																																																																																																																																																				
1.011	S1-S15	-0.176	0.000	1.17			472.8	SURCHARGED																																																																																																																																																																																				
4.000	S1-S16	-0.023	0.000	0.92			9.0	OK																																																																																																																																																																																				
4.001	S1-S17	-0.078	0.000	0.46			14.6	OK																																																																																																																																																																																				
4.002	S1-S18	0.048	0.000	0.95			29.2	SURCHARGED																																																																																																																																																																																				
4.003	S1-S19	0.329	0.000	0.95			34.7	SURCHARGED																																																																																																																																																																																				
1.012	S1-S20	0.338	0.000	1.21			514.1	SURCHARGED																																																																																																																																																																																				
5.000	S1-S21	0.366	0.000	1.20			14.1	SURCHARGED																																																																																																																																																																																				
5.001	S1-S22	-0.132	0.000	0.35			34.7	OK																																																																																																																																																																																				
5.002	S1-S23	-0.079	0.000	0.74			73.0	OK																																																																																																																																																																																				
5.003	S1-S24	-0.157	0.000	0.46			94.3	OK																																																																																																																																																																																				
5.004	S1-S25	-0.099	0.000	0.78			160.2	OK																																																																																																																																																																																				
5.005	S1-S26	-0.184	0.000	0.51			186.4	OK																																																																																																																																																																																				
5.006	S1-S27	-0.182	0.000	0.52			185.7	OK																																																																																																																																																																																				
1.013	S1-S28	0.429	0.000	0.03			9.8	SURCHARGED																																																																																																																																																																																				
©1982-2020 Innovyze																																																																																																																																																																																												

Ardent		Page 16
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE	1734483 Land at Tortington, Arundel Western Parcel	
Date 01/10/2020 File 173483- SW NETWORK 1.MDX	Designed by vlander Checked by	
Innovyze	Network 2020.1	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Surcharged Flooded		Flow / Cap.	Overflow (l/s)	Half Drain Pipe		Status	Level Exceeded
		Depth (m)	Volume (m³)			Time (mins)	Flow (l/s)		
1.000	S1-S01	0.303	0.000	1.09			86.7	SURCHARGED	
1.001	S1-S02	0.011	0.000	1.01		11	80.0	SURCHARGED	
2.000	S1-S03	0.521	0.000	1.34			68.8	SURCHARGED	
1.002	S1-S04	0.345	0.000	1.03			162.4	SURCHARGED	
1.003	S1-S05	0.401	0.000	1.55		7	196.4	SURCHARGED	
1.004	S1-S06	0.323	0.000	0.75			223.2	SURCHARGED	
3.000	S1-S07	-0.095	0.000	0.62			62.4	OK	
3.001	S1-S08	0.294	0.000	1.10			224.1	SURCHARGED	
1.005	S1-S09	1.423	0.000	1.34			398.4	SURCHARGED	
1.006	S1-S10	1.250	0.000	0.94			413.1	SURCHARGED	
1.007	S1-S11	1.376	0.000	0.91			478.7	SURCHARGED	
1.008	S1-S12	1.618	0.000	1.08			542.8	SURCHARGED	

Ardent		Page 1
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE	173483 Land at Tortington, Arundel Eastern Catchment	
Date 26/10/2020 18:46 File	Designed by vlander Checked by	
Innovyze Source Control 2020.1		

ICP SUDS Mean Annual Flood

Input

Return Period (years) 100 SAAR (mm) 782 Urban 0.000
Area (ha) 1.000 Soil 0.300 Region Number Region 7

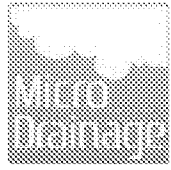
Results 1/s

QBAR Rural 2.1
QBAR Urban 2.1

Q100 years 6.6

Q1 year 1.8
Q30 years 4.7
Q100 years 6.6

©1982-2020 Innovyze

Ardent		Page 1
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE	1734483 Land at Tortington, Arundel Western Parcel	
Date 01/10/2020 File 173483- SW NETWORK 1 COP...	Designed by vlander Checked by	
Innovyze Network 2020.1		

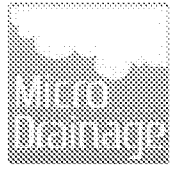
Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	1.745	4-8	0.794

Total Area Contributing (ha) = 2.539

Total Pipe Volume (m³) = 73.450

©1982-2020 Innovyze

Ardent		Page 2
3rd Floor, The Hallmark Building 52-56 Leadenhall Street London, EC3M 5JE	1734483 Land at Tortington, Arundel Western Parcel	
Date 01/10/2020 File 173483- SW NETWORK 1 COP...	Designed by vlander Checked by	
Innovyze	Network 2020.1	

STORM SEWER DESIGN by the Modified Rational Method

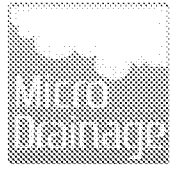
Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	56.900	1.897	30.0	0.168	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	55.200	1.840	30.0	0.123	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	32.500	0.271	119.9	0.136	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	25.500	0.850	30.0	0.052	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.003	10.200	0.340	30.0	0.176	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	64.300	2.143	30.0	0.133	0.00	0.0	0.600	o	375	Pipe/Conduit	
3.000	59.900	1.997	30.0	0.112	5.00	0.0	0.600	o	225	Pipe/Conduit	
3.001	30.700	1.023	30.0	0.288	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.005	11.200	0.373	30.0	0.020	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.006	29.900	0.997	30.0	0.067	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.007	40.900	1.363	30.0	0.178	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.008	26.800	0.893	30.0	0.163	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.009	20.400	0.680	30.0	0.061	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.40	25.300	0.168	0.0	0.0	9.1	2.40	95.3	31.8
1.001	50.00	5.78	23.403	0.291	0.0	0.0	15.8	2.40	95.3	55.2
2.000	50.00	5.45	21.565	0.136	0.0	0.0	7.4	1.19	47.4	25.8
1.002	50.00	5.93	21.217	0.479	0.0	0.0	25.9	2.88	203.7	90.8
1.003	50.00	5.99	20.367	0.655	0.0	0.0	35.5	2.88	203.7	124.2
1.004	50.00	6.31	19.952	0.788	0.0	0.0	42.7	3.32	366.5	149.4
3.000	50.00	5.42	24.600	0.112	0.0	0.0	6.1	2.40	95.3	21.2
3.001	50.00	5.59	21.400	0.400	0.0	0.0	21.7	2.88	203.6	75.8
1.005	50.00	6.36	17.734	1.208	0.0	0.0	65.4	3.72	591.8	229.0
1.006	50.00	6.49	17.361	1.275	0.0	0.0	69.1	3.72	592.1	241.7
1.007	50.00	6.68	16.364	1.453	0.0	0.0	78.7	3.72	592.0	275.5
1.008	50.00	6.80	15.001	1.616	0.0	0.0	87.5	3.72	591.9	306.4
1.009	50.00	6.89	14.108	1.677	0.0	0.0	90.8	3.72	592.1	317.9

Ardent		Page 3
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE	1734483 Land at Tortington, Arundel Western Parcel	
Date 01/10/2020 File 173483- SW NETWORK 1 COP...	Designed by vlander Checked by	
Innovyze	Network 2020.1	

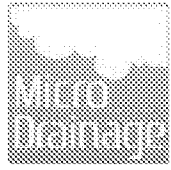
STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.010	32.000	1.067	30.0	0.109	0.00	0.0	0.600	o	450	Pipe/Conduit	☑
1.011	15.500	0.517	30.0	0.032	0.00	0.0	0.600	o	575	Pipe/Conduit	☑
4.000	10.900	0.363	30.0	0.029	5.00	0.0	0.600	o	100	Pipe/Conduit	☑
4.001	10.800	0.360	30.0	0.017	0.00	0.0	0.600	o	150	Pipe/Conduit	☑
4.002	46.000	1.533	30.0	0.050	0.00	0.0	0.600	o	150	Pipe/Conduit	☑
4.003	6.700	0.449	14.9	0.025	0.00	0.0	0.600	o	150	Pipe/Conduit	☑
1.012	21.800	0.517	42.2	0.025	0.00	0.0	0.600	o	575	Pipe/Conduit	☑
5.000	20.600	1.030	20.0	0.054	5.00	0.0	0.600	o	225	Pipe/Conduit	☑
5.001	35.800	1.790	20.0	0.065	0.00	0.0	0.600	o	225	Pipe/Conduit	☑
5.002	32.400	1.620	20.0	0.115	0.00	0.0	0.600	o	225	Pipe/Conduit	☑
5.003	35.100	1.755	20.0	0.064	0.00	0.0	0.600	o	300	Pipe/Conduit	☑
5.004	34.100	1.705	20.0	0.198	0.00	0.0	0.600	o	300	Pipe/Conduit	☑
5.005	37.600	1.880	20.0	0.079	0.00	0.0	0.600	o	375	Pipe/Conduit	☑
5.006	20.000	2.000	10.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	☑

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.010	50.00	7.03	13.428	1.786	0.0	0.0	96.7	3.72	592.2	338.6
1.011	50.00	7.09	12.236	1.818	0.0	0.0	98.5	4.34	1127.1	344.7
4.000	50.00	5.13	14.890	0.029	0.0	0.0	1.6	1.41	11.1	5.5
4.001	50.00	5.23	14.387	0.046	0.0	0.0	2.5	1.84	32.6	8.7
4.002	50.00	5.64	14.027	0.096	0.0	0.0	5.2	1.84	32.6	18.2
4.003	50.00	5.68	12.493	0.121	0.0	0.0	6.6	2.62	46.3	22.9
1.012	50.00	7.19	11.620	1.964	0.0	0.0	106.4	3.66	950.1	372.3
5.000	50.00	5.12	21.475	0.054	0.0	0.0	2.9	2.94	116.9	10.2
5.001	50.00	5.32	20.445	0.119	0.0	0.0	6.4	2.94	116.9	22.6
5.002	50.00	5.50	18.655	0.234	0.0	0.0	12.7	2.94	116.9	44.4
5.003	50.00	5.67	16.960	0.298	0.0	0.0	16.1	3.53	249.6	56.5
5.004	50.00	5.83	15.205	0.496	0.0	0.0	26.9	3.53	249.6	94.0
5.005	50.00	5.98	13.425	0.575	0.0	0.0	31.1	4.07	449.2	109.0
5.006	50.00	6.04	12.500	0.575	0.0	0.0	31.1	5.76	635.9	109.0

Ardent		Page 4
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE	1734483 Land at Tortington, Arundel Western Parcel	
Date 01/10/2020 File 173483- SW NETWORK 1 COP...	Designed by vlander Checked by	
Innovyze	Network 2020.1	

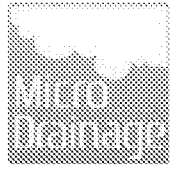
STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.013	20.000	0.200	100.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.013	50.00	7.37	11.200	2.539	0.0	0.0	137.5	1.81	200.14	481.3

Ardent		Page 7
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE	1734483 Land at Tortington, Arundel Western Parcel	
Date 01/10/2020 File 173483- SW NETWORK 1 COP...	Designed by vlander Checked by	
Innovyze	Network 2020.1	

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.013	Outfall 1	12.130	11.000	10.800	0	0

Simulation Criteria for Storm

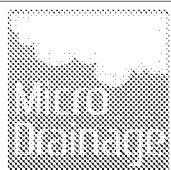
Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	4	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.500	Storm Duration (mins)	30
Ratio R	0.332		

©1982-2020 Innovyze

Ardent		Page 8
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE	1734483 Land at Tortington, Arundel Western Parcel	
Date 01/10/2020 File 173483- SW NETWORK 1 COP...	Designed by vlander Checked by	
Innovyze	Network 2020.1	

Online Controls for Storm

Complex Manhole: S1-S28, DS/PN: 1.013, Volume (m³): 10.5

Orifice

Diameter (m) 0.075 Discharge Coefficient 0.600 Invert Level (m) 11.200

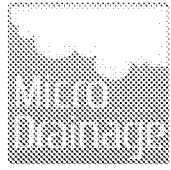
Hydro-Brake® Optimum

Unit Reference MD-SHE-0147-1400-2500-1400
Design Head (m) 2.500
Design Flow (l/s) 14.0
Flush-Flo™ Calculated
Objective Minimise upstream storage
Application Surface
Sump Available Yes
Diameter (mm) 147
Invert Level (m) 12.100
Minimum Outlet Pipe Diameter (mm) 225
Suggested Manhole Diameter (mm) 1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.500	14.0	Kick-Flo®	1.315	10.3
Flush-Flo™	0.638	13.2	Mean Flow over Head Range	-	11.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.3	1.200	11.5	3.000	15.3	7.000	22.9
0.200	10.7	1.400	10.6	3.500	16.4	7.500	23.7
0.300	12.0	1.600	11.3	4.000	17.5	8.000	24.4
0.400	12.7	1.800	12.0	4.500	18.5	8.500	25.1
0.500	13.0	2.000	12.6	5.000	19.5	9.000	25.8
0.600	13.1	2.200	13.2	5.500	20.4	9.500	26.5
0.800	13.0	2.400	13.7	6.000	21.3		
1.000	12.5	2.600	14.3	6.500	22.1		

Ardent		Page 9
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE	1734483 Land at Tortington, Arundel Western Parcel	
Date 01/10/2020 File 173483- SW NETWORK 1 COP...	Designed by vlander Checked by	
Innovyze	Network 2020.1	

Storage Structures for Storm

Porous Car Park Manhole: S1-S02, DS/PN: 1.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	22.0
Membrane Percolation (mm/hr)	1000	Length (m)	25.5
Max Percolation (l/s)	155.8	Slope (1:X)	400.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	23.403	Cap Volume Depth (m)	0.450

Porous Car Park Manhole: S1-S05, DS/PN: 1.003

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	11.0
Membrane Percolation (mm/hr)	1000	Length (m)	20.0
Max Percolation (l/s)	61.1	Slope (1:X)	400.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	20.367	Cap Volume Depth (m)	0.450

Porous Car Park Manhole: S1-S12, DS/PN: 1.008

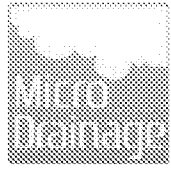
Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	12.3
Max Percolation (l/s)	34.2	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	15.001	Cap Volume Depth (m)	0.450

Tank or Pond Manhole: S1-S28, DS/PN: 1.013

Invert Level (m) 11.200

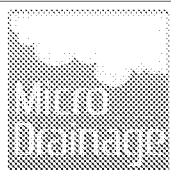
Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	1200.0	1.800	1954.7

©1982-2020 Innovyze

Ardent		Page 11
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE	1734483 Land at Tortington, Arundel Western Parcel	
Date 01/10/2020 File 173483- SW NETWORK 1 COP...	Designed by vlander Checked by	
Innovyze	Network 2020.1	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Half Drain	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)	Cap.	(l/s)	Time (mins)	Flow (l/s)		
1.000	S1-S01	-0.151	0.000	0.23			21.0	OK	
1.001	S1-S02	-0.155	0.000	0.21		10	19.6	OK	
2.000	S1-S03	-0.127	0.000	0.39			17.2	OK	
1.002	S1-S04	-0.210	0.000	0.20			35.9	OK	
1.003	S1-S05	-0.181	0.000	0.33		9	48.2	OK	
1.004	S1-S06	-0.271	0.000	0.17			58.8	OK	
3.000	S1-S07	-0.166	0.000	0.15			14.1	OK	
3.001	S1-S08	-0.199	0.000	0.24			45.1	OK	
1.005	S1-S09	-0.285	0.000	0.29			99.2	OK	
1.006	S1-S10	-0.311	0.000	0.21			105.5	OK	
1.007	S1-S11	-0.303	0.000	0.23			122.5	OK	
1.008	S1-S12	-0.290	0.000	0.27		10	136.8	OK	
1.009	S1-S13	-0.279	0.000	0.31			142.6	OK	
1.010	S1-S14	-0.282	0.000	0.30			152.5	OK	
1.011	S1-S15	-0.386	0.000	0.24			155.5	OK	

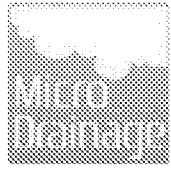
Ardent		Page 12
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE	1734483 Land at Tortington, Arundel Western Parcel	
Date 01/10/2020 File 173483- SW NETWORK 1 COP...	Designed by vlander Checked by	
Innovyze	Network 2020.1	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
4.000	S1-S16	15 Winter	1	+0%	100/15 Summer				14.841
4.001	S1-S17	15 Winter	1	+0%	100/15 Summer				14.431
4.002	S1-S18	15 Winter	1	+0%	100/15 Summer				14.088
4.003	S1-S19	15 Winter	1	+0%	100/15 Summer				12.554
1.012	S1-S20	15 Winter	1	+0%	100/15 Winter				11.817
5.000	S1-S21	15 Winter	1	+0%					21.512
5.001	S1-S22	15 Winter	1	+0%					20.498
5.002	S1-S23	15 Winter	1	+0%	100/15 Summer				18.730
5.003	S1-S24	15 Winter	1	+0%					17.036
5.004	S1-S25	15 Winter	1	+0%	100/15 Summer				15.304
5.005	S1-S26	15 Winter	1	+0%					13.524
5.006	S1-S27	15 Winter	1	+0%					12.586
1.013	S1-S28	1440 Winter	1	+0%	1/1440 Winter				11.577

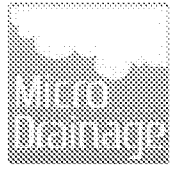
PN	US/MH Name	Depth (m)	Surcharged Volume (m³)	Flooded Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
4.000	S1-S16	-0.059	0.000	0.35			3.7	OK	
4.001	S1-S17	-0.106	0.000	0.19			5.5	OK	
4.002	S1-S18	-0.089	0.000	0.34			10.9	OK	
4.003	S1-S19	-0.089	0.000	0.34			13.5	OK	
1.012	S1-S20	-0.377	0.000	0.26			169.8	OK	
5.000	S1-S21	-0.188	0.000	0.06			6.9	OK	
5.001	S1-S22	-0.172	0.000	0.13			13.8	OK	
5.002	S1-S23	-0.150	0.000	0.24			26.2	OK	
5.003	S1-S24	-0.224	0.000	0.14			33.1	OK	
5.004	S1-S25	-0.201	0.000	0.24			54.4	OK	
5.005	S1-S26	-0.276	0.000	0.16			63.0	OK	
5.006	S1-S27	-0.289	0.000	0.12			63.2	OK	
1.013	S1-S28	0.002	0.000	0.04			6.8	SURCHARGED	

ARUN DISTRICT COUNCIL AB/135/20/OUT

Ardent		Page 14
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE	1734483 Land at Tortington, Arundel Western Parcel	
Date 01/10/2020 File 173483- SW NETWORK 1 COP...	Designed by vlander Checked by	
Innovyze	Network 2020.1	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

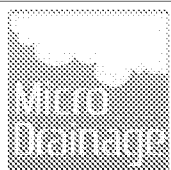
PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Half Drain	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)	Cap.	(l/s)	Time (mins)	Flow (l/s)		
1.000	S1-S01	-0.102	0.000	0.56			51.4	OK	
1.001	S1-S02	-0.094	0.000	0.64		8	58.3	OK	
2.000	S1-S03	-0.050	0.000	0.94			41.7	OK	
1.002	S1-S04	-0.133	0.000	0.58			104.9	OK	
1.003	S1-S05	-0.065	0.000	0.97		7	141.2	OK	
1.004	S1-S06	-0.185	0.000	0.49			170.2	OK	
3.000	S1-S07	-0.128	0.000	0.37			34.4	OK	
3.001	S1-S08	-0.112	0.000	0.70			130.2	OK	
1.005	S1-S09	-0.126	0.000	0.85			292.7	OK	
1.006	S1-S10	-0.193	0.000	0.61			312.3	OK	
1.007	S1-S11	-0.172	0.000	0.69			364.1	OK	
1.008	S1-S12	-0.139	0.000	0.81		7	407.6	OK	
1.009	S1-S13	-0.111	0.000	0.91			421.9	OK	
1.010	S1-S14	-0.118	0.000	0.88			448.9	OK	
1.011	S1-S15	-0.217	0.000	0.69			457.9	OK	

Ardent		Page 15
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE	1734483 Land at Tortington, Arundel Western Parcel	
Date 01/10/2020 File 173483- SW NETWORK 1 COP...	Designed by vlander Checked by	
Innovyze	Network 2020.1	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
4.000	S1-S16	15 Winter	30	+0%	100/15 Summer				14.873
4.001	S1-S17	15 Winter	30	+0%	100/15 Summer				14.463
4.002	S1-S18	15 Winter	30	+0%	100/15 Summer				14.146
4.003	S1-S19	15 Winter	30	+0%	100/15 Summer				12.615
1.012	S1-S20	15 Winter	30	+0%	100/15 Winter				12.000
5.000	S1-S21	15 Winter	30	+0%					21.535
5.001	S1-S22	15 Winter	30	+0%					20.537
5.002	S1-S23	15 Winter	30	+0%	100/15 Summer				18.795
5.003	S1-S24	15 Winter	30	+0%					17.097
5.004	S1-S25	15 Winter	30	+0%	100/15 Summer				15.394
5.005	S1-S26	15 Winter	30	+0%					13.606
5.006	S1-S27	15 Winter	30	+0%					12.655
1.013	S1-S28	1440 Winter	30	+0%	1/1440 Winter				11.975

PN	US/MH Name	Depth (m)	Surcharged Volume (m³)	Flooded Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
4.000	S1-S16	-0.027	0.000	0.87			9.0	OK	
4.001	S1-S17	-0.074	0.000	0.50			14.6	OK	
4.002	S1-S18	-0.031	0.000	0.96			30.6	OK	
4.003	S1-S19	-0.028	0.000	0.98			38.5	OK	
1.012	S1-S20	-0.195	0.000	0.76			500.3	OK	
5.000	S1-S21	-0.165	0.000	0.16			16.8	OK	
5.001	S1-S22	-0.133	0.000	0.35			38.4	OK	
5.002	S1-S23	-0.085	0.000	0.70			76.7	OK	
5.003	S1-S24	-0.163	0.000	0.43			97.9	OK	
5.004	S1-S25	-0.111	0.000	0.71			163.8	OK	
5.005	S1-S26	-0.194	0.000	0.47			189.5	OK	
5.006	S1-S27	-0.220	0.000	0.35			188.4	OK	
1.013	S1-S28	0.400	0.000	0.06			10.1	SURCHARGED	

Ardent		Page 16
3rd Floor, The Hallmark Building 52-56 Leadenhall Street London, EC3M 5JE	1734483 Land at Tortington, Arundel Western Parcel	
Date 01/10/2020 File 173483- SW NETWORK 1 COP...	Designed by vlander Checked by	
Innovyze	Network 2020.1	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 1 Number of Storage Structures 4 Number of Real Time Controls 0

Synthetic Rainfall Details

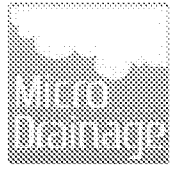
Rainfall Model FSR Ratio R 0.332
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 19.500 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status OFF
 Inertia Status OFF

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 40

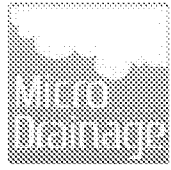
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S1-S01	15 Winter	100	+40%					25.523
1.001	S1-S02	15 Winter	100	+40%					23.622
1.000	S1-S03	15 Winter	100	+40%	100/15 Summer				22.273
1.002	S1-S04	15 Winter	100	+40%	100/15 Summer				21.815
1.003	S1-S05	15 Winter	100	+40%	100/15 Summer				21.114
1.004	S1-S06	15 Winter	100	+40%	100/15 Winter				20.353
3.000	S1-S07	15 Winter	100	+40%					24.139
3.001	S1-S08	15 Winter	100	+40%	100/15 Summer				22.146
1.005	S1-S09	15 Winter	100	+40%	100/15 Summer				19.272
1.006	S1-S10	15 Winter	100	+40%	100/15 Summer				18.674
1.007	S1-S11	15 Winter	100	+40%	100/15 Summer				17.860
1.008	S1-S12	15 Winter	100	+40%	100/15 Summer				16.535
1.009	S1-S13	15 Winter	100	+40%	100/15 Summer				15.398
1.010	S1-S14	15 Winter	100	+40%	100/15 Summer				14.330
1.011	S1-S15	15 Winter	100	+40%					12.678

©1982-2020 Innovyze

Ardent		Page 17
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE	1734483 Land at Tortington, Arundel Western Parcel	
Date 01/10/2020	Designed by vlander	
File 173483- SW NETWORK 1 COP...	Checked by	
Innovyze	Network 2020.1	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

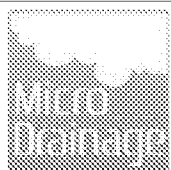
PN	US/MH Name	Surcharged Flooded		Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)					
1.000	S1-S01	-0.002	0.000	1.00		91.8	OK	
1.001	S1-S02	-0.006	0.000	1.00	7	91.7	OK	
1.000	S1-S03	0.483	0.000	1.57		69.8	SURCHARGED	
1.002	S1-S04	0.298	0.000	0.94		171.6	SURCHARGED	
1.003	S1-S05	0.447	0.000	1.48	9	215.6	SURCHARGED	
1.004	S1-S06	0.026	0.000	0.74		253.3	SURCHARGED	
3.000	S1-S07	-0.086	0.000	0.68		62.4	OK	
3.001	S1-S08	0.448	0.000	1.19		221.1	SURCHARGED	
1.005	S1-S09	1.088	0.000	1.29		443.5	SURCHARGED	
1.006	S1-S10	0.863	0.000	0.91		460.5	FLOOD RISK	
1.007	S1-S11	1.046	0.000	0.98		515.1	FLOOD RISK	
1.008	S1-S12	1.083	0.000	1.13	6	564.2	FLOOD RISK	
1.009	S1-S13	0.840	0.000	1.25		581.8	FLOOD RISK	
1.010	S1-S14	0.452	0.000	1.20		613.4	SURCHARGED	
1.011	S1-S15	-0.133	0.000	0.94		622.6	OK	

Ardent		Page 18
3rd Floor, The Hallmark Building 52-56 Leadenhall Street London, EC3M 5JE	1734483 Land at Tortington, Arundel Western Parcel	
Date 01/10/2020 File 173483- SW NETWORK 1 COP...	Designed by vlander Checked by	
Innovyze	Network 2020.1	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
4.000	S1-S16	15 Winter	100	+40%	100/15 Summer				15.433
4.001	S1-S17	15 Winter	100	+40%	100/15 Summer				14.972
4.002	S1-S18	15 Winter	100	+40%	100/15 Summer				14.818
4.003	S1-S19	15 Winter	100	+40%	100/15 Summer				12.874
1.012	S1-S20	960 Winter	100	+40%	100/15 Winter				12.441
5.000	S1-S21	15 Winter	100	+40%					21.558
5.001	S1-S22	15 Winter	100	+40%					20.576
5.002	S1-S23	15 Winter	100	+40%	100/15 Summer				19.433
5.003	S1-S24	15 Winter	100	+40%					17.149
5.004	S1-S25	15 Winter	100	+40%	100/15 Summer				16.091
5.005	S1-S26	15 Winter	100	+40%					13.777
5.006	S1-S27	15 Winter	100	+40%					12.704
1.013	S1-S28	960 Winter	100	+40%	1/1440 Winter				12.437

PN	US/MH Name	Surcharged		Flooded		Half Drain		Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)			
4.000	S1-S16	0.533	0.000	1.14			11.8	FLOOD RISK		
4.001	S1-S17	0.435	0.000	0.67			19.7	FLOOD RISK		
4.002	S1-S18	0.441	0.000	1.15			36.6	FLOOD RISK		
4.003	S1-S19	0.231	0.000	1.24			48.5	SURCHARGED		
1.012	S1-S20	0.246	0.000	0.13			84.3	SURCHARGED		
5.000	S1-S21	-0.142	0.000	0.29			30.5	OK		
5.001	S1-S22	-0.094	0.000	0.63			69.6	OK		
5.002	S1-S23	0.559	0.000	1.16			127.1	SURCHARGED		
5.003	S1-S24	-0.111	0.000	0.70			160.9	OK		
5.004	S1-S25	0.586	0.000	1.16			265.9	SURCHARGED		
5.005	S1-S26	-0.023	0.000	0.75			305.9	OK		
5.006	S1-S27	-0.171	0.000	0.57			305.1	OK		
1.013	S1-S28	0.862	0.000	0.15			25.1	SURCHARGED		

Ardent		Page 1
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE	173483 Land at Tortington Arundel Eastern Parcel	
Date 01/10/2020 File 173483- SW NETWORK 2.MDX	Designed by vlander Checked by	
Innovyze	Network 2020.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.500	Add Flow / Climate Change (%)	0
Ratio R	0.332	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.066	4-8	0.400	8-12	0.000

Total Area Contributing (ha) = 0.467

Total Pipe Volume (m³) = 593.632

Network Design Table for Storm

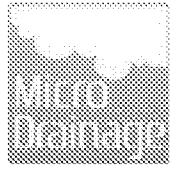
PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k	n	HYD SECT	DIA (mm)	Section Type	Auto Design
6.000	44.000	0.733	60.0	0.130	4.00	0.0	0.600		o	225	Pipe/Conduit	
6.001	24.300	0.405	60.0	0.044	0.00	0.0	0.600		o	300	Pipe/Conduit	
6.002	16.300	0.272	60.0	0.032	0.00	0.0	0.600		o	300	Pipe/Conduit	
6.003	37.200	0.620	60.0	0.070	0.00	0.0	0.600		o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
6.000	50.00	4.43	10.100	0.130	0.0	0.0	0.0	1.69	67.2	17.6
6.001	50.00	4.63	9.292	0.174	0.0	0.0	0.0	2.03	143.7	23.6
6.002	50.00	4.77	8.887	0.206	0.0	0.0	0.0	2.03	143.7	27.9
6.003	50.00	5.07	8.615	0.276	0.0	0.0	0.0	2.03	143.7	37.4

©1982-2020 Innovyze

Ardent										Page 2		
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE						173483 Land at Tortington Arundel Eastern Parcel						
Date 01/10/2020						Designed by vlander						
File 173483- SW NETWORK 2.MDX						Checked by						
Innovyze						Network 2020.1						
<u>Network Design Table for Storm</u>												
PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
6.004	7.700	0.128	60.0	0.011	0.00	0.0	0.600		o	300	Pipe/Conduit	
6.005	5.000	0.083	60.0	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	
7.000	47.800	2.390	20.0	0.180	4.00	0.0	0.600		o	225	Pipe/Conduit	
6.006	8.000	0.133	60.0	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	
6.007	55.000	0.260	211.5	0.000	0.00	0.0		0.045	3 \=/	800	1:3 Swale	
6.008	10.000	0.100	100.0	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	
<u>Network Results Table</u>												
PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)		
6.004	50.00	5.13	7.995	0.287	0.0	0.0	0.0	2.03	143.7	38.9		
6.005	50.00	5.18	7.867	0.287	0.0	0.0	0.0	2.03	143.7	38.9		
7.000	50.00	4.27	10.675	0.180	0.0	0.0	0.0	2.94	116.9	24.4		
6.006	50.00	5.24	7.784	0.467	0.0	0.0	0.0	2.03	143.7	63.2		
6.007	50.00	7.90	7.650	0.467	0.0	0.0	0.0	0.34	64.7	63.2		
6.008	50.00	8.01	7.386	0.467	0.0	0.0	0.0	1.57	111.1	63.2		
©1982-2020 Innovyze												

Ardent		Page 3
3rd Floor, The Hallmark Building 52-56 Leadenhall Street London, EC3M 5JE	173483 Land at Tortington Arundel Eastern Parcel	
Date 01/10/2020 File 173483- SW NETWORK 2.MDX	Designed by vlander Checked by	
Innovyze	Network 2020.1	

PIPELINE SCHEDULES for Storm

Upstream Manhole

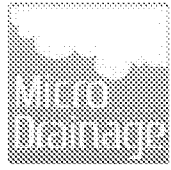
PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
6.000	o	225	S2-S01	12.600	10.100	1.675	Open Manhole	1200
6.001	o	300	S2-S02	11.120	9.292	1.528	Open Manhole	1200
6.002	o	300	S2-S03	10.400	8.887	1.213	Open Manhole	1200
6.003	o	300	S2-S04	10.170	8.615	1.255	Open Manhole	1200
6.004	o	300	S2-S05	9.960	7.995	1.665	Open Manhole	1200
6.005	o	300	S2-S06	9.850	7.867	1.683	Open Manhole	1200
7.000	o	225	S2-S07	12.100	10.675	1.200	Open Manhole	1200
6.006	o	300	S2-S08	9.860	7.784	1.716	Open Manhole	1200
6.007	3 \=/	800	S2-HW1	9.400	7.650	1.600	Open Manhole	10000
6.008	o	300	S2-HW3	8.500	7.390	0.810	Open Manhole	10000

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
6.000	44.000	60.0	S2-S02	11.120	9.367	1.528	Open Manhole	1200
6.001	24.300	60.0	S2-S03	10.400	8.887	1.213	Open Manhole	1200
6.002	16.300	60.0	S2-S04	10.170	8.615	1.255	Open Manhole	1200
6.003	37.200	60.0	S2-S05	9.960	7.995	1.665	Open Manhole	1200
6.004	7.700	60.0	S2-S06	9.850	7.867	1.683	Open Manhole	1200
6.005	5.000	60.0	S2-S08	9.860	7.784	1.716	Open Manhole	1200
7.000	47.800	20.0	S2-S08	9.860	8.285	1.290	Open Manhole	1200
6.006	8.000	60.0	S2-HW1	9.400	7.650	1.450	Open Manhole	10000
6.007	55.000	211.5	S2-HW3	8.500	7.390	0.960	Open Manhole	10000
6.008	10.000	100.0		8.700	7.290	1.110	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
6.008		8.700	7.290	7.400	0	0

Ardent		Page 4
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE	173483 Land at Tortington Arundel Eastern Parcel	
Date 01/10/2020 File 173483- SW NETWORK 2.MDX	Designed by vlander Checked by	
Innovyze	Network 2020.1	

Online Controls for Storm

Complex Manhole: S2-HW3, DS/PN: 6.008, Volume (m³): 563.6

Orifice

Diameter (m) 0.033 Discharge Coefficient 0.600 Invert Level (m) 7.390

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0089-3500-1000-3500
Design Head (m)	1.000
Design Flow (l/s)	3.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	89
Invert Level (m)	7.790
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	3.5	Kick-Flo®	0.632	2.8
Flush-Flo™	0.300	3.5	Mean Flow over Head Range	-	3.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.7	1.200	3.8	3.000	5.8	7.000	8.7
0.200	3.4	1.400	4.1	3.500	6.2	7.500	9.0
0.300	3.5	1.600	4.3	4.000	6.7	8.000	9.2
0.400	3.4	1.800	4.6	4.500	7.0	8.500	9.5
0.500	3.3	2.000	4.8	5.000	7.4	9.000	9.8
0.600	3.0	2.200	5.0	5.500	7.7	9.500	10.0
0.800	3.1	2.400	5.2	6.000	8.1		
1.000	3.5	2.600	5.4	6.500	8.4		

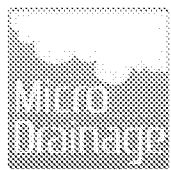
Ardent		Page 6	
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE		173483 Land at Tortington Arundel Eastern Parcel	
Date 01/10/2020 File 173483- SW NETWORK 2.MDX		Designed by vlander Checked by	
Innovyze		Network 2020.1	
<u>1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm</u>			
<u>Simulation Criteria</u>			
Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000 Hot Start Level (mm) 0 Inlet Coefficient 0.800 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000 Foul Sewage per hectare (l/s) 0.000			
Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0			
<u>Synthetic Rainfall Details</u>			
Rainfall Model FSR Ratio R 0.332 Region England and Wales Cv (Summer) 0.750 M5-60 (mm) 19.500 Cv (Winter) 0.840			
Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF Analysis Timestep Fine Inertia Status OFF DTS Status ON			
Profile(s) Summer and Winter Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440 Return Period(s) (years) 1, 30, 100 Climate Change (%) 0, 0, 40			

Ardent		Page 7
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE	173483 Land at Tortington Arundel Eastern Parcel	
Date 01/10/2020 File 173483- SW NETWORK 2.MDX	Designed by vlander Checked by	
Innovyze	Network 2020.1	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Half Drain	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)	Cap.	(l/s)	Time (mins)	Flow (l/s)		
6.001	S2-S02	-0.215	0.000	0.18			22.5	OK	
6.002	S2-S03	-0.206	0.000	0.21			25.8	OK	
6.003	S2-S04	-0.198	0.000	0.25			33.4	OK	
6.004	S2-S05	-0.170	0.000	0.39			34.7	OK	
6.005	S2-S06	-0.154	0.000	0.48			34.6	OK	
7.000	S2-S07	-0.154	0.000	0.22			24.6	OK	
6.006	S2-S08	-0.126	0.000	0.63			57.4	OK	
6.007	S2-HW1	-1.625	0.000	0.00			45.3	OK	
6.008	S2-HW3	-0.139	0.000	0.01			0.9	OK	

Ardent		Page 8
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE		173483 Land at Tortington Arundel Eastern Parcel
Date 01/10/2020 File 173483- SW NETWORK 2.MDX		Designed by vlander Checked by
Innovyze		Network 2020.1



30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.332
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 19.500 Cv (Winter) 0.840

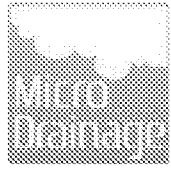
Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
6.000	S2-S01	15 Winter	30	+0%	100/15 Summer				10.236
6.001	S2-S02	15 Winter	30	+0%	100/15 Summer				9.434
6.002	S2-S03	15 Winter	30	+0%	100/15 Summer				9.048
6.003	S2-S04	15 Winter	30	+0%	100/15 Summer				8.800
6.004	S2-S05	15 Winter	30	+0%	30/15 Summer				8.520
6.005	S2-S06	15 Winter	30	+0%	30/15 Summer				8.394
7.000	S2-S07	15 Winter	30	+0%					10.793
6.006	S2-S08	15 Winter	30	+0%	30/15 Summer				8.263
6.007	S2-HW1	15 Winter	30	+0%					7.861
6.008	S2-HW3	1440 Winter	30	+0%	30/960 Winter				7.705

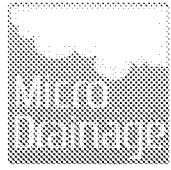
PN	US/MH Name	Depth (m)	Surcharged Volume (m³)	Flooded Flow / Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
6.000	S2-S01	-0.089	0.000	0.67		43.2	OK	

©1982-2020 Innovyze

Ardent		Page 9
3rd Floor, The Hallmark Building 52-56 Leadenhall Street London, EC3M 5JE	173483 Land at Tortington Arundel Eastern Parcel	
Date 01/10/2020 File 173483- SW NETWORK 2.MDX	Designed by vlander Checked by	
Innovyze	Network 2020.1	

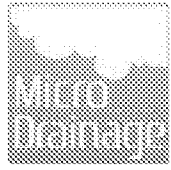
30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Surcharged	Flooded	Flow / Overflow		Half Drain	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)	Cap.	(l/s)	Time (mins)	Flow (l/s)		
6.001	S2-S02	-0.158	0.000	0.45			57.7	OK	
6.002	S2-S03	-0.139	0.000	0.56			68.0	OK	
6.003	S2-S04	-0.116	0.000	0.68			89.7	OK	
6.004	S2-S05	0.225	0.000	1.00			89.7	SURCHARGED	
6.005	S2-S06	0.227	0.000	1.26			91.3	SURCHARGED	
7.000	S2-S07	-0.107	0.000	0.54			60.2	OK	
6.006	S2-S08	0.180	0.000	1.56			142.7	SURCHARGED	
6.007	S2-HW1	-1.539	0.000	0.01			135.4	OK	
6.008	S2-HW3	0.015	0.000	0.02			1.2	SURCHARGED	

Ardent		Page 11
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE	173483 Land at Tortington Arundel Eastern Parcel	
Date 01/10/2020 File 173483- SW NETWORK 2.MDX	Designed by vlander Checked by	
Innovyze	Network 2020.1	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Surcharged		Flooded		Half Drain		Pipe	Status	Level Exceeded
		Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)			
6.001	S2-S02	0.488	0.000	0.68			86.9		SURCHARGED	
6.002	S2-S03	0.736	0.000	0.79			96.5		SURCHARGED	
6.003	S2-S04	0.848	0.000	0.93			123.8		SURCHARGED	
6.004	S2-S05	0.917	0.000	1.45			130.1		SURCHARGED	
6.005	S2-S06	0.783	0.000	1.84			133.0		SURCHARGED	
7.000	S2-S07	-0.028	0.000	0.97			108.0		OK	
6.006	S2-S08	0.612	0.000	2.39			218.9		SURCHARGED	
6.007	S2-HW1	-1.487	0.000	0.02			212.0		OK	
6.008	S2-HW3	0.181	0.000	0.05			3.8		SURCHARGED	

Ardent		Page 1
3rd Floor, The Hallmark Building 52-56 Leadenhall Street London, EC3M 5JE	173483 Land at Tortington, Arundel Network 3 (Access Road)	
Date 01/10/2020 File 173483- SW NETWORK 3.MDX	Designed by vlander Checked by	
Innovyze	Network 2020.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.500	Add Flow / Climate Change (%)	0
Ratio R	0.332	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.061	4-8	0.014

Total Area Contributing (ha) = 0.075

Total Pipe Volume (m³) = 88.571

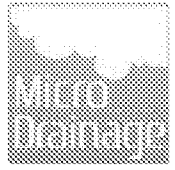
Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
8.000	30.000	1.500	20.0	0.045	4.00	0.0	0.600		o	450	Pipe/Conduit	
8.001	30.000	1.500	20.0	0.030	0.00	0.0	0.600		o	450	Pipe/Conduit	
8.002	7.000	0.350	20.0	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
8.003	20.000	0.333	60.1	0.000	0.00	0.0		0.045	3 \=/	600	1:3 Swale	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
8.000	50.00	4.11	5.600	0.045	0.0	0.0	0.0	4.56	725.6	6.1
8.001	50.00	4.22	4.100	0.075	0.0	0.0	0.0	4.56	725.6	10.2
8.002	50.00	4.26	2.600	0.075	0.0	0.0	0.0	2.94	116.9	10.2
8.003	50.00	4.79	2.250	0.075	0.0	0.0	0.0	0.62	98.4	10.2

©1982-2020 Innovyze

Ardent		Page 2
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE	173483 Land at Tortington, Arundel Network 3 (Access Road)	
Date 01/10/2020 File 173483- SW NETWORK 3.MDX	Designed by vlander Checked by	
Innovyze	Network 2020.1	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
8.000	o	450	S3-S01	8.800	5.600	2.750	Open Manhole	1350
8.001	o	450	S3-S02	6.500	4.100	1.950	Open Manhole	1350
8.002	o	225	S3-S03	3.900	2.600	1.075	Open Manhole	1350
8.003	3 \=/	600	S3-S04	2.500	2.250	0.900	Open Manhole	10000

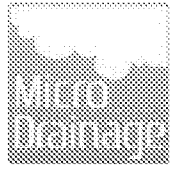
Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
8.000	30.000	20.0	S3-S02	6.500	4.100	1.950	Open Manhole	1350
8.001	30.000	20.0	S3-S03	3.900	2.600	0.850	Open Manhole	1350
8.002	7.000	20.0	S3-S04	3.300	2.250	0.825	Open Manhole	10000
8.003	20.000	60.1		2.500	1.917	0.433	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
8.003		2.500	1.917	1.500	0	0

Ardent		Page 3
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE	173483 Land at Tortington, Arundel Network 3 (Access Road)	
Date 01/10/2020 File 173483- SW NETWORK 3.MDX	Designed by vlander Checked by	
Innovyze	Network 2020.1	
Online Controls for Storm Orifice Manhole: S3-S04, DS/PN: 8.003, Volume (m³): 82.5 Diameter (m) 0.040 Discharge Coefficient 0.600 Invert Level (m) 2.250		
©1982-2020 Innovyze		

Ardent		Page 4
3rd Floor, The Hallmark Building 52-56 Leadenhall Street London, EC3M 5JE	173483 Land at Tortington, Arundel Network 3 (Access Road)	
Date 01/10/2020 File 173483- SW NETWORK 3.MDX	Designed by vlander Checked by	
Innovyze	Network 2020.1	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 0 Number of Real Time Controls 0

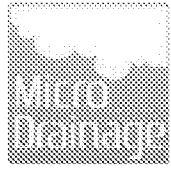
Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.332
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.500 Cv (Winter) 0.840
Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

	US/MH		Return Climate	First (X)	First (Y)	First (Z)	Overflow	Water
PN	Name	Storm	Period Change	Surcharge	Flood	Overflow	Act.	Level
8.000	S3-S01	15 Winter	1	+0%				5.621
8.001	S3-S02	15 Winter	1	+0%				4.132
8.002	S3-S03	15 Winter	1	+0%				2.650
8.003	S3-S04	240 Winter	1	+0%				2.345

	US/MH	Depth	Volume	Flow / Overflow	Half Drain	Pipe		Level
PN	Name	(m)	(m³)	Cap. (l/s)	Time (mins)	Flow (l/s)	Status	Exceeded
8.000	S3-S01	-0.429	0.000	0.01		6.1	OK	
8.001	S3-S02	-0.418	0.000	0.02		9.4	OK	
8.002	S3-S03	-0.175	0.000	0.11		9.4	OK	
8.003	S3-S04	-0.955	0.000	0.00		0.9	OK	

Ardent		Page 5
3rd Floor, The Hallmark Building 52-56 Leadenhall Street London, EC3M 5JE	173483 Land at Tortington, Arundel Network 3 (Access Road)	
Date 01/10/2020 File 173483- SW NETWORK 3.MDX	Designed by vlander Checked by	
Innovyze	Network 2020.1	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.332
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.500 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

	US/MH		Return Climate	First (X)	First (Y)	First (Z)	Overflow	Water	
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	Level
8.000	S3-S01	15 Winter	30	+0%					5.647
8.001	S3-S02	15 Winter	30	+0%					4.158
8.002	S3-S03	15 Summer	30	+0%					2.684
8.003	S3-S04	240 Winter	30	+0%					2.478

	US/MH	Depth	Volume	Flow /	Half Drain	Pipe		Level
PN	Name	(m)	(m³)	Cap.	Overflow	Time	Flow	Status
					(l/s)	(mins)	(l/s)	Exceeded
8.000	S3-S01	-0.403	0.000	0.02			15.1	OK
8.001	S3-S02	-0.392	0.000	0.04			25.1	OK
8.002	S3-S03	-0.141	0.000	0.30			25.1	OK
8.003	S3-S04	-0.822	0.000	0.00			1.5	OK

5 6789 101112131415161718192021222324252627282930313233343536373839404142434445464748495051525354555657585960616263646566676869707172737475767778798081828384858687888990919293949596979899100

101112131415161718192021222324252627282930313233343536373839404142434445464748495051525354555657585960616263646566676869707172737475767778798081828384858687888990919293949596979899100

101112131415161718192021222324252627282930313233343536373839404142434445464748495051525354555657585960616263646566676869707172737475767778798081828384858687888990919293949596979899100

$$Vol_{ss} = RD \times A \times 10 \left(0.8 - \frac{PIMP}{100} \right)$$

101112131415161718192021222324252627282930313233343536373839404142434445464748495051525354555657585960616263646566676869707172737475767778798081828384858687888990919293949596979899100

w5	ぢわ	101112131415161718192021222324252627282930313233343536373839404142434445464748495051525354555657585960616263646566676869707172737475767778798081828384858687888990919293949596979899100
!	3	101112131415161718192021222324252627282930313233343536373839404142434445464748495051525354555657585960616263646566676869707172737475767778798081828384858687888990919293949596979899100
{tw	ぢわ	101112131415161718192021222324252627282930313233343536373839404142434445464748495051525354555657585960616263646566676869707172737475767778798081828384858687888990919293949596979899100
tla t	ぢわ	101112131415161718192021222324252627282930313233343536373839404142434445464748495051525354555657585960616263646566676869707172737475767778798081828384858687888990919293949596979899100

101112131415161718192021222324252627282930313233343536373839404142434445464748495051525354555657585960616263646566676869707172737475767778798081828384858687888990919293949596979899100

t↑↑↑It LtDt ½	ぢわ	I ぢ	101112131415161718192021222324252627282930313233343536373839404142434445464748495051525354555657585960616263646566676869707172737475767778798081828384858687888990919293949596979899100
tIX↑↑↑It LtDt ½	ぢわ	I ぢ	101112131415161718192021222324252627282930313233343536373839404142434445464748495051525354555657585960616263646566676869707172737475767778798081828384858687888990919293949596979899100
5 6789 101112131415161718192021222324252627282930313233343536373839404142434445464748495051525354555657585960616263646566676869707172737475767778798081828384858687888990919293949596979899100	ぢわ	I ぢ	101112131415161718192021222324252627282930313233343536373839404142434445464748495051525354555657585960616263646566676869707172737475767778798081828384858687888990919293949596979899100

101112131415161718192021222324252627282930313233343536373839404142434445464748495051525354555657585960616263646566676869707172737475767778798081828384858687888990919293949596979899100

Appendix H

Development Type	No. Persons	Hours (hrs)	Foul Flow Rate l/day	Peak Factor	Peaked Loading l/s	Development Loading (l/s)
Standard Residential	450 Persons	24	150 per person per day	6.6	0.011458 per property	5.156
TOTAL PROPOSED FOUL LOADING (l /s)						= 5.156

 BRITISH WATER water solutions			
Table of Loadings for Sewage Treatment Systems			
Per person / activity / day (unless otherwise specified)	FLOW	BOD	Ammonia
	(Litres)	(Grams)	as N
DOMESTIC DWELLINGS			
(Grams)			
Standard residential	150	60	8
Mobile home type caravans with full services	150	60	8