

Calcinotto

civil and structural engineers

114334

Former Civil Offices
Leigh Road
Eastleigh
SO50 9ZN

Drainage Strategy Statement for Planning
Leigh Road, Eastleigh
Car Dealership Development

October 22nd 2021
Revision 1.1

Produced By
Daniel Bott
Senior Civil Engineer

Checked By
Paul Westcott
Associate Director

Content

Drainage Strategy Statement for Planning for Hendy Phase 2, Leigh Road, Eastleigh.

Section	Title	Page
1	Executive Summary	1
2	Introduction	3
2.1	Site Location	3
3	Existing Site	4
3.1	Existing Use	4
3.3	Foul and Surface Water Drainage	4
3.4	Ground Investigation	4
3.5	Geology	5
3.6	Topography	7
4	Public Sewers	8
4.1	Water Authority Apparatus	8
5	Proposed Development Philosophy	9
5.1	Development Proposals Background	9
5.5	Foul Drainage	10
5.6	EA Flood Risk Review	11
5.7	Surface Water Design	12
6	Water Quality	15
7	Conclusion	17
Appendix	Title	
A	Architects Site Layout	18
B	Topographical Survey	19
C	Southern Water Sewer Records	20
D	Proposed Drainage Strategy Layouts	21
E	Causeway Flow Surface Water Calculations	22
F	Maintenance and Management Plan	23
G	Pre-Development Surface Water Calculations	24

1 Executive Summary

- 1.1 Calcinotto have been appointed to prepare a Drainage Strategy Statement in support of a Planning Application for a redevelopment of the site at Leigh Road, Eastleigh, Hampshire, SO50 9ZN. The development comprises of the following:
- Car showroom
 - Multi-deck car park
 - Access Road and parking
 - Services and Infrastructure
- 1.2 The drainage strategy discusses the intended method of disposal for both foul and surface water discharges from the site, into the sewers outside of the site. The information made in support of the application is to demonstrate that a suitable means of managing and controlling surface water on the site is deliverable. In order to devise a surface water strategy, it is also necessary to consider whether the site is subject to Flood Risk. This statement therefore includes a short reference to Flood Risk.
- 1.3 The existing site is a mix of permeable vegetated areas and impermeable areas and is currently in a demolished state. An assessment has been made of the existing surface water flows generated by the existing site prior to demolition and leaving the site through the existing points of outfall, with the site proposed discharge rate agreed with the LLFA at 30% of existing brownfield rates.
- 1.4 Reference has been made to the British Geological Survey (BGS) mapping web site and the Environment Agency web site links to GOV.UK. The Geological survey mapping site shows the site is underlain with a Bedrock of Wittering formation comprising of Sand, Silt and Clay. The mapping indicates superficial deposits of River Terrace Deposits consisting of Sand and Gravel.
- 1.5 The GOV.UK flood mapping indicates the site is wholly within Flood Zone 1 and is in majority at very low risk from surface water flooding. A localised small portion of low to medium risk surface water flooding is shown on Villeneuve St Georges Way, however this is outside of the application boundary and does not encroach within the site.
- 1.6 The existing topography of the site is relatively flat with a 1m level difference from north-east to south-west at an average gradient of approximately 1:100.
- 1.7 Site investigations from the adjacent site have revealed below ground conditions with a poor infiltration potential, in addition to groundwater monitoring presenting groundwater levels up to 1.47m below existing ground levels. Therefore, infiltration drainage is not a viable method of surface water disposal for this development.
- 1.8 Foul water flows generated by the development will discharge to the existing foul water drain to the south-east of the site on Villeneuve St Georges Way. The drain flows further to the south-east before joining up with the public Southern Water foul water sewer. Southern Water will be contacted to confirm the public sewer has sufficient capacity to receive the site discharge.
- 1.9 The design has been examined in line with the current water quality guidelines outlined in Ciria C753 SuDS Manual Version 6 and provides SuDS features to meet these requirements. Further development on these may be made at detailed design stage post planning when co-ordinated with detailed landscape proposals.

- 1.10 The drainage proposals within this statement represent a design / strategy which has been well developed and in sufficient detail on the basis of what information is available to date and proves that a workable solution can be achieved within the constraints that exist for the site. Any drawings and calculations prepared at this time are preliminary only and should not be relied upon as a detailed design information, suitable for construction.
- 1.11 Post Planning consent the drainage details will be developed in greater detail when further investigations are carried out and be co-ordinated with the structural and landscape elements of the project.
- 1.12 This document has been prepared for the sole use of Lambert Smith Hampton to support the planning submission for the development on site. The contents of this report should not be relied upon without the written authority of Calcinotto Ltd.

2 Introduction

2.1 Site Location

2.1.1 Calcinotto Ltd have been appointed by Lambert Smith Hampton to prepare a drainage strategy for development proposed within the land at the existing Court House, Leigh Road, Eastleigh, Hampshire, SO50 9ZN. The site is bounded by the existing office buildings to the east, Villeneuve St Georges Way to the west, Kornwestheim Way to the South and Leigh Road to the north. The site layout is detailed within Appendix A.

2.1.2 The application site has an area of 0.76ha. The site has a postcode of SO50 9ZN and national grid reference is SU 44233 19331. The site location can be seen in Figure 1 below.

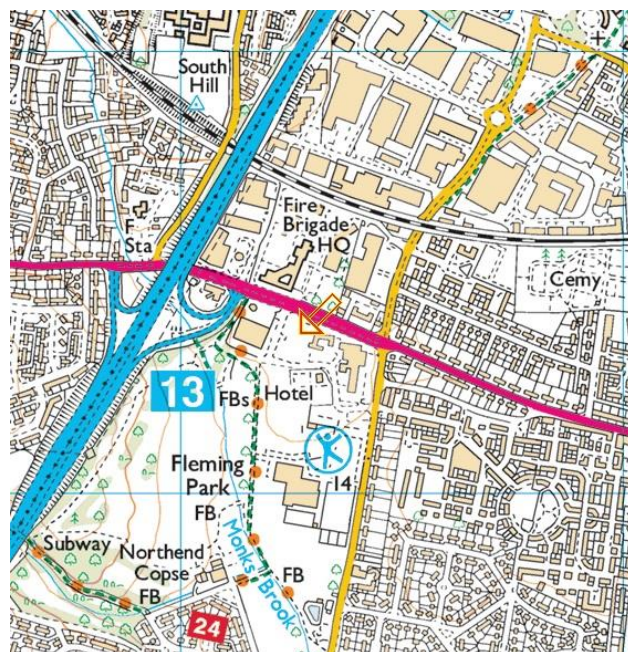


Figure 1. Site Location

2.1.3 This statement is made in support of a proposed drainage strategy to service development of the site into a Car Dealership with associated parking and landscaping. A brief comment on Flood Risk is contained within this statement however there is also a separate stand-alone FRA report available which addressed flood risk, planning policy and BREEAM.

- 3 Existing Site**
- 3.1 Existing Use**
- 3.2 The existing site is a mix of permeable and impermeable areas as a result of the demolition of the previous site structures. The existing site state is approximately 49% impermeable based on existing drainage calculations.
- 3.3 Foul and Surface Water Drainage**
- 3.4 A topographical survey by Greenhatch Group Ltd highlighted existing drainage within Kornwestheim Way and Villeneuve St Georges Way including a 1250mm existing surface water culvert. This culvert has been recently surveyed as an exercise by the Environment Agency for Eastleigh Borough Council. On the basis of that survey the EA are proposing to carry out remedial works within the culvert to remove debris.
- 3.5 The Environment Agency have also suggested they are going to upgrade the status of this culvert to a main river because of the catchment that it serves upstream.
- 3.6 There is a system of surface water drainage in the roadways and part of which crosses the application site and will need to be diverted as part of the project.
- 3.7 There is an existing surface water manhole within the site, which is deep enough for re-use, however the downstream connection has been highlighted as silted and therefore the downstream system will need jetting prior to re-connection.
- 3.8 There is an existing 150mm diameter foul water drain across Villeneuve St Georges Way to the south-west of the site which is suitable for connection for the development proposals.
- 3.9 Ground Investigation**
- 3.9.1 Ground investigations had not be carried out within the application site at the time of producing this report. However, a ground Investigation study was carried out on the adjacent site by Ridge and Partners LLP in June 2017 for the same client and for the similar type of development For the purposes of this assessment, the adjacent site investigation has been used as a preliminary assessment of the ground conditions for the development proposals.
- 3.9.2 The investigation identified 'a thin layer of Made Ground overlying the River Terrace Deposits over the Wittering Formation. Detailed descriptions of each layer are as follows:-
- Made Ground – Comprising grey and red crushed brick and concrete fill with frequent medium to coarse angular to sub angular flint gravel and occasional metal tile and plastic fragments laid over a geotextile.
 - River Terrace Deposits – orange, brown locally silty sandy fine to coarse angular to rounded flint gravel.
 - Wittering Formation – stiff to very still bluish greenish grey thinly laminated silty clay, clay silt and fine to medium sand.
- 3.9.3 Groundwater monitoring was undertaken on 4 dates across a period of a month, groundwater was recorded between 1.45-2.67m depth across 7 standpipes throughout the site. The table below presents all groundwater recordings to date: -

Trial Hole	Well Depth (m bgl)	Depth to Water (m bgl)			
		09/05/17	19/05/17	24/05/17	05/06/17
WS101	3.41	2.42	2.29	2.29	2.46
WS103	2.94	2.52	2.50	2.50	2.67
WS104	2.96	2.17	1.98	1.98	2.20
WS105	3.01	1.64	1.45	1.45	1.96
WS106	3.07	2.39	2.20	2.20	2.38
WS110	2.96	1.75	1.58	1.58	1.89
BH104	14.23	1.78	1.72	1.72	1.87

Groundwater Monitoring Levels

3.10 Geology

3.10.1 Examination of the British Geological Survey web site identifies the general Geology to be as follows:

- Superficial Deposits – The site appears to be in an area of River Terrace Deposits consisting of Sand and Gravel. Refer to Figure 2 below.
- Bedrock Layer - The site is underlain by the London Clay Formation comprising of sand, silt and clay.

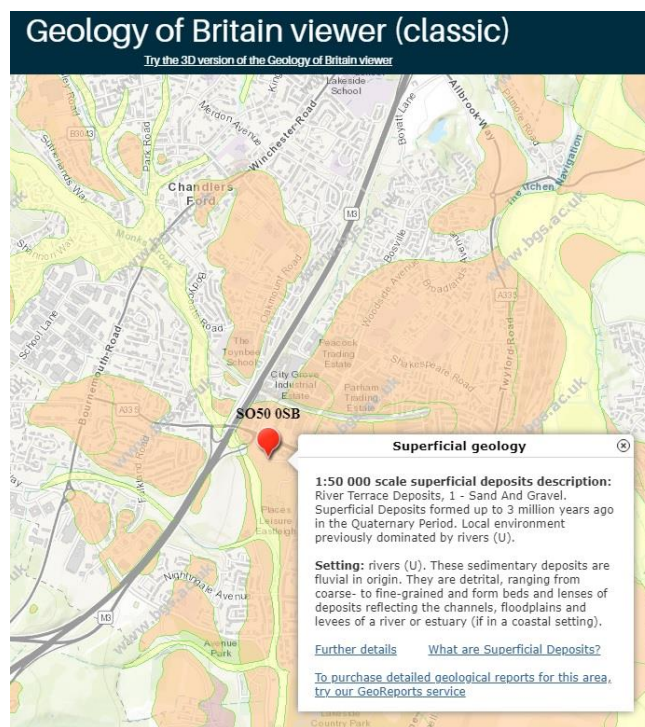


Figure 2 Superficial Geology

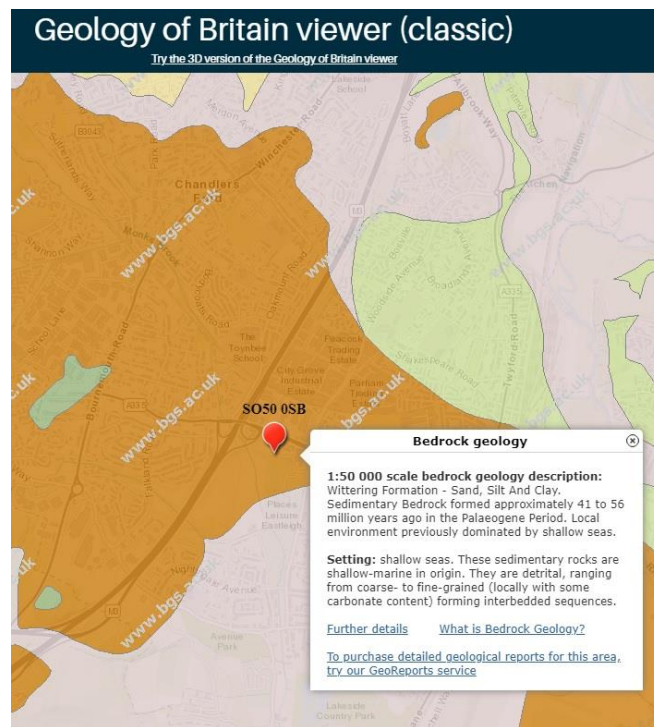


Figure 3 Bedrock Geology

3.10.2 Inspection of the DEFRA Magic map system and the Soilscales diagram describes the site as Freely Draining lime rich loamy soils. See Figure 4 below.

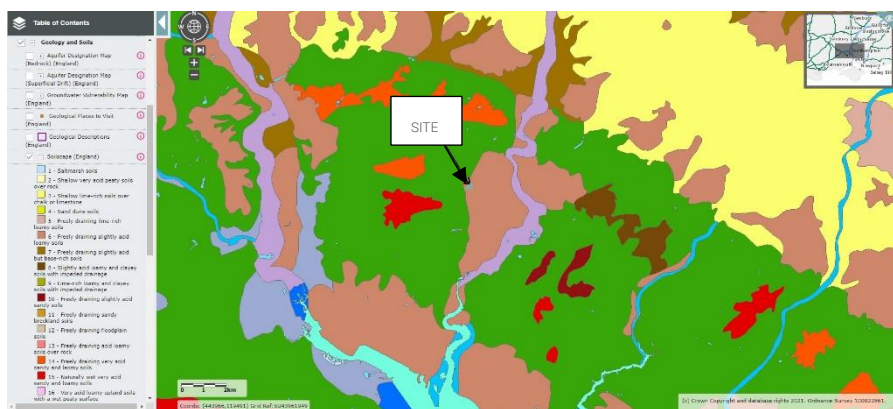


Figure 4 – DEFRA SoilScape Map

3.11 Topography

- 3.11.1 A topographical survey has been produced by Greenhatch Group Ltd dated July 2018. The survey shows the site generally falling to the north-east corner with levels ranging across the site from approximately 17mAOD to 15mAOD
- 3.11.2 A copy of the survey 'PL_003' can be found in Appendix B.

4 Public Sewers

4.1 Water Authority Apparatus

4.1.1 The Public Sewer Record plan obtained from Southern Water highlights a 300mm and 450 diameter public foul water sewers in parallel to the south-west of Villeneuve St Georges Way.

4.1.2 The nearest public surface water sewer to the site is to the north on Leigh Road and is 225mm diameter.

4.1.3 A copy of the Public Sewer records is within Appendix C.

4.2 Eastleigh Borough Council

4.2.1 There is an existing 1350mm culvert running through the western side of the site which has been confirmed as in the ownership of Eastleigh Borough Council.

4.2.2 This culvert has been recently surveyed as an exercise by the Environment Agency for Eastleigh Borough Council. On the basis of that survey the EA are proposing to carry out remedial works within the culvert to remove debris.

4.2.3 The Environment Agency have also suggested they are going to upgrade the status of this culvert to a main river because of the catchment that it serves upstream.

4.2.4 There is a system of surface water drainage in the roadways and part of which crosses the application site and will need to be diverted as part of the project.

4.2.5 There is an existing surface water manhole within the site, which is deep enough for re-use, however the downstream connection has been highlighted as silted and therefore the downstream system will need jetting prior to re-connection.

4.2.6 There is an existing 150mm diameter foul water drain across Villeneuve St Georges Way to the south-west of the site which is suitable for connection for the development proposals.

5 Proposed Development Philosophy

5.1 Development Proposals Background

A breakdown of the proposal is as follows: -

- Car showroom
- Multi deck car park
- Access Road and parking
- Services and Infrastructure

5.1.1 A copy of the Site Layout is within Appendix A.

5.2 Drainage Design Guidelines and Parameters

5.2.1 In accordance with good practice and guidance the surface water system will not interact and is to be kept separate to the foul system.

5.3 All new private drainage will be designed in accordance with Approved Document H of the National Building Regulations 2000:2015 Edition and BS EN 752:2008.

5.4 All new surface water drainage will be designed to comply with current CIRIA design guidance C697 and C753, using the storm return periods listed below and latest climate change allowances as contained within the Guidance Document dated 19th February and updated 12th April 2016 – Flood Risk Assessments: Climate Change Allowances.

- 1 in 1 year no climate change
- 1 in 30 year with 20% climate change
- 1 in 100 year with 40% climate change

5.4.1 Where appropriate, an allowance for Urban Creep can be made, but in this instance, it is very unlikely there would be any possibility of any increase in area to the buildings due to the site being developed for a specific purpose and any future expansion would require a planning approval. Any potential future expansion will have the scope to introduce new separate infiltration drainage measures to deal with the additional runoff independent from the proposed drainage system.

5.4.2 In Accordance with Part H of the Building Regulations the hierarchy for consideration of dealing with surface water run-off is as given in Table 2 below.

Building Regulations Part H3 (2002):

- (1) Adequate provision shall be made for rainwater to be carried from the roof of the building.
- (2) Paved areas around the building shall be so constructed as to be adequately drained.
- (3) Rainwater from a system provided pursuant to sub-paragraphs (1) or (2) shall discharge to one of the following, listed in order of priority:
 - (a) An adequate soakaway or some other adequate infiltration system; or, where that is not reasonably practicable,
 - (b) A watercourse or, where that is not reasonably practicable,
 - (c) A sewer

Table 2: Part H3 Hierarchy

5.4.3 In terms of the SuDS 'Management Train' the drainage strategy for the proposed development seek to address the quality and quantity of run off using the hierarchy points listed below.:

- i) Prevention - to minimise the risk of pollution and introduce measures to cover maintenance of the drainage system for the lifetime of development.
- ii) Source Control – Control and discharge of run off at its source using infiltration measures to eliminate offsite surface water discharge. Where possible measures have been incorporated to integrate this with landscape features.
- iii) Site control - The proposed surface water system separates the run-off from the roofs, road, and paved areas for each part of the development and deals with it at source via infiltration methods.
- iv) Regional control - Management of run off from more than one site at a time but in this is not applicable and so is covered by site control.

5.4.4 Exceedance of a system can be caused by blockage, element system failure, or by rainfall events in excess of the design storm events used to size the system. It is important to consider exceedance and to know where the water will travel and to ensure its passage and point of collection will not put property and people at risk. It is further important to ensure exceedance routes are kept clear and protected from any future land changes.

5.4.5 It is anticipated that Hampshire County Council as Lead Local Flood Authority (LLFA) will be consulted through the planning process in relation to the management of surface water generated by this site and to a lesser extent of flood risk. Any comments made will be reviewed and where required addressed at a detailed design.

5.5 Foul Drainage

5.5.1 The foul drainage network will discharge via 100mm and 150mm diameter pipework surrounding the building by gravity to the foul water drain to the southeast of the site on Villeneuve St Georges Way. This will be an indirect connection to the public foul water sewer.

- 5.5.2 The peak foul water flow from the new development will be assessed in detail using British Flows and Loads 4 once population figures have been received. However, using the Construction Design Guidance design flow rates for industrial developments (where actual details are unknown), the calculated flow rate is as follows: -

Domestic flow: $0.6 \text{ l/s/ha} \times 0.76 \text{ ha} = 0.46 \text{ l/s}$

Trade Effluent Flow: $0.7 \text{ l/s/ha} \times 0.76 \text{ ha} = 0.53 \text{ l/s}$

Total Design Flow: 0.99 l/s

- 5.5.3 The proposed foul water drainage system will have a washdown separator integrated within to treat potential contaminants entering the foul drainage system.
- 5.5.4 The proposed foul discharge from the development will be subject to available capacity within the Southern Water public foul sewer. It is anticipated that this assessment will be ongoing through the determination period of the application.

5.6 EA Flood Risk Review

- 5.6.1 Before a surface water strategy was developed, an analysis of the EA flood maps was made to determine if certain flood defence/preventative measures would need to be integrated into the design.
- 5.6.2 The nearest fluvial source is the Monks Brook Watercourse located approximately 180m south-west of the site as indicated on Figure 5 below which was taken from the Environment Agency website.

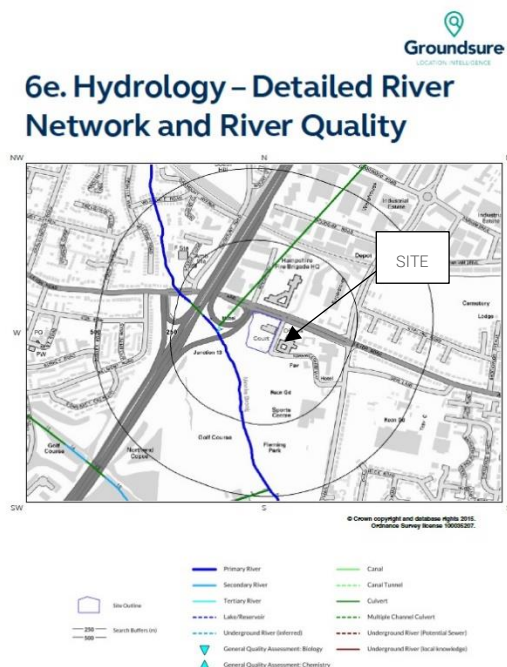


Figure 5. Main Water Features Map

5.6.3 Figure 6 below, taken directly from the GOV.UK website highlights the site to be within Flood Zone 1 which by definition is designated as Low risk and has a less than 0.1% probability of flooding annually (i.e. <1 in 1000yr). The nearest visible flooding is the Monks Brook watercourse which as mentioned above is 180m south-west of the site.



Figure 6. Environment Agency River and Sea flood risk map

5.6.4 A review of the GOV.UK website indicates the surface water flood map which can be seen in Figure 7 below shows the site to be at a “Very Low Risk” probability of surface water flooding which has by definition less than 0.1% annual probability of occurring. The site is also outside of the surface water flood risk zone, with a small, localised area of surface water flooding at the junction of Villeneuve St Georges Way and Leigh Road which is situated outside of the site application boundary.

5.6.5 The Flood Mapping information within this statement ‘Contains Public Sector information licensed under the open Government Licence V3.0.

5.7 Surface Water Design

5.7.1 The surface water strategy has been developed using site constraints considered from the topographical survey undertaken by Greenhatch Group Ltd.

5.7.2 Using the existing topographical survey information and current Architectural layout, an assessment of the existing and proposed impermeable areas is as given below.

Existing Impermeable Area	0.303ha
Proposed Impermeable Area	0.663ha

Table 2 – Impermeable Areas

5.7.3 Based on the ratio of existing impermeable area to proposed impermeable area, a Q Bar (Urban) value has been generated using the UK SuDS greenfield runoff rate tool. The value proven is 3.72l/s for the urban environment that the application site falls within. The corresponding flow rates are given below in Table 3 below.

Storm	Flow Rate l/s
Q Bar (Urban)	4.21
Q 1 year	3.58
Q 30 year	9.69
Q 100 year	15.76

Table 3 – Greenfield Run-Off Rates

- 5.7.4 Existing brownfield rates have been calculated based on the split of impermeable and permeable areas on the topographical survey. The existing brownfield rates calculated are shown in table 4 below: See Appendix G:-

Storm	Flow Rate l/s
2-year	35.5
30-year	64.5
100-year	73.0

Table 4 – Brownfield Run-Off Rates

- 5.7.5 In accordance with best practice guidelines and in particular Ciria Documents C753, C697 and C687 the new surface water drainage system will be designed using the following design return periods criteria and Hampshire County Council criteria.

1 in 1 year no climate change

1 in 30 year + 10-20% climate change

1 in 100 year + 20-40% climate change

- 5.7.6 Following agreement with Hampshire County Council, the proposed surface water discharge rate for the site is to be set at a 30% betterment over the 2-year brownfield runoff rate of 35.5l/s, which equates to a surface water discharge rate of 24.9l/s.

- 5.7.7 It is proposed to drain the site by employing the following features in this design:

- Porous paving installed within the car parking bays with sub-base used as attenuation storage
- A geo-cellular attenuation tank within the car park lane with an orifice flow control chamber downstream limiting flows to 24.9l/s.
- The surface water network is composed of pipework ranging from 150mm up to 375mm connected by a series of inspection chambers and catchpits where required to reduce risk of silt and debris within the drainage system.
- Deep pot gullies with smart sponge filters have been proposed where appropriate to filter and treat runoff.

- 5.7.8 The surface water system has been designed using Causeway Flow software and has been tested for the guideline storm events set out by the Local Authority of 1 year, 30 year and 100 year in accordance with Building Reg's with their relevant climate change requirements.
- 5.7.9 The private drainage system will provide adequate working capacity and temporary storage on site through the pipework, tank and porous paving to manage the surface water runoff from all roof and hardstanding areas.
- 5.7.10 Exceedance of a system can be caused by blockage, element system failure, or by rainfall events in excess of the design storm events used to size the system. In an exceedance event the surface water would emerge out of the porous surfacing and gullies within the car park and run onto the proposed site access, eventually finding its way into the surface water culvert in Villeneuve St Georges Way.
- 5.7.11 A list of the SuDS components considered in the drainage strategy proposed have been compiled in Table 4 below.

SUDS	Viability	Rationale
Living Roofs	No	Living roofs are not being considered for roof areas.
Ponds/Wetlands/Detention Basins	No	Levels, poor infiltration at shallow depth and available area don't allow this option.
Swales/Filter Drains	No	Swale not included due to site landscaping constraints.
Soakaways	No	Poor ground conditions and high groundwater levels mean that soakaways are not an option for this site.
Porous Paving (Infiltration)	No	Poor ground conditions and high groundwater levels mean that permeable paving is not an option for this site.
Porous Paving (Attenuation)	Yes	Due to poor infiltration potential, porous paving is to be used within the site as part of the attenuation storage system.
Attenuation/ Source Control	Yes	A geo-cellular attenuation tank is to be used as the main source of attenuation storage within the system.

Table 4. SuDS Component Viability and Rationale

- 5.7.12 The surface water drainage outlined is a detailed strategy to support this application. There will be a need for more detailed development of the proposal coordinating with other design elements Architecturally and Structurally post planning consent. However, the strategy design shown to date is sufficient to show and prove a workable solution, based on the sites individual site constraints, can be implemented to provide a full working solution.
- 5.7.13 There are further offsite investigations to be carried out to confirm all points of outfall that will be carried out at a later stage in the further detailed design stage of the scheme.
- 5.7.14 The drainage strategy proposed is shown on drawing 114222-CAL-XX-XX-DR-D-0002 to 0003 in Appendix D and full Causeway Flow output calculations to support the proposal in Appendix E.

6 Water Quality

- 6.1.1 Adequate treatment must be delivered to the water run-off to remove pollutants through SuDS devices, which are able to provide pollution mitigation. Pollution Hazards and the SuDS Mitigation have been indexed in the specialised literature CIRIA 753 'The SuDS Manual'. This is determined by the following restriction:

$$\text{Total SuDS Mitigation Index} \geq \text{Pollution Hazard Index}$$

- 6.1.2 The Pollution hazard Indices are summarised in Table 5 – Summary of Pollution Hazard Indices for different land Use Below:

POLLUTION HAZARD INDICES FOR DIFFERENT LAND USE CLASSIFICATIONS				
Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Other Roofs (typically commercial/industrial roofs)	Low	0.3	0.2	0.05
Non-residential car parking with frequent change (e.g. hospitals, retail)	Medium	0.7	0.6	0.7

Table 5 – Summary of Pollution Hazard Indices for different Land Use

- 6.1.3 The Mitigation Indices direct from the CIRIA C753 SuDS Manual Version 6 of the proposed SuDS techniques are summarised in Table 6 – Indicative SuDS Mitigation Indices below.

INDICATIVE SuDS MITIGATION INDICES FOR DISCHARGES TO SURFACE WATER			
SuDS Component	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Porous Pavement	0.7	0.6	0.7
Cellular Attenuation System	-	-	-

Table 6 – Indicative SuDS Mitigation Indices

- 6.1.4 Where there are more than one mitigation indices, the total SuDS mitigation in calculations is as follows:

$$\text{Total SuDS Mitigation Index} = \text{Mitigation Index (1)} + 0.5 \text{ Mitigation Index (2)}$$

- 6.1.5 In the case of the porous paving within the hardstanding areas (parking bays), the upper layers of the construction are proven to intercept and break down any possible contaminants from oil and fuel spillages through microbial action.
- 6.1.6 Using the above SuDS features will ensure sufficient protection to the Water Environment by reducing the amount of pollution in run off, as a whole, in line with the Water Framework Directive.
- 6.1.7 The total SuDS mitigation index for the porous pavement provides sufficient pollution mitigation indices to combat the pollution present for this site.

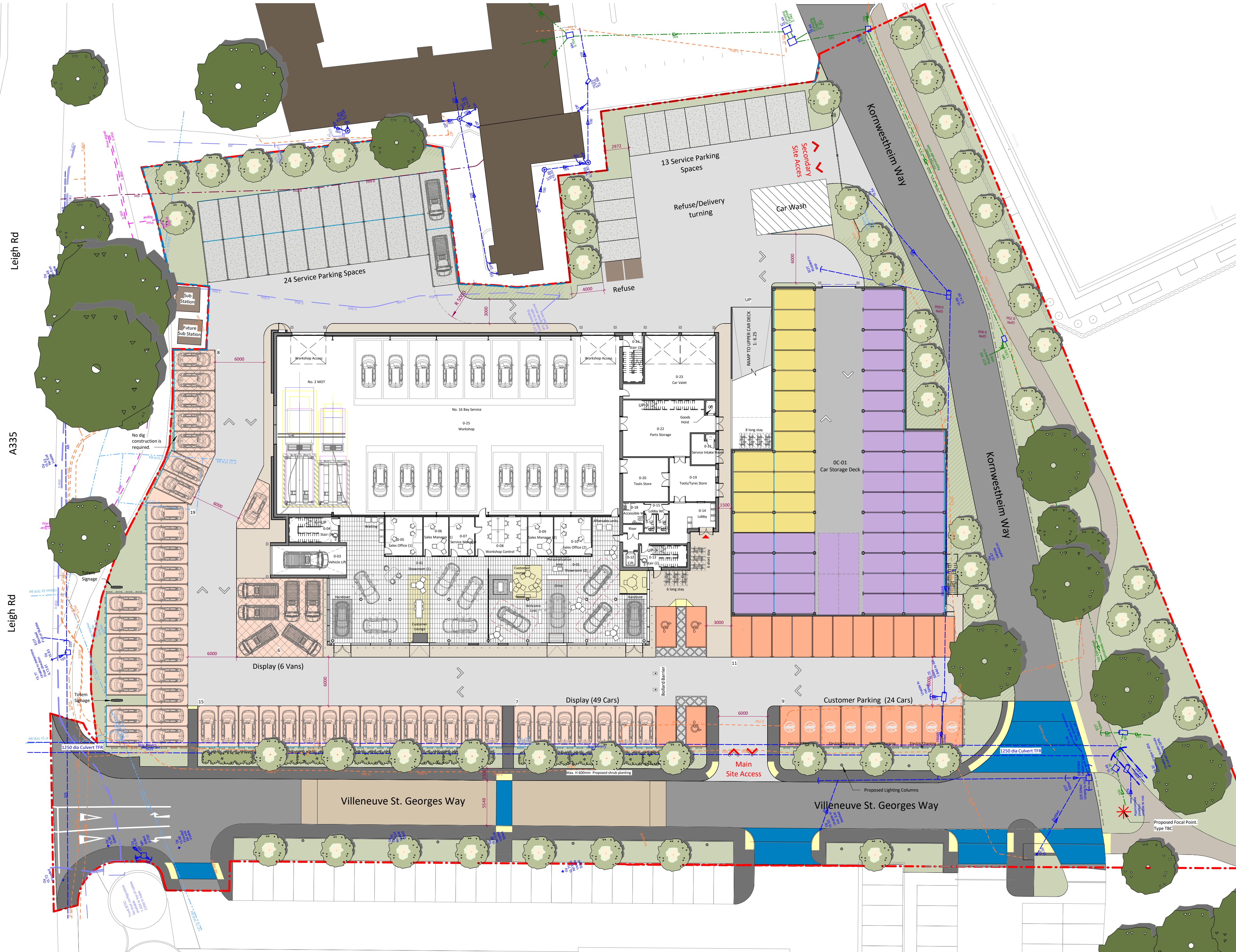
6.2 Management and Maintenance Plan

- 6.2.1 A list of the principal components to be included in a 'Management and Maintenance Plan' have been put together and are listed in Appendix F. These items and possibly others will be formalised into a fully detailed document at detailed design stage post planning consent.
- 6.2.2 It is anticipated provision of such a document will be requested as part of a drainage condition applied to the development.
- 6.2.3 The final document will be a live one that will be reviewed through the lifetime of the development to ensure that the drainage systems are maintained and continue to work efficiently as designed.
- 6.2.4 The responsibility for the management of the drainage system will be formalised by the building provider / developer post planning consent during the detailed design stage.

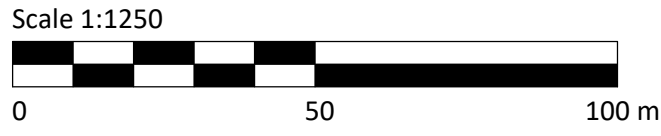
7 Conclusion

- 7.1.1 An outline site specific strategy for both foul and surface water drainage systems at the proposed Hendy Car Showroom development at Leigh Road, Eastleigh, Hampshire, SO50 9ZN has been prepared and shown on drawing 114334-CAL-XX-XX-DR-D-0002 to 0003 in Appendix D.
- 7.2 The surface water drainage scheme includes proposed features to manage and limit the peak surface water run-off from the new development to a rate which minimises any risk to increasing flood risk downstream and on site. The design for the new Surface Water Drainage System has included an allowance for climate change which has been added to the two extreme events of 1 in 30yr + 20 % and 1 in 100yr + 40%.
- 7.3 The proposals are generally in compliance with all parts of the non-Statutory technical standards for sustainable drainage systems.
- 7.4 Agreement has been reached with Hampshire County Council as LLFA on an allowable flow rate from the development proposals based on 30% betterment of the existing 2-year brownfield runoff rate.
- 7.5 Following Planning Consent, any outstanding discussions to be had with Southern Water following submission of a capacity check during the Planning determination will be finalised on foul water related matters of capacity. Hampshire County Council as LLFA will also be consulted.
- 7.6 Flood Risk has been analysed briefly using the EA Flood Map services within Section 5.6 and concludes the site to be within Flood Zone 1 which by definition is designated as Low risk and has a less than 0.1% probability of flooding annually. The site is also at very low risk of surface water flooding. For full comment on Flood Risk refer to the standalone Flood Risk Assessment by Calcinotto Ltd.
- 7.7 An assessment on Water Quality has been made in Section 6.0 which concludes there is sufficient SuDS features within the proposed scheme to minimise pollutants within the drainage system. Porous paving is a well proven technique for intercepting and breaking down pollutants.
- 7.8 The proposal for the redevelopment works would have no adverse effects on the surrounding area and the proposed drainage strategy detailed within this statement for the foul and surface water disposal is sufficiently detailed for this submission and demonstrates a workable solution is achievable whilst ensuring alignment with the local authority is achieved and complied with.
- 7.9 The proposals will be developed further based on the principles outlined in this statement post planning consent. The statement covers how surface water runoff will be managed on site and to comply with current design guidelines and at the same time to minimise the risk of onsite and off-site flooding.
- 7.10 Regular maintenance and inspection of the proposed drainage is imperative to the efficiency and effectiveness of the system and if not carried can put additional strain on the system, causing flooding. The inspection and maintenance regime has been covered in Appendix F.

A Architects Site Layout



Proposed Site Plan
1 : 250



Preliminary Issue

Client:
Hendy Group Ltd

Project:
**Hendy Villeneuve Way St. Georges Way
Villeneuve St. Georges Way, Eastleigh
SO50 9SJ**

Drawing Title:
**Car Wash Relocation -
SK005**

Scale @ A1: 1 : 250
Checked by: Checker
Date: 09/08/21
Job No: 11331
Stage_Drawing No: BR_006
Rev:

Issue Status:
Construction Information Tender
Preliminary Approval
Architecture
Planning
Master Planning
Urban Design
Interiors

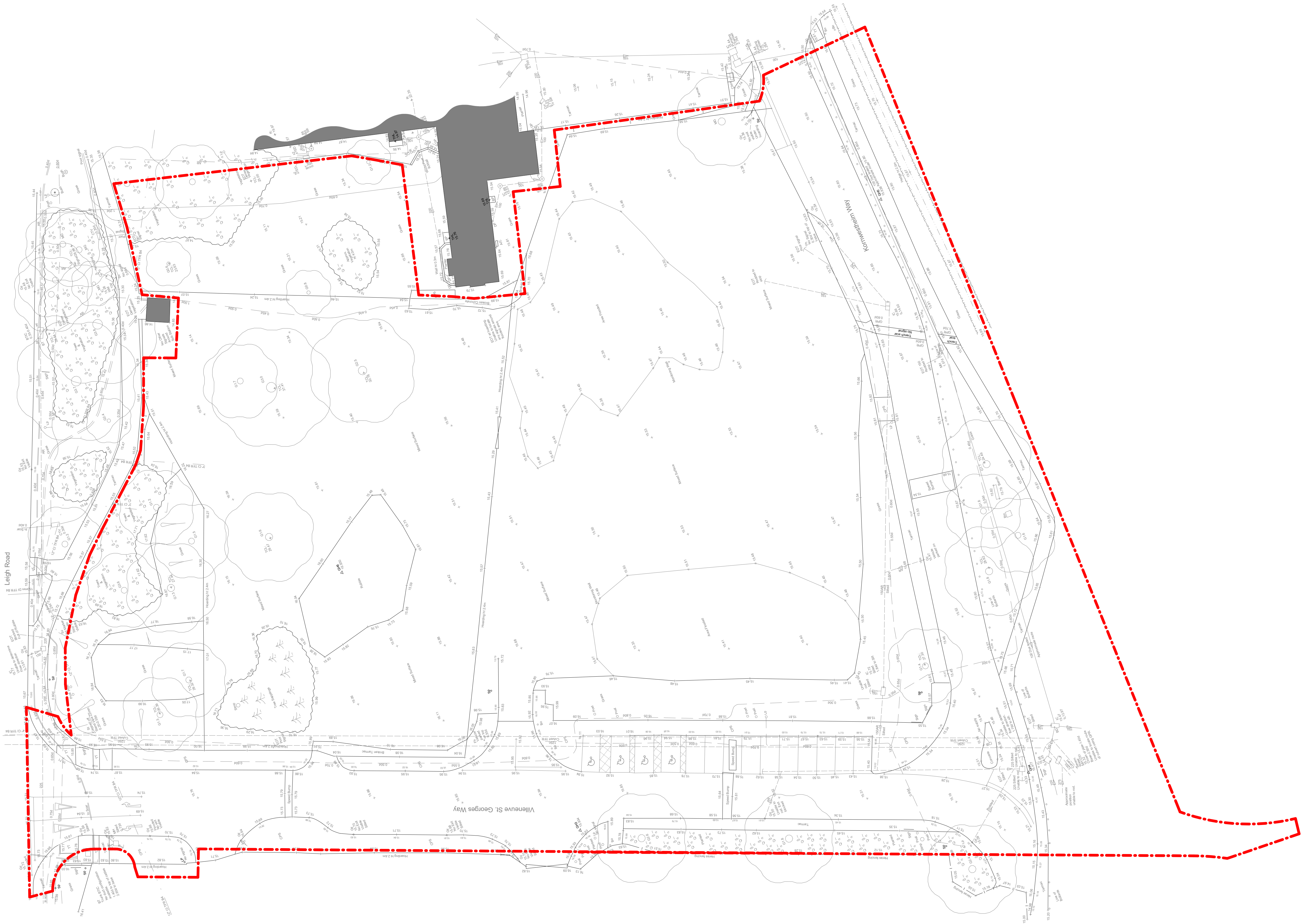
Offices
Woking
London
Milton Keynes
Warsaw
PRC Architecture & Planning
16/09/2021 18:45:35

B Topographical Survey

NOTES:

Existing Site information taken from Greenhatch
Group Ltd dated by July 2018.

--- APPLICATION BOUNDARY



Existing Site Plan Survey
1 : 250



Client:
Hendy Group Ltd

Project:
**Hendy Villeneuve Way St. Georges Way
Villeneuve St. Georges Way, Eastleigh
SO50 9SJ**

Drawing Title:
Existing Site Plan Survey



24 Church St. West,
Woking, Surrey,
GU21 6HT
01483 494 350
info@prc-group.com
www.prc-group.com

Architecture
Planning
Master Planning
Urban Design
Interiors

Scale @ A1: As indicated
Checked by: CL
Date: 28/07/21

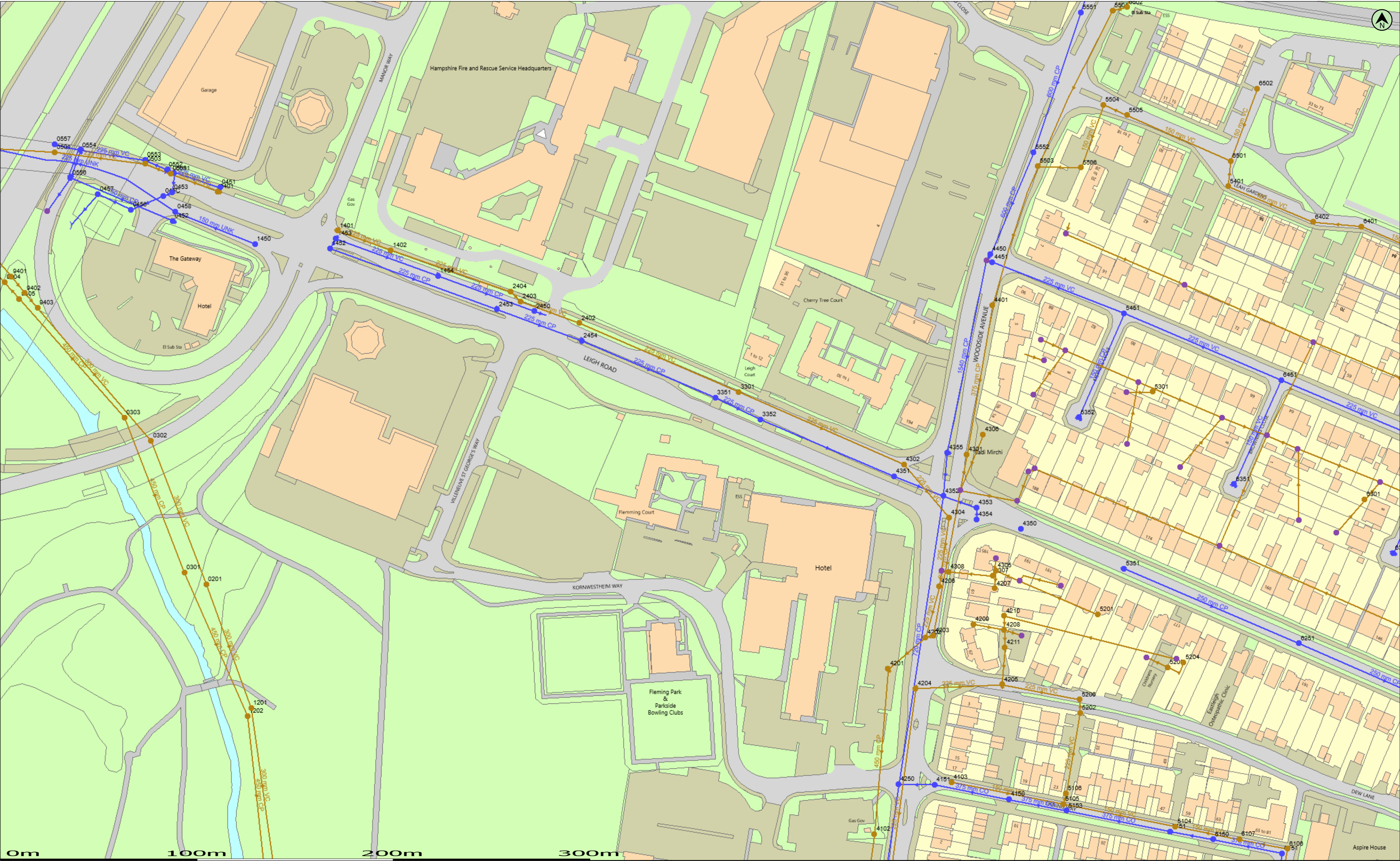
Job No: 11331
Stage_Drawing No: PL_003
Rev: P1

Issue Status:
Construction ☐ Preliminary ☐
Information ☒ Approval ☐
Tender ☐

Offices
Woking
London
Milton Keynes
Warsaw

PRC Architecture & Planning
29/07/2021 10:28:40

C Southern Water Sewer Records



(c) Crown copyright and database rights 2021 Ordnance Survey 100031673

Date: 23/08/21

Scale: 1:1250

Map Centre: 444331,119375

Data updated: 16/08/21

Our Ref: 631142 - 1

Wastewater Plan A2

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

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

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

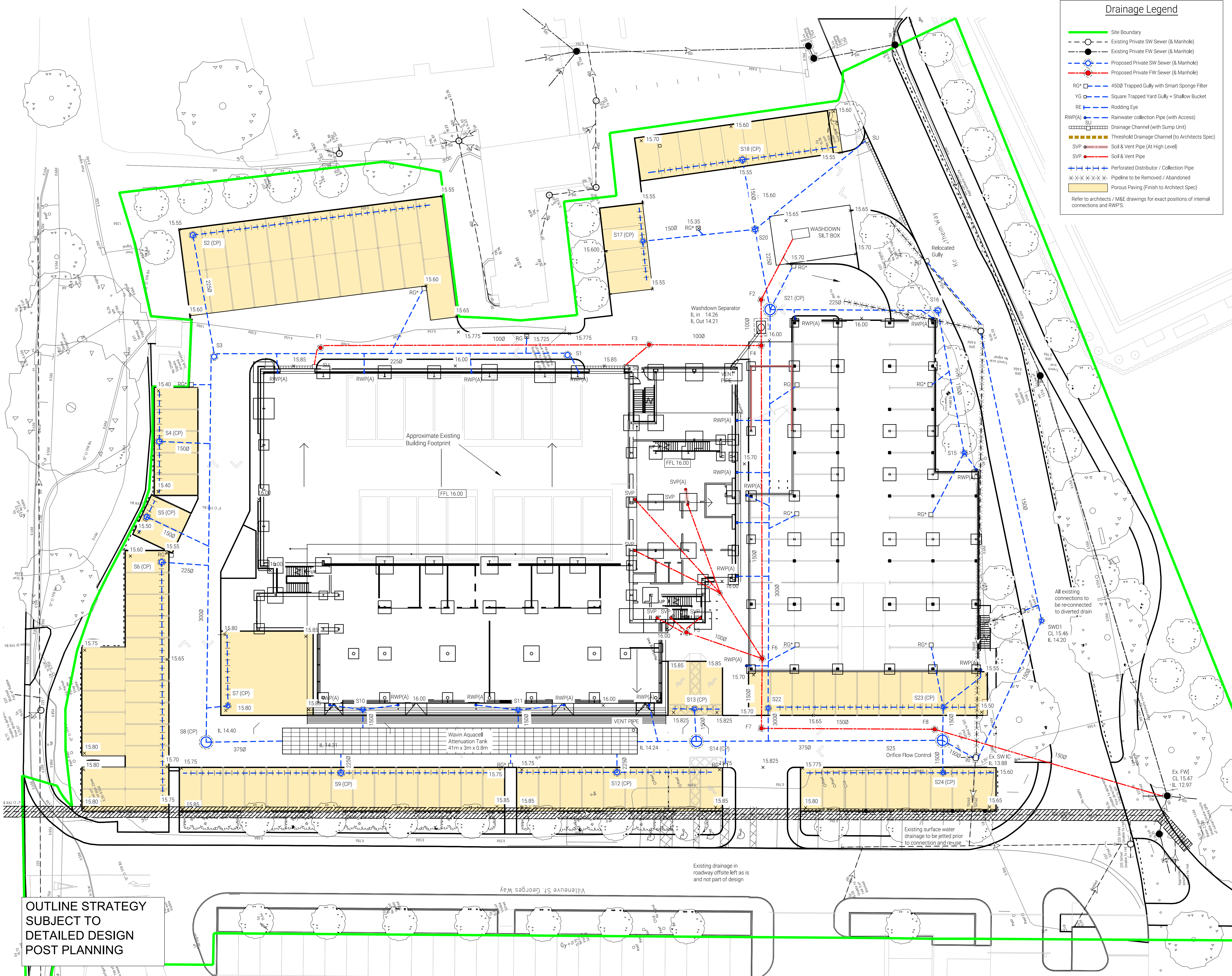
Foul Gravity Sewer	Combined Gravity Sewer	Culverted Water Course or Treated Effluent	Surface Water Gravity Sewer	Rising Main, Vacuum or Syphon
Combined Pumping Station	Surface Water Pumping Station	Foul Pumping Station	Water Treatment Works	Section 104 Area
Combined Outfall	Foul Outfall	Surface Water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

j.hayward@calcinotto.co.uk

Handy



D Proposed Drainage Strategy Layouts



Drainage Legend

- Site Boundary
- Existing Private SW Sewer (& Manhole)
- Existing Private FW Sewer (& Manhole)
- Proposed Private SW Sewer (& Manhole)
- Proposed Private FW Sewer (& Manhole)
- RG* 4500 Trapped Gully with Smart Sponge Filter
- YG Square Trapped Yard Gully + Shallow Bucket
- RE Rodding Eye
- RWP(A) Rainwater collection Pipe (with Access)
- SU Drainage Channel (with Sump Unit)
- Threshold Drainage Channel (to Architects Spec)
- SVP Soil & Vent Pipe (At High Level)
- SVP Soil & Vent Pipe
- Perforated Distributor / Collection Pipe
- Pipeline to be Removed / Abandoned
- Porosity Paving (Finish to Architect Spec)

Refer to architects' / M&E drawings for exact positions of internal connections and RWP'S.

- Notes:**
- This drawing is to be read in conjunction with all relevant architects, engineers and specialist sub-contractors drawings and the specification.
 - All setting out to be in accordance with the schedules, any discrepancies between the engineers and the architects drawings to be referred to the architect before proceeding. Dimensions must not be scaled.
 - All private drainage is to be in accordance with BS EN 752-1-2-3-4, BS EN 1295-1, BS EN 1610 and all relevant sections of approved document H of the building regulations (2015 Edition).
 - Where drainage pipework is to be flexibly jointed extra strength vitrified clay it should be to BS EN 295-1, Hepworth 'Supersieve' or equivalent.
 - Where drainage pipework is plastic i.e. PVC-U it shall be to BS EN 1401-1, Osma or equivalent. Private pipework to be type SN4 and all adoptable pipework to be type SN8.
 - Where drainage pipework is cast iron it shall be to BS EN 877 and for ductile iron it shall be to BS EN 598.
 - All concrete pipework, shall be to BS EN 1916 and BS 5911-1. Manholes and fittings shall be to BS 5911 parts 3 and 4 and BS EN 1917.
 - All materials for adoptable drainage are to be Kitemarked as appropriate.
 - All adoptable manhole covers and frames are to be 150mm deep minimum and the covers badged as appropriate i.e. 'FW' or 'SW'.
 - Where drains pass through foundations or connect to manholes, flexible pipe joints are to be provided within 150mm of the face of the structure and within a further 600mm to form a rocker pipe.
 - Where pipes pass through screen walls, footings or retaining walls, lintels are to be provided.
 - Where pipelines pass within 1.0m of buildings or walls the foundations are to be taken down below the bottom of the trench. Where pipelines are more than 1.0m away from foundations the trench shall be backfilled with concrete up to a point that meets a 45° angle line taken from the bottom corner of the nearest foundation.
 - Where depth to invert does not exceed 600mm and the pipe size does not exceed 100mm diameter, 300mm dia. polypropylene access chambers may be used. Elsewhere, proprietary polypropylene or precast concrete manholes are to be used.
 - Where connections are to be made to existing manholes / sewers, invert levels, pipe sizes and orientation should be checked prior to the commencement of the works and any variance reported to the engineer immediately. Where connections are to be made on or off site the contractor is to check the line and level of any services / mains, to ensure that no clashes exist prior to works commencing.
 - Where pipelines cross, each is to be surrounded with grade ST4 mass concrete for a distance not less than 1.0m centred on the crossing point. Length of surround to be extended as necessary to within 150mm of the next nearest flexible joints.
 - For private drainage, concrete protection is to be provided where the effective cover to the crown of the pipe(s) is less than 1.2m in trafficked areas and 0.6m in soft landscaped or pedestrianised areas.
 - The contractor is to ensure that protective measures are taken to ensure that drainage pipework and fittings are not damaged by site traffic prior to oversite filling operations being completed around buildings.
 - The top run of each private foul drainage network is to be laid to falls no slacker than 1:40, the head of each run is to be vented to atmosphere in accordance with approved document H.
 - All surface water drainage to be min 100mm dia, laid at a gradient no slacker than 1:80. And all foul water drainage to be min 100mm dia. unless stated otherwise.
 - The contractor is to ensure that all pipework connections are arranged to direct flows down or into the main channel in the direction of the main flow. Where necessary 3/4 bends are to be used on oblique connections inside the manhole benching where sufficient room exists or the pipelines on oblique connections are arranged outside the chamber to be able to divert flows down the main channel. Connections brought in perpendicular to the main channel are not acceptable. Where possible the main channel flow shall be from any connections with WC's to ensure a flush through the main channel is achieved.
 - The contractor is to ensure that when preformed polypropylene manhole bases are used that they are orientated such that the main flow is through the main channel of the base. This should be achieved by incorporating long radius bends outside of the manhole.
 - The contractors attention is drawn to the need to ensure that any trenches excavated through previously compacted filled areas, in particular under the building footprint and immediately around the outside, are re-compacted to ensure localised differential settlement does not occur.
 - Where new connections are to be made into existing manholes or sewers, all invert levels, pipe orientation and sizes should be checked on-site prior to the commencement of the works, with any variance reported to the engineer once identified. Where new connections are to be made either on or off-site, the contractor is to check the line and level of any existing services / mains, to ensure that no clashes exist prior to the works commencing.
 - Any and all new connections into a public sewer are to be inspected by the local water authority and carried out fully in accordance with their requirements. The contractor is to allow for obtaining the appropriate 'Section Agreements' as well as paying all necessary fees.
 - The contractor is to allow for obtaining the appropriate road opening licence's from the local highway authority and paying all necessary fees. All reinstatement works within the public highway are to be carried out in accordance with the requirements of the local highway authority.
 - Porosity paving surface finish 'to the architects spec'. Any alteration to the extents of the porosity paving may have an adverse affect upon the Surface water drainage design and must therefore be discussed with the engineer.
 - Modular crate attenuation system(s) to be 'Wavin Aquacell' or 'Polypipe Polystorm'. Any other system offered will need to be provided with a separate warranty for design and installation.
 - Contractor to allow for threshold channel drainage to building access points where required.

Revision Table

P1	14.10.21	First Issue for Planning
Rev	Date	Description

Client: Hendy Group Ltd

Project Title: Hendy, Villeneuve St Georges Way, Eastleigh

Drawing Title: Proposed Drainage Layout

Drawing Status: Planning

Originator No	Rev By	Chk By	Scale
114334	DB	PW	1:200 @A1

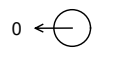
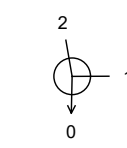
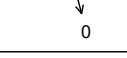
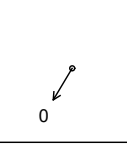
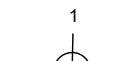
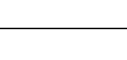
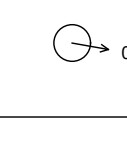
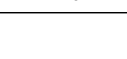
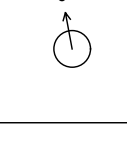
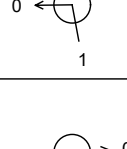
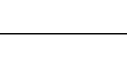
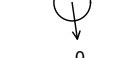
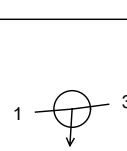
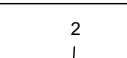
PROJECT / ORIGINATOR / ZONE / LEVEL / TYPE / ROLE / NO

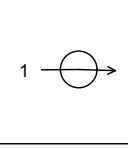
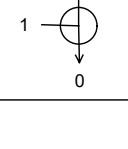
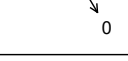
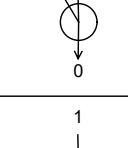
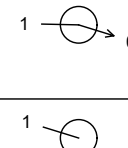
114334-CAL-XX-XX-DR-D-0002	P1
----------------------------	----

Revision

01/2022 23/2207	info@calanotto.co.uk	www.calanotto.co.uk
-----------------	----------------------	---------------------

OUTLINE STRATEGY
SUBJECT TO
DETAILED DESIGN
POST PLANNING

MH Ref	CL (m)	Depth (m)	Dia (mm)	MH Type	Connections	Link ID	IL (m)	Dia (mm)
S1	15.800	0.710	600	PP Inspection Chamber	 0	S1.000	15.090	225
S2	15.550	0.675	600	PP Inspection Chamber	 0	S2.000	14.875	225
S3	15.600	0.910	1200	PCC Rings	 2 1 0 2 0 0	S1.000 S2.000 S1.001	14.765 14.765 14.690	225 225 300
S4	15.400	0.600	600	PP Inspection Chamber	 0	S3.000	14.800	150
S5	15.500	0.750	600	PP Inspection Chamber	 0	S4.000	14.750	150
S6	15.550	0.750	600	PP Inspection Chamber	 0	S5.000	14.800	150
S7	15.800	1.000	600	PP Inspection Chamber	 0	S6.000	14.800	225
S8	15.750	1.425	1200	PCC Rings	 1 5 0 0	S1.001 S1.002	14.400 14.325	300 375
S9	15.750	0.750	600	PP Inspection Chamber	 0	S7.000	15.000	225
S10	16.000	0.750	450	PP Inspection Chamber	 0	S8.000	15.250	150
S11	16.000	0.750	450	PP Inspection Chamber	 0	S9.000	15.250	150
S12	15.750	0.750	600	PP Inspection Chamber	 0	S10.000	15.000	225
S13	16.000	1.000	450	PP Inspection Chamber	 0	S11.000	15.000	150
S14	15.800	1.685	1350	PCC Rings	 6 1 0 6 0 0	S1.002 S11.000 S1.003	14.115 14.190 14.115	375 150 375
S15	15.810	0.810	1200	PCC Rings	 0	S12.000	15.000	150
S16	15.720	0.975	600	PP Inspection Chamber	 0 1 0	S12.000 S12.001	14.820 14.745	150 225
S17	15.550	0.750	450	PP Inspection Chamber	 0	S13.000	14.800	150
S18	15.550	0.825	600	PP Inspection Chamber	 0	S14.000	14.800	150
S19	15.650	0.750	450	PP Inspection Chamber	 0	S15.000	14.900	150
S20	15.600	1.005	600	PP Inspection Chamber	 1 3 0 0	S13.000 S15.000 S13.001	14.670 14.670 14.595	150 150 225
S21	16.000	1.560	1200	PCC Rings	 2 1 0 2 0 0	S12.001 S13.001 S12.002	14.515 14.515 14.440	225 225 300
S22	15.700	1.575	600	PP Inspection Chamber	 1 0 0	S12.002 S12.003	14.125 14.125	300 300
S23	15.540	0.740	450	PP Inspection Chamber	 0	S16.000	14.800	150
S24	15.640	0.840	450	PP Inspection Chamber	 0	S17.000	14.800	150
S25	15.720	1.720	1350	PCC Rings	 3 1 2 2 3 3 4 4 0 0	S1.003 S12.003 S16.000 S17.000 S1.004	14.000 14.000 14.225 14.225 14.000	375 300 150 150 150
EX SW_IC	15.600	1.720	Existing	Existing	 1	S1.004	13.880	150

Node ID	CL (m)	Depth (m)	Dia (mm)	MH Type	Connections	Link ID	IL (m)	Dia (mm)
F1	15.850	1.100	450	PP Inspection Chamber	 0	F1.000	14.750	100
F2	15.900	1.300	450	PP Inspection Chamber	 0	F2.000	14.600	100
F3	15.800	1.510	450	PP Inspection Chamber	 1 2 0 0	F1.000 F1.001	14.290 14.290	100 100
F4	16.000	1.930	450	PP Inspection Chamber	 2 1 1 0 0	F1.001 F2.000 F1.002	14.120 14.120 14.070	100 100 150
F5	16.000	1.250	450	PP Inspection Chamber	 0	F3.000	14.750	100
F6	15.825	2.185	450	PP Inspection Chamber	 2 1 2 2 0 0	F1.002 F3.000 F1.003	13.640 13.690 13.640	150 100 150
F7	15.825	2.245	450	PP Inspection Chamber	 1 0 0	F1.003 F1.004	13.580 13.580	150 150
F8	15.550	2.270	450	PP Inspection Chamber	 1 0 0	F1.004 F1.005	13.280 13.280	150 150
EX FW	15.470	2.500	Existing	Existing	 1	F1.005	12.970	150

Notes:

- This drawing is to be read in conjunction with all relevant architects, engineers and specialist sub-contractors drawings and the specification.
- All setting out to be in accordance with the schedules, any discrepancies between the engineers and the architects drawings to be referred to the architect before proceeding. Dimensions must not be scaled.
- All private drainage is to be in accordance with BS EN 752:1-2-3-4, BS EN 1295-1, BS EN 1610 and all relevant sections of approved document H of the building regulations (2015 Edition).
- Where drainage pipework is to be flexibly jointed extra strength vitrified clay it should be to BS EN 295-1, Hepworth 'Supersieve' or equivalent.
- Where drainage pipework is plastic i.e. PVC-U it shall be to BS EN 14011-1, Cerna or equivalent. Private pipework to be type SN4 and all adoptable pipework to be type SN8.
- Where drainage pipework is cast iron it shall be to BS EN 877 and for ductile iron it shall be to BS EN 598.
- All concrete pipework, shall be to BS EN 1916 and BS 5911-1. Manholes and fittings shall be to BS 5911 parts 3 and 4 and BS EN 1917.
- All materials for adoptable drainage are to be Kitemarked as appropriate.
- All adoptable manhole covers and frames are to be 150mm deep minimum and the covers badged as appropriate i.e. 'FW' or 'SW'.
- Where drains pass through foundations or connect to manholes, flexible pipe joints are to be provided within 150mm of the face of the structure and within a further 600mm to form a rocker pipe.
- Where pipes pass through screen walls, footings or retaining walls, lintels are to be provided.
- Where pipelines pass within 1.0m of buildings or walls the foundations are to be taken down below the bottom of the trench. Where pipelines are more than 1.0m away from foundations the trench shall be backfilled with concrete up to a point that meets a 45° angle line taken from the bottom corner of the nearest foundation.
- Where depth to invert does not exceed 600mm and the pipe size does not exceed 100mm diameter, 300mm dia. polypropylene access chambers may be used. Elsewhere, proprietary polypropylene or precast concrete manholes are to be used.
- Where connections are to be made to existing manholes / sewers, invert levels, pipe sizes and orientation should be checked prior to the commencement of the works and any variance reported to the engineer immediately. Where connections are to be made on or off site the contractor is to check the line and level of any services / mains, to ensure that no clashes exist prior to works commencing.
- Where pipelines cross, each is to be surrounded with grade ST4 mass concrete for a distance not less than 1.0m centred on the crossing point. Length of surround to be extended as necessary to within 150mm of the next nearest flexible joints.
- For private drainage, concrete protection is to be provided where the effective cover to the crown of the pipe(s) is less than 1.2m in trafficked areas and 0.6m in soft landscaped or pedestrianised areas.
- The contractor is to ensure that protective measures are taken to ensure that drainage pipework and fittings are not damaged by site traffic prior to oversite filling operations being completed around buildings.
- The top run of each private foul drainage network is to be laid to falls no slacker than 1:40, the head of each run is to be vented to atmosphere in accordance with approved document H.
- All surface water drainage to be min 100mm dia, laid at a gradient no slacker than 1/80. And all foul water drainage to be min 100mm dia, unless stated otherwise.
- The contractor is to ensure that all pipework connections are arranged to direct flows down or into the main channel in the direction of the main flow. Where necessary 3/4 bends are to be used on oblique connections inside the manhole benching where sufficient room exists or the pipelines on oblique connections are arranged outside the chamber to be able to divert flows down the main channel. Connections brought in perpendicular to the main channel are not acceptable. Where possible the main channel flow shall be from any connections with WC's to ensure a flush through the main channel is achieved.
- The contractor is to ensure that when preformed polypropylene manhole bases are used that they are orientated such that the main flow is through the main channel of the base, this should be achieved by incorporating long radius bends outside of the manhole.
- The contractors attention is drawn to the need to ensure that any trenches excavated through previously compacted filled areas, in particular under the building footprint and immediately around the outside, are re-compacted to ensure localised differential settlement does not occur.
- Where new connections are to be made into existing manholes or sewers, all invert levels, pipe orientation and sizes should be checked on-site prior to the commencement of the works, with any variance reported to the engineer once identified. Where new connections are to be made either on or off-site, the contractor is to check the line and level of any existing services / mains, to ensure that no clashes exist prior to the works commencing.
- Any and all new connections into a public sewer are to be inspected by the local water authority and carried out fully in accordance with their requirements. The contractor is to allow for obtaining the appropriate 'Section Agreements' as well as paying all necessary fees.
- The contractor is to allow for obtaining the appropriate road opening licences from the local highway authority and paying all necessary fees. All reinstatement works within the public highway are to be carried out in accordance with the requirements of the local highway authority.
- Porous paving surface finish 'to the architects spec'. Any alteration to the extents of the porous paving may have an adverse affect upon the Surface water drainage design and must therefore be discussed with the engineer.
- Modular crate attenuation system(s) to be 'Wavin Aquacell' or 'Polypipe Polystorm'. Any other system offered will need to be provided with a separate warranty for design and installation.
- Contractor to allow for threshold channel drainage to building access points where required.

P1

14.10.21

First Issue for Planning

Rev

Date

Description



Calconotto

Jarvis House

43 Commercial Rd

Poole BH14 0HU

01202 237297

info@calconotto.co.uk

www.calconotto.co.uk

Client

Hendy Group Ltd

Project Title

Hendy, Villeneuve St Georges Way, Eastleigh

Drawing Title

Proposed Drainage Schedules

Drawing Status

Planning

Originator No

114334

Rev By

DB

Chk By

PW

Scale

N/A @A1

PROJECT / ORIGINATOR / ZONE / LEVEL / TYPE / ROLE / NO

114334-CAL-XX-XX-DR-D-0003

Revision

P1

E Causeway Flow Surface Water Calculations

Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	40	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.101	5.00	15.800	450	-6.199	8.116	0.710
2	0.046	5.00	15.550	450	-49.780	23.750	0.675
3	0.066	5.00	15.600	1200	-47.041	7.935	0.910
4		5.00	15.400	450	-53.372	-1.860	0.600
5		5.00	15.500	450	-54.810	-10.575	0.700
6		5.00	15.550	450	-53.095	-15.790	0.750
7		5.00	15.800	450	-45.430	-32.395	1.000
8	0.081	5.00	15.750	1200	-47.948	-36.590	1.425
9		5.00	15.750	450	-32.360	-40.140	0.750
10	0.043	5.00	16.000	450	-29.839	-32.840	0.750
11	0.048	5.00	16.000	450	-11.899	-32.875	0.750
12		5.00	15.750	450	-0.483	-40.072	0.750
13	0.017	5.00	16.000	450	8.459	-32.758	1.000
14	0.019	5.00	15.800	1350	8.713	-36.496	1.685
15	0.009	5.00	15.810	1200	39.613	-3.154	0.810
16	0.013	5.00	15.720	450	36.583	13.271	0.975
17	0.024	5.00	15.550	450	-0.430	21.336	0.750
18	0.028	5.00	15.550	450	14.007	30.675	0.825
19	0.010	5.00	15.650	450	20.214	23.305	0.750
20			15.600	450	15.169	22.636	1.005
21	0.100	5.00	16.000	450	14.587	13.029	1.560
22	0.008	5.00	15.700	450	14.590	-34.213	1.575
23	0.037	5.00	15.540	450	37.208	-32.544	0.740
24	0.011	5.00	15.640	450	37.178	-40.127	0.840
25			15.720	1350	37.123	-36.381	1.720
25_OUT			15.600	1350	40.999	-38.398	1.720

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	40.842	125.7	225	Circular	15.800	15.090	0.485	15.600	14.765	0.610
2.000	16.050	145.9	225	Circular	15.550	14.875	0.450	15.600	14.765	0.610
1.001	44.534	153.6	300	Circular	15.600	14.690	0.610	15.750	14.400	1.050
3.000	35.151	108.2	225	Circular	15.400	14.800	0.375	15.750	14.475	1.050

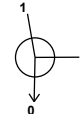
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	450	Manhole	Adoptable	3	1200	Manhole	Adoptable
2.000	2	450	Manhole	Adoptable	3	1200	Manhole	Adoptable
1.001	3	1200	Manhole	Adoptable	8	1200	Manhole	Adoptable
3.000	4	450	Manhole	Adoptable	8	1200	Manhole	Adoptable

Pipeline Schedule

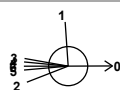
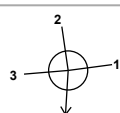
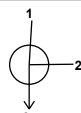
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
4.000	26.905	82.8	225	Circular	15.500	14.800	0.475	15.750	14.475	1.050
5.000	21.427	65.9	225	Circular	15.550	14.800	0.525	15.750	14.475	1.050
6.000	4.893	15.1	225	Circular	15.800	14.800	0.775	15.750	14.475	1.050
1.002	56.661	269.8	375	Circular	15.750	14.325	1.050	15.800	14.115	1.310
7.000	41.234	103.1	225	Circular	15.750	15.000	0.525	15.800	14.600	0.975
8.000	38.725	96.8	150	Circular	16.000	15.250	0.600	15.800	14.850	0.800
9.000	20.928	52.3	150	Circular	16.000	15.250	0.600	15.800	14.850	0.800
10.000	9.867	65.8	225	Circular	15.750	15.000	0.525	15.800	14.850	0.725
11.000	3.747	4.6	150	Circular	16.000	15.000	0.850	15.800	14.190	1.460
1.003	28.410	247.0	375	Circular	15.800	14.115	1.310	15.720	14.000	1.345
12.000	16.702	92.8	150	Circular	15.810	15.000	0.660	15.720	14.820	0.750
12.001	21.997	95.6	225	Circular	15.720	14.745	0.750	16.000	14.515	1.260
13.000	15.653	120.4	150	Circular	15.550	14.800	0.600	15.600	14.670	0.780
14.000	8.123	62.5	225	Circular	15.550	14.725	0.600	15.600	14.595	0.780
15.000	5.089	22.1	150	Circular	15.650	14.900	0.600	15.600	14.670	0.780
13.001	9.625	120.3	225	Circular	15.600	14.595	0.780	16.000	14.515	1.260
12.002	47.242	150.0	300	Circular	16.000	14.440	1.260	15.700	14.125	1.275
12.003	22.637	181.1	300	Circular	15.700	14.125	1.275	15.720	14.000	1.420
16.000	3.838	6.7	150	Circular	15.540	14.800	0.590	15.720	14.225	1.345
17.000	3.746	6.5	150	Circular	15.640	14.800	0.690	15.720	14.225	1.345
1.004	4.369	36.4	150	Circular	15.720	14.000	1.570	15.600	13.880	1.570

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
4.000	5	450	Manhole	Adoptable	8	1200	Manhole	Adoptable
5.000	6	450	Manhole	Adoptable	8	1200	Manhole	Adoptable
6.000	7	450	Junction		8	1200	Manhole	Adoptable
1.002	8	1200	Manhole	Adoptable	14	1350	Manhole	Adoptable
7.000	9	450	Manhole	Adoptable	14	1350	Manhole	Adoptable
8.000	10	450	Manhole	Adoptable	14	1350	Manhole	Adoptable
9.000	11	450	Manhole	Adoptable	14	1350	Manhole	Adoptable
10.000	12	450	Manhole	Adoptable	14	1350	Manhole	Adoptable
11.000	13	450	Manhole	Adoptable	14	1350	Manhole	Adoptable
1.003	14	1350	Manhole	Adoptable	25	1350	Manhole	Adoptable
12.000	15	1200	Manhole	Adoptable	16	450	Manhole	Adoptable
12.001	16	450	Manhole	Adoptable	21	450	Manhole	Adoptable
13.000	17	450	Manhole	Adoptable	20	450	Manhole	Adoptable
14.000	18	450	Manhole	Adoptable	20	450	Manhole	Adoptable
15.000	19	450	Manhole	Adoptable	20	450	Manhole	Adoptable
13.001	20	450	Manhole	Adoptable	21	450	Manhole	Adoptable
12.002	21	450	Manhole	Adoptable	22	450	Manhole	Adoptable
12.003	22	450	Manhole	Adoptable	25	1350	Manhole	Adoptable
16.000	23	450	Manhole	Adoptable	25	1350	Manhole	Adoptable
17.000	24	450	Manhole	Adoptable	25	1350	Manhole	Adoptable
1.004	25	1350	Manhole	Adoptable	25_OUT	1350	Manhole	Adoptable

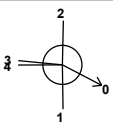
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
1	-6.199	8.116	15.800	0.710	450		0	1.000	15.090	225
2	-49.780	23.750	15.550	0.675	450		0	2.000	14.875	225
3	-47.041	7.935	15.600	0.910	1200		1 2 0	2.000 1.000 1.001	14.765 14.765 14.690	225 225 300
4	-53.372	-1.860	15.400	0.600	450		0	3.000	14.800	225
5	-54.810	-10.575	15.500	0.700	450		0	4.000	14.800	225
6	-53.095	-15.790	15.550	0.750	450		0	5.000	14.800	225
7	-45.430	-32.395	15.800	1.000	450		0	6.000	14.800	225
8	-47.948	-36.590	15.750	1.425	1200		1 2 3 4 5 0	6.000 5.000 4.000 3.000 1.001 1.002	14.475 14.475 14.475 14.475 14.400 14.325	225 225 225 225 300 375
9	-32.360	-40.140	15.750	0.750	450		0	7.000	15.000	225
10	-29.839	-32.840	16.000	0.750	450		0	8.000	15.250	150
11	-11.899	-32.875	16.000	0.750	450		0	9.000	15.250	150
12	-0.483	-40.072	15.750	0.750	450		0	10.000	15.000	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
13	8.459	-32.758	16.000	1.000	450		0	11.000	15.000	150
14	8.713	-36.496	15.800	1.685	1350		1 2 3 4 5 6 0	11.000 10.000 9.000 8.000 7.000 1.002 1.003	14.190 14.850 14.850 14.850 14.600 14.115 14.115	150 225 150 150 225 375 375
15	39.613	-3.154	15.810	0.810	1200		0	12.000	15.000	150
16	36.583	13.271	15.720	0.975	450		1 0	12.000 12.001	14.820 14.745	150 225
17	-0.430	21.336	15.550	0.750	450		0	13.000	14.800	150
18	14.007	30.675	15.550	0.825	450		0	14.000	14.725	225
19	20.214	23.305	15.650	0.750	450		0	15.000	14.900	150
20	15.169	22.636	15.600	1.005	450		1 2 3 0	15.000 14.000 13.000 13.001	14.670 14.595 14.670 14.595	150 225 150 225
21	14.587	13.029	16.000	1.560	450		1 2 0	13.001 12.001 12.002	14.515 14.515 14.440	225 225 300
22	14.590	-34.213	15.700	1.575	450		1 0	12.002 12.003	14.125 14.125	300 300
23	37.208	-32.544	15.540	0.740	450		0	16.000	14.800	150
24	37.178	-40.127	15.640	0.840	450		0	17.000	14.800	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
25	37.123	-36.381	15.720	1.720	1350		17.000	14.225	150
						2	16.000	14.225	150
						3	12.003	14.000	300
						4	1.003	14.000	375
						0	1.004	14.000	150
25_OUT	40.999	-38.398	15.600	1.720	1350		1.004	13.880	150

Simulation Settings

Rainfall Methodology	FEH-13	Analysis Speed	Normal	Additional Storage (m ³ /ha)	20.0
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.840	Drain Down Time (mins)	240	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
30	20	0	0
100	40	0	0

Node 25 Online Orifice Control

Flap Valve	x	Design Depth (m)	1.000	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	24.9		
Invert Level (m)	14.000	Diameter (m)	0.110		

Node 14 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	14.115
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	165

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	123.0	0.0	0.800	123.0	0.0	0.801	0.0	0.0

Node 24 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	14.800	Slope (1:X)	200.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	71	Depth (m)	0.350
Safety Factor	2.0	Width (m)	22.600	Inf Depth (m)	
Porosity	0.30	Length (m)	4.800		

Node 23 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	14.800	Slope (1:X)	200.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	72	Depth (m)	0.350
Safety Factor	2.0	Width (m)	27.600	Inf Depth (m)	
Porosity	0.30	Length (m)	4.800		

Node 17 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	14.800	Slope (1:X)	200.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	77	Depth (m)	0.350
Safety Factor	2.0	Width (m)	7.200	Inf Depth (m)	
Porosity	0.30	Length (m)	4.800		

Node 18 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	14.725	Slope (1:X)	200.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	93	Depth (m)	0.350
Safety Factor	2.0	Width (m)	12.000	Inf Depth (m)	
Porosity	0.30	Length (m)	4.800		

Node 19 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	14.900	Slope (1:X)	200.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	48	Depth (m)	0.350
Safety Factor	2.0	Width (m)	7.200	Inf Depth (m)	
Porosity	0.30	Length (m)	4.800		

Node 13 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	15.000	Slope (1:X)	200.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	14	Depth (m)	0.350
Safety Factor	2.0	Width (m)	6.300	Inf Depth (m)	
Porosity	0.30	Length (m)	4.800		

Node 12 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	15.000	Slope (1:X)	200.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	14	Depth (m)	0.350
Safety Factor	2.0	Width (m)	23.800	Inf Depth (m)	
Porosity	0.30	Length (m)	4.800		

Node 9 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	15.000	Slope (1:X)	200.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	14	Depth (m)	0.350
Safety Factor	2.0	Width (m)	37.600	Inf Depth (m)	
Porosity	0.30	Length (m)	4.800		

Node 6 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	14.800	Slope (1:X)	200.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	69	Depth (m)	0.350
Safety Factor	2.0	Width (m)	45.600	Inf Depth (m)	
Porosity	0.30	Length (m)	4.800		

Node 5 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	14.800	Slope (1:X)	200.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	73	Depth (m)	0.350
Safety Factor	2.0	Width (m)	4.800	Inf Depth (m)	
Porosity	0.30	Length (m)	4.800		

Node 4 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	14.800	Slope (1:X)	200.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	78	Depth (m)	0.350
Safety Factor	2.0	Width (m)	12.000	Inf Depth (m)	
Porosity	0.30	Length (m)	4.800		

Node 7 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	14.800	Slope (1:X)	200.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	72	Depth (m)	0.350
Safety Factor	2.0	Width (m)	10.000	Inf Depth (m)	
Porosity	0.30	Length (m)	10.000		

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.21%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	15.262	0.172	42.0	0.5170	0.0000	OK
15 minute winter	2	10	14.982	0.107	19.0	0.1625	0.0000	OK
60 minute winter	3	54	14.940	0.250	47.0	0.6474	0.0000	OK
60 minute winter	4	59	14.939	0.139	7.0	2.2143	0.0000	OK
60 minute winter	5	59	14.938	0.138	3.8	0.8942	0.0000	OK
60 minute winter	6	58	14.938	0.138	12.4	8.3163	0.0000	OK
60 minute winter	7	58	14.938	0.138	8.3	3.3949	0.0000	OK
60 minute winter	8	58	14.938	0.613	64.8	1.3906	0.0000	SURCHARGED
15 minute summer	9	1	15.000	0.000	0.0	0.0000	0.0000	OK
15 minute winter	10	11	15.371	0.121	17.7	0.1559	0.0000	OK
15 minute winter	11	10	15.358	0.108	20.1	0.1570	0.0000	OK
15 minute summer	12	1	15.000	0.000	0.0	0.0000	0.0000	OK
15 minute winter	13	10	15.029	0.029	6.9	0.1680	0.0000	OK
60 minute winter	14	57	14.936	0.821	107.4	94.9009	0.0000	SURCHARGED
15 minute winter	15	10	15.047	0.047	3.8	0.0636	0.0000	OK
60 minute winter	16	58	14.938	0.193	4.8	0.0818	0.0000	OK
60 minute winter	17	58	14.939	0.139	5.8	1.4289	0.0000	OK
60 minute winter	18	57	14.938	0.213	10.6	3.6610	0.0000	OK
60 minute winter	19	58	14.939	0.039	2.3	0.2966	0.0000	OK
60 minute winter	20	58	14.938	0.343	13.8	0.0546	0.0000	SURCHARGED
60 minute winter	21	58	14.938	0.498	40.2	0.7198	0.0000	SURCHARGED
60 minute winter	22	58	14.936	0.810	36.0	0.2140	0.0000	SURCHARGED
60 minute winter	23	58	14.934	0.134	10.4	5.0255	0.0000	OK
60 minute winter	24	58	14.934	0.134	7.8	4.0367	0.0000	OK
60 minute winter	25	58	14.934	0.934	44.5	1.3368	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	3	40.6	1.277	0.876	1.3253	
15 minute winter	2	2.000	3	18.9	0.846	0.440	0.4057	
60 minute winter	3	1.001	8	46.9	1.233	0.524	2.9663	
60 minute winter	4	3.000	8	-7.0	-0.243	-0.140	1.1506	
60 minute winter	5	4.000	8	-3.8	-0.144	-0.066	0.8784	
60 minute winter	6	5.000	8	-12.4	-0.419	-0.193	0.7002	
60 minute winter	7	6.000	8	-8.3	-0.280	-0.062	0.1598	
60 minute winter	8	1.002	14	58.2	1.102	0.480	6.2495	
15 minute summer	9	7.000	14	0.0	0.000	0.000	0.5343	
15 minute winter	10	8.000	14	17.1	1.148	0.946	0.5757	
15 minute winter	11	9.000	14	19.7	1.501	0.801	0.2750	
15 minute summer	12	10.000	14	0.0	0.000	0.000	0.0000	
15 minute winter	13	11.000	14	6.8	2.245	0.081	0.0374	
60 minute winter	14	1.003	25	-23.0	0.262	-0.182	3.1335	
15 minute winter	15	12.000	16	3.7	0.806	0.201	0.0770	
60 minute winter	16	12.001	21	4.8	0.747	0.090	0.8362	
60 minute winter	17	13.000	20	5.5	0.798	0.342	0.2710	
60 minute winter	18	14.000	20	6.1	0.622	0.093	0.3198	
60 minute winter	19	15.000	20	2.4	1.144	0.064	0.0540	
60 minute winter	20	13.001	21	13.3	0.951	0.281	0.3828	
60 minute winter	21	12.002	22	34.4	0.780	0.380	3.3267	
60 minute winter	22	12.003	25	34.0	0.515	0.413	1.5941	
60 minute winter	23	16.000	25	8.0	1.787	0.116	0.0657	
60 minute winter	24	17.000	25	-6.3	1.274	-0.089	0.0641	
60 minute winter	25	Orifice	25_OUT	23.7				213.6

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.21%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	25_OUT	1	13.880	0.000	20.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
--------------------------------	---------	------	---------	---------------	----------------	----------	---------------	--------------------

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.21%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	12	15.797	0.707	61.2	2.1266	0.0000	FLOOD RISK
15 minute winter	2	12	15.407	0.532	27.7	0.8045	0.0000	FLOOD RISK
15 minute winter	3	12	15.368	0.678	111.1	1.7539	0.0000	FLOOD RISK
60 minute winter	4	57	15.313	0.513	20.6	5.9321	0.0000	FLOOD RISK
60 minute winter	5	57	15.317	0.517	12.9	2.4230	0.0000	FLOOD RISK
60 minute winter	6	59	15.321	0.521	39.0	22.3113	0.0000	FLOOD RISK
60 minute winter	7	59	15.316	0.516	37.7	9.7675	0.0000	SURCHARGED
60 minute winter	8	59	15.316	0.991	91.8	2.2491	0.0000	SURCHARGED
60 minute winter	9	60	15.317	0.317	22.8	16.5455	0.0000	SURCHARGED
15 minute winter	10	11	15.672	0.422	25.8	0.5459	0.0000	SURCHARGED
15 minute winter	11	11	15.577	0.327	29.3	0.4731	0.0000	SURCHARGED
60 minute winter	12	59	15.314	0.314	19.3	10.4112	0.0000	SURCHARGED
60 minute winter	13	59	15.314	0.314	7.3	2.8930	0.0000	SURCHARGED
60 minute winter	14	59	15.314	1.199	138.1	95.5270	0.0000	SURCHARGED
60 minute winter	15	58	15.316	0.316	3.3	0.4291	0.0000	SURCHARGED
60 minute winter	16	58	15.316	0.571	7.2	0.2422	0.0000	SURCHARGED
60 minute winter	17	58	15.317	0.517	11.6	3.9297	0.0000	FLOOD RISK
60 minute winter	18	58	15.316	0.591	17.7	6.3460	0.0000	FLOOD RISK
60 minute winter	19	58	15.316	0.416	10.4	3.6932	0.0000	SURCHARGED
60 minute winter	20	58	15.317	0.722	16.1	0.1148	0.0000	FLOOD RISK
60 minute winter	21	58	15.316	0.876	45.6	1.2663	0.0000	SURCHARGED
60 minute winter	22	58	15.312	1.187	42.2	0.3133	0.0000	SURCHARGED
60 minute winter	23	59	15.311	0.511	34.3	14.0475	0.0000	FLOOD RISK
60 minute winter	24	59	15.310	0.510	26.2	11.2362	0.0000	SURCHARGED
60 minute winter	25	59	15.310	1.310	66.0	1.8749	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	3	49.6	1.269	1.071	1.6243	
15 minute winter	2	2.000	3	24.1	0.846	0.560	0.6383	
15 minute winter	3	1.001	8	106.1	1.507	1.186	3.1361	
60 minute winter	4	3.000	8	-20.6	-0.560	-0.411	1.3980	
60 minute winter	5	4.000	8	-12.9	-0.335	-0.225	1.0700	
60 minute winter	6	5.000	8	-39.0	-1.031	-0.607	0.8522	
60 minute winter	7	6.000	8	-37.7	-1.048	-0.279	0.1946	
60 minute winter	8	1.002	14	70.0	1.205	0.578	6.2495	
60 minute winter	9	7.000	14	-22.8	-0.592	-0.445	1.6399	
15 minute winter	10	8.000	14	23.1	1.313	1.280	0.6654	
15 minute winter	11	9.000	14	27.8	1.577	1.127	0.3645	
60 minute winter	12	10.000	14	-19.3	-0.512	-0.301	0.3924	
60 minute winter	13	11.000	14	5.5	1.573	0.066	0.0660	
60 minute winter	14	1.003	25	41.9	0.380	0.331	3.1335	
60 minute winter	15	12.000	16	3.0	0.742	0.163	0.2940	
60 minute winter	16	12.001	21	5.8	0.748	0.109	0.8748	
60 minute winter	17	13.000	20	7.2	0.827	0.443	0.2756	
60 minute winter	18	14.000	20	-8.7	0.610	-0.132	0.3231	
60 minute winter	19	15.000	20	-7.3	1.175	-0.193	0.0896	
60 minute winter	20	13.001	21	-14.8	0.962	-0.313	0.3828	
60 minute winter	21	12.002	22	39.8	0.837	0.440	3.3267	
60 minute winter	22	12.003	25	41.1	0.584	0.499	1.5941	
60 minute winter	23	16.000	25	-22.4	1.781	-0.323	0.0676	
60 minute winter	24	17.000	25	-22.6	-1.471	-0.322	0.0659	
60 minute winter	25	Orifice	25_OUT	28.3				316.5

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.21%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	25_OUT	1	13.880	0.000	23.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
--------------------------------	------------	------	------------	------------------	-------------------	----------	------------------	-----------------------

F Maintenance and Management Plan

Calcinotto

civil and structural engineers

114334

Hendy Eastleigh Phase 2
Drainage Management and Maintenance Report

22th October 2019
Revision 1.0

Produced By
Daniel Bott
Senior Engineer

Checked By
Paul Westcott
Associate Director

Content

Section	Title	Page
1	Background	1
Appendix	Title	
A	Drainage Components Inspection & Maintenance Regime	

1 Background

This document has been produced to aid and inform the maintenance and inspection regimen required to maintain the performance of the foul and surface water drainage systems designed to serve the proposed development over the lifetime of the finished site.

The guidance highlighted within this report has been referenced from the CIRIA document C753 SuDS Manual and CIRIA RP992.

- A detailed breakdown of the 'Drainage Components, Inspection & Maintenance Regime Can be viewed in Appendix A.

A Drainage Components Inspection & Maintenance Regime

SuDS Components Operation and Maintenance Activities

Operation and Maintenance Activity	SuDS Component												
	NOTE: Only components highlighted in BLUE are relevant to this project.												
	Pond	Wetland	Detention Basin	Infiltration Basin	Soakaway	Infiltration Trench	Filter Drain	Modular Storage	Porous Paving	Swale / Bioretention / Trees	Filter Strip	Green Roofs	Proprietary Treatment Systems
Regular Maintenance													
Inspection	●	●	●	●	●	●	●	●	●	●	●	●	●
Litter and Debris Removal	●	●	●	●	○	●	●	○	●	●	●		○
Grass Cutting	●	●	●	●	○	●	●	○	○	●	●		
Weed and Invasive Plant Control	○	○	○	○		○	○		○		○	●	
Shrub Management (Including Pruning)	○	○	○	○					○	○	○		
Shoreline Vegetation Management	●	●	○										
Aquatic Vegetation Management	●	●	○										
Occasional Maintenance													
Sediment Management ¹	●	●	●	●	●	●	●	●	●	●	●		●
Vegetation Replacement	○	○	○	○						○	○	●	
Vacuum Sweeping and Brushing									●				
Remedial Maintenance													
Structure Rehabilitation / Repair	○	○	○	○	○	○	○	○	○	○	○	○	
Infiltration Surface Reconditioning				○	○	○	○		○	○	○		

¹ Sediment should be collected and managed in pre-treatment systems, upstream of the main device

Legend: ● Will be required ○ May be required

General Foul and Surface Water Drainage Maintenance

Piped Network/Chambers Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	The entire on-site foul and surface water drainage system should be visually inspected by lifting all manhole covers and checking the silt traps of catchpits, sump units and gullies.	Every six months
	The entire on-site foul and surface water drainage system should be CCTV surveyed to identify any damage, blockages or silt build-up. Any obstructions to be jet cleaned and any damage repaired.	Every 5 Years
Remedial Maintenance	Any identified blockages within the drainage system to inspected via a CCTV survey, jet cleaned and repaired if necessary.	As required

Piped Network/Chambers

Piped Network/Chambers Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect and identify any features that are not operating correctly. If required take remedial action.	Monthly for three months, then six monthly.
	Debris removal from catchment surface/gratings (where may cause risks to performance)	Monthly (and after large storms)
	Remove sediment from trapped sumps, manholes and catchpits.	Annually or as required
Remedial Maintenance	Repair/rehabilitation of gratings, inlets and outlets.	As required
Monitoring	Inspect/check all gratings, trapped sumps, manholes and catchpits to ensure that they are in good condition and operating as designed.	Annually and after large storm events
Structure Rehabilitation/Repair	Regular maintenance and monitoring to identify if repair and/or replacement of features or pipework is required.	As required

Cellular/Modular Storage

Cellular Storage Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect and identify any features that are not operating correctly. If required take remedial action.	Monthly for three months, then annually.
	Remove debris from catchment surface (where may cause risks to performance)	Annually or as required
Remedial Maintenance	Repair/rehabilitate inlets, outlets, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed.	Annually and after large storm events
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required
Structure Rehabilitation/Repair	Regular maintenance and monitoring to identify if repair and/or replacement of storage units is required.	As required
The SuDS Manual Table 21.3: Operation and maintenance requirements for attenuation storage tanks.		

Permeable Pavements

Permeable Pavement Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over the whole surface). Care should be taken in adjusting vacuuming equipment to avoid removal of jointing material if present. Any lost material should be replaced	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturers' recommendations – pay particular attention to areas where water runs from adjacent impermeable areas, as this area is most likely to collect the most sediment
Occasional Maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weed or management using glyphosate applied directly to the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Maintenance	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structured performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration and filtration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, forty-eight hours after large rainfall events in the first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually
The SuDS Manual Table 20.15: Operation and maintenance requirements for pervious pavements		

Proprietary Treatment Systems (Interceptors and Separators)

P.T.S. Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspection of the accumulated oil / silt build-up within the PTS and removal if necessary	Annually or as required
	Physical inspection of the PTS including all mechanical parts and maintenance as required	Annually or as required
	All electrical equipment such as alarms and management systems to be serviced	Annually or as required
	The entire PTS is to be emptied and given a general inspection to test the integrity and performance of the system. Following the inspection, the PTS is to be re-filled with clean water.	Every 5 Years
Remedial Maintenance	Repair/rehabilitate inlets, outlets, overflows and vents.	As required
	The PTS system is to be emptied as soon as a significant amount of oil / silt has built-up. The retained materials are to be removed and the PTS re-filled with clean water. This is to be done immediately if an alarm system is triggered.	As required
	Any coalescing devices to be checked and replaced as necessary	As required
Monitoring	Inspect/check all gratings, trapped sumps, manholes and catchpits to ensure that they are in good condition and operating as designed.	Annually and after large storm events
Structure Rehabilitation/Repair	Regular maintenance and monitoring to identify if repair and/or replacement of features or pipework is required.	As required

Proprietary Treatment Systems (Road Gully's with Smart Gully's Adaptors)

P.T.S. Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspection of the silt build-up within the road gully sumps and removal if necessary	Annually or as required
	Inspection of the smart sponges housed within the Smart gully's adaptors and replacement if necessary	Annually or as required
Remedial Maintenance	Inspect/check all gratings, trapped sumps, manholes and catchpits to ensure that they are in good condition and operating as designed.	Annually and after large storm events
	Regular maintenance and monitoring to identify if repair and/or replacement of features or pipework is required.	As required
Monitoring	The smart sponges should be weighed to determine when they require replacement. Once the smart sponges reach 2-3 times their original starting weight of 0.5 kg (Due to absorbing hydrocarbons) they must be replaced.	Annually or as required
Structure Rehabilitation/Repair	Regular maintenance and monitoring to identify if repair and/or replacement of features or pipework is required.	As required

G Pre-Development Surface Water Calculations

[Print](#)[Close Report](#)

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by: Daniel Bott

Site name: Hendy Phase 2

Site location: Eastleigh

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude: 50.97155° N

Longitude: 1.3713° W

Reference: 3721668986

Date: Oct 20 2021 16:55

Runoff estimation approach: IH124

Site characteristics

Total site area (ha): 0.76

Methodology

Q_{BAR} estimation method: Calculate from SPR and SAAR

SPR estimation method: Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	788	788
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is $SPR/SPRHOST \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	4.21	4.21
1 in 1 year (l/s):	3.58	3.58
1 in 30 years (l/s):	9.69	9.69
1 in 100 year (l/s):	13.44	13.44
1 in 200 years (l/s):	15.76	15.76

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Calcinotto		Page 1
Jonsen House 43 Commercial Road Poole BH14 0HU	114334 Hendy Ex. SW Model	
Date 20/09/2021 16:18	Designed by JH	
File 114334 - HENDY - APPROXIMATE EX...	Checked by PW	
XP Solutions	Network 2018.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD	
FEH Rainfall Model	
Return Period (years)	100
FEH Rainfall Version	2013
Site Location GB 444242 119333 SU 44242 19333	
Data Type	Point
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

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
S1.000	49.007	0.620	79.0	0.101	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	20.133	0.300	67.0	0.101	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.002	3.022	0.052	58.5	0.101	0.00	0.0	0.600	o	150	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)
S1.000	50.00	5.72	14.500	0.101	0.0	0.0	0.0	1.13	20.0	13.7
S1.001	50.00	5.99	13.880	0.202	0.0	0.0	0.0	1.23	21.7«	27.4
S1.002	50.00	6.03	13.580	0.303	0.0	0.0	0.0	1.32	23.3«	41.0

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN Invert Level (m)	Diameter (mm)	Pipes In PN Invert Level (m)	Diameter (mm)	Backdrop (mm)
S1	15.660	1.160	Open Manhole	1200	S1.000	14.500	150		
S2	15.720	1.840	Open Manhole	1200	S1.001	13.880	150	S1.000	13.880
S3	15.340	1.760	Open Manhole	1200	S1.002	13.580	150	S1.001	13.580
S	15.540	2.012	Open Manhole	0		OUTFALL	S1.002	13.528	150

Calcinotto		Page 3
Jonsen House 43 Commercial Road Poole BH14 0HU	114334 Hendy Ex. SW Model	
Date 20/09/2021 16:18 File 114334 - HENDY - APPROXIMATE EX...	Designed by JH Checked by PW	
XP Solutions	Network 2018.1	

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)
S1.000	o	150	S1	15.660	14.500	1.010	Open Manhole	1200
S1.001	o	150	S2	15.720	13.880	1.690	Open Manhole	1200
S1.002	o	150	S3	15.340	13.580	1.610	Open Manhole	1200

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)
S1.000	49.007	79.0	S2	15.720	13.880	1.690	Open Manhole	1200
S1.001	20.133	67.0	S3	15.340	13.580	1.610	Open Manhole	1200
S1.002	3.022	58.5	S	15.540	13.528	1.862	Open Manhole	0

Calcinotto		Page 4
Jonsen House 43 Commercial Road Poole BH14 0HU	114334 Hendy Ex. SW Model	
Date 20/09/2021 16:18	Designed by JH	
File 114334 - HENDY - APPROXIMATE EX...	Checked by PW	
XP Solutions	Network 2018.1	

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.101	0.101	0.101
1.001	-	-	100	0.101	0.101	0.101
1.002	-	-	100	0.101	0.101	0.101
				Total	Total	Total
				0.303	0.303	0.303

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)
---------------------	--------------	--------------	--------------	------------------	----------	--------

S1.002	S	15.540	13.528	0.000	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 Coefficient	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	0	Number of Storage Structures	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH	Summer Storms	Yes
Return Period (years)	100	Winter Storms	Yes
FEH Rainfall Version	2013	Cv (Summer)	0.750
Site Location	GB 444242 119333 SU 44242 19333	Cv (Winter)	0.840
Data Type		Point Storm Duration (mins)	30

2 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 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Data Type Point
 FEH Rainfall Version 2013 Cv (Summer) 0.750
 Site Location GB 444242 119333 SU 44242 19333 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 450.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
 Return Period(s) (years) 2, 30, 100
 Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.000	S1 15	Winter	2	+0%	2/15 Winter	30/15 Summer			14.668	0.018	0.000
S1.001	S2 15	Winter	2	+0%	2/15 Summer	100/15 Summer			14.411	0.381	0.000
S1.002	S3 15	Winter	2	+0%	2/15 Summer				13.997	0.267	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.76		14.8	SURCHARGED	10
S1.001	S2	1.18		24.0	SURCHARGED	4
S1.002	S3	2.49		35.5	SURCHARGED	

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 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Data Type Point
 FEH Rainfall Version 2013 Cv (Summer) 0.750
 Site Location GB 444242 119333 SU 44242 19333 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 450.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
 Return Period(s) (years) 2, 30, 100
 Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.000	S1	15 Winter	30	+0%	2/15 Winter	30/15 Summer			15.664	1.014	4.071
S1.001	S2	15 Winter	30	+0%	2/15 Summer	100/15 Summer			15.665	1.635	0.000
S1.002	S3	15 Winter	30	+0%	2/15 Summer				14.766	1.036	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	1.26		24.6	FLOOD	10
S1.001	S2	1.71		35.0	FLOOD RISK	4
S1.002	S3	4.53		64.5	SURCHARGED	

Calcinotto		Page 7
Jonsen House 43 Commercial Road Poole BH14 0HU	114334 Hendy Ex. SW Model	
Date 20/09/2021 16:18	Designed by JH	
File 114334 - HENDY - APPROXIMATE EX...	Checked by PW	
XP Solutions		Network 2018.1

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 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 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Data Type Point
 FEH Rainfall Version 2013 Cv (Summer) 0.750
 Site Location GB 444242 119333 SU 44242 19333 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 450.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
 Return Period(s) (years) 2, 30, 100
 Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.000	S1 15	Winter	100	+0%	2/15	Winter	30/15		15.670	1.020	10.372
S1.001	S2 15	Winter	100	+0%	2/15	Summer	100/15		15.721	1.691	1.327
S1.002	S3 15	Winter	100	+0%	2/15	Summer			15.055	1.325	0.000

PN	US/MH Name	Pipe Flow / Overflow		Pipe Flow (l/s)	Status	Level Exceeded
		Cap.	(l/s)			
S1.000	S1	1.39		27.1	FLOOD	10
S1.001	S2	1.78		36.5	FLOOD	4
S1.002	S3	5.13		73.0	FLOOD RISK	