SuDS Statement

December 2019

EAS

27 Clements Lane
Haverhill
Suffolk

Susan Franks

EAS

Document History

JOB NUMBER: 2478/2019
DOCUMENT REF: 27 Clements Lane SuDS Statement
REVISIONS: B – For Review

Revision	Comments	By	Checked	Authorised	Date
A	Draft	RC	SA	SA	22/11/2019
B	For review following updates from Anglian Water	RC	SA	SA	04/12/2019
C					
D					
E					

TRANSPORT PLANNING ■ HIGHWAYS AND DRAINAGE ■ FLOOD RISK ■ TOPOGRAPHICAL SURVEYS
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1 Introduction

1.1 EAS has been commissioned to prepare a Sustainable Drainage Strategy to support a planning application for a residential development comprising of 3 X 4-bedroom properties at 27 Clements Lane Haverhill Suffolk CB9 8JR. A location plan is in **Appendix A** and the proposed development plans are in **Appendix B**.

1.1 The existing site comprises of a single residential property and private rear garden. The red line boundary covers an area of 0.13 hectares (ha).

1.2 The contents of this SuDS statement are based on advice set out in The National Planning Policy Framework (NPPF), published February 2019; the Technical Guidance to the NPPF, published in July 2018; and the Planning Practice Guidance (PPG), published March 2014. Climate Change guidance published in February 2016 has also been considered.

1.3 This SuDS statement includes the following:

- Assessment of flood risks including surface water, groundwater and sewer flood risk within the site and discussion of any mitigation measures for the proposed development;
- Surface water drainage calculations for all rainfall events up to and including the 1 in 100 year event plus 40% as a proxy for future climate change impacts;
- Existing and proposed discharge rates and volumes, the former comprising pre-development greenfield runoff rates;
- Recommendations for the proposed surface water system to serve the site; and
- Drainage layout plan for the entire site, including the location of the point of discharge and any existing overland flow routes.

1.4 The information set out in this report demonstrates that the proposed development uses sustainable methods of drainage and will not increase the rate of surface water runoff.

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2 Policy Context

Introduction

2.1 This section sets out the policy context. The contents of this SuDS Statement are based on the advice set out in The National Planning Policy Framework (NPPF) published in February 2019 and updated June 2019, and the Planning Practice Guidance (PPG), published March 2014.

National Planning Policy Framework

2.2 Paragraphs 165 NPPF discusses the application of sustainable drainage systems:

"Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:

- *Take account of advice from the lead local flood authority;*
- *Have appropriate proposed minimum operational standards;*
- *Have maintenance arrangements in place to ensure an acceptable standard of operation of the lifetime of the development; and*
- *Where possible, provide multifunctional benefits."*

2.3 The EA Flood Map for Planning shows the site to be located entirely in Flood Zone 1, at 'Low' risk of flooding from fluvial sources. The EA Flood Map has been enclosed on **Appendix C**. This is considered to be an area with less than 1 in 1000 chance of flooding each year. As the site is in Flood Zone 1 and less than 1 hectare in area, a full Flood Risk Assessment is not required.

Non-Statutory Technical Standards for Sustainable Drainage Systems (2015)

2.4 This document published by Defra in March 2015 provides technical standards for SuDS systems, which should be used in conjunction with the NPPF and PPG. Standards include management of flood risk within and outside of the development; peak flow and volume control; construction and structural integrity; and designing for maintenance considerations. These have been considered in designing of the SuDS strategy for the site.

Local Policy

West Suffolk Local Plan (Former St Edmundsbury)

2.5 The West Suffolk DC website states that the adopted and emerging Local Plans covering the former St Edmundsbury and Forest Heath areas will continue to apply to these parts of West Suffolk Council area until a new Local Plan for West Suffolk is adopted (schedule for mid-2023). Therefore, the St Edmundsbury Local Plan has been reviewed for this SuDs statement.

2.6 The St Edmundsbury Core Strategy was adopted in December 2010 and sets out the vision, objectives, spatial strategy and overarching policies for new development in the borough until 2031.

2.7 Policy CS2: Sustainable Development notes the importance of using sustainable drainage systems to manage runoff and prevent reduce flood risk, and has been considered during the preparation of this letter report.

Forest Heath District Council and St Edmundsbury Borough Council SFRA Level 1 and Water Cycle Study August 2009

2.8 A Level 1 Strategic Flood Risk Assessment (SFRA) was published by Forest Heath DC and St Edmundsbury BC in 2009, to inform development control in the local area. The SFRA reviews all sources of flooding, using data from the Environment Agency, the Local Authorities and Anglian Water. The SFRA Level 1 highlights that there is a general presumption against development in Flood Zones 2 and 3; future development will be required to manage surface water more sustainably; and areas where development has been identified will require further reviewing informed by flood risk modelling and mapping, to be undertaken in a Level 2 SFRA.

2.9 North of Haverhill are the Meldham Washland which act as a flood attenuation basin, restricting the flows through Haverhill. It is noted this area is to never be developed. Approximately, 25,000m^3 of storage is provided by the wetlands and thus the area is classified as a reservoir. The area is subject to regular maintenance however there is a residual risk of failure which would have significant impact in Haverhill.

2.10 Appendix D of the SFRA notes several recorded incidents of external sewer flooding in Haverhill. Causes of flooding include rising main failure and blockages. The site is not noted to have been specifically affected.

2.11 Figure 5-3 does not identify any recorded incidents of groundwater flooding at the site.

3 Existing Site Assesment

Site Description

3.1 The development site is at 27 Clements Lane Haverhill Suffolk CB9 8JR. The existing site comprises of a single residential dwelling, garage and rear garden. A location plan is included in **Appendix A**.

3.2 The site is surrounded on all sides by residential buildings and is located approximately 680m west of Haverhill High Street. The site is accessed via Old Clements Lane.

3.3 The proposed scheme will demolish the existing property and garage and redevelop the site with 3 residential properties each with parking and private rear garden.

3.4 The red line boundary covers approximately 0.13 hectares.

3.5 Proposed development plans are included at **Appendix B**.

Local Watercourses

3.6 There are no watercourses within the immediate vicinity of the site. The nearest EA Main river is the Stour Brook which is culverted through the town of Haverhill parallel to the A143. The Stour Brook daylights approximately 3.5km south east of the site when it joins the River Stour.

3.7 A minor section of ordinary watercourse is located 560m south of the site and is indicated to be culverted through the residential area.

Site Levels

3.8 A topographical survey enclosed in **Appendix D.** Levels along the south east perimeter of the site are around 91m AOD. Levels in the northern perimeter fall to a low of around 87m AOD. The levels in the central area of the rear garden vary between 89.13m AOD and 90.92m AOD.

3.9 Levels at the rear of the existing property range between 87m AOD and 88m AOD. At the front of the property facing Old Clements Lane, levels fall to a low of 86m AOD. Levels within Old Clements Lane area also around 86m AOD.

3.10 There is a retaining wall along the western boundary of the site which forms the entrance to the existing property. Levels at the top of the retaining wall and front garden are around 87m AOD, again falling to 86m AOD along Old Clements Lane.

Sewer Records

3.11 Sewer records obtained by Anglian Water are enclosed in **Appendix E.** A 225mmdia foul sewer is located within Old Clements Lane and is indicated to flow north east. A 375mmdia surface water sewer is located within Clements Lane and is also indicated to flow north east.

Geology

3.12 With reference to the British Geological Survey online mapping, the site is located within an area with a bedrock of Lewes Nodular Chalk Formation And Seaford Chalk Formation (undifferentiated) – Chalk with superficial deposits of Lowestoft Formation - Diamicton. This suggests that infiltration methods may be a viable means of drainage at the site.

Existing Drainage

3.13 The topographic survey indicates a rainwater downpipe on the existing property however the ultimate connection is not indicated. It is therefore assumed the roof runoff is simply shed to ground. The garage also simply sheds roof runoff to ground. The existing areas of hardstanding are also not formally drained with surface water runoff from the existing driveway flowing into Old Clements Lane which is also not formally drained with no gullies identified or highway drainage present.

3.14 As such, there is currently no formal drainage strategy at the site.

Fluvial Flood Risk

3.15 A copy of the Environment Agency's Flood Map is enclosed in **Appendix C**. The mapping shows the whole site to be located in Flood Zone 1, at 'Low' risk of flooding from fluvial or tidal sources. Areas in Flood Zone 1 have a less than 1 in 1000 probability of flooding each year.

3.16 The risk from fluvial flooding is therefore deemed low.

Surface Water Flood Risk

3.1 Surface water flooding refers to flooding caused when the intensity of rainfall, particularly in urban areas, can create runoff which temporarily overwhelms the capacity of the local drainage systems or does not infiltrate into the ground. The water ponds on the ground and flows towards low-lying land. This source of flood risk is also known as 'pluvial'.

3.2 Figure 3.1 an extract from the Long-Term Flood Risk Map, shows the site is at 'very low' risk of surface water flooding. Surface water flooding with depths below 300mm are shown within Old Clements Lane and is only present in a low risk scenario. The risk from surface water flooding is therefore considered low and no mitigation measures are considered necessary.

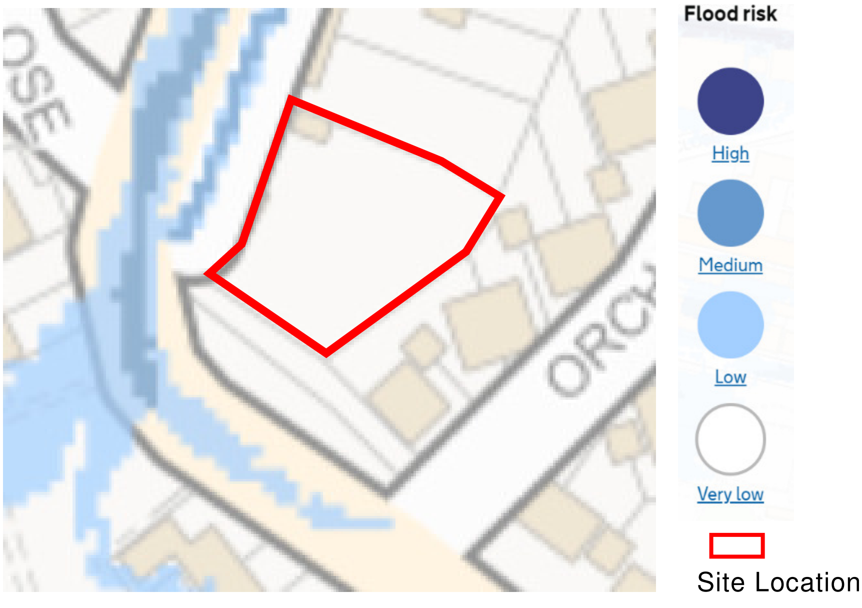

Figure 3.1: https://flood-warning-information.service.gov.uk/long-term-flood-risk/map?easting=566529&northing=244956

Contains public sector information licensed under the Open Government Licence v3.0.

4 Outline Drainage Strategy

Pre-Development Runoff Rate

4.1 The existing site covers an area of approximately 0.13ha with an impermeable area of 0.013ha (133.41m^2) consisting of roof area and hardstanding. Using the Modified Rational Method detailed in Butler, D and Davies, J. (2006), Urban Drainage, 2nd ed., SPON, the surface water runoff for the existing site has been calculated as follows:-

Q = CiA where Q = maximum flow rate (l/s)

C= PIMP/PR

i= rainfall intensity (mm/hr),

A=area (ha)

4.2 It should be noted that a fixed rainfall intensity of 50mm/hr is used in this case, which has been recommended by Butler & Davies (2006) to avoid using inappropriately high intensities for very low concentration times, i.e. small sites.

4.3 Using the Modified Rationale Method (Butler and Davies, 2006), and a measured impermeable area on the existing site of 133.41m^2, the total rate of runoff from the impermeable areas of the existing site is estimated to be 1.83l/s. The run off calculations are enclosed in **Appendix F**.

4.4 Greenfield runoff rates calculations have been carried out using the WINDES MicroDrainage software. The ICP SUDS Mean Annual Flood method was used. Greenfield runoff rates at the site for QBAR, 1 year, 30 year and 100-year events are summarised below per hectare and for the total proposed impermeable area of 0.045 hectares:

- QBAR – 2.8l/s/ha (0.126l/s)
- 1 in 100 year-10.1 l/s/ha (0.454l/s)
- 1 in 30 year- 6.8l/s/ha (0.306l/s)
- 1 in 1 year- 2.5l/s/ha (0.112l/s)

4.5 The WINDES MicroDrainage runoff output is included in **Appendix G.**

Relevant SuDS Policy

4.6 SUDS mimic the natural drainage system and provide a method of surface water drainage which can decrease the quantity of water discharged, and hence reduce the risk of flooding. In addition to reducing flood risk, these features can improve water quality and provide biodiversity and amenity benefits.

4.7 The SUDS management train incorporates a hierarchy of techniques and considers all three SUDS criteria of flood reduction, pollution reduction, and landscape and wildlife benefit. In decreasing order of preference, the preferred means of disposal of surface water runoff is:

- Discharge to ground.

- Discharge to a surface water body.
- Discharge to a surface water sewer.
- Discharge to a combined sewer.

4.8 The philosophy of SUDS is to replicate as closely as possible the natural drainage from a site pre-development and to treat runoff to remove pollutants, resulting in a reduced impact on the receiving watercourses. The benefits of this approach are as follows:

- Reducing runoff rates, thus reducing the flood risk downstream.
- Reducing pollutant concentrations, thus protecting the quality of the receiving water body.
- Groundwater recharge.
- Contributing to the enhanced amenity an aesthetic value of development areas.
- Providing habitats for wildlife in developed areas, and opportunity for biodiversity enhancement.

Site-Specific SuDS

4.9 The various SUDS methods need to be considered in relation to site-specific constraints. Several SUDS options are available to reduce or temporarily hold back the discharge of surface water runoff. **Table 1** outlines the constraints and opportunities to each of the SUDS devices in accordance with the hierarchical approach outlined in The SUDS Manual CIRIA C753. It also indicates what could and could not be incorporated within the development, based upon site-specific criteria.

Device	Description	Constraints / Comments	Appropriate
Living roofs (source control)	Provide soft landscaping at roof level which reduces surface water runoff.	Difficult to implement and manage on buildings with pitched roofs.	No
Infiltration devices & Soakaways (source control)	Store runoff and allow water to percolate into the ground via natural infiltration.	The underlying geology of chalk means that infiltration may be effective. Logistical and spatial constraints mean that infiltration is not considered appropriate at this site.	No
Pervious surfaces (source control)	Storm water is allowed to infiltrate through the surface into a storage layer, from which it can either infiltrate and/or slowly release to sewers.	Due to the significant level difference at the site, traditional permeable paving is not appropriate.	No

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Rainwater harvesting (source control)	Reduces the annual average rate of runoff from the Site by reusing water for non-potable uses e.g. toilet flushing, recycling processes.	Unlikely to be implemented at a small-scale site however water saving devices e.g. low flow flush and water butts could be incorporated into the design.	No
Swales (permeable conveyance)	Broad shallow channels that convey / store runoff, and allow infiltration (ground conditions permitting).	Spatial constraints within development area so no room for swales.	No
Filter drains & perforated pipes (permeable conveyance)	Trenches filled with granular materials (to take flows from adjacent impermeable areas) that convey runoff while allowing infiltration.	Not considered necessary. A linear drain has been proposed to manage surface water runoff.	No
Filter Strips (permeable conveyance)	Wide gently sloping areas of grass or dense vegetation that remove pollutants from run-off from adjacent areas.	Spatial constraints within the site mean this method has not been used. Significant level differences across the site means this option would likely result in extensive groundworks.	No
Infiltration basins (end of pipe treatment)	Depressions in the surface designed to store runoff and allow infiltration.	Spatial constraints within development area so no room for infiltration basin. Site access restraints to the rear of the site means maintenance would not be possible. Level differences across the site means significant groundworks would be needed. Trees are also being retained at the site, limiting suitable locations	No
Wet ponds & constructed wetlands (end of pipe treatment)	Provide water quality treatment & temporary storage above the permanent water level.	Spatial constraints within development area so no room for pond or wetland. Site access restraints to the rear of the site means maintenance would not be possible.	No
Attenuation Underground (end of pipe treatment)	Oversized pipes or geo-cellular tanks designed to store water below ground level.	An attenuation tank has been proposed to manage roof runoff and surface water runoff from the driveway area.	Yes

Table 1: Site Specific Sustainable Drainage

SuDs Considerations

4.10 The site has various constraints, particularly significant level differences. Three SuDs options were extensively considered and are outlined below.

Infiltration Strategy

4.11 A geology of chalk suggests that infiltration methods could be viable at the site, subject to infiltration tests. However, this approach was not pursued. Firstly, carrying out infiltration tests would be difficult due to the presence of the retaining walls and would require the breaking up of hardstanding. Also access to the existing rear garden is limited and it would be difficult to serve a plant machinery and a water bowser during the testing.

4.12 An infiltration strategy could involve the application of either unlined permeable paving or a soakaway. However, each of these strategies have significant constraints. Using unlined permeable paving would not be suitable for the front drives given the slope towards Old

Clements Road. As a result, all surface water would need to be directed to the rear of the properties and at least 5m away from the building. Due to the site levels being significantly lower at the front of the site, soakaways in the rear gardens would need to be very deep (estimated to be between 4-5m deep). This is not considered financially sustainable due to the requirement to extensive dig and groundworks and exceeds the generally recommended maximum depth of 2.5m.

4.13 Due to some trees being retained on site, the location of the soakaway could be problematic. The soakaway would have to avoid root protection zones and achieve building regulation requirements (e.g. 5m minimum distance from a building and from the site boundary). It would therefore be problematic to size and locate a soakaway given the number of constraints. Lastly, access for maintenance would also be problematic. There is no clear access should machinery need to service the soakaways post-construction.

Pumped Outfall to Surface Water Sewer

4.14 A surface water sewer is present along the length of Clements Lane, adjacent to the site however Old St Clements Lane is significantly lower meaning a gravity connection to the surface water sewer nearest the site cannot be achieved. The nearest surface water manhole has an invert of 85.94m AOD with the lowest cover level at the site at 85.5m AOD, hence the need for a pumped outfall.

4.15 Surface water from the site would need to be pumped, to a demarcation chamber where the final gravity connection to the sewer network is achieved. This chamber usually must be within the red line boundary of a site and due to spatial constraints within the site, this would not be possible. A demarcation chamber would thus have to be located within the highway which would have cost and management implications. A pumping strategy is not considered a sustainable option, both finically and in terms of required maintenance. Noteworthy, this would have to be designed around the existing 225mmdia foul sewer located within Old Clements Lane.

New section of Surface Water in Old Clements Lane

4.16 The chosen option is to install a new surface water sewer along Old Clements Lane to achieve a gravity connection to MH 7152 located in Clements Lane. Although initially costly, this is the most sustainable in the long term. A gravity connection is more sustainable and will not require the maintenance of a pump and rising main.

4.17 Anglian Water do not usually undertake a predevelopment enquiry for proposals with less than 10 dwelling however they were contacted to comment on the proposed drainage strategy. At this stage, Anglian Water have confirmed they are happy with the proposed outfall rate and drainage strategy. Email communications are enclosed in **Appendix H.**

Proposed Drainage Strategy

4.18 As discussed above, the best option for the site is an attenuation strategy with a restricted outfall to the Anglian Water surface water sewer.

4.19 The QBAR greenfield runoff rate is very low and would likely result in blockages. As a result, it has been proposed to restrict runoff from the site to 1.0l/s. This nonetheless provides a betterment to the existing site.

4.20 It is proposed to directed roof runoff and surface water runoff from the driveways and rear patio areas to an attenuation tank located at the front of the site. It is not proposed to formally

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drain the footpaths leading the rear gardens. This area is likely to drain to the surrounding ground or the patio areas which are formally drained.

4.21 A linear drain is proposed to manage the surface water runoff from the driveways which are to be constructed of hardstanding. This will prevent runoff flowing off-site and instead will be directed to the attenuation tank. A sump unit will be located prior to the outfall to the attenuation tank to remove sediment which can reduce efficiently and cause blockages.

4.22 The attenuation tank has been sized at 14m^2 and 1.32m deep to provide the required attenuation. Two surface water catchpits are located prior to their outfall to the tank, again to prevent blockages. A hydrobrake will restrict the outfall from the site to 1.0l/s for all events up to and including the 1 in 100 year plus 40% climate change event.

4.23 A new 1200mm chamber is proposed to be located within Old Clements Lane where a new 150mmdia surface water sewer will be constructed. A pre-development enquiry has been submitted to Anglian Water. A response has not yet been received. The sketch in **Appendix I** (SK02) indicates the surface water sewers indicative route and proposed connection point at MH7152 located in Clements Lane.

4.24 The proposed SuDs layout has been enclosed in **Appendix J** and the WINDES calculation are enclosed in **Appendix K**.

Maintenance of Development Drainage

4.25 It is assumed that all elements of the proposed drainage system will remain private and the responsibility for maintenance will remain with a maintenance company set up by the developer. Some maintenance activities for the attenuation tank detailed in CIRIA C753 'The SuDS Manual' are set out in Table 4.1 below.

Maintenance Schedule	Required Action	Frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually.
	Remove debris from the catchment surface (where if may cause risks to performance).	Monthly
	Remove sediment from pre-treatment structures and/or internal forebays.	Annually or as required.
Remedial actions	Repair/rehabilitate inlets, outlet, 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
	Survey inside of tank/crate system for sediment build-up and remove if necessary.	Every 5 years or as required.

Table 4.1: Maintenance tasks for attenuation tank (Source: CIRIA C753, The SUDS Manual)

Manholes and Sewers

4.26 Manhole covers should be lifted each year to remove visible debris and check for blockages – it is suggested that this is undertaken every November after the heaviest leaf-fall has occurred.

4.27 Should a blockage occur at any time, it is advised to seek professional help to jet the drainage system to clean and clear the system.

Gutters and Downpipes

4.28 It is good practice to ensure that these are occasionally inspected to ensure they are in good order and free of leaves & debris. Once every 6 months should be sufficient

4.29 If a gravity connection to the private sewers cannot be achieved, a surface water pump will need to be installed.

Catchpit/Silt Trap

4.30 A maintenance schedule should be agreed with the chosen manufacture. Depending on the size and manufacture, maintenance tasks can includes removing the inner silt bucket or sucking out the silt.

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5 Conclusions

5.1 EAS has been commissioned to prepare a Sustainable Drainage Strategy to support a planning application for a residential development for 3x 4-bedrrom dwellings at 27 Clements Lane Haverhill Suffolk CB9 8JR.

5.2 The proposed scheme will demolish the existing property and garage and redevelop the site with 3 residential properties each with parking and private rear garden. The site is located in Flood Zone 1 and is not identified to be at risk of surface water flooding.

5.3 Three SuDS options were carefully considered at the site. An infiltration strategy was not considered feasible and a pumped outfall was ruled out because it is not a sustainable strategy.

5.4 The most sustainable and suitable option would be to construct a new 150mmdia surface water sewer along Old Clements Lane prior to a final gravity connection to the existing 375mmdia surface water sewer located in Clements Lane. This would require an agreement from Anglian Water who can requisition the sewer on the developer's behalf. Anglian Water have provided initial comments and in principle agree to the proposed drainage strategy and proposed outfall rate.

5.5 The QBAR greenfield runoff rate is too low and would likely result in blockages. As a result, it is proposed to manage all roof area and surface water runoff from the rear patio and driveways via an attenuation tank with a restricted outfall of 1.0l/s via a hydrobrake for all events up to and including a 1 in 100 year plus 40% climate change event.

5.6 The proposed drainage features are to remain private and the responsibility of a dedicated management company. Maintenance tasks associated with the proposed drainage system, including tasks associated with the attenuation tank, have been included in this report.

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6 Appendices

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Appendix: A – Location Plan

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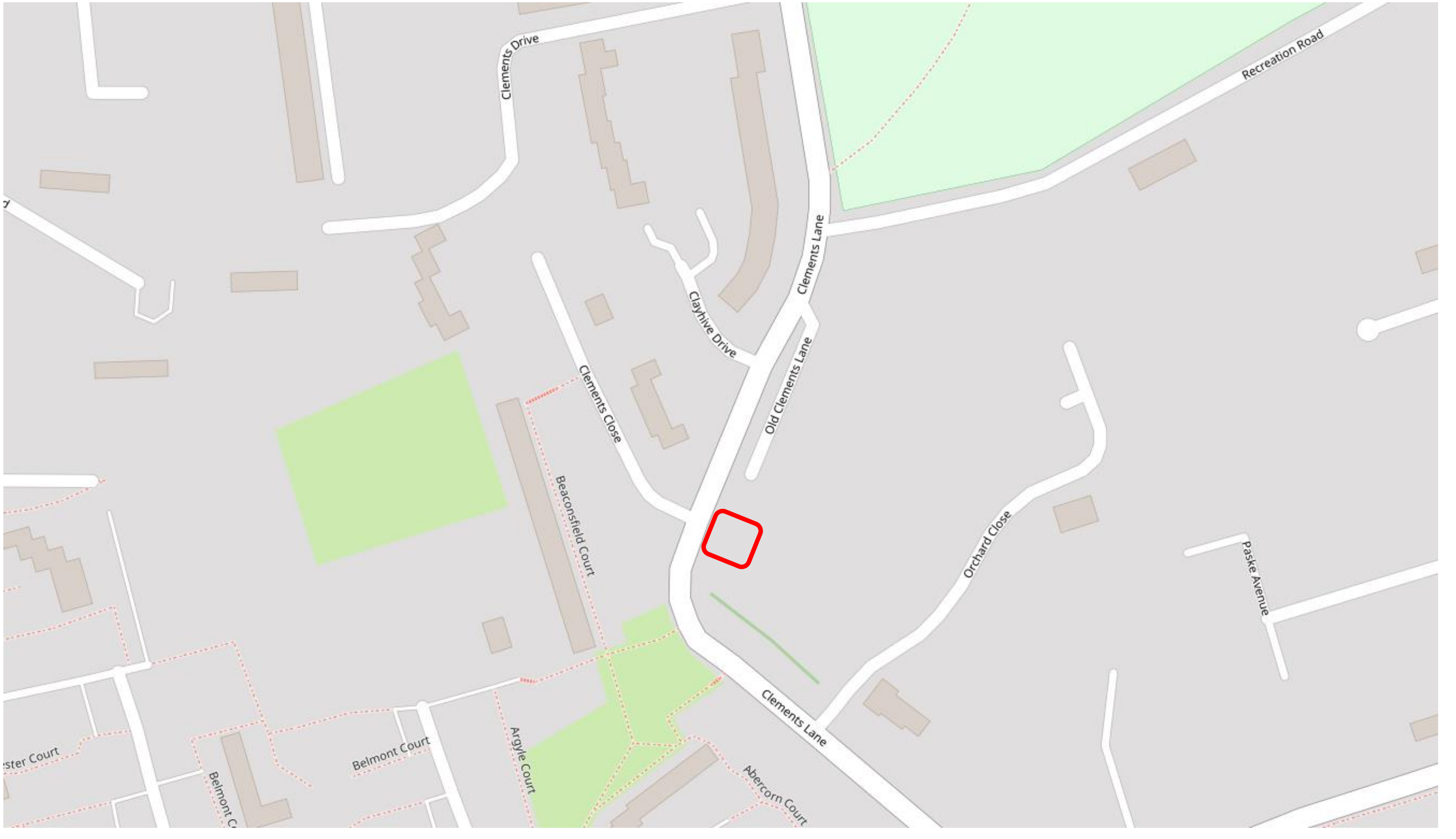

Site Location

Source: Open Street Map

Appendix: B – Proposed Development Plans

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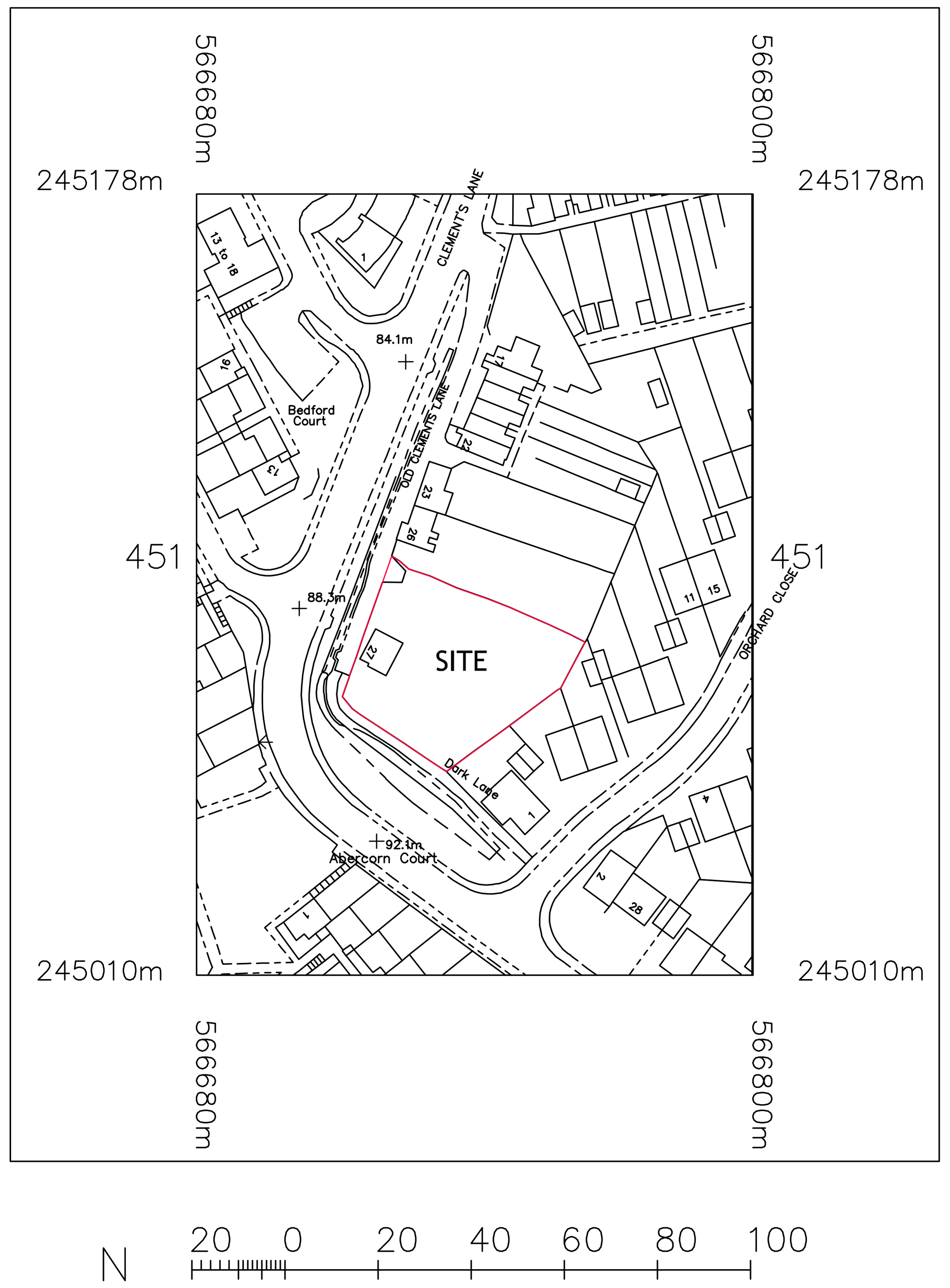
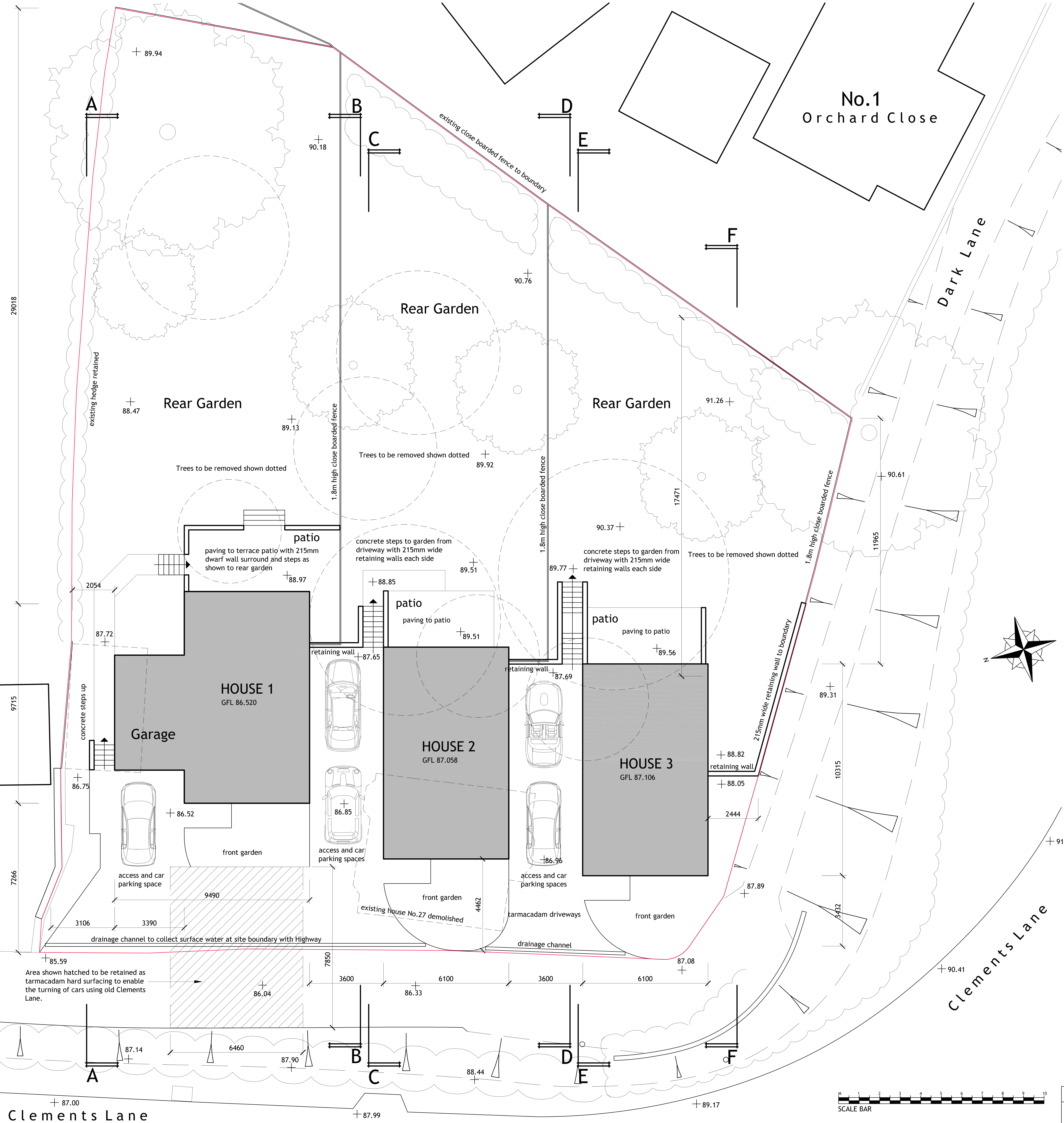
Stanfords VectorMap



SITE LOCATION PLAN 1:1250

LICENSE NUMBER OI1172094



SITE LAYOUT PLAN 1:100

General Notes:

Do not scale from these drawings. The Contractor is responsible for checking all dimensions on site prior to commencement of the works with any errors being reported to Neil Cutforth & Associates as soon as possible.

Any construction work carried out prior to receiving all necessary approvals is entirely at the householders / clients risk.

All building work to be carried out to the satisfaction of the Local Authority Building Control Officer and in accordance with the current Building Regulations and as such additional unforeseen building works may be required on site.

The Contractor shall inspect all adjoining properties which may be affected by the works prior to commencement or works and record and report with the owner any defects.

The Contractor shall be entirely responsible for the security, strength and stability of the building during the course of the works.

Drawings produced for the purpose of obtaining Building Regulations approvals only and do not constitute full working drawings.

Notes:

REVISIONS

Rev	Description	Date	By

Neil Cutforth & Associates

Architectural Consultants

1A, CENTURY PARK, LYNN ROAD, CHETTISHAM, ELY, CAMBRIDGESHIRE, CB6 1SA

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Architectural Services - Local Authority Approvals - Project Management
Extensions - Loft Conversions - Flat Conversions - Housing Developments

Project
PROPOSED HOUSING DEVELOPMENT
27 OLD CLEMENTS LANE HAVERILL

Client
MRS SUSAN FRANKS

Drawing Title
SITE PLAN AS PROPOSED

Drawing Status
PLANNING

Paper Size	Date	SEPT '19	Drg No	Rev
A1	Scale	1:100	826/17/01C	
	Drawn	NMC		

Appendix: C – Topograhic Survey

SURVEY STATIONS				
Name	Easting	Northing	Height	Remark
1	566721.383	245097.738	85.714	PK Nail
2	566734.981	245140.752	83.346	PK Nail
3	566709.345	245114.174	86.396	PK Nail
4	566693.686	245076.036	89.441	PK Nail
5	566730.872	245036.360	92.722	PK Nail
6	566760.038	245030.902	94.219	PK Nail

Legend:

Abbreviated Features:

AV	Air Valve
Av.	Average
B	Bollard
BB	Belisha Beacon
BH	Borehole
BL	Bed Level
BS	Bus Stop
BT	British Telecom Cover
B/RW	Brick Retaining Wall
Br/W	Brick Wall
CATV	Cable TV Cover
CCTV	Close Circuit TV
CL	Cover Level
Col.	Column
C/RW	Concrete Retaining Wall
C/Pit	Catch Pit
DPC	Damp Proof Course
DK	Drop Kerb
Dr	Drain
EL	Eaves Level
ER	Earth Rod
EP	Electricity Pole
FH	Fire Hydrant
FL	Floor Level
F/Light	Flood Light
FW	Foul Water
FP	Foot Path
G	Gully
GV	Gas Valve
GP	Gate Post
Ht.	Height
IC	Inspection Chamber
IL	Invert Level
KO	Kerb Outlet
LB	Letter Box
LP	Lamp Post
MH	Manhole
Mkr	Marker Post
MS	Mile Stone
OSBM	Ordnance Survey Bench Mark
OH	Overhead
P	Post
PB	Post Box
PE	Pipe
PM	Parking Meter
RE	Rodding Eye
RL	Ridge Level
RP	Reflector Post
RS	Road Sign
RW	Retaining Wall
RWP	Rain Water Pipe
S	Stump
SL	Soffit Level
SN	Sign
SNP	Street Name Plate
SV	Stop Valve
SVP	Soil & Vent Pipe
SW	Surface Water
S/RW	Stone Retaining Wall
St/W	Stone Wall
TCB	Telephone Call Box
TL	Traffic Light
TP	Telegraph Pole
UG	Underground
US	Underside
UTL	Unable To Lift
DUTL	Damaged UTL
OUTL	Obstructed UTL
SUTL	Sealed UTL
VP	Vent Pipe
WL	Water Level
WM	Water Meter
WO	Wash Out
WT	Water Tap
Ø	Diameter

Fence Abbreviations:

B/W	Barbed Wire
C/B	Close Boarded
C/I	Corrugated Iron
C/L	Chain Link
C/P	Chestnut Paling
I/R	Iron Railing
P/R	Post & Rail
P/W	Post & Wire

Symbols:

Control Station :

Manhole/Inspection Chamber :

Inlet Pipe
Inlet Pipe
Out Flow Pipe

Bush :

Tree : Spread & Girth Shown to Scale

Gate :

Spot Level : 52.65

Bore Hole :

Trial Hole :

Lines:

Wall :

Verge :

Fence :

Boundary :

Edge of Spread :

Hedge :

Embankment : Top of Bank / Bottom of Bank

OH Electric :

OH Telecom :

Drainage Flow :

Contours : 85.00 / 84.75

Hatching:

Building :

Open Sided Building :

General Notes:

1. Man entry to sewers has not been undertaken. Depths, pipe sizes and quantity of pipes are measured from the surface. We therefore cannot guarantee the completeness or accuracy of the sewer data which should be checked with the local authority and/or on site.

2. All tree heights and spreads are approximate. The plan position of trunks are taken at ground level. Girth measurements are taken at a 1.5m height. We have attempted to identify tree species, however if tree species are critical specialist advice should be sought.

3. Survey information is as result of measurement to existing features and does not imply legal ownership of boundaries or land divisions. Where boundary alignment lines are added to the survey drawing and are taken from legal documents or other information supplied they are done so within the constraints of drawing quality and scale. They are provided on the basis of opinion and do not imply legal contract.

Plan Coordinate Control:–
Plan Coordinates relate to National Grid OSGB36(02) using GPS
LSF 1.000 at Stn 1

Level Datum:–
All Levels relate to OSGB36(02) using GPS

Sheet Location Diagram:

1

Notes:

REV NO	REV NOTE	DATE	SIGNED

chartered ices

CHAS

THE SURVEY ASSOCIATION

smas

GLOBAL SURVEYS

6 Franklin's Close, Ecton, Northants, NN6 0QG
Tel: 01604 491543 Fax: 01604 790361
Email: info@globalsurveys.co.uk

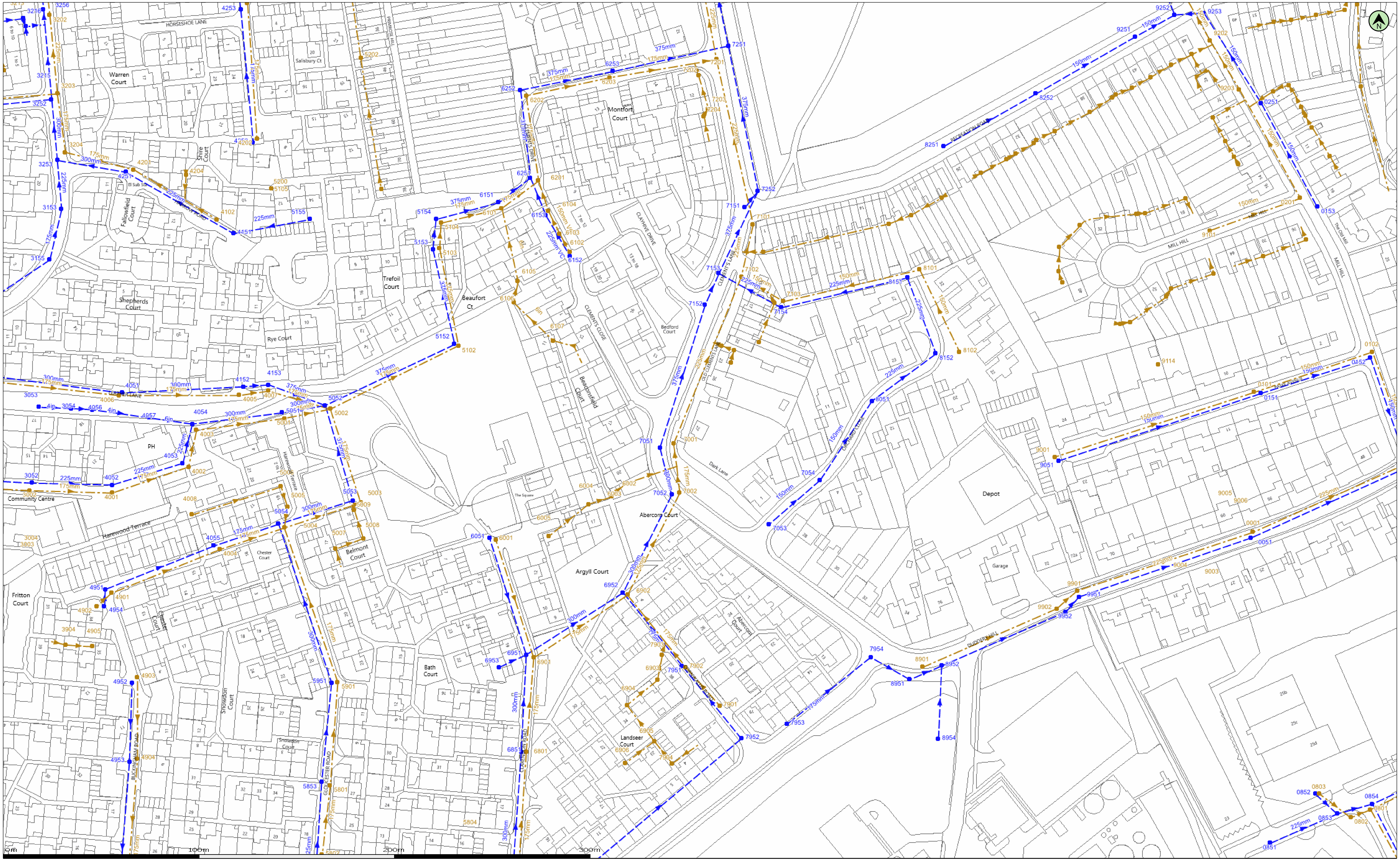
Site: Old Clements Lane, Haverhill, CB9 8JP

Client: Mrs Susan Franks

Survey Description: Topographical Survey

Date	August 2017	Scale	1/200 @ A0
Dwg No.	17227_TOPO	Surveyor	KMG
Sheet	1 of 1	Checked	SJH

Appendix: D – Anglian Water Sewer Records



 Date: 04/11/19 Scale: 1:1250 Map Centre: 566721,245080 Data updated: 01/10/19 Our Ref: 351645 - 1 Wastewater Plan A2

Foul Sewer	Outfall*	Sewage Treatment Works	
Surface Sewer			
Combined Sewer	Inlet*	Public Pumping Station	
Final Effluent			
Rising Main*			
Private Sewer*	Manhole*	Decommissioned Pumping Station	
Decommissioned Sewer*		*(Colour denotes effluent type)	

rose.cargill@eastp.co.uk

old clements lane

love every drop anglianwater

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
0001	F	-	90.18	-
0101	F	-	90.18	-
0102	F	-	87.97	-
0201	F	-	86.38	-
0801	F	-	-	-
0802	F	-	-	-
0803	F	-	-	-
3002	F	-	97.46	-
3202	F	-	75.12	-
3203	F	-	78.26	-
3204	F	-	81.34	-
3212	F	-	-	-
3904	F	-	-	-
4001	F	-	96.46	-
4002	F	-	95.61	-
4003	F	-	94.6	-
4004	F	-	99.24	-
4005	F	-	91.93	-
4006	F	-	92.77	-
4007	F	-	91.87	-
4008	F	-	-	-
4102	F	-	83.18	-
4201	F	-	82.62	-
4202	F	-	80.54	-
4203	F	-	74.39	-
4204	F	-	-	-
4901	F	-	100.7	-
4902	F	-	101.12	-
4903	F	-	100.89	-
4904	F	-	99.86	-
4905	F	-	-	-
5001	F	-	93.73	-
5002	F	-	91.35	-
5003	F	-	97.48	-
5004	F	-	98.31	-
5005	F	-	-	-
5006	F	-	-	-
5007	F	-	-	-
5008	F	-	-	-
5009	F	-	-	-
5102	F	-	88.7	-
5103	F	-	85.62	-
5104	F	-	84.89	-
5200	F	-	-	-
5202	F	-	-	-
5801	F	-	100.04	-
5802	F	-	100.26	-
5901	F	-	99.37	-
6001	F	-	96.06	-
6002	F	-	-	-
6003	F	-	-	-
6004	F	-	-	-
6005	F	-	-	-
6101	F	-	83.48	-
6102	F	88.787	85.257	3.53
6103	F	87.802	85.042	2.76
6104	F	86.86	84.78	2.08
6105	F	-	-	-
6106	F	-	-	-
6107	F	-	-	-
6201	F	84.667	81.49	3.177
6202	F	-	79.63	-
6203	F	-	77.99	-
6801	F	-	96.42	-
6901	F	-	96.42	-
6902	F	-	92.94	-
6903	F	-	-	-
6904	F	-	-	-
6905	F	-	-	-
6906	F	-	-	-
7001	F	-	85.89	-

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
7002	F	-	87.88	-
7101	F	-	80.09	-
7102	F	-	-	-
7103	F	-	-	-
7201	F	-	75.79	-
7202	F	-	-	-
7203	F	-	-	-
7204	F	-	-	-
7901	F	-	96.21	-
7902	F	-	95.68	-
7903	F	-	-	-
7904	F	-	-	-
8101	F	-	-	-
8102	F	-	-	-
8901	F	-	92.57	-
9001	F	-	92.52	-
9101	F	-	87.06	-
9114	F	-	-	-
9202	F	-	80.05	-
9203	F	-	83.37	-
9901	F	-	91.32	-
9902	F	-	91.55	-
0051	S	-	90.14	-
0151	S	-	90.14	-
0152	S	-	86.17	-
0153	S	-	87.28	-
0251	S	-	84.56	-
0851	S	-	-	-
0852	S	-	-	-
0853	S	-	-	-
0854	S	-	-	-
3052	S	-	97.9	-
3053	S	-	-	-
3054	S	-	-	-
3153	S	-	84.11	-
3155	S	-	84.82	-
3216	S	-	-	-
3217	S	-	-	-
3252	S	-	78.74	-
3253	S	-	82.08	-
3256	S	-	75.58	-
4051	S	-	93.24	-
4052	S	-	96.88	-
4053	S	-	95.94	-
4054	S	-	95.01	-
4055	S	-	99.63	-
4056	S	-	-	-
4057	S	-	-	-
4151	S	-	83.87	-
4152	S	-	92.43	-
4153	S	-	92.25	-
4251	S	-	82.9	-
4252	S	-	80.91	-
4253	S	-	74.75	-
4951	S	-	100.7	-
4952	S	-	101.25	-
4953	S	-	100.31	-
4954	S	-	101.12	-
5051	S	-	94.14	-
5052	S	-	91.76	-
5053	S	-	97.8	-
5054	S	-	98.65	-
5152	S	-	89.1	-
5153	S	-	86	-
5154	S	-	85.31	-
5155	S	-	-	-
5853	S	-	100.4	-
5951	S	-	99.67	-
6051	S	-	96.47	-
6151	S	-	83.97	-
6152	S	88.873	85.273	3.6

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
6153	S	86.978	84.908	2.07
6251	S	84.703	81.93	2.773
6252	S	-	80.02	-
6253	S	-	78.34	-
6851	S	-	96.84	-
6951	S	-	95.84	-
6952	S	-	93.45	-
6953	S	-	-	-
7051	S	-	85.94	-
7052	S	-	88.37	-
7053	S	-	-	-
7054	S	-	-	-
7151	S	-	80.39	-
7152	S	-	81.37	-
7153	S	-	-	-
7154	S	-	-	-
7251	S	-	74.85	-
7252	S	-	78.32	-
7951	S	-	96.12	-
7952	S	-	97.53	-
7953	S	-	96.54	-
7954	S	-	94.74	-
8051	S	-	-	-
8151	S	-	-	-
8152	S	-	-	-
8251	S	-	80.73	-
8252	S	-	80.18	-
8951	S	-	94.17	-
8952	S	-	92.86	-
8954	S	-	94.03	-
9051	S	-	92.5	-
9251	S	-	79.7	-
9252	S	-	79.53	-
9253	S	-	79.79	-
9951	S	-	91.58	-
9952	S	-	91.72	-

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Appendix: E – Flood Map for Planning

TRANSPORT PLANNING ■ HIGHWAYS AND DRAINAGE ■ FLOOD RISK ■ TOPOGRAPHICAL SURVEYS
Unit 23 The Maltings Stanstead Abbotts Hertfordshire SG12 8HG **Tel 01920 871 777** **e: contact@eastp.co.uk** **www.eastp.co.uk**

Environment Agency

Flood map for planning

Your reference	Location (easting/northing)	Created
fmfp	**566741/245075**	**5 Nov 2019 10:29**

Your selected location is in flood zone 1, an area with a low probability of flooding.

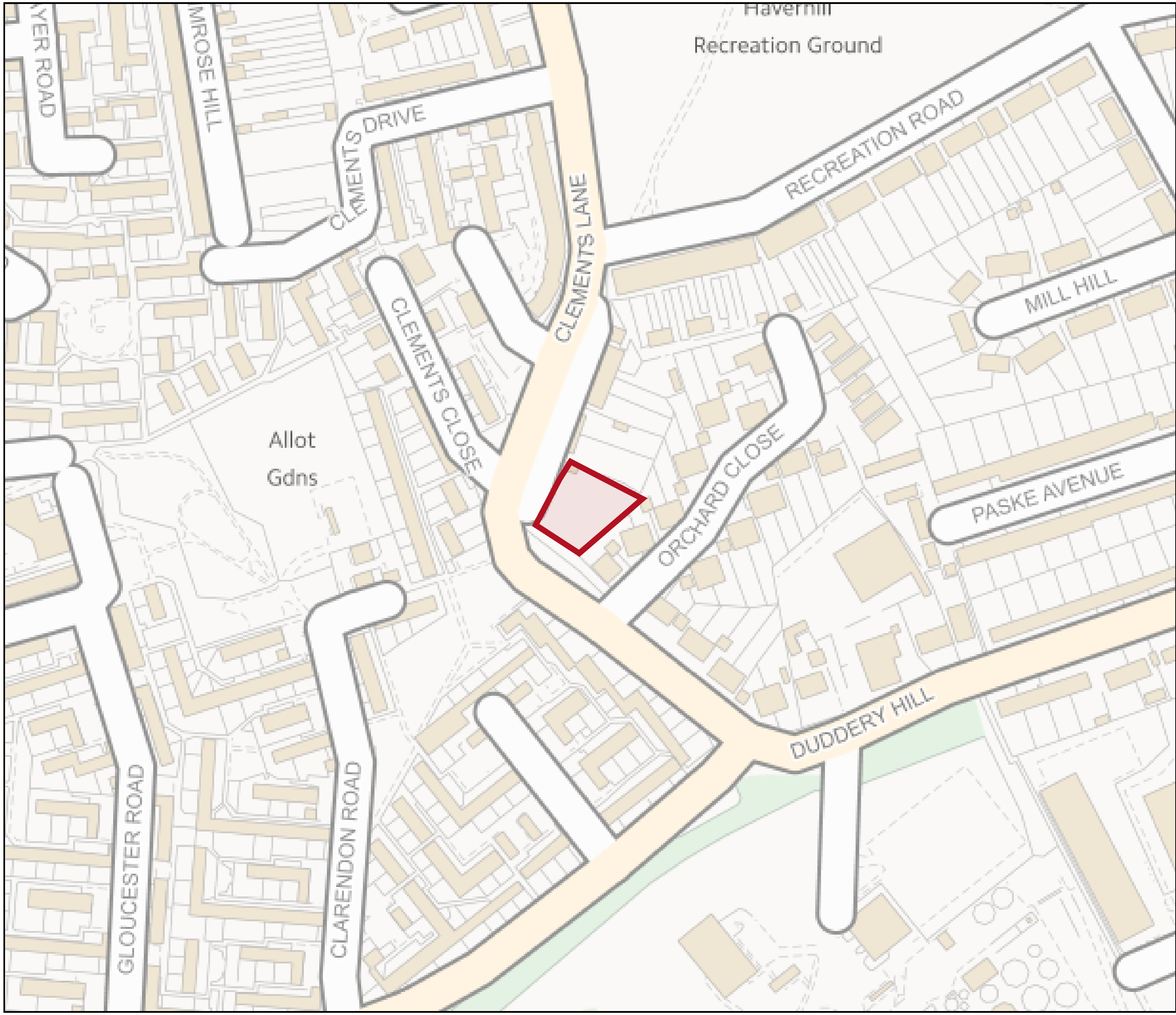
This means:

- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.



Environment Agency

Flood map for planning

Your reference
fmfp

Location (easting/northing)
566741/245075

Scale
1:2500

Created
5 Nov 2019 10:29

Selected area

Flood zone 3

Flood zone 3: areas benefitting from flood defences

Flood zone 2

Flood zone 1

Flood defence

Main river

Flood storage area

0 20 40 60m

Appendix: F – Existing Site Runoff

TRANSPORT PLANNING ■ HIGHWAYS AND DRAINAGE ■ FLOOD RISK ■ TOPOGRAPHICAL SURVEYS
Unit 23 The Maltings Stanstead Abbotts Hertfordshire SG12 8HG **Tel 01920 871 777** **e: contact@eastp.co.uk** **www.eastp.co.uk**

Run-off from Existing Site

Methodology

Using the Modified Rational Method, the surface water run-off rate, has been calculated for the existing site which is assumed to be 100% impermeable.

Ref: Butler, D and Davies, J. (2006), Urban Drainage, 2nd ed, SPON.

Q = CiA

where

$$C = \frac{PIMP}{PR}$$

PIMP = Percentage of impervious area to total area
PR = Percentage Runoff

	Surface Area (m^2)
Existing Impervious Areas	133
Total Area	133

i (Rainfall intensity, mm/hr) = 50.00
i (Rainfall intensity, m/hr) = 0.050
i (Rainfall intensity, m/s) = 1.38×10^{-5}

Percentage run-off (PR)
Existing Impervious Area = 100%

Percentage of impervious area to total area (PIMP)
PIMP =133/133= 100%

Therefore $C = \frac{PIMP}{PR} = 1$

Runoff from existing site:
Q = CiA
$Q = 1 \times 1.38\text{x}10^{-5} \times 133m^2$
$Q = 1.83\text{x}10^{-3}ms^{-1}$
$Q = 1.83ls^{-1}$

Total Q for the existing site = 1.83l/s

Appendix: G – Greenfield Runoff Rate

TRANSPORT PLANNING ■ HIGHWAYS AND DRAINAGE ■ FLOOD RISK ■ TOPOGRAPHICAL SURVEYS

Unit 23 The Maltings Stanstead Abbotts Hertfordshire SG12 8HG **Tel 01920 871 777** **e: contact@eastp.co.uk** **www.eastp.co.uk**

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.400
Area (ha)	1.000	Urban	0.000
SAAR (mm)	600	Region Number	Region 5

Results	**l/s**
QBAR Rural	2.8
QBAR Urban	2.8
Q100 years	10.1
Q1 year	2.5
Q30 years	6.8
Q100 years	10.1

Appendix: H – Anglian Water Communications

Rose Cargill

From: Planning Liaison <planningliaison@anglianwater.co.uk>
Sent: 29 November 2019 14:30
To: Rose Cargill
Subject: PPE-0073161

Good afternoon Rose,

I understand that you have spoken with Rob, and he has confirmed that the principle of your surface water and foul strategy is sound. He also mentioned that a pre-planning report is not necessary in this instance and as such if you are happy we are prepared to offer you a refund if you wish. I will need written confirmation of this so that I can get this arranged.

Just to confirm that your preferred connection points for both used water and surface water are acceptable and understand the reason for the surface water connection is chosen so that you are able to achieve a gravity connection.

If you have any other questions please do not hesitate to contact us and we will endeavour to be of continued assistance.

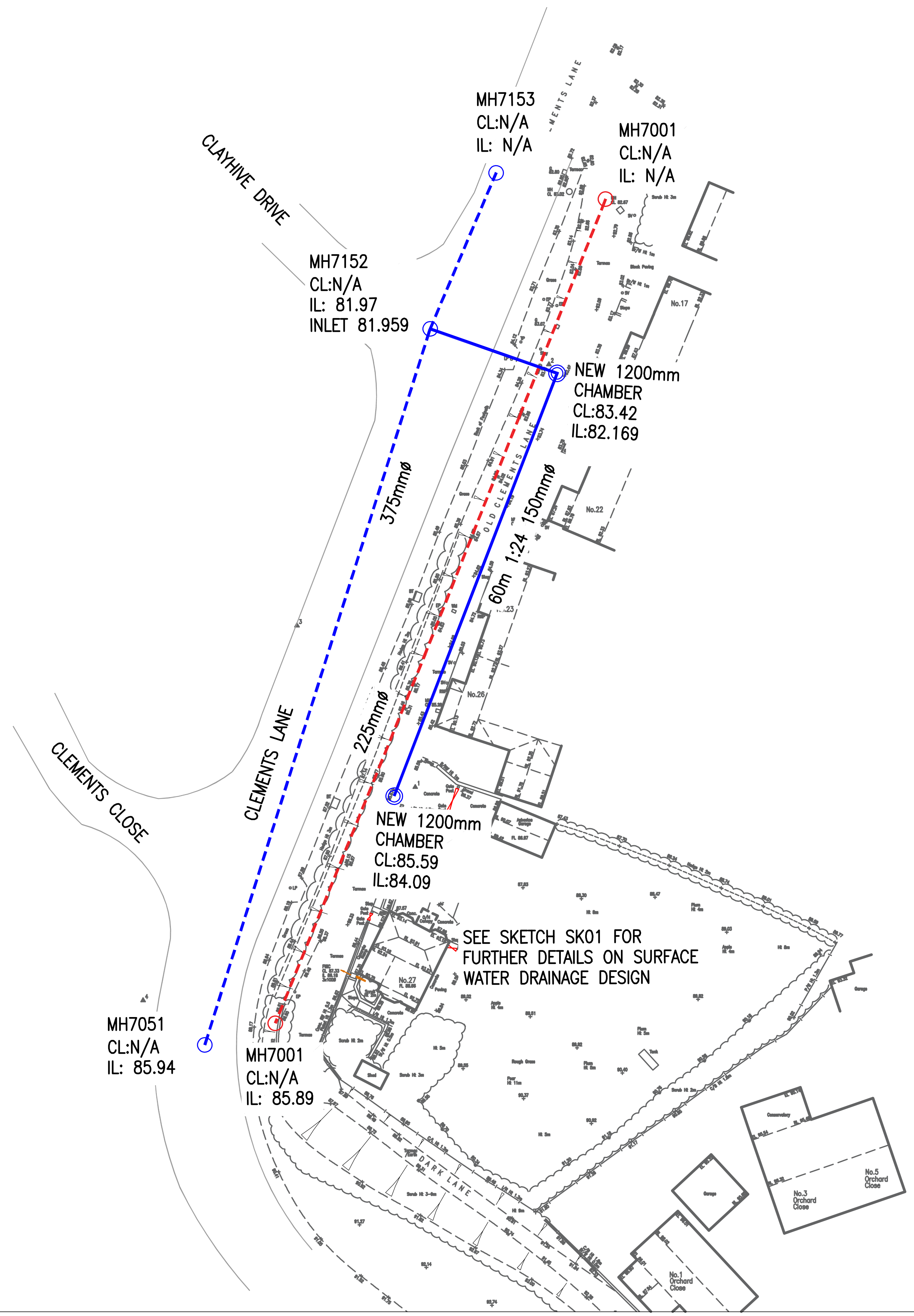
Kind regards,

Kimberley

Pre- Development Team
Development Services

Anglian Water Services Limited
Thorpe Wood House, Thorpe Wood,
Peterborough, Cambridgeshire, PE3 6WT
Telephone: 0345 606 6087 option 1
www.anglianwater.co.uk

Appendix: I – Proposed Surface Water Sewer Connection



KEY

- - - EXISTING ANGLIAN WATER 375mmø SURFACE WATER SEWER

- - - EXISTING ANGLIAN WATER 225mmø FOUL SEWER

—— PROPOSED NEW 150mmø SURFACE WATER SEWER

REV	DATE	BY	DESCRIPTION	CHK	APD

DRAWING STATUS:

EAS
Unit 23, The Maltings, Stanstead Abbotts, Hertfordshire, SG12 8HG
Tel: 01920 871777
www.eastp.co.uk

CLIENT:

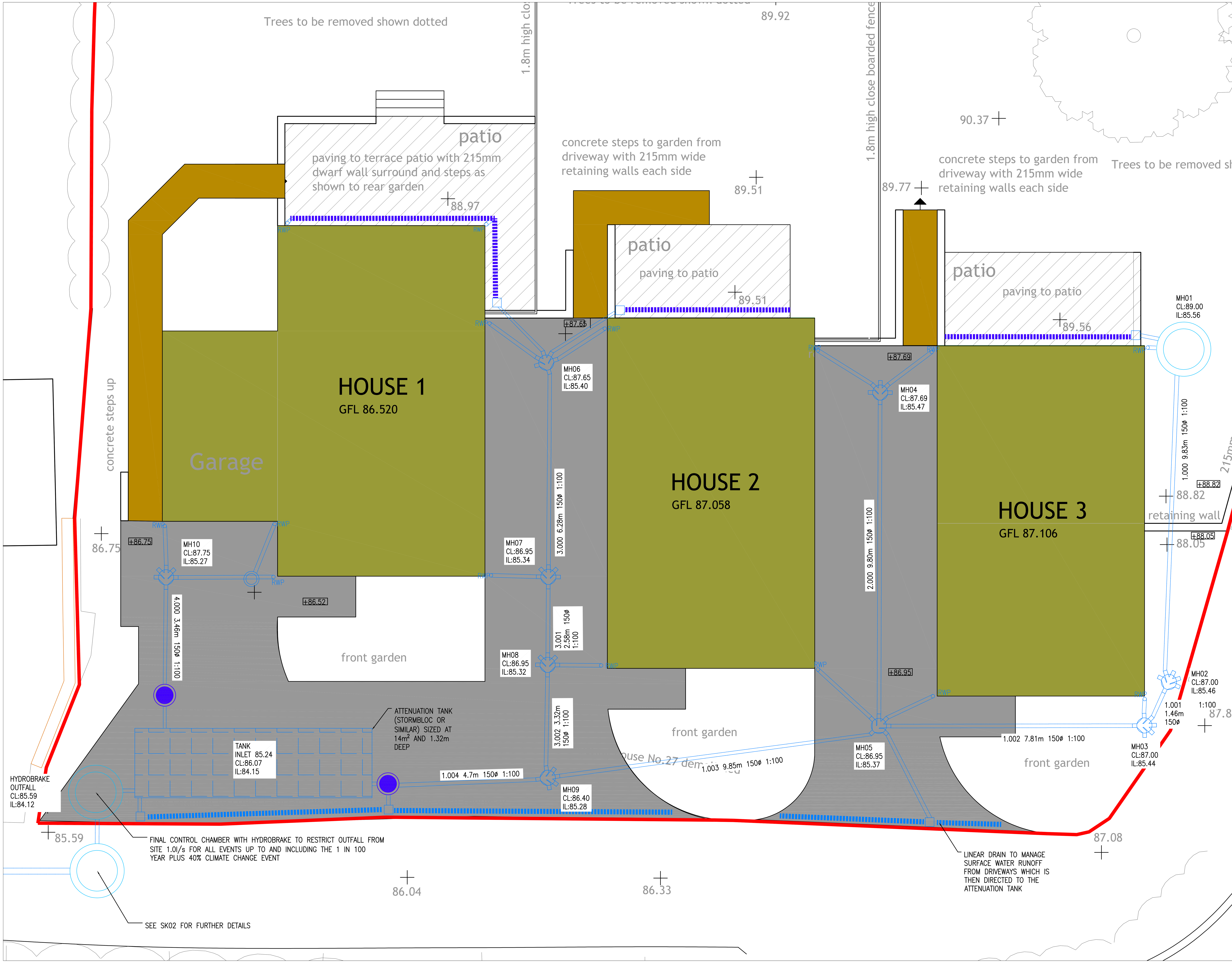
ARCHITECT:

PROJECT:
LAND AT 27 CLEMENTS LANE
HAVERHILL

TITLE:
INDICATIVE NEW SURFACE
WATER SEWER LOCATION AND CONNECTION POINT

SCALE @ A3:	DESIGN–DRAWN:	DATE:
1:500	RC	22/11/2019
PROJECT No: 2478	DRAWING No: SK02	

Appendix: J – SuDS Layout



KEY

- ROOF AREA= 208m²
- HARDSTANDING= 187m²
- REAR PATIO= 56m²
- FOOTPATHS= 24m² (NOT PROPOSED TO BE FORMALLY DRAINED)
- 650mm INSPECTION CHAMBER
- 1.2m INSPECTION CHAMBER
- RWP RAINWATER DOWNPIPE
- 650mm SURFACE WATER CATCHPIT
- LINEAR DRAIN TO SERVE SURFACE WATER RUNOFF FROM DRIVEWAYS
- SUMP UNIT WITH GALVANISED GRATE
- LINEAR DRAIN TO SERVE SURFACE WATER RUNOFF FROM REAR PATIOS
- +87.65 PROPOSED SITE LEVEL

NB: RWP FINAL LOCATION TO BE CONFIRMED
CONNECTION TO ANGLIAN WATER SURFACE WATER SEWER SUBJECT TO APPROVAL

REV	DATE	BY	DESCRIPTION	CHK	APD

DRAWING STATUS:

EAS
Unit 23, The Maltings, Stanstead Abbotts, Hertfordshire, SG12 8HG
Tel: 01920 871777
www.eastp.co.uk

CLIENT:

ARCHITECT:

PROJECT: LAND AT 27 OLD CLEMENTS LANE HAVERHILL

TITLE: PROPOSED SUDS LAYOUT

SCALE @ A1:	DESIGN–DRAWN:	DATE:
1:50	RC	21/11/2019

PROJECT No:	DRAWING No:
2478	SK01

Appendix: K– WINDES Calculations

Existing Network Details for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	9.830	0.100	98.3	0.005	5.00	0.0	0.600	o	150
1.001	1.460	0.020	73.0	0.005	0.00	0.0	0.600	o	150
1.002	7.810	0.070	111.6	0.005	0.00	0.0	0.600	o	150
2.000	9.800	0.100	98.0	0.005	5.00	0.0	0.600	o	150
1.003	9.850	0.090	109.4	0.005	0.00	0.0	0.600	o	150
3.000	6.280	0.060	104.7	0.005	5.00	0.0	0.600	o	150
3.001	2.580	0.020	129.0	0.005	0.00	0.0	0.600	o	150
3.002	3.320	0.040	83.0	0.005	0.00	0.0	0.600	o	150
1.004	4.700	0.047	100.0	0.000	0.00	0.0	0.600	o	150
4.000	3.460	0.035	100.0	0.005	5.00	0.0	0.600	o	150
1.005	1.050	0.030	35.0	0.000	0.00	0.0	0.600	o	150
1.006	60.000	2.525	23.8	0.000	0.00	0.0	0.600	o	150

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
1.000	85.560	0.005	0.0	1.01	17.9
1.001	85.460	0.010	0.0	1.18	20.8
1.002	85.440	0.015	0.0	0.95	16.8
2.000	85.470	0.005	0.0	1.02	17.9
1.003	85.370	0.025	0.0	0.96	17.0
3.000	85.400	0.005	0.0	0.98	17.4
3.001	85.340	0.010	0.0	0.88	15.6
3.002	85.320	0.015	0.0	1.10	19.5
1.004	85.280	0.040	0.0	1.00	17.8
4.000	85.270	0.005	0.0	1.00	17.8
1.005	84.150	0.045	0.0	1.71	30.2
1.006	84.120	0.045	0.0	2.07	36.7

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
MH01	89.000	3.440	Open Manhole	600	1.000	85.560	150				
MH02	87.000	1.540	Open Manhole	600	1.001	85.460	150	1.000	85.460	150	
MH03	87.000	1.560	Open Manhole	600	1.002	85.440	150	1.001	85.440	150	
MH04	87.690	2.220	Open Manhole	600	2.000	85.470	150				
MH05	86.950	1.580	Open Manhole	600	1.003	85.370	150	1.002	85.370	150	
								2.000	85.370	150	
MH06	87.650	2.250	Open Manhole	600	3.000	85.400	150				
MH07	86.950	1.610	Open Manhole	600	3.001	85.340	150	3.000	85.340	150	
MH08	86.950	1.630	Open Manhole	600	3.002	85.320	150	3.001	85.320	150	
MH09	86.400	1.120	Open Manhole	600	1.004	85.280	150	1.003	85.280	150	
								3.002	85.280	150	
MH10	86.750	1.480	Open Manhole	600	4.000	85.270	150				
TANK	86.070	1.920	Open Manhole	600	1.005	84.150	150	1.004	85.233	150	1083
								4.000	85.235	150	1085
OUTFALL	85.590	1.470	Open Manhole	1200	1.006	84.120	150	1.005	84.120	150	
	85.590	3.995	Open Manhole	0		OUTFALL		1.006	81.595	150	

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)
1.000	o	150	MH01	89.000	85.560	3.290	Open Manhole	600
1.001	o	150	MH02	87.000	85.460	1.390	Open Manhole	600
1.002	o	150	MH03	87.000	85.440	1.410	Open Manhole	600
2.000	o	150	MH04	87.690	85.470	2.070	Open Manhole	600
1.003	o	150	MH05	86.950	85.370	1.430	Open Manhole	600
3.000	o	150	MH06	87.650	85.400	2.100	Open Manhole	600
3.001	o	150	MH07	86.950	85.340	1.460	Open Manhole	600
3.002	o	150	MH08	86.950	85.320	1.480	Open Manhole	600
1.004	o	150	MH09	86.400	85.280	0.970	Open Manhole	600
4.000	o	150	MH10	86.750	85.270	1.330	Open Manhole	600
1.005	o	150	TANK	86.070	84.150	1.770	Open Manhole	600
1.006	o	150	OUTFALL	85.590	84.120	1.320	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)
1.000	9.830	98.3	MH02	87.000	85.460	1.390	Open Manhole	600
1.001	1.460	73.0	MH03	87.000	85.440	1.410	Open Manhole	600
1.002	7.810	111.6	MH05	86.950	85.370	1.430	Open Manhole	600
2.000	9.800	98.0	MH05	86.950	85.370	1.430	Open Manhole	600
1.003	9.850	109.4	MH09	86.400	85.280	0.970	Open Manhole	600
3.000	6.280	104.7	MH07	86.950	85.340	1.460	Open Manhole	600
3.001	2.580	129.0	MH08	86.950	85.320	1.480	Open Manhole	600
3.002	3.320	83.0	MH09	86.400	85.280	0.970	Open Manhole	600
1.004	4.700	100.0	TANK	86.070	85.233	0.687	Open Manhole	600
4.000	3.460	100.0	TANK	86.070	85.235	0.685	Open Manhole	600
1.005	1.050	35.0	OUTFALL	85.590	84.120	1.320	Open Manhole	1200
1.006	60.000	23.8		85.590	81.595	3.845	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.006		85.590	81.595	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 * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.900	Storm Duration (mins)	30
Ratio R	0.427		

Online Controls for Storm

Hydro-Brake® Manhole: TANK, DS/PN: 1.005, Volume (m³): 0.7

Design Head (m) 1.600 Hydro-Brake® Type Md7 Invert Level (m) 84.150
Design Flow (l/s) 1.0 Diameter (mm) 34

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.2	1.200	0.9	3.000	1.4	7.000	2.1
0.200	0.3	1.400	0.9	3.500	1.5	7.500	2.1
0.300	0.4	1.600	1.0	4.000	1.6	8.000	2.2
0.400	0.5	1.800	1.0	4.500	1.7	8.500	2.3
0.500	0.6	2.000	1.1	5.000	1.7	9.000	2.3
0.600	0.6	2.200	1.2	5.500	1.8	9.500	2.4
0.800	0.7	2.400	1.2	6.000	1.9		
1.000	0.8	2.600	1.3	6.500	2.0		

Storage Structures for Storm

Tank or Pond Manhole: TANK, DS/PN: 1.005

Invert Level (m) 84.150

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	14.0	0.660	14.0	1.320	14.0	1.321	0.0

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

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.427
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 20.900 Cv (Winter) 0.840

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

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

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	120 Winter	100	+40%	100/120 Winter				
1.001	120 Winter	100	+40%	100/15 Summer				
1.002	120 Winter	100	+40%	100/15 Summer				
2.000	120 Winter	100	+40%	100/15 Summer				
1.003	120 Winter	100	+40%	100/15 Summer				
3.000	120 Winter	100	+40%	100/15 Summer				
3.001	120 Winter	100	+40%	100/15 Summer				
3.002	120 Winter	100	+40%	100/15 Summer				
1.004	120 Winter	100	+40%	100/15 Summer				
4.000	120 Winter	100	+40%	100/60 Winter				
1.005	120 Winter	100	+40%	100/15 Summer				
1.006	120 Winter	100	+40%					

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	MH01	86.007	0.297	0.000	0.06	0.0	1.0	SURCHARGED
1.001	MH02	86.007	0.397	0.000	0.19	0.0	2.0	SURCHARGED
1.002	MH03	86.007	0.417	0.000	0.21	0.0	3.1	SURCHARGED
2.000	MH04	86.006	0.386	0.000	0.06	0.0	1.0	SURCHARGED
1.003	MH05	86.005	0.485	0.000	0.34	0.0	5.1	SURCHARGED
3.000	MH06	86.005	0.455	0.000	0.07	0.0	1.0	SURCHARGED

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

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m^3)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
3.001	MH07	86.004	0.514	0.000	0.19	0.0	2.0	SURCHARGED
3.002	MH08	86.004	0.534	0.000	0.24	0.0	3.1	SURCHARGED
1.004	MH09	86.003	0.573	0.000	0.60	0.0	8.2	SURCHARGED
4.000	MH10	86.002	0.582	0.000	0.09	0.0	1.0	SURCHARGED
1.005	TANK	86.002	1.702	0.000	0.10	0.0	1.0	FLOOD RISK
1.006	OUTFALL	84.137	-0.133	0.000	0.03	0.0	1.0	OK