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FLOOD RISK ASSESSMENT

HARTFORD END, FELSTED

Client: Stockplace Investments Ltd

Job no: SPD306

Revision: 01

Date: 27th November 2023

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Revision	Date issued	Description
00	18/09/2023	First issue
01	05/12/2023	Updated to include foul water

Document review and verification (current issue)

Author

George Westgarth

Reviewed and Approved by

Daniel Lee

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1. INTRODUCTION

SPD Studio has been appointed by Stockplace Investments Ltd to undertake a Flood Risk Assessment for a new residential development proposed on land adjacent to the former Ridley's Brewery Site, Hartford End, Felsted, Essex.

This report has been prepared to support an outline planning application, with all matters reserved but access to develop the existing site and provide up to 50 dwellings.

The site is situated entirely within Flood Zone 1 with a site boundary of 2.41ha. As such, a formal site-specific flood risk assessment is required in line with the principles outlined within the National Planning Policy Framework (NPPF) and accompanying web-based planning policy guidance.

The NPPF was first published in March 2012 and later updated in February 2019 and July 2021 by the Department for Communities & Local Government (now referred to as the Ministry of Housing, Communities and Local Government), and is now considered the standard for Flood Risk and Surface Water Management.

This report aims to demonstrate to the Local Planning Authority and Statutory Consultees that the existing site can be successfully developed whilst adhering to the requirements of the NPPF. Supporting evidence will be presented in the following sections of this report so to allow the planning application to be considered in terms of flood risk and surface water disposal.

Should additional detailed information be required with regards to flood risk and surface water disposal, it is anticipated that appropriate planning conditions will be recommended for future consideration.

2. EXISTING SITE PARAMETERS

2.1 SITE LOCATION

The proposed development the adjacent to the road B1417, Hartford End. The nearest postcode is CM3 1JY, grid reference TL 68743 17590.

The site is bound by the B1417B to the east, a residential development to the south and northeast, and agricultural land to the west and northwest. The application site boundary comprises an area of approximately 2.41ha and is greenfield land, as shown by Figures 1 and 2:

Figure 1 – Site Location

Figure 2 – Aerial Site Imagery

2.2 SITE TOPOGRAPHY

A detailed topographical survey of the existing development site was undertaken by Survey Solutions in July 2023 and all finished ground levels related to Ordnance Survey datum. The topographical survey confirms that the site is greenfield land throughout. The survey indicates that the site generally slopes to the south, with levels ranging from approximately 49.2m to 42.9m AOD. A copy of the detailed topographical survey has been provided within Appendix A of this report for further reference, along with an extract seen in Figure 3.

2.3 SITE GEOLOGY

The British Geological Survey map records show the site has a bedrock formation geology of London Clay throughout. This suggests that it will not be likely to use infiltration drainage techniques on site. An extract from the map can be seen on Figure 4.

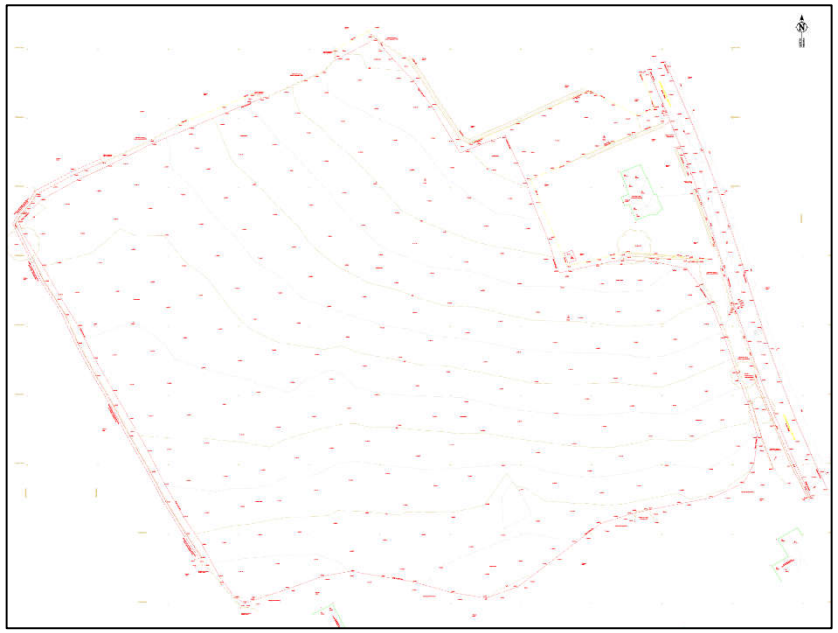


Figure 3 – Topographical Survey Extract

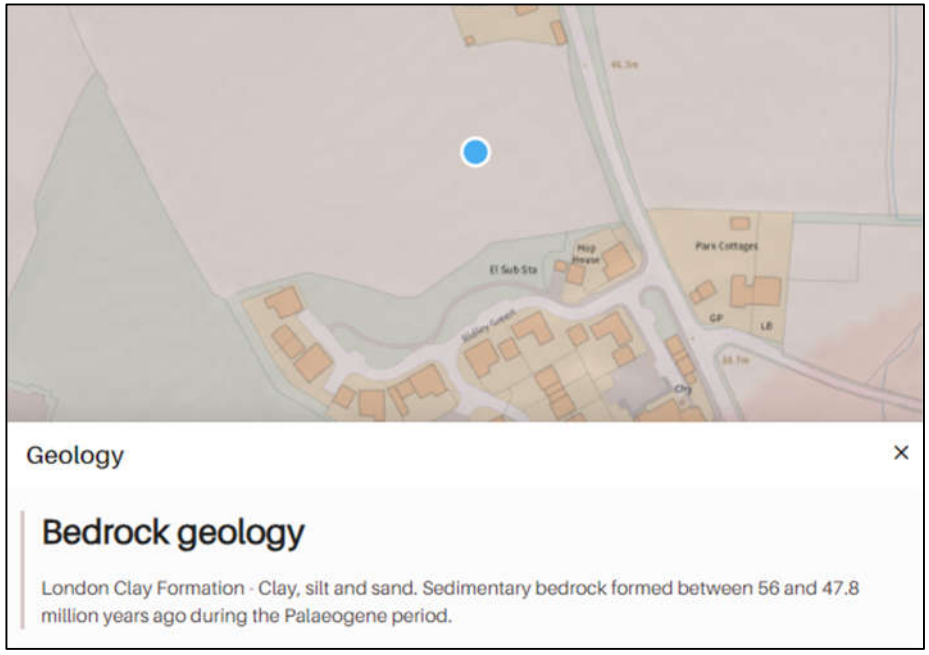


Figure 4 - British Geological Survey Map Extract

2.4 HYDROGEOLOGY

The Bedrock material for the site is classified as 'Unproductive' and therefore considered largely unable to provide usable water supplies and are unlikely to be depended upon by surface water or wetland ecosystems.

The site is located 0.7km east from a source protection zone catchment area. Therefore, it is classified as having low risk of groundwater vulnerability.

2.5 INFILTRATION FEASIBILITY

Adopting the national SuDS hierarchy, the use of infiltration techniques as a method of surface water disposal should be considered in the first instance. If infiltration can be successfully utilised, the required post-development surface water run-off attenuation provision could be reduced and would also help to replicate existing, pre-development surface water drainage conditions. There are no nearby borehole logs available to suggest soil makeup, but based off the BGS survey map it will likely be a non-infiltration formation of London Clay.

2.6 HYDROLOGY

Adopting the national SuDS hierarchy, in the absence of suitable infiltration soils, the next preferred option for the disposal of surface water from a development would be to an available nearby watercourse, of which a possible area has been identified in the vicinity of the application site.

The detailed topographical survey of the existing site confirms the site falls to the south west towards an assumed open watercourse. The watercourse was not able to be surveyed due to heavy vegetation and will need to be investigated at a later stage of development.

2.7 EXISTING PUBLIC SEWER ASSETS

The public sewer asset record plans obtained for the local area from Anglian Water confirm that there are no strategic public foul or surface water sewers within the vicinity of the site. Therefore it is likely that surface water will have to be discharged to the nearby watercourse. Foul ill be treated on site and the treated effluent will discharge into the surface water system.

3. FLOOD RISK ASSESSMENT

3.1 TIDAL + FLUVIAL FLOODING

The Environment Agency's indicative flood plain mapping indicates that the site is not deemed to be situated within the undefended flood plain of any nearby designated main river, watercourse or tidal estuary, as illustrated in Figure 5.

The site is therefore classified as being within Flood Zone 1, which is defined as land having a low probability of tidal or fluvial flooding (less than 0.1% annual probability).

The NPPF's Planning Practice Guidance (Flood Risk Vulnerability and Flood Zone Compatibility), Table 2, classifies residential schemes as a 'more vulnerable' land-class usage in term of flood risk. Therefore, in accordance with NPPF Annex 3: Flood Risk Vulnerability Classification, the site is considered appropriate for development.

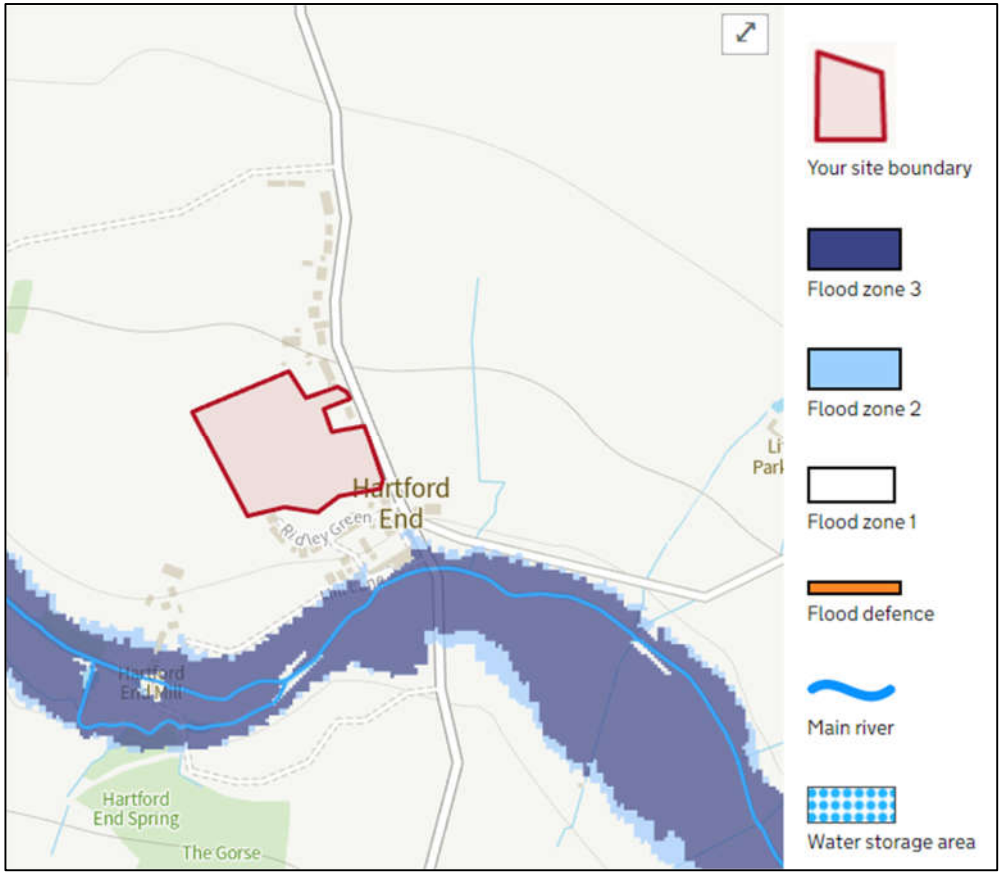


Figure 5 - Flood Zone Map

3.2 OTHER POTENTIAL SOURCES OF FLOODING

A further consultation of Environment Agency indicative flood map records shows that for surface water the site appears to have some areas of low risk to surface water (flooding for the low 1:100-year scenario) towards the western boundary. This is due to a ditch connecting to a local watercourse running from north to south. An assessment of the topo shows that the site falls to the west into the ditch, it is likely this is how the existing site drains surface water. This is shown illustrated in Figure 6.

Proposed finished floor levels to dwellings should adhere to normal good practice and be raised above existing ground levels, with external finishes designed to fall away from buildings. This should minimise the risk of minor localised ponding or overland surface flows from encroaching into proposed buildings.

Environment Agency records also confirm that the site is not shown to be affected by flooding as a result of a breach of a nearby reservoir.

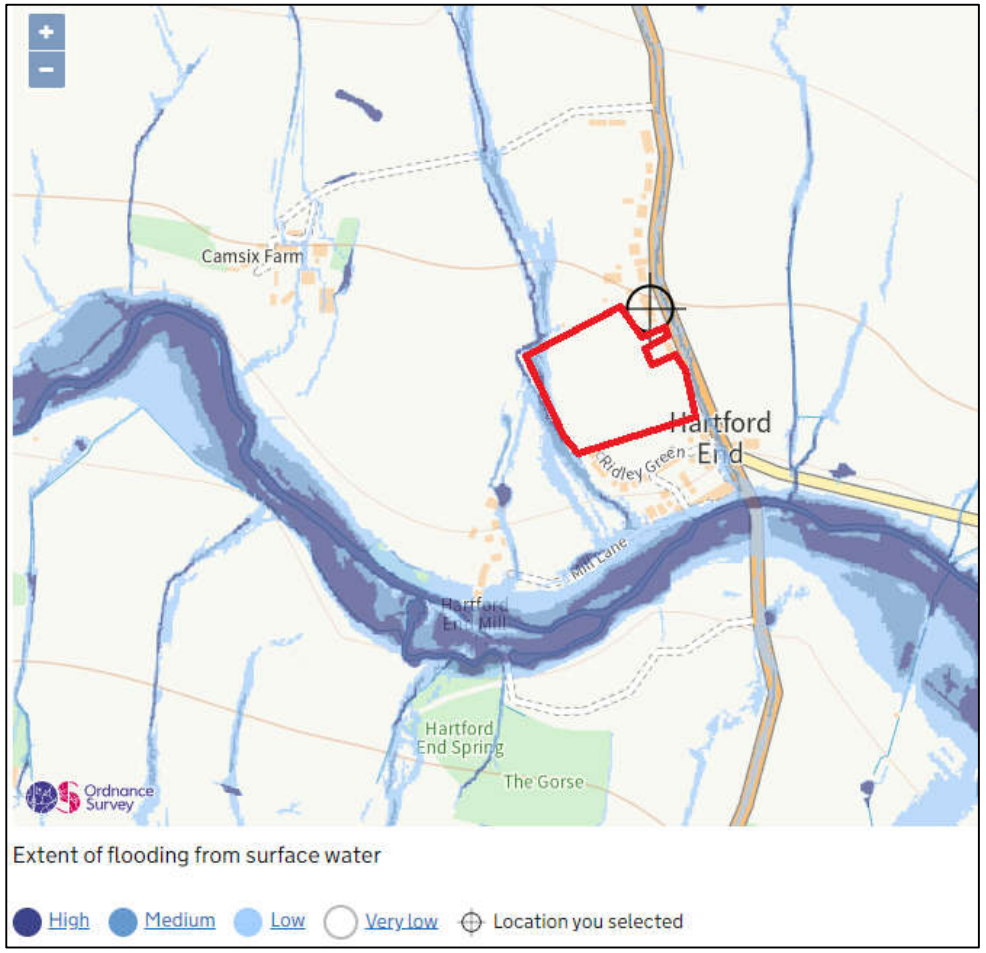


Figure 6 - Flood Risk from Surface Water

4. SURFACE WATER DRAINAGE STRATEGY

4.1 DEVELOPMENT PROPOSALS

An outline planning application, with all matters reserved but access is to be submitted to the local planning authority at Uttlesford District Council, which seeks permission to develop the land and construct up to 50 dwellings.

An illustrative layout for the proposed site has been prepared by SPD Studio Ltd which outlines the proposals, as illustrated in Figure 7.

A detailed version of the illustrative proposed layout plan has been provided within Appendix B of this report for further reference.

4.2 PRE-DEVELOPMENT DISCHARGE RATES

According to the topographical survey, the application site is greenfield and comprises an area of 2.41ha. The sites greenfield runoff rate has been calculated using Causeway Flow software to generate a peak surface water run-off rate of 4.7l/s for the 1:1 rainfall event as illustrated in Figure 8.

It is therefore concluded that the proposed site will look into discharging at a similar rate to the existing greenfield conditions of 4.7 l/s for a 1:100 year storm plus 45% climate change.

Figure 7 – Development Site Area

QBar (l/s) 5.5

Return Period (years)	Growth Factor	Q (l/s)
1	0.85	4.7
30	1.95	10.8
100	2.48	13.8

Figure 8 - Existing Greenfield Run-Off Rate

4.3 POST DEVELOPMENT CATCHMENT AREAS + RUN-OFF RATES

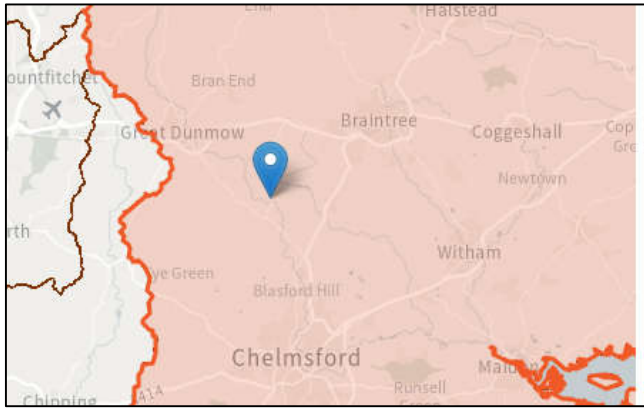
A total post-development impermeable area of 9,754m^2 has been calculated based on the illustrative proposed site layout, comprising roof areas, access roads and parking provisions, with the remainder of the site being permeable soft landscaping.

However, for the purposes of quantifying the impact of future urban creep, an additional 10% factor of safety has been applied to the total proposed house roof areas of 342m^2 to allow for any potential construction of domestic extensions or additional hardstandings. Consequently, a total impermeable area of 10,096m^2 (1.01ha) will be considered within the hydraulic modelling of the proposed surface water drainage scheme.

4.4 ATTENUATION PROVISION

The surface water drainage strategy for the development will adopt appropriate forms of sustainable drainage systems (SuDS) to comply with the requirements of the NPPF and to ensure that post-development surface water flood volumes are managed on-site in a sustainable manner.

Attenuation will be provided within the application site in order to manage the calculated peak run-off volumes required during rainfall events up to and including the 1:100-year + 45% climate change allowance in accordance with the Environment Agency's peak rainfall allowance guidance for sites within the Combined Essex Management Catchment, as shown by Figure 9.



1% annual exceedance rainfall event

Epoch

	Central allowance	Upper end allowance
2050s	20%	45%
2070s	25%	40%

*Use '2050s' for development with a lifetime up 2060 and use the 2070s epoch for development with a lifetime between 2061 and 2125.

Figure 9 – Peak Rainfall Climate Change Allowance

A preliminary assessment of the required attenuation provision for the development has been carried out based on the parameters outlined above, using the Causeway Flow hydraulic simulation software. The preliminary simulation results indicate that between 677m^3 and 884m^3 of storage will be required to manage the peak 1:100-year (including 45% climate change allowance) run-off volume generated by the development based on restricting discharge from the site to the Q1:1 year greenfield run-off rate, as shown in Figure 10.

This calculation is an initial estimate of the required attenuation volume at this stage and has been assessed in more detail in later sections of this report which includes detailed hydraulic modelling of the SuDS/Surface Water Drainage Strategy.

A Surface Water Drainage Strategy incorporating sustainable drainage systems (SuDS) has been prepared for the purposes of this assessment and to demonstrate how surface water run-off from the proposed development will be effectively managed and disposed of whilst simultaneously reducing the risk of flooding.

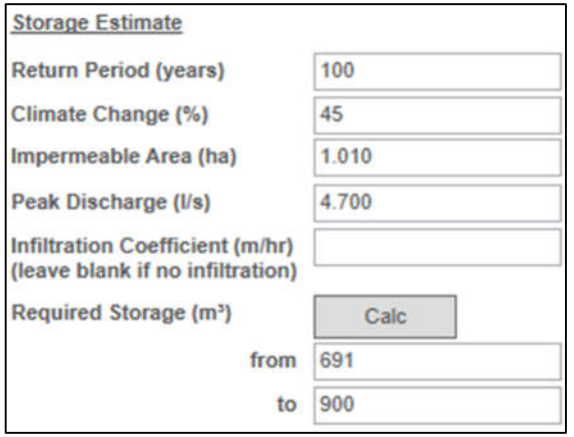


Figure 10 – Quick Storage Estimate

The key principles of the proposed surface water drainage strategy for the development are summarised as follows:

- Post-development surface water run-off will be restricted to 4.7 l/s for all storm events up to and including the 1:100-year event (inclusive of a 45% climate change).
- Surface water will be discharged from the site to the existing watercourse to the southwest of the site. The assumed IL must be confirmed prior to commencement of any construction.
- The proposed connection to the existing watercourse is proposed via an onsite hydrobrake. Surface water flows from the site internally at the calculated Q1:1yr greenfield run-off rate, before connecting to the watercourse and discharging via gravity.
- To facilitate the proposed connection to the open watercourse, it is acknowledged that formal consent from the LLFA will be required under Section 23 of the Land Drainage Act 1991 prior to commencement of works.
- Flood volumes will be stored and treated on site within two online SuDS attenuation basins located within the open space area in the southern area of the development site.
- Hydraulic modelling of the network demonstrates that the strategic network is capable of withstanding the 1:100-year peak rainfall event, inclusive of an additional 45% climate change allowance.

- All private individual driveways and visitor parking bays will be constructed using a lined permeable paving system to provide treatment at source before being conveyed to the strategic network. This will be determined at a later stage when a confirmed architectural strategy has been confirmed.

The surface water drainage strategy drawing SPD306-E-100-P01 has been included within Appendix D, and the detailed surface water network hydraulic simulation results have been provided within Appendix E of this report for reference.

The following series of tables outline the water quality assessment in accordance with CIRIA SuDS Manual 753. A residential scheme comprising 50 dwellings would fall within the low pollution hazard indices, as outlined in table 26.2, Chapter 26 of the CIRIA SuDS Manual 753.

Land-use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Residential roofs	**Very low**	**0.2**	**0.2**	**0.05**
Other roofs (typically commercial/industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (e.g. cul-de-sacs, home zones and general access roads) and non-residential car parking with infrequent change (e.g. schools, offices) i.e. < 300 traffic movements/day	**Low**	**0.5**	**0.4**	**0.4**
Commercial yard and delivery areas, non-residential car parking with frequent change (e.g. hospitals, retail), all roads except low traffic roads and trunk roads/motorways	Medium	0.7	0.6	0.7
Sites with heavy pollution (e.g. haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways	High	0.8	0.8	0.9

Table 1- Pollution Hazard Indices for Different Land-use Classifications

Type of SuDS component	Mitigation indices		
	TSS	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4	0.4	0.4
Swale	0.5	0.6	0.6
Bio retention system	0.8	0.8	0.8
Permeable Pavement	**0.7**	**0.6**	**0.7**
Detention Basin	**0.5**	**0.5**	**0.6**
Pond	0.7	0.7	0.5
Wetland	0.8	0.8	0.8
Downstream Defender (Proprietary Treatment System*)	0.5	0.4	0.8
*Proprietary treatment systems	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1-year return period event, for inflow concentrations relevant to the contributing drainage area.		

Table 2- Indicative SuDS Mitigation Indices

Individual property driveways, residential car parks, low traffic roads (e.g., cul-de-sacs, home zones and general access roads) and non-residential car parking with infrequent change (e.g., schools, offices) i.e., < 300 traffic movements/day			
	Required mitigation indices		
Source	**TSS**	**Metals**	**Hydro-carbons**
Site Total	0.7	0.6	0.45
Mitigation Indices			
Permeable Pavement *(Mitigation index$_1$)*	0.7	0.6	0.7
Detention Basin *(Mitigation index$_2$)*	0.25 (0.5 x 0.5)	0.25 (0.5 x 0.5)	0.3 (0.6 x 0.5)
Total Performance	0.95	0.85	1.0
Check	**Criteria Exceeded**	**Criteria Exceeded**	**Criteria Exceeded**

Table 3- Indicative SuDS Mitigation Criteria Assessment

The above tables 1-3 conclude that the proposed SuDS features provided in the drainage strategy satisfy the water quality treatment criteria for the type and size of the application site in accordance with CIRIA SuDS Manual 753.

To ensure that the system is regularly and appropriately managed and maintained, it is anticipated that the external drainage systems will be placed under a formal agreement with an independent Maintenance Company to carry out periodic inspections and any necessary remediation/maintenance works, thus safeguarding the long-term operational performance of the proposed drainage system and SuDS components within the development.

It is anticipated that a formal Maintenance & Management Plan/Statement will be required to protect the longevity of the scheme's drainage infrastructure and it is recommended that a planning condition is assigned to the outline planning permission to fulfil these criteria.

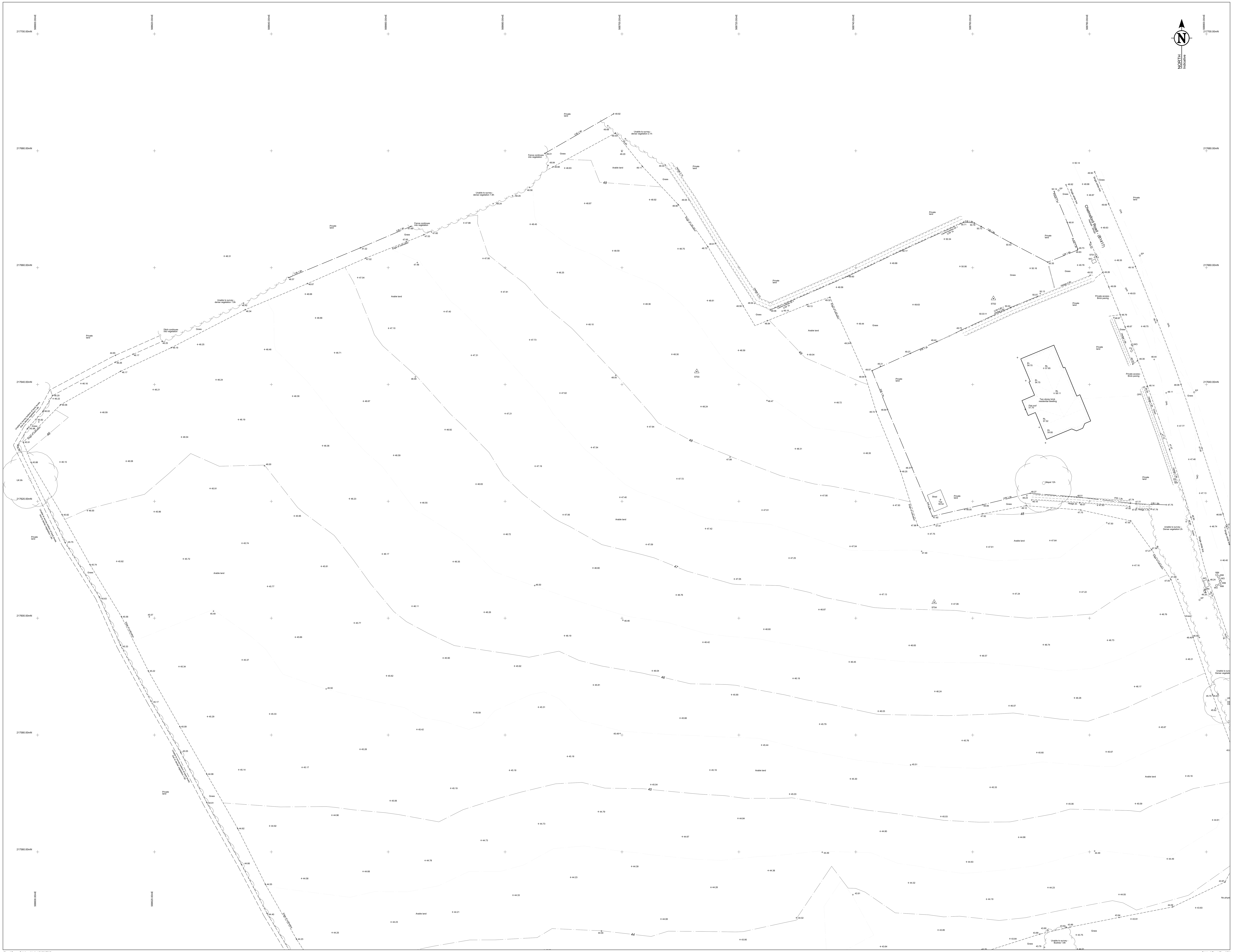
5. FOUL WATER DRAINAGE STRATEGY

The public sewer records for the local area have been obtained from the Statutory Sewerage Undertaker for the region (Anglian Water) which indicate that there is no existing foul water sewer network present within the vicinity of the site.

It is anticipated that foul water flows from the proposed development will be conveyed to a communal package foul water treatment device. Here it will be treated and cleansed to a standard acceptable to discharge with the surface water basins and then through into the existing ditch.

Formal consent from the LLFA will need to be sought under Section 23 once planning permission has been granted, prior to construction of the connection to the existing watercourse.

APPENDIX A- TOPOGRAPHICAL SURVEY



TOPOGRAPHICAL & MEASURED BUILDING SURVEYS

ABBREVIATIONS & SYMBOLS

AH	Arch Head Height	ER	Earth Rod	RSD	Roller Shutter Door
A/B	Air Brick	ET	EP+Transformer	RSJ	Rolled Steel Joist
AR	Assumed Route	FB	Flower Bed	SI	Sign Post
AV	Air Valve	FBD	Floor Board Direction	SP	Arch Spring Point Height
BB	Belisha Beacon	FH	Fire Hydrant	SV	Stop Valve
BH	Bore Hole	FL	Floor Level	SW	Surface Water
BL	Bed Level	FP	Flag Pole	SY	Cable Stay
BO	Bollard	FW	Foul Water	Tac	Tactile Paving
BrP	Brace Post	GG	Gully Grate	TC	Telecom Cover
BS	Bus Stop	GV	Gas Valve	TH	Trial Pit
BU	Bush	HH	Head Height	THL	Threshold Level
B/W	Barbed Wire Fence	IC	Inspection Cover	TL	Traffic Light
BX	Box (Utilities)	IL	Invert Level	ToW	Top of Wall
C/B	Close Board Fence	I/R	Iron Railings	TP	Telegraph Pole
CH	Cill Height	KO	Kerb Outlet	TS	Traffic Signal Cover
CL	Cover Level	LP	Lamp Post	TV	Cable TV Cover
C/L	Chain Link Fence	MH	Manhole	UB	Universal Beam
C-Lev	Ceiling Level	MP	Marker Post	UC	Unknown Cover
Col	Column	NB	Name Board	UK	Unknown Tree
C/P	Chestnut Paling Fence	OHL	Overhead Line (approx)	UMG	Unmade Ground
CR	Cable Riser	Pan	Panel Fence	USB	Under Side Beam
C/W	Chicken Wire	PB	Post Box	UTL	Unable To Lift
DC	Drainage Channel	PM	Parking Meter	UTS	Unable To Survey
DH	Door Head Height	PO	Post	VP	Vent Pipe
Dil.	Dilapidated	P/R	Post & Rail Fence	WB	Waste Bin
DP	Down Pipe	P/W	Post & Wire Fence	WH	Weep Hole
DR	Drain	P/Wall	Partition Wall	WL	Water Level
EBx	Electric Box	RE	Rodding Eye	WM	Water Meter
EC	Electric Supply Cover	RL	Ridge Level	WO	Wash Out
EL	Eaves Level	RP	Reflector Post	(X.XX)	Floor to Ceiling Height
EP	Electric Pole	RS	Road Sign	(X.XX)F/C	Floor to False Ceiling Ht
				△	Survey Control Station

DRAWING NOTES

Topographical Surveys

Trees are drawn to scale showing the average canopy spread. Descriptions and heights should be used as a guide only.

All building names, descriptions, number of storeys, construction type including roof line details are indicative only and taken externally from ground level.

All below ground details including drainage, voids and services have been identified from above ground and therefore all details relating to these features including; sizes, depth, description etc will be approximate only. All critical dimensions and connections should be checked and verified prior to starting work.

Detail, services and features may not have been surveyed if obstructed or not reasonably visible at the time of the survey.

Surveyed physical features may not necessarily represent the legal boundary line.

Measured Building Surveys

Measurements to internal walls are taken to the wall finishes at approx 1m above the floor level and the wall assumed to be vertical.

Cill heights are measured as floor to the cill and head heights are measured from cill to the top of window.

General

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SURVEY CONTROL CO-ORDINATES

STATIONS	EASTINGS	NORTHINGS	LEVEL	DESCRIPTION
ST01	568781.154	217661.921	49.419	PK Nail
ST02	568763.561	217654.706	50.033	Peg & Nail
ST03	568712.802	217642.209	48.456	Peg & Nail
ST04	568753.419	217602.723	47.233	Peg & Nail
ST05	568803.487	217615.671	46.538	PK Nail

SURVEY GRID AND LEVEL DATUM

The coordinate system established for this survey is related to Ordnance Survey (OS) national grid at a single point using Smartnet, then orientated to grid north with a scale factor of 1.000.

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To avoid discrepancies any coordinated data used in conjunction with this survey must be derived directly from this control data.

REV	DESCRIPTION	DRAWN	APPR	DATE

SURVEY SOLUTIONS

LAND SURVEYING
BUILDING SURVEYING
UNDERGROUND SURVEYING
SITE ENGINEERING
MONITORING

0845 040 5969
survey-solutions.co.uk

IPSWICH BEDFORD COVENTRY GLASGOW LONDON MANCHESTER NORWICH NOTTINGHAM YEOVIL

PROJECT TITLE CHELMSFORD ROAD, HARTFORD END, CHELMSFORD, ESSEX, CM3 1JY.				
DRAWING DETAIL TOPOGRAPHICAL SURVEY Sheet 1 of 2				
CLIENT SPD STUDIO				SCALE 1:200
SURVEYOR BM	SURVEY DATE 06.07.2023	CHECKED BY RC	APPROVED BY JLH	DWG STATUS FINAL
DRAWING NUMBER 50803IPLS-01			REVISION	ISSUE DATE 12.07.2023

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MONITORING

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IPSWICH BEDFORD COVENTRY GLASGOW LONDON MANCHESTER NORWICH NOTTINGHAM YEOVIL

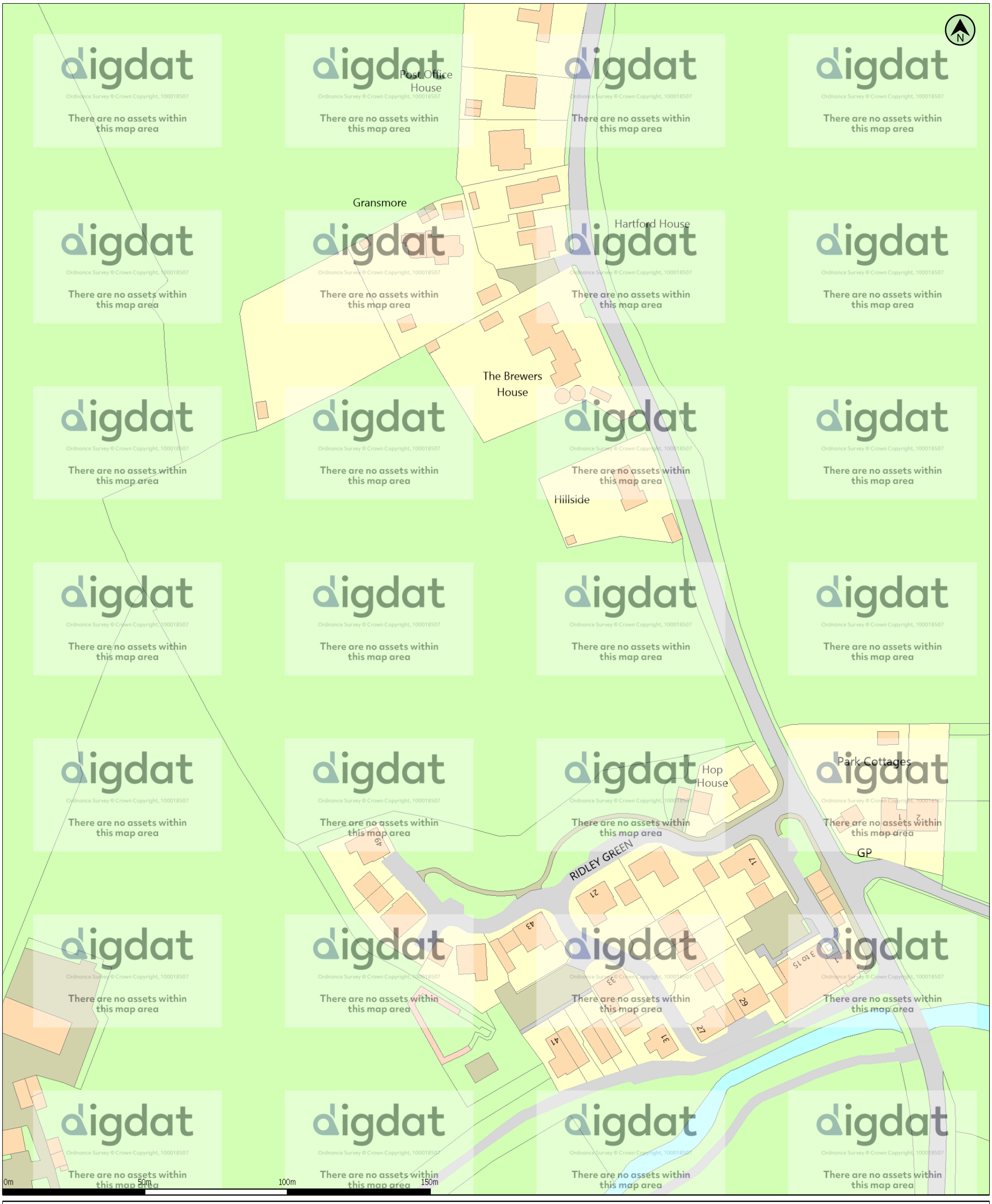
PROJECT TITLE
CHELMSFORD ROAD, HARTFORD END,
CHELMSFORD, ESSEX, CM3 1JY.

DRAWING DETAIL
TOPOGRAPHICAL SURVEY
Sheet 2 of 2

CLIENT				SCALE
SPD STUDIO				1:200
SURVEYOR	SURVEY DATE	CHECKED BY	APPROVED BY	DWG STATUS
BM	06.07.2023	RC	JLH	FINAL
DRAWING NUMBER		REVISION		ISSUE DATE
50803IPLS-02				12.07.2023

Original Sheet Size A0H

APPENDIX B- EXISTING PUBLIC SEWER ASSET RECORD PLANS



(c) Crown copyright and database rights 2023 Ordnance Survey 100019209 | Scale: 1:1250 | Date: 21/07/23 | Wastewater Plan A3

Data updated: 30/06/23 | Map Centre: 568729,217600 | Our Ref: 1231347 - 1 | Powered by digdat

Foul Sewer
Surface Sewer
Combined Sewer
Final Effluent
Rising Main*
Private Sewer*
Decommissioned Sewer*

Outfall*
Inlet*
Manhole*

Sewage Treatment Works
Public Pumping Station
Decommissioned Pumping Station

*(Colour denotes effluent type)

[redacted]

Hartford End Felsted

love every drop
anglianwater

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

APPENDIX C- ILLUSTRATIVE PROPOSED SITE LAYOUT

MIX

	1B	2B	3B	4B	5B	Total
Private Sale	0	14	7	6	3	30
Affordable Rent	3	7	4	0	0	14
Shared Ownership	0	1	0	0	0	1
First Home	0	3	2	0	0	5
Total:						50 houses

Key:

V Visitor Parking Space

The Brewers House
Public Open Space
Hillside
Footpath Access
B1417
PRIVATE DRIVE
SHARED SURFACE
ACCESS ROAD
Site Entrance
Attenuation Basin
LAP
Public Open Space
RIDLEY GREEN

1:1000
0m 10m 30m 60m

PROPOSED ILLUSTRATIVE SITE LAYOUT PLAN

Rev.	Amendment	Date

SPD STUDIO
SUSTAINABLE . PLANNING . DESIGN

RESIDENTIAL DEVELOPMENT

PROP ILLUSTRATIVE SITE LAYOUT PLAN

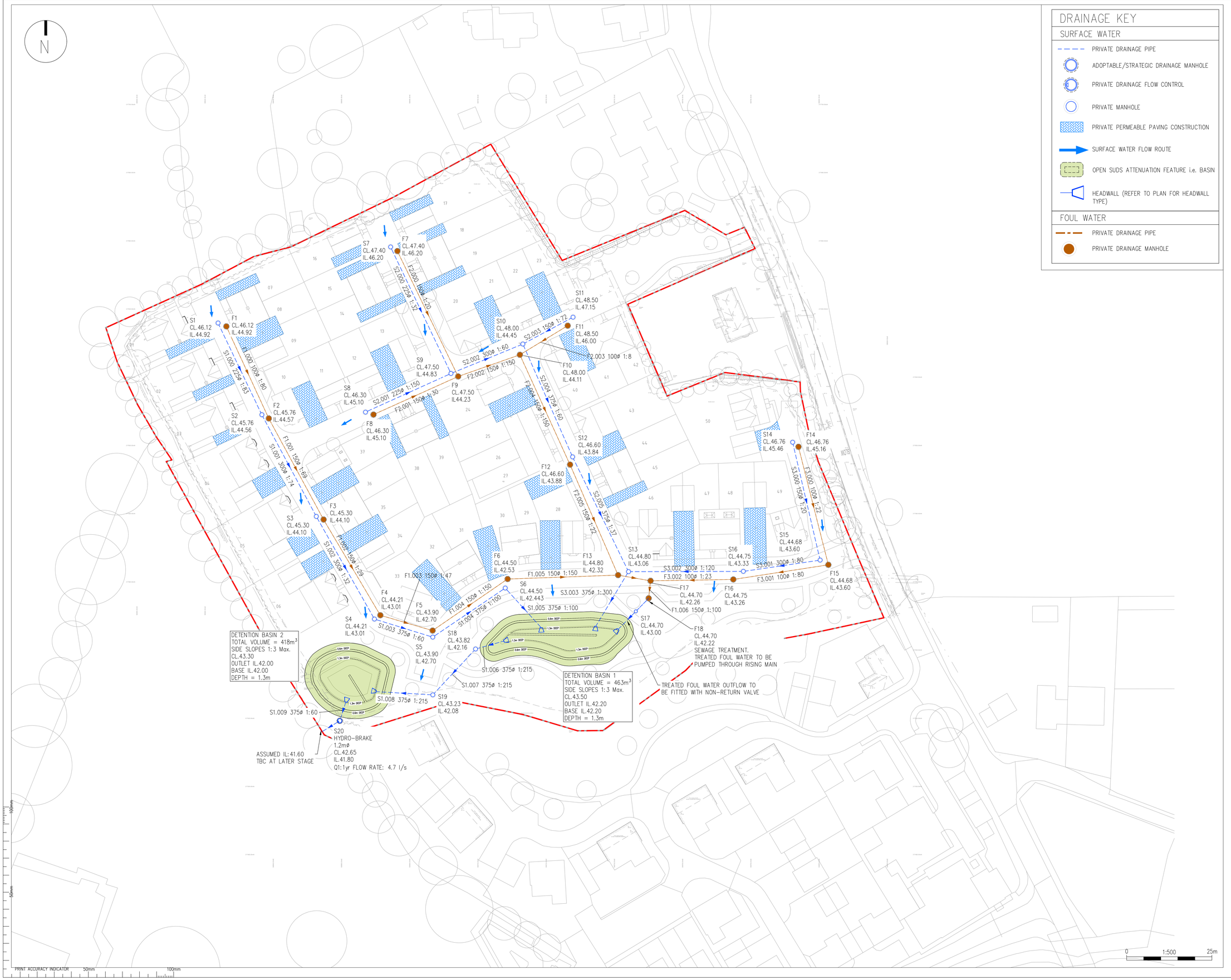
STOCKPLACE INVESTMENTS LTD

LAND AT CHELMSFORD ROAD
HARTFORD END
CM3 1JY

SPD306.300.01 1:1000 @ A3 07.07.2023

WWW.SPD-STUDIO.CO.UK

APPENDIX D – DRAINAGE STRATEGY PLAN



DRAINAGE KEY

SURFACE WATER

- PRIVATE DRAINAGE PIPE
- ADOPTABLE/STRATEGIC DRAINAGE MANHOLE
- PRIVATE DRAINAGE FLOW CONTROL
- PRIVATE MANHOLE
- PRIVATE PERMEABLE PAVING CONSTRUCTION
- SURFACE WATER FLOW ROUTE
- OPEN SUDS ATTENUATION FEATURE i.e. BASIN
- HEADWALL (REFER TO PLAN FOR HEADWALL TYPE)

FOUL WATER

- PRIVATE DRAINAGE PIPE
- PRIVATE DRAINAGE MANHOLE

DRAINAGE STRATEGY NOTES

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELATED ENGINEERS, ARCHITECTS & SUB-CONTRACTORS DRAWINGS. IN THE CASE OF DISCREPANCIES BETWEEN DRAWINGS REFER TO SPD STUDIO FOR CLARIFICATION.
2. TOPOGRAPHICAL SURVEY UNDERTAKEN BY SURVEY SOLUTIONS, DRAWING REF. 50803IPLS-01_02 DATED JULY 2023.
3. THIS DRAWING IS BASED ON THE PROPOSED **SITE PLAN PRODUCED BY SPD STUDIO LTD, DRAWING REF. SPD306_300_01 DATED JULY 2023.**
4. RAIN WATER PIPE & SOIL AND VENT PIPE LOCATIONS ARE TO BE CONFIRMED AT THE DETAILED DESIGN STAGE.
5. ALL INVERT AND COVER LEVELS ARE TO BE CONFIRMED AT THE DETAILED DESIGN STAGE.
6. PROPOSED SURFACE AND FOUL WATER DRAINAGE CONNECTIONS TO THE EXISTING WATER COURSE IS SUBJECT TO APPROVAL BY THE LEAD LOCAL FLOOD AUTHORITY.
7. THIS LAYOUT INDICATES THE MAIN ADOPTABLE DRAINAGE RUNS FOR THE DEVELOPMENT. PRIVATE, BELOW GROUND DRAINAGE IS TO BE CONSIDERED AT DETAILED DESIGN STAGE.
8. EXACT POSITION, TYPE AND NUMBER OF ABOVE GROUND DRAINAGE POINTS TO BE CONFIRMED BY ARCHITECT DURING THE DETAILED DESIGN STAGE. THEREFORE ALLOWANCE SHOULD BE MADE FOR INDIVIDUAL DRAINAGE CONNECTIONS ACCORDINGLY.
9. EXTERNAL LEVELS AT LEVEL THRESHOLDS TO BE DESIGNED TO HAVE SUFFICIENT FALL AWAY FROM STRUCTURE TO OMIT THE NEED FOR THRESHOLD DRAINS.
10. FOOTWAYS AND PATIO AREAS TO BE LAID TO FALL TO SOFT LANDSCAPED AREAS. LANDSCAPED AREAS TO BE NO HIGHER THAN ADJACENT HARD STANDING AREAS.
11. FINISHED FLOOR LEVELS TO BE TYPICALLY 150mm ABOVE EXISTING SITE LEVELS.

DRAINAGE STRATEGY DESIGN CRITERIA:

1. PRELIMINARY SURFACE WATER ATTENUATION SIMULATIONS HAVE IDENTIFIED A POTENTIAL STORAGE REQUIREMENT OF 677-884m³ TO ACCOMMODATE A 1:100 YEAR RAINFALL EVENT (INCLUDING AN ADDITIONAL 45% FOR ANY POTENTIAL CLIMATE CHANGE IMPACT) BASED ON THE FOLLOWING DESIGN PARAMETERS:

   M5-60mm = 20.000mm
   RATIO, R = 0.400
   IMPERMEABLE AREA = 1.01 HECTARES
   1:100yr (+45%) DISCHARGE RATE = 4.7 l/s

2. THE SURFACE WATER DETAILS ILLUSTRATED ON THIS PLAN ARE SUBJECT TO HYDRAULIC MODELING DURING THE DETAILED DESIGN STAGE TO ESTABLISH THE PEAK WATER LEVEL ASSOCIATED WITH A 1:100 YEAR RAINFALL EVENT (INCLUDING CLIMATE CHANGE).
3. EXISTING WATERCOURSE COVER AND INVERT LEVEL TO BE CONFIRMED AT A LATER STAGE.

NOT FOR CONSTRUCTION

REV	DESCRIPTION	DRAWN	CHECKED	DATE
P03	UPDATED TO INCLUDE FOUL WATER NETWORK	GW	JR	05.12.23
P02	UPDATED TO SUIT CLIENT COMMENTS	GW	DL	04.08.23
P01	FIRST ISSUE	GW	DL	20.07.23

SPD STUDIO
SUSTAINABLE . PLANNING . DESIGN
Unit 5 Tollgate Business Park, Colchester, CO8 8AB
T. 01206 265 224 | E. info@spd-studio.co.uk | W. www.spd-studio.co.uk

CLIENT
STOCKPLACE INVESTMENTS LTD

PROJECT TITLE
LAND AT CHELMSFORD ROAD, HARTFORD END, FELSTED

DRAWING TITLE
DRAINAGE STRATEGY LAYOUT

SCALE	DRAWING STATUS
1:500 @ A1	PLANNING

DRAWN BY	CHECKED BY	APPROVED BY	DATE
GW	EJS	DL	JULY 2023

DRAWING NO. SPD306-E-100
REV P03

APPENDIX E – SURFACE WATER DRAINAGE SIMULATION OUTPUTS

Links

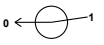
Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
S1.004	S5	S6	25.671	0.600	42.700	42.443	0.257	100.0	375	6.22	50.0
S2.001	S8	S9	27.519	0.600	45.100	44.917	0.183	150.0	225	5.43	50.0
S2.003	S11	S10	16.692	0.600	47.150	46.917	0.233	71.6	150	5.23	50.0
S3.000	S14	S15	35.505	0.600	45.460	43.600	1.860	19.1	150	5.26	50.0
S.3001	S15	S16	22.761	0.600	43.600	43.177	0.423	53.8	300	5.43	50.0
S3.002	S16	S13	33.656	0.600	43.177	42.920	0.257	131.0	300	5.84	50.0
S1.007	S18	S19	18.385	0.600	42.100	42.075	0.025	735.4	525	7.23	50.0
S1.008	S19	Pond	16.687	0.600	42.075	42.000	0.075	222.5	525	7.41	50.0
S1.005	S6	Swale	15.611	0.600	42.368	42.200	0.168	92.9	375	6.36	50.0
S1.009	Pond	S20	13.654	0.600	42.000	41.800	0.200	68.3	375	7.52	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
S1.004	1.812	200.1	42.6	0.825	1.682	0.314	0.0	117	1.450
S2.001	1.065	42.3	12.2	0.975	2.358	0.090	0.0	82	0.922
S2.003	1.189	21.0	8.9	1.200	0.933	0.066	0.0	68	1.142
S3.000	2.316	40.9	5.7	1.150	0.930	0.042	0.0	38	1.638
S.3001	2.148	151.8	11.4	0.780	1.273	0.084	0.0	55	1.280
S3.002	1.372	97.0	20.5	1.273	1.580	0.151	0.0	93	1.093
S1.007	0.818	177.1	136.4	1.195	0.800	1.006	0.1	347	0.899
S1.008	1.497	324.1	136.4	0.800	0.775	1.006	0.1	237	1.435
S1.005	1.880	207.6	51.2	1.757	0.925	0.378	0.0	126	1.567
S1.009	2.195	242.5	148.8	0.925	0.475	1.097	0.1	213	2.302

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S1	568623.348	217636.328	46.120	1.200	1200	0	S1.000	44.920	225
S2	568636.188	217609.422	45.760	1.200	1200	1	S1.000	44.560	225
						0	S1.001	44.560	300
S3	568652.149	217579.614	45.300	1.200	1200	1	S1.001	44.100	300
						0	S1.002	44.100	300
S6	568707.540	217558.608	44.500	2.132	1350	1	S1.004	42.443	375
						0	S1.005	42.368	375
S7	568673.927	217658.644	47.400	1.200	1200	0	S2.000	46.200	225
S9	568691.635	217621.537	47.500	2.583	1200	1	S2.001	44.917	225
						2	S2.000	44.917	225
						0	S2.002	44.917	300
S12	568727.285	217597.067	46.600	2.666	1350	1	S2.004	43.934	375
						0	S2.005	43.934	375
S10	568712.713	217630.163	48.000	3.463	1350	1	S2.003	46.917	150
						2	S2.002	44.537	300
						0	S2.004	44.537	375
S13	568743.686	217563.426	44.800	1.880	1350	1	S3.002	42.920	300
						2	S2.005	42.920	375
						0	S3.003	42.920	375

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
Pond	568669.648	217528.242	43.300	1.300		1	S1.008	42.000	525
									
						0	S1.009	42.000	375
Swale	568718.077	217547.089	43.500	1.300		1	S1.005	42.200	375
						2	S3.003	42.826	375
									
						0	S1.006	42.200	375
S20	568659.020	217519.670	42.650	0.850	1350	1	S1.009	41.800	375
									
S5	568686.287	217544.209	43.900	1.200	1350	1	S1.003	42.700	375
									
						0	S1.004	42.700	375
S4	568669.199	217549.518	44.210	1.200	1350	1	S1.002	43.010	300
									
						0	S1.003	43.010	375
S8	568666.560	217610.200	46.300	1.200	1200				
						0	S2.001	45.100	225
S11	568727.423	217638.052	48.500	1.350	1200				
						0	S2.003	47.150	150
S14	568791.804	217601.371	46.760	1.300	1200				
						0	S3.000	45.460	150
S15	568799.863	217566.793	44.680	1.080	1200	1	S3.000	43.600	150
									
						0	S.3001	43.600	300
S16	568777.342	217563.495	44.750	1.573	1200	1	S.3001	43.177	300
									
						0	S3.002	43.177	300
S18	568698.846	217540.733	43.820	1.720	1500	1	S1.006	42.100	375
									
						0	S1.007	42.100	525
S19	568686.308	217527.287	43.400	1.325	1500	1	S1.007	42.075	525
									
						0	S1.008	42.075	525

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal	30 year (l/s)	10.8
FSR Region	England and Wales	Skip Steady State	x	100 year (l/s)	13.8
M5-60 (mm)	20.000	Drain Down Time (mins)	240	Check Discharge Volume	✓
Ratio-R	0.400	Additional Storage (m³/ha)	0.0	100 year 360 minute (m³)	
Summer CV	0.750	Check Discharge Rate(s)	✓		
Winter CV	0.840	1 year (l/s)	4.7		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0	100	0	0	0
30	35	0	0	100	45	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	SPR	0.37	Betterment (%)	0
Greenfield Method	IH124	Region	6	QBar	5.5
Positively Drained Area (ha)	2.410	Growth Factor 1 year	0.85	Q 1 year (l/s)	4.7
SAAR (mm)	579	Growth Factor 30 year	1.95	Q 30 year (l/s)	10.8
Soil Index	3	Growth Factor 100 year	2.48	Q 100 year (l/s)	13.8

Pre-development Discharge Volume

Site Makeup	Greenfield	SPR	0.37	Storm Duration (mins)	360
Greenfield Method	FSR/FEH	CWI		Betterment (%)	0
Positively Drained Area (ha)	2.410	Return Period (years)	100	PR	
Soil Index	3	Climate Change (%)	0	Runoff Volume (m^3)	

Node Pond Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Downstream Link	S1.009	Sump Available	✓
Replaces Downstream Link	✓	Product Number	CTL-SHE-0098-4700-1300-4700
Invert Level (m)	42.000	Min Outlet Diameter (m)	0.150
Design Depth (m)	1.300	Min Node Diameter (mm)	1200
Design Flow (l/s)	4.7		

Node Swale Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	42.200
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

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	138.0	0.0	0.600	380.0	0.0	1.300	562.0	0.0

Node Pond Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	42.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m^2)	Inf Area (m^2)	Depth (m)	Area (m^2)	Inf Area (m^2)
0.000	174.2	0.0	1.300	463.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	10	44.989	0.069	12.0	0.0782	0.0000	OK
15 minute winter	S2	10	44.652	0.092	24.1	0.1038	0.0000	OK
15 minute winter	S3	11	44.172	0.072	25.4	0.0813	0.0000	OK
15 minute winter	S6	11	42.501	0.133	51.8	0.1897	0.0000	OK
15 minute winter	S7	10	46.251	0.051	10.5	0.0575	0.0000	OK
15 minute winter	S9	10	45.017	0.100	33.5	0.1130	0.0000	OK
15 minute winter	S12	11	44.044	0.110	63.1	0.1573	0.0000	OK
15 minute winter	S10	10	44.653	0.116	51.1	0.1666	0.0000	OK
15 minute winter	S13	11	43.164	0.244	86.3	0.3490	0.0000	OK
360 minute winter	Pond	296	42.409	0.409	21.4	89.8914	0.0000	SURCHARGED
360 minute winter	Swale	296	42.409	0.209	21.6	37.7109	0.0000	OK
15 minute summer	S20	1	41.800	0.000	4.5	0.0000	0.0000	OK
15 minute winter	S5	11	42.824	0.124	42.9	0.1770	0.0000	OK
15 minute winter	S4	11	43.107	0.097	36.6	0.1381	0.0000	OK
15 minute winter	S8	10	45.185	0.085	12.7	0.0966	0.0000	OK
15 minute winter	S11	10	47.223	0.073	9.3	0.0820	0.0000	OK
15 minute winter	S14	10	45.498	0.038	5.9	0.0434	0.0000	OK
15 minute winter	S15	10	43.656	0.056	11.7	0.0631	0.0000	OK
15 minute winter	S16	11	43.270	0.093	21.0	0.1050	0.0000	OK
360 minute winter	S18	296	42.409	0.309	20.8	0.5464	0.0000	OK
360 minute winter	S19	296	42.409	0.334	20.2	0.5905	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	S1.000	S2	11.9	0.930	0.207	0.3809	
15 minute winter	S2	S1.001	S3	23.7	1.530	0.183	0.5257	
15 minute winter	S3	S1.002	S4	25.3	1.566	0.128	0.5622	
15 minute winter	S6	S1.005	Swale	51.7	1.952	0.249	0.6495	
15 minute winter	S7	S2.000	S9	10.4	0.891	0.113	0.4876	
15 minute winter	S9	S2.002	S10	32.8	1.444	0.228	0.5211	
15 minute winter	S12	S2.005	S13	63.4	1.279	0.192	1.9224	
15 minute winter	S10	S2.004	S12	51.0	1.826	0.197	1.0108	
15 minute winter	S13	S3.003	Swale	85.0	1.213	0.768	2.1368	
120 minute winter	Pond	Hydro-Brake®	S20	4.7				87.1
30 minute winter	Swale	S1.006	S18	71.2	1.149	0.508	1.2552	
15 minute winter	S5	S1.004	S6	43.3	1.422	0.216	0.7816	
15 minute winter	S4	S1.003	S5	36.7	1.364	0.139	0.4835	
15 minute winter	S8	S2.001	S9	12.5	0.812	0.295	0.4240	
15 minute winter	S11	S2.003	S10	9.2	1.120	0.436	0.1365	
15 minute winter	S14	S3.000	S15	5.8	1.237	0.143	0.1688	
15 minute winter	S15	S.3001	S16	11.6	0.855	0.076	0.3133	
15 minute winter	S16	S3.002	S13	20.6	0.537	0.212	1.3440	
30 minute winter	S18	S1.007	S19	70.7	1.026	0.399	1.6340	
30 minute winter	S19	S1.008	Pond	69.8	1.646	0.215	1.9400	

Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 99.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	10	45.063	0.143	39.6	0.1616	0.0000	OK
15 minute winter	S2	10	44.743	0.183	79.8	0.2075	0.0000	OK
15 minute winter	S3	10	44.235	0.135	84.5	0.1527	0.0000	OK
720 minute winter	S6	705	43.001	0.633	13.9	0.9062	0.0000	SURCHARGED
15 minute winter	S7	10	46.295	0.095	34.6	0.1072	0.0000	OK
15 minute winter	S9	10	45.135	0.218	110.3	0.2465	0.0000	OK
15 minute winter	S12	11	44.227	0.293	208.8	0.4194	0.0000	OK
15 minute winter	S10	10	44.771	0.234	168.4	0.3346	0.0000	OK
15 minute winter	S13	11	43.822	0.902	275.1	1.2907	0.0000	SURCHARGED
720 minute winter	Pond	705	43.001	1.001	22.2	285.7399	0.0000	FLOOD RISK
720 minute winter	Swale	705	43.001	0.801	36.8	237.1358	0.0000	SURCHARGED
15 minute summer	S20	1	41.800	0.000	4.7	0.0000	0.0000	OK
720 minute winter	S5	705	43.001	0.301	11.5	0.4311	0.0000	OK
15 minute winter	S4	10	43.213	0.203	122.4	0.2901	0.0000	OK
15 minute winter	S8	10	45.302	0.202	41.9	0.2285	0.0000	OK
15 minute winter	S11	11	47.606	0.456	30.8	0.5153	0.0000	SURCHARGED
15 minute winter	S14	10	45.533	0.073	19.6	0.0825	0.0000	OK
15 minute winter	S15	11	43.997	0.397	39.0	0.4493	0.0000	SURCHARGED
15 minute winter	S16	11	43.963	0.786	65.0	0.8885	0.0000	SURCHARGED
720 minute winter	S18	705	43.001	0.901	19.0	1.5920	0.0000	SURCHARGED
720 minute winter	S19	705	43.001	0.926	18.9	1.6369	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	S1.000	S2	39.2	1.272	0.686	0.9132	
15 minute winter	S2	S1.001	S3	78.9	2.077	0.608	1.2828	
15 minute winter	S3	S1.002	S4	83.7	2.056	0.423	1.4076	
15 minute winter	S6	S1.005	Swale	170.2	2.291	0.820	1.7006	
15 minute winter	S7	S2.000	S9	34.4	1.168	0.373	1.1358	
15 minute winter	S9	S2.002	S10	108.9	1.923	0.757	1.2953	
15 minute winter	S12	S2.005	S13	204.0	1.916	0.618	3.7936	
15 minute winter	S10	S2.004	S12	167.9	2.269	0.649	2.9620	
15 minute winter	S13	S3.003	Swale	273.0	2.476	2.467	3.3130	
15 minute summer	Pond	Hydro-Brake®	S20	4.7				68.5
15 minute winter	Swale	S1.006	S18	186.2	1.689	1.329	2.2340	
15 minute winter	S5	S1.004	S6	143.4	1.870	0.717	1.9686	
15 minute winter	S4	S1.003	S5	121.4	1.720	0.460	1.2599	
15 minute winter	S8	S2.001	S9	40.9	1.068	0.967	1.0593	
15 minute winter	S11	S2.003	S10	29.6	1.684	1.411	0.2909	
15 minute winter	S14	S3.000	S15	19.5	1.778	0.476	0.4633	
15 minute summer	S15	S.3001	S16	37.6	1.086	0.248	1.6028	
15 minute winter	S16	S3.002	S13	63.6	0.904	0.656	2.3700	
15 minute winter	S18	S1.007	S19	184.6	1.327	1.043	3.8523	
15 minute winter	S19	S1.008	Pond	181.1	2.091	0.559	3.5809	

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	10	45.059	0.139	38.2	0.1569	0.0000	OK
15 minute winter	S2	10	44.739	0.179	76.9	0.2023	0.0000	OK
15 minute winter	S3	10	44.232	0.132	81.3	0.1493	0.0000	OK
720 minute winter	S6	705	42.964	0.596	13.4	0.8522	0.0000	SURCHARGED
15 minute winter	S7	10	46.293	0.093	33.3	0.1047	0.0000	OK
15 minute winter	S9	10	45.128	0.211	106.3	0.2388	0.0000	OK
15 minute winter	S12	11	44.203	0.269	201.1	0.3845	0.0000	OK
15 minute winter	S10	10	44.765	0.228	162.1	0.3260	0.0000	OK
15 minute winter	S13	11	43.764	0.844	264.0	1.2079	0.0000	SURCHARGED
720 minute winter	Pond	705	42.963	0.963	21.3	270.9427	0.0000	SURCHARGED
720 minute winter	Swale	705	42.964	0.764	39.9	221.0276	0.0000	SURCHARGED
15 minute summer	S20	1	41.800	0.000	4.7	0.0000	0.0000	OK
720 minute winter	S5	705	42.964	0.264	11.1	0.3772	0.0000	OK
15 minute winter	S4	10	43.207	0.197	117.8	0.2822	0.0000	OK
15 minute winter	S8	10	45.290	0.190	40.4	0.2150	0.0000	OK
15 minute winter	S11	11	47.565	0.415	29.6	0.4688	0.0000	SURCHARGED
15 minute winter	S14	10	45.531	0.071	18.9	0.0807	0.0000	OK
15 minute winter	S15	11	43.923	0.323	37.7	0.3650	0.0000	SURCHARGED
15 minute winter	S16	11	43.889	0.712	62.5	0.8054	0.0000	SURCHARGED
600 minute winter	S18	600	42.963	0.863	20.9	1.5250	0.0000	SURCHARGED
720 minute winter	S19	705	42.964	0.889	18.3	1.5707	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	S1.000	S2	37.8	1.260	0.660	0.8876	
15 minute winter	S2	S1.001	S3	75.9	2.061	0.585	1.2452	
15 minute winter	S3	S1.002	S4	80.5	2.042	0.407	1.3653	
15 minute winter	S6	S1.005	Swale	164.9	2.278	0.794	1.6502	
15 minute winter	S7	S2.000	S9	33.0	1.159	0.358	1.1124	
15 minute winter	S9	S2.002	S10	104.8	1.909	0.729	1.2571	
15 minute winter	S12	S2.005	S13	198.8	1.889	0.602	3.6455	
15 minute winter	S10	S2.004	S12	161.6	2.283	0.625	2.7789	
15 minute winter	S13	S3.003	Swale	260.9	2.365	2.357	3.3046	
15 minute summer	Pond	Hydro-Brake®	S20	4.7				68.6
15 minute winter	Swale	S1.006	S18	182.4	1.654	1.301	2.2340	
15 minute winter	S5	S1.004	S6	138.3	1.876	0.691	1.8919	
15 minute winter	S4	S1.003	S5	116.8	1.710	0.443	1.2200	
15 minute winter	S8	S2.001	S9	39.6	1.061	0.935	1.0253	
15 minute winter	S11	S2.003	S10	28.5	1.620	1.357	0.2909	
15 minute winter	S14	S3.000	S15	18.8	1.760	0.458	0.4592	
15 minute summer	S15	S.3001	S16	38.0	1.079	0.250	1.4628	
15 minute winter	S16	S3.002	S13	61.0	0.866	0.629	2.3700	
15 minute winter	S18	S1.007	S19	180.7	1.319	1.020	3.7770	
15 minute winter	S19	S1.008	Pond	177.6	2.102	0.548	3.5525	

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	10	45.111	0.191	55.2	0.2163	0.0000	OK
15 minute winter	S2	10	44.794	0.234	110.9	0.2651	0.0000	OK
15 minute winter	S3	10	44.264	0.164	117.6	0.1856	0.0000	OK
960 minute winter	S6	930	43.272	0.904	15.1	1.2943	0.0000	SURCHARGED
15 minute winter	S7	11	46.336	0.136	48.2	0.1539	0.0000	OK
15 minute winter	S9	12	45.979	1.062	142.4	1.2009	0.0000	SURCHARGED
15 minute winter	S12	11	45.059	1.125	262.2	1.6101	0.0000	SURCHARGED
15 minute winter	S10	11	45.551	1.014	211.1	1.4512	0.0000	SURCHARGED
15 minute winter	S13	11	44.270	1.350	358.3	1.9313	0.0000	SURCHARGED
960 minute winter	Pond	930	43.272	1.272	23.1	401.4240	0.0000	FLOOD RISK
960 minute winter	Swale	930	43.272	1.072	40.4	363.9510	0.0000	FLOOD RISK
15 minute summer	S20	1	41.800	0.000	4.7	0.0000	0.0000	OK
960 minute winter	S5	930	43.272	0.572	12.8	0.8192	0.0000	SURCHARGED
15 minute winter	S4	11	43.366	0.356	170.6	0.5101	0.0000	OK
15 minute winter	S8	11	46.288	1.188	58.5	1.3442	0.0000	FLOOD RISK
15 minute winter	S11	11	48.106	0.956	42.9	1.0809	0.0000	SURCHARGED
15 minute winter	S14	11	45.562	0.102	27.3	0.1148	0.0000	OK
15 minute winter	S15	11	44.594	0.994	53.7	1.1239	0.0000	FLOOD RISK
15 minute winter	S16	11	44.535	1.358	90.1	1.5358	0.0000	FLOOD RISK
960 minute winter	S18	930	43.273	1.173	19.6	2.0720	0.0000	SURCHARGED
960 minute winter	S19	945	43.273	1.198	19.4	2.1164	0.0000	FLOOD RISK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	S1.000	S2	54.3	1.399	0.951	1.1292	
15 minute winter	S2	S1.001	S3	109.8	2.216	0.846	1.6651	
15 minute winter	S3	S1.002	S4	116.7	2.158	0.589	1.8960	
15 minute winter	S6	S1.005	Swale	225.3	2.389	1.085	1.7218	
15 minute winter	S7	S2.000	S9	46.4	1.342	0.503	1.3337	
15 minute winter	S9	S2.002	S10	135.1	1.961	0.940	1.6038	
15 minute winter	S12	S2.005	S13	259.6	2.354	0.786	4.1280	
15 minute winter	S10	S2.004	S12	210.2	2.256	0.812	3.9886	
15 minute winter	S13	S3.003	Swale	356.6	3.233	3.222	3.3166	
15 minute summer	Pond	Hydro-Brake®	S20	4.7				66.1
15 minute winter	Swale	S1.006	S18	218.7	1.983	1.560	2.2340	
15 minute winter	S5	S1.004	S6	186.4	1.915	0.932	2.8314	
15 minute winter	S4	S1.003	S5	172.2	1.760	0.653	1.9553	
15 minute winter	S8	S2.001	S9	51.7	1.301	1.222	1.0945	
15 minute winter	S11	S2.003	S10	41.0	2.328	1.950	0.2909	
15 minute winter	S14	S3.000	S15	26.5	1.836	0.647	0.5378	
15 minute winter	S15	S.3001	S16	49.0	1.033	0.323	1.6028	
15 minute winter	S16	S3.002	S13	88.8	1.261	0.915	2.3700	
15 minute winter	S18	S1.007	S19	217.0	1.348	1.225	3.9718	
15 minute winter	S19	S1.008	Pond	211.8	2.106	0.653	3.6049	

APPENDIX F – ESSEX SUDS PROFORMA

Essex County Council

SuDS Water quantity and Quality – LLFA Technical Assessment Proforma

Introduction

This proforma identifies the information required by Essex LLFA to enable technical assessment the Designers approach to water quantity and water quality as part of SuDS design approach in compliance with Essex SuDS Design Guide.

Completion of the proforma will also allow for technical assessment against Non-statutory technical standards (NSTS) for Sustainable Drainage. The proforma will accompany the site specific Flood Risk Assessment and Drainage Strategy submitted as part of the planning application.

Please complete this form in full for full applications and the coloured sections for outline appllications. This will help us identify what information has been included and will assist with a smoother and quicker application.

Instructions for use

Use the units defined for input of figures

Numbers in brackets refer to accompanying notes.

Where ……m^3 .....m^3/m^2 *are noted – both values should be filled in.*

Site details

1.1	Planning application reference (if known)	-		
1.2	Site name	Hartford End, Felsted		
1.3	Total application site area (1)	2.41	ha	
1.4	Predevelopment use (4)	Greenfield		
1.5	Post development use	Residential		
	If other, please sepcify	-		
1.6	Urban creep applicable	Yes	if yes, factor applied:	10%
1.7	Proposed design life / planning application life	100		
1.8	Method(s) of discharge: (5)			

☐ *Reuse* ☐ *Infiltration* ☐ *Hybrid* ☑ *Waterbody* ☐ *Storm sewer* ☐ *Combined sewer*

1.9	Is discharge direct to estuary / sea	No
1.10	Have agreements in principle (where applicable) for discharge been provided	No

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SuDS Water quantity and Quality – LLFA Technical Assessment

Calculation inputs

2.1	Area within site which is drained by SuDS (2)	9754	m^2
2.2	Impermeable area drained pre development (3)	0	m^2
2.3	Impermeable area drained post development (3)	9754	m^2
2.4	Additional impermeable area (2.3 minus 2.2)	342	m^2
2.5	Method for assessing greenfield runoff rate	IH124	
2.6	Method for assessing brownfield runoff rate	-	
2.7	Coefficient of runoff (Cv) (6)	.75	
2.8	Source of rainfall data (FEH Preferred)	FSR	
2.9	Climate change factor applied 45	%	

Attenuation (positive outlet)

2.10 Drainage outlet at risk of drowning (tidal locking, elevated water levels in watercourse/sewer)
Note: Vortex controls require conditions of free discharge to operate as per manufacturers specification.

2.11 Invert level at final outlet TBC mAOD

2.12 Design level used for surcharge water level at point of discharge (16) 43.27 mAOD

Infiltration (Discharge to Ground)

2.13 Have infiltration tests been undertaken No

2.14 If yes, which method has been used -

2.15 Infiltration rate (where applicable) - m/s

2.16 Depth to highest known ground water table - mAOD

2.17 If there are multiple infiltration features please specify where they can be found in the FRA -

2.18 Depth of infiltration feature - mAOD

2.19 Factor of safety used for sizing infiltration storage -

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SuDS Water quantity and Quality – LLFA Technical Assessment Proforma

Calculation outputs

Sections 3 and 4 refer to site where storage is provided by full attenuation or partial infiltration. Where all flows are infiltrated to ground go straight to Section 6.

3.0	**Greenfield runoff rates** (incl. Urban Creep)			
3.1	1 in 1 year rainfall	l/s/ha, 4.7	l/s for the site	
3.2	1 in 30 year rainfall	l/s/ha, 10.8	l/s for the site	
3.3	1 in 100 year rainfall + CCA	l/s/ha, 13.8	l/s for the site	
4.0	**Brownfield runoff rates** (incl. Urban Creep)			
4.1	1 in 1 year rainfall	l/s/ha, -	l/s for the site	
4.2	1 in 30 year rainfall	l/s/ha, -	l/s for the site	
4.3	1 in 100 year rainfall + CCA	l/s/ha, -	l/s for the site	
5.0	Proposed maximum rate of runoff from site (incl. Urban Creep) (7)			
5.1	1 in 1 year rainfall	~~4.7~~ l/s/ha, 4.7	l/s for the site	
5.2	1 in 30 year rainfall	~~4.7~~ l/s/ha, 4.7	l/s for the site	
5.3	1 in 100 year rainfall + CCA	~~4.7~~ l/s/ha, 4.7	l/s for the site	
6.0	Attenuation storage to manage flow rates from site (incl. **Climate Change Allowance** (CCA) and Urban Creep)			
6.1	Storage - 1 in 100 year + CCA (9)	401	m^3	m^3/m^2
6.2	50% storage drain down time 1 in 30 years	10	hours	
7.0	Controlling volume of runoff from the site(10)			
7.1	Pre development runoff volume(12) (development area)	-	m^3 for the site	
7.2	Post development runoff volume (unmitigated) (12)	401	m^3 for the site	
7.3	Volume to be controlled (5.2 - 5.1)	401	m^3 for the site	

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7.4	Volume control provided by:				
	- Interception losses[13]	-	m^3		
	- Rain harvesting [14]	-	m^3		
	- Infiltration	-	m^3		
	- Attenuation	401	m^3		
	- Separate volume designated as long term storage[15]			-	m^3
7.5	Total volume control (sum of inputs for 5.4)			401	m^3 [17]

8.0 Site storage volumes (full infiltration only)

8.1	Storage - 1in 30 year + CCA [8]	-	m^3	-	m^3/m^2 (of developed impermeable area)
8.2	Storage - 1 in 100 year + CCA [11]	-	m^3	-	m^3/m^2

SuDS Water quantity and Quality – LLFA Technical Assessment Proforma

Design Inputs

Proposed site use: Residential

Pollution hazard category (see C753 Table 26.2): Low

High risk area defined as area storing fuels chemicals, refuelling area, washdown area, loading bay.

Design Outputs

List order of SuDS techniques proposed for treatment: Permeable paving, detention basin 1, detention basin 2

Note that gully pots, pipes and tanks are not accepted by Essex LLFA as a form of treatment (for justification see C753 Section 4.1, Table 26.15 and Box B.2)

Are very high pollution risk areas drained separate from SuDS to foul system: No

Other

Please include any other information that is relevant to your application

-

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SuDS Water quantity and Quality – LLFA Technical Assessment Proforma

Notes

1. All area with the proposed application site boundary to be included.
2. The site area which is positively drained includes all green areas which drain to the SuDS system and area of surface SuDS features. It excludes large open green spaces which do not drain to the SuDS system.
3. Impermeable area should be measured pre and post development. Impermeable surfaces include, roofs, pavements, driveways and paths where runoff is conveyed to the drainage system.
4. Predevelopment use may impact on the allowable discharge rate. The LLFA will seek for reduction in flow rates to GF (Essex SuDS Design Guide).
5. Runoff may be discharge via one or more methods.
6. Sewers for Adoption 6th Edition recommends a Cv of 100% when designing drainage for impermeable area (assumes no loss of runoff from impermeable surfaces) and 0% for permeable areas. Where lower Cv's are used the applicant should justify the selection of Cv.
7. It is Essex County Council's preference that discharge rates for all events up to the 1 in 100 year event plus climate change are limited to the 1 in 1 greenfield rate. This is also considered to mitigate the increased runoff volumes that occur with the introduction of impermeable surfaces. If discharge rates are limited to a range of matched greenfield flows then it is necessary to provide additional mitigation of increased runoff volumes by the provision of Long-term Storage.
8. Storage for the 1 in 30 year must be fully contained within the SuDS components. Note that standing water within SuDS components such as ponds, basins and swales is not classified as flooding. Storage should be calculated for the critical duration rainfall event.
9. Runoff generated from rainfall events up to the 1 in 100 year will not be allowed to leave the site in an uncontrolled way. Temporary flooding of designated areas to shallow depths and velocities may be acceptable.
10. The following information should only be provided if increased runoff volumes are not mitigated by limiting all discharge rates back to the greenfield 1 in 1 year rate.
11. Climate change is specified as 40% increase to rainfall intensity, unless otherwise agreed with the LLFA / EA.
12. To be determined using the 100 year return period 6 hour duration winter rainfall event.
13. Where Source Control is provided Interception losses will occur. An allowance of 5mm rainfall depth can be subtracted from the net inflow to the storage calculation where interception losses are demonstrated. The Applicant should demonstrate use of subcatchments and source control techniques. Further information is available in the SuDS Design Guide.
14. Please refer to Rain harvesting BS for guidance on available storage.
15. Flows within long term storage areas should be infiltrated to the ground or discharged at low flow rate of maximum 2 l/s/ha.
16. Careful consideration should be used for calculations where flow control / storage is likely to be influenced by surcharged sewer or peak levels within a watercourse. Outlets can be tidally locked where discharge is direct to estuary or sea. Calculations should demonstrate that risk of downed outlet has been taken into consideration. Vortex controls require conditions of free discharge to operate as per specification.
17. In controlling the volume of runoff the total volume from mitigation measures should be greater than or equal to the additional volume generated.

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