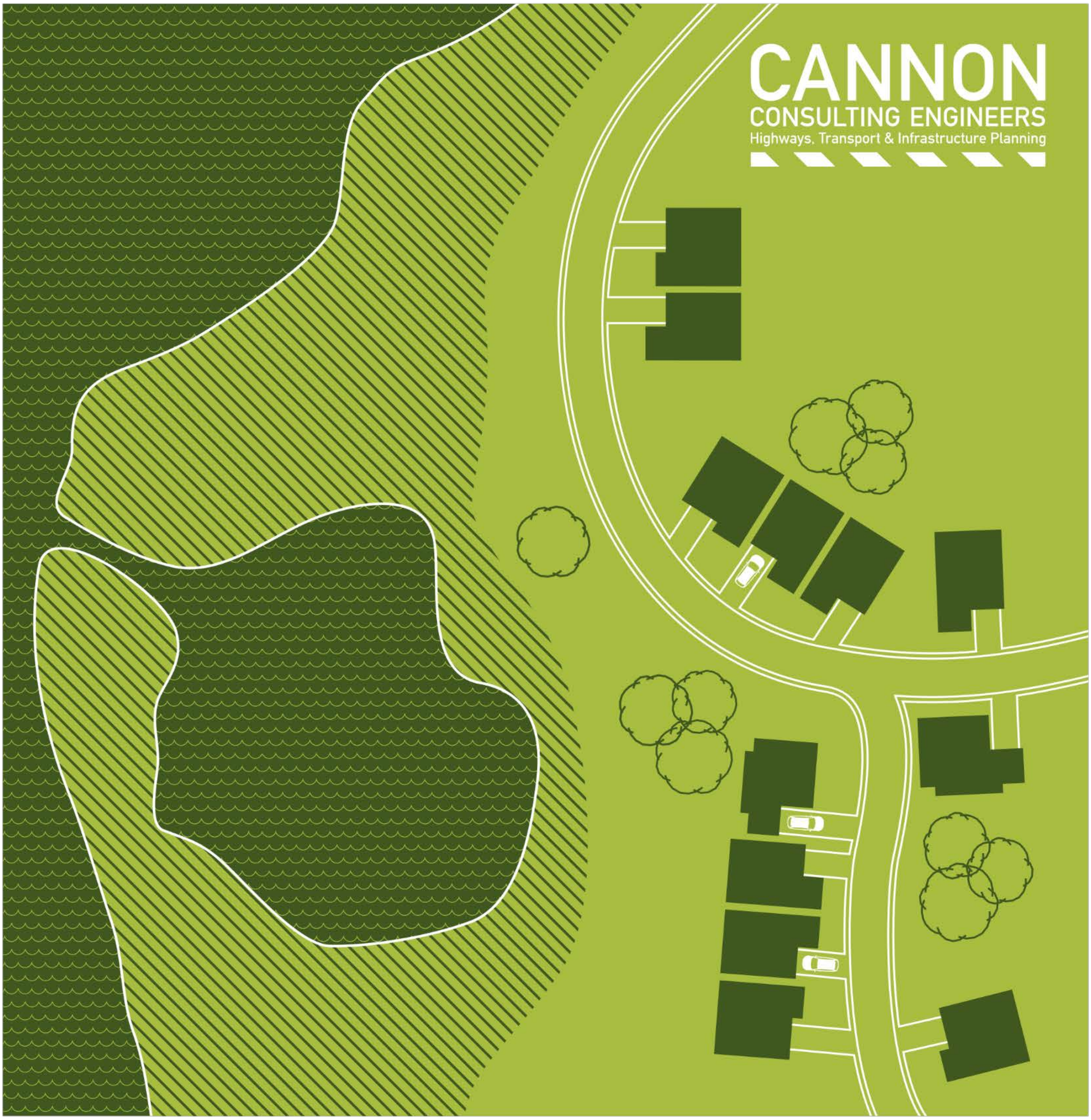

flood risk assessment

Little Court, Haverhill Road, Haverhill

CCE/ZA921/FRA-03

February 2021

For
CARE (Little Court) Ltd

Document Review Sheet

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Reference	**Date**	**Author**	**Checked**
CCE/ZA821/FRA-01	January 2021	JH	RT
CCE/ZA821/FRA-02	January 2021	JH	
CCE/ZA821/FRA-03	February 2021	JH	

Contents

Figures

Appendices

Summary Table

Site location	Little Court, Haverhill Road, Little Wratting, CB9 7UD Grid reference 568550, 247028.
Planning application	Full
Existing site	Stables, grassland and scrub.
Site area	Approximately 1.18 ha
Proposed development	Care village.
Flood Zone	1
Reservoir Inundation Zone	None
Surface water flooding	None
Surface water management	On-site treatment and attenuation with restricted discharge to the boundary watercourse.

1.0 Introduction

1.1 This Flood Risk Assessment (FRA) has been prepared for the use of CARE (Little Court) Ltd to support a planning application for the construction of a dementia care village at land to the south of Haverhill Road, Little Wratting, CB9 7UD. Refer to Figure 1 for the site location.

1.2 The proposed development comprises:

"Specialist dementia care village for up to 120 residents, including central amenity building (shop, restaurant, pub, communal hall, treatment/counselling rooms, offices and staff accommodation), club/hobby rooms, vehicle parking, landscaping proposals and associated works."

1.3 This assessment takes account of the National Planning Policy Framework (NPPF) and the definitions of sources of flooding within the Flood and Water Management Act (FWMA) 2010. The report has been prepared following a site visit and a review of the West Suffolk Strategic Flood Risk Assessment (SFRA).

1.4 The site is approximately 1.18 ha and is centred on Ordnance Survey grid reference 568550, 247028. The majority of the site (some two thirds) is laid to grassland and scrub, with a stable complex and menage area in the north.

1.5 The development site falls from approximately 15.0 m AOD in the north to 13.8 m AOD in the south-eastern corner (refer to the topographical survey in Appendix A).

1.6 The northern boundary is formed by Haverhill Road. The eastern boundary is marked by a surfaced public footpath (footpath 05). The land to the south of the site is open arable land. The land to the west is currently arable but benefits from permission for residential development.

1.7 There is a roadside ditch running along the north of the site which continues west along Haverhill Road. There is an overgrown pond in the north of the site (north of the horse menage). Judging from on and off-site levels (as the site sits on or close to a watershed) the pond serves a limited, local land drainage function.

1.8 There is a land drainage ditch midway down the site which runs west to the south of the residential property to the west of the menage and stables. There is also a ditch which forms part of the southern boundary of the site. This ditch is connected (via a pipe) to a ditch/watercourse which runs southwards through the fields to the south of the site. The outgoing pipe from the southern boundary ditch was not visible during the topographical survey but was found during our site visit. The off-site ditch/watercourse runs southwards for approximately 380 m before turning east and entering a culvert beneath footpath 05 (the culvert is included on the topographical survey).

1.9 The site lies in Flood Zone 1 (the low probability flood area).

1.10 British Geological Survey (BGS) mapping describes the site geology as diamicton (Boulder Clay) over Chalk. BGS borehole data for the area suggests that the top of the Chalk is more than 20 m deep.

2.0 Forms of Flooding

Watercourses

2.1 As discussed and shown on the Flood Map for Planning (refer to Figure 1) the site sits in Flood Zone 1 (the low probability flood area) and is not considered likely to flood as the result of overtopping from a named or significantly sized watercourse.

Surface water flooding

2.2 Surface water flood mapping (see Figure 4) shows that the site is not at any notable risk of surface water flooding (which is to be expected given its position in the catchment).

Surface Water Sewers

2.3 Anglian Water sewer plans (included in Appendix A) show no adopted surface water sewers in the area and hence no associated flood risk.

Groundwater

2.4 The geology in the area means that groundwater flooding is not a realistic threat for the site.

Reservoirs

2.5 The site does not lie in a reservoir inundation area (see Figure 2).

3.0 Surface Water Management

3.1 As the geology is unlikely to support the effective disposal of surface water via infiltration the proposed surface water management scheme relies on a restricted discharge to the southern boundary ditch. As discussed in Section 1, this ditch is connected to the channel/ditch which runs southwards through the fields to the south of the site. The pipe is not shown on the topographical survey, but was observed during a site visit. If infiltration is found to be effective during the later detailed design stages (for all or part of the site) it will be pursued.

3.2 The proposed discharge rate of 3 l/s is made up of half of the calculated brownfield rate and the mean annual greenfield rate (2.3 l/s/ha) for the additional impermeable area. The existing impermeable catchment has been established from measuring the area of buildings within the site boundary. The existing impermeable catchment is 340 m^2 (0.034 ha). The brownfield rate has been calculated using the 1 in 2 year storm with a 15 minute duration. The 1 in 2 year storm is the lowest return period storm supported in Microdrainage when using FEH13 data.

Brownfield runoff calculation = 2.78 x 0.95 x 0.034ha x 34mm = 3.05l/s x 0.5 = 1.53l/s

3.3 The proposed management scheme incorporates:

- Attenuation crates beneath the car park in the north draining the car park and part of the northernmost building. The car park surface will be formed from permeable/porous macadam which will filter water prior to entering the crates (through a stone distribution layer/perforated pipe network).
- A grassed attenuation basin, approximately 1.2 m deep with 1 in 3 side slopes.
- Internal footpaths and hard landscaping will be formed from permeable/porous resin bound gravel.
- The outlet from the basin will be protected by a gabion filter box to prevent debris from entering the flow control chamber. The flow control will also have 'in chamber' protection (a perforated riser/cover).

3.4 All proposals are subject to detailed design and the approval of relevant parties.

Treatment

3.5 Based on Table 26.2 in the SuDS Manual the overall pollution hazard level for the development is low. The treatment provided by the proposed impermeable hard surfaces and grassed attenuation basin (with filter box) is therefore suitable and exceeds the minimum treatment scores.

Maintenance

3.6 The ongoing maintenance of the surface water management scheme will be the responsibility of the site owner/operator. Appendix B includes a maintenance plan.

4.0 Conclusions

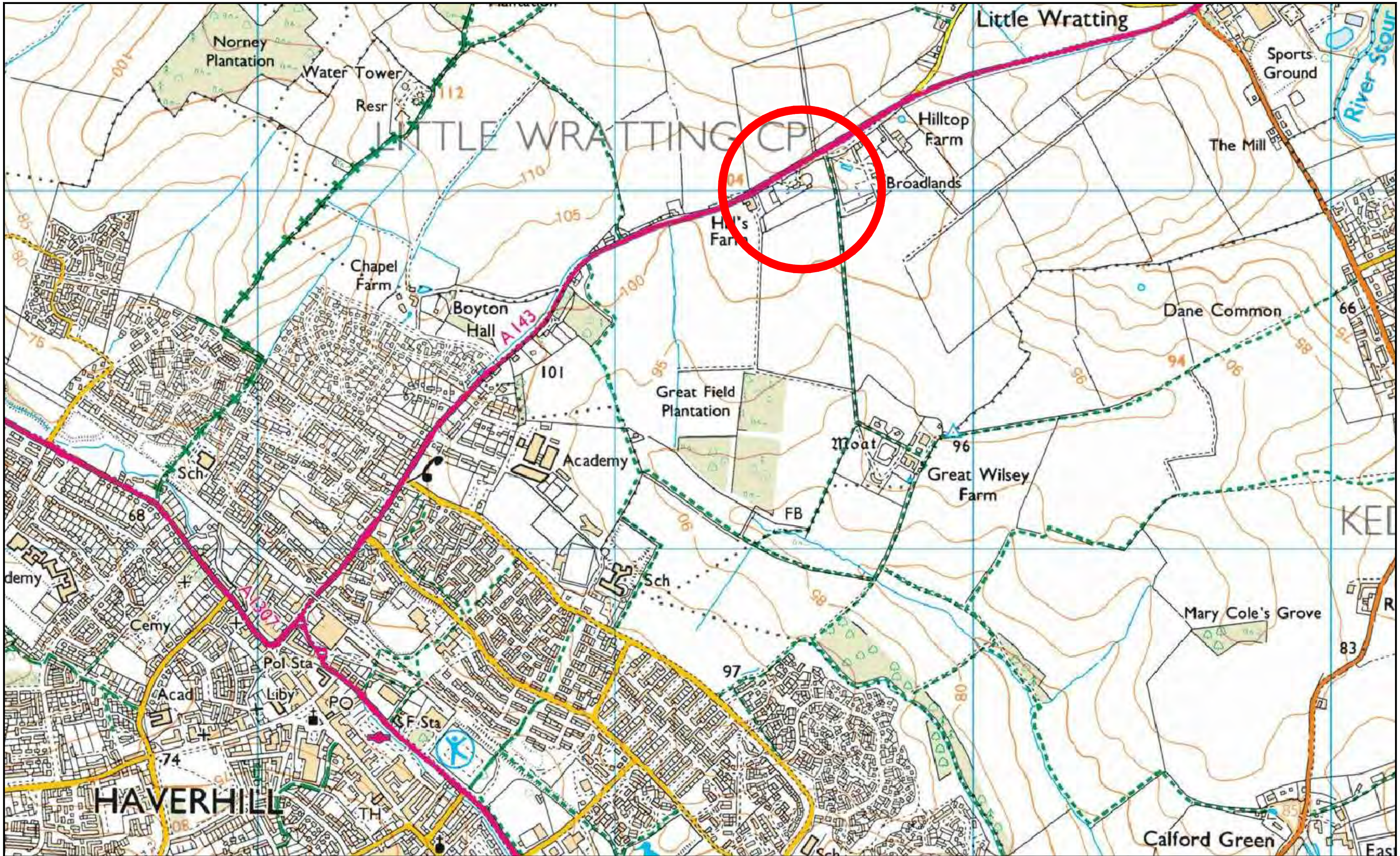
4.1 The proposed development is not considered to be subject to significant or unmanageable flooding from the sources identified in the Flood and Water Management Act 2010 (FWMA).

4.2 The surface water management strategy relies on restricted discharge to the boundary watercourse.

4.3 The surface water management scheme provides sufficient on-site attenuation to manage the 1 in 100 annual probability storm plus 40 % climate change allowance.

4.4 The proposed features provide a suitable level of treatment for the proposed land uses.

Figures



DATE	PROJECT TITLE	FIGURE NUMBER	PROJECTNO.	
22/01/2021	LITTLE COURT, WRATTING ROAD, HAVERHILL	1	ZA921	CANNON CONSULTING ENGINEERS Highways, Transport & Infrastructure Planning
DRAWN BY DP	FIGURE TITLE			
SCALE @ A4 SIZE D.N.S.	SITE LOCATION PLAN			

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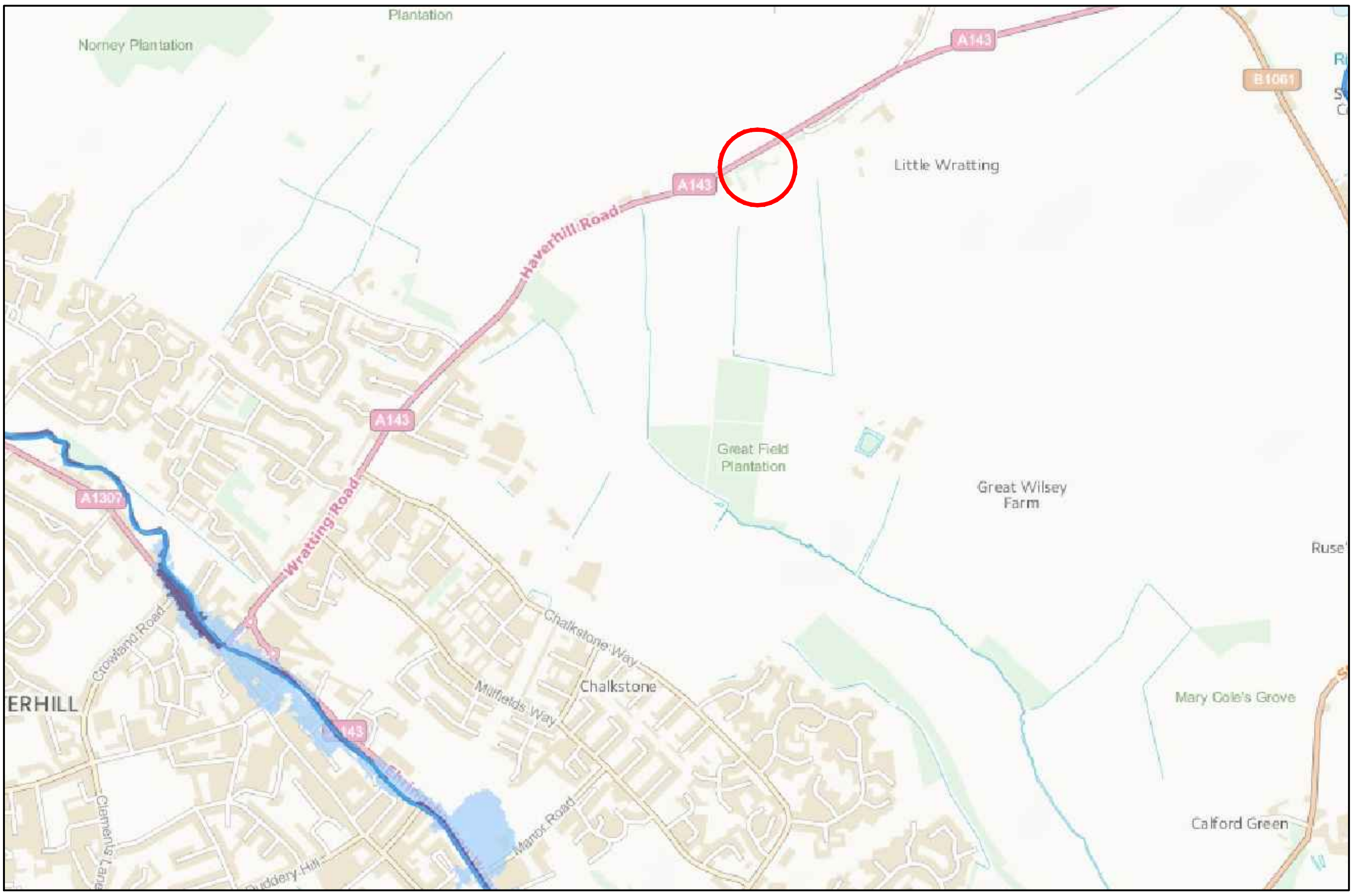

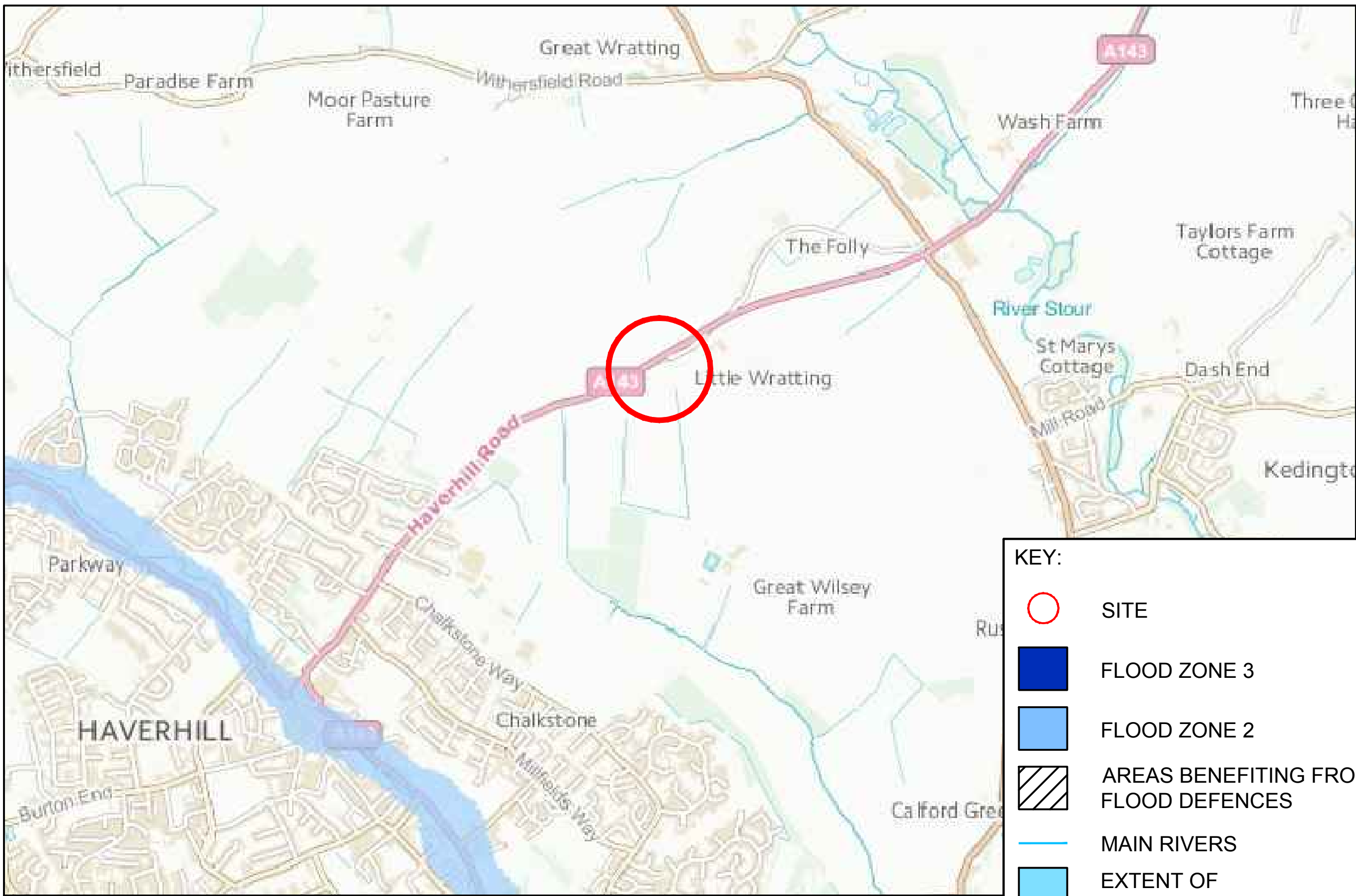

KEY:

- SITE
- FLOOD ZONE 3
- FLOOD ZONE 2
- AREAS BENEFITING FROM FLOOD DEFENCES
- MAIN RIVERS
- EXTENT OF RESERVOIR FLOODING

DATE	PROJECT TITLE	DRAWING NUMBER	PROJECT NO.	
22/01/21	LITTLE COURT, WRATTING ROAD, HAVERHILL	2	ZA921	CANNON CONSULTING ENGINEERS Highways, Transport & Infrastructure Planning
DRAWN BY DP	FIGURE TITLE			
SCALE @ A4 SIZE D.N.S.	FLOOD ZONE & RESERVOIR INUNDATION PLAN			

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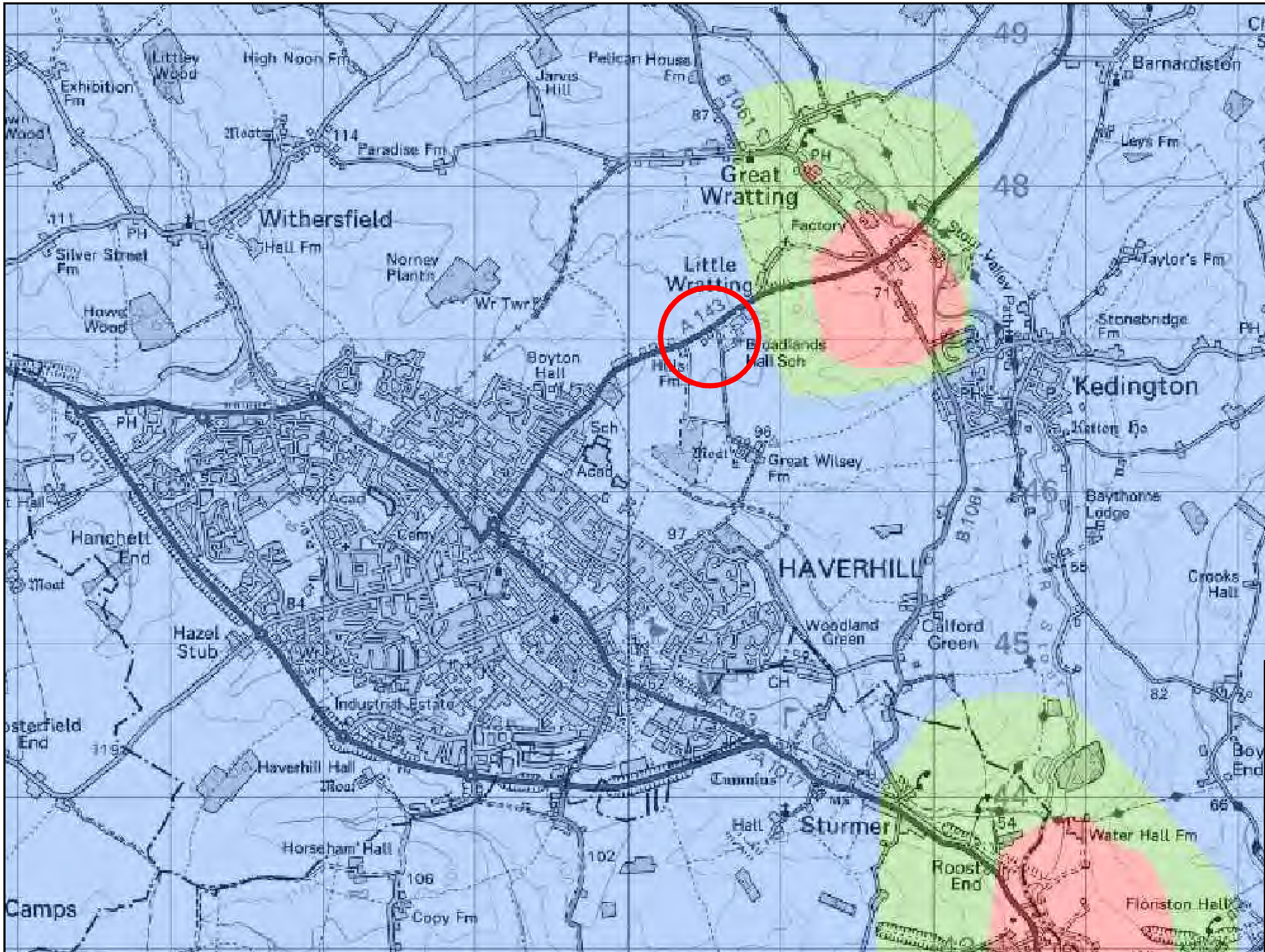
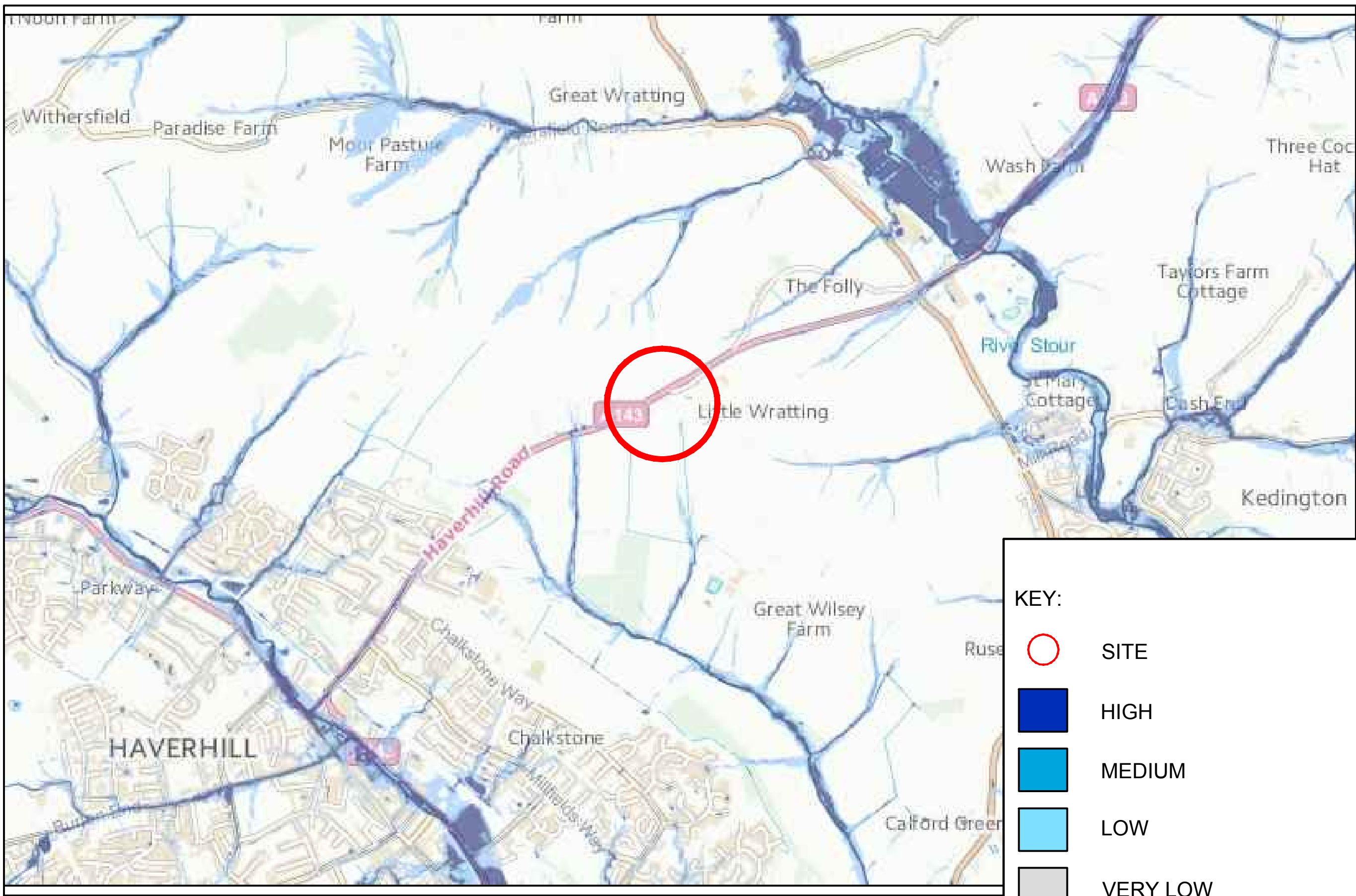


KEY:

- SITE
- INNER ZONE
- OUTER ZONE
- TOTAL CATCHMENT
- SPECIAL INTEREST

DATE 22/01/2021	PROJECT TITLE LITTLE COURT, WRATTING ROAD, HAVERHILL	FIGURE NUMBER 3	PROJECTNO. ZA921
DRAWN BY DP			
SCALE @ A4 SIZE D.N.S.	FIGURE TITLE GROUNDWATER SOURCE PROTECTION ZONE PLAN		

CANNON CONSULTING ENGINEERS
Highways, Transport & Infrastructure Planning



KEY:

SITE

HIGH

MEDIUM

LOW

VERY LOW

DATE	PROJECT TITLE	DRAWING NUMBER	PROJECT NO.	
22/01/2021	LITTLE COURT, WRATTING ROAD, HAVERHILL	4	ZA921	CANNON CONSULTING ENGINEERS Highways, Transport & Infrastructure Planning
DRAWN BY: DP	FIGURE TITLE: SURFACE WATER FLOOD MAP			
SCALE @ A4 SIZE: D.N.S.				

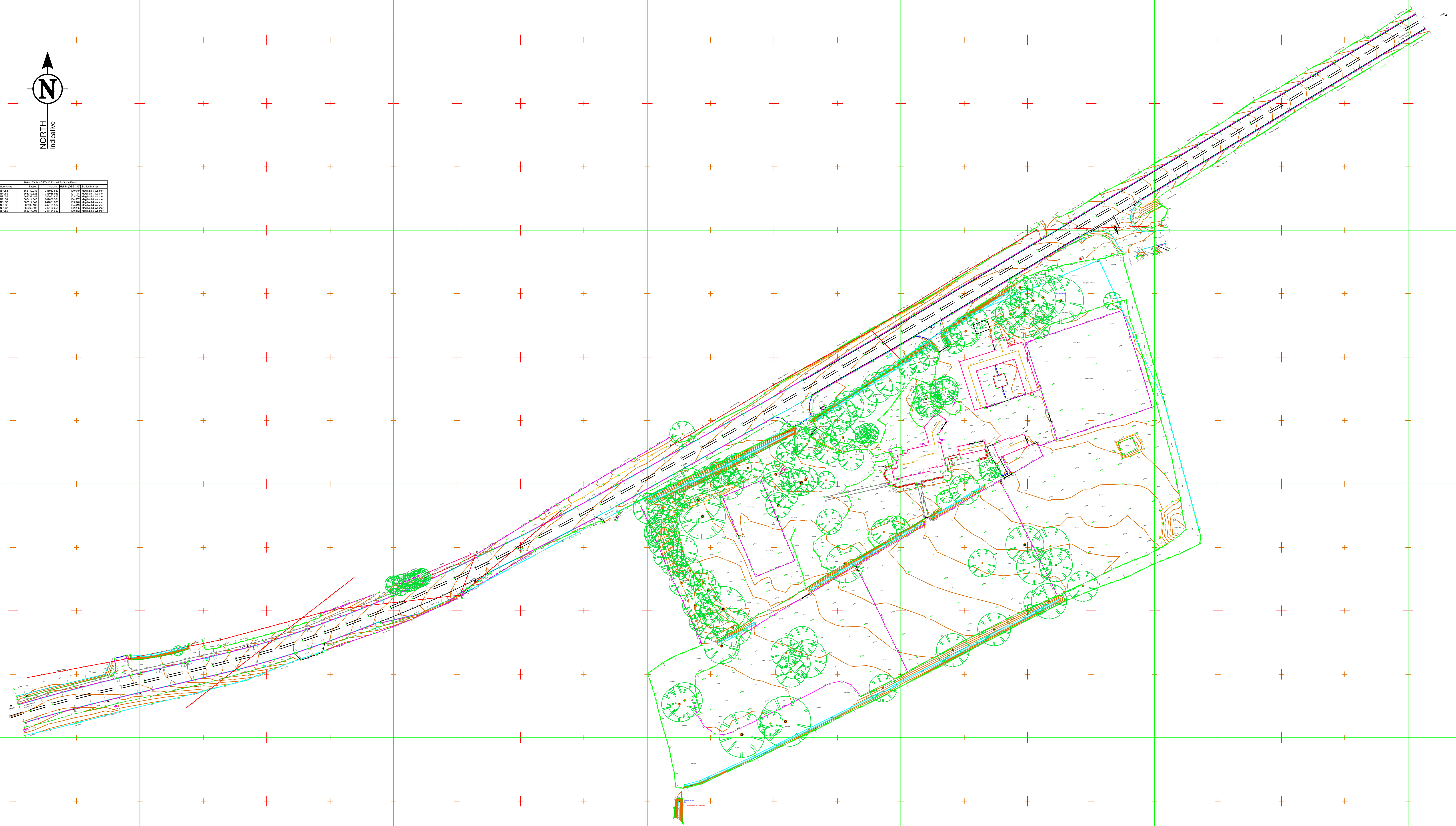
C:\Users\DJP\Desktop\Work From Home 2.0\ZA921 Little Court, Wratting Road, Haverhill\3 PLANS\DRAWINGS\CURRENT DRGS\Flood Maps\FZ RI SW MAPS

A. Existing Site

Topographical survey
Anglian Water sewer plans

PLS - NP - FT - TS - 00 | -

Originator | Initials | Detail | Type | Number | Revision



NORTH
Indicative

Station Table - OSTN15 Forced To Scale Factor 1				
Station Name	Easting	Northing	Height (OSGM15)	Station Marker
STNPLS1	568149.238	246912.580	100.649	Mag Nail & Washer
STNPLS2	568242.528	246935.983	101.718	Mag Nail & Washer
STNPLS3	568332.188	246961.812	103.759	Mag Nail & Washer
STNPLS4	568414.845	247006.521	104.557	Mag Nail & Washer
STNPLS5	568512.047	247061.860	105.346	Mag Nail & Washer
STNPLS6	568592.137	247109.962	104.419	Mag Nail & Washer
STNPLS7	568662.506	247160.655	102.255	Mag Nail & Washer
STNPLS8	568714.995	247184.659	100.812	Mag Nail & Washer

Scale 0 18 36 54 72 90
Custom

ABBREVIATIONS

AV	Air Valve
BCN X	Beacon (No. if known)
0.00	Borehole
BL X	Lit Bollard (No. if Known)
B	Bollard
BMP	Boundary Marker
BS	Bus Stop
BT	Small Telecoms
CATV	Small Cable TV
CCTV	Small CCTV
MH 0.00	Small Electical Manhole
EP	Electric Pole
ER	Earth Rod
FEED X	Feeder Pillar (No. if Known)
FH	Fire Hydrant
FL P	Flag Pole
IL X 0.00	Pipe Invert Level
0.00 KI	Kerb Inlet (Water onto Rd)
0.00 KO	Kerb Outlet (Water off Rd)
LP X	Lampost (No. if Known)
Mast	Telecoms Mast
MH 0.00	Manhole
MP	Marker Post
PBOX	Post Box

0.00
Trees - Scaled With Canopy and Girth - Canopy is Approx and Girth is Taken at 1.5m Above Ground - Level is Ground Level at Trunk

0.00
Individual Bushes Scaled for Size Ground Level at Centre

Safety Fence FF@GL

Safety Fences are Shown at Front Face FF at Ground Level GL

To Reduce Clutter and Improve Clarity All Other Salient Features Can be Identified by Their CAD Layer or By Annotation in CAD Layer NOTES

DRAWING NOTES

This survey has been carried out using a Trimble S7 Total Station and fixed to OSTN15 / OSGM15 using Trimble R10 GPS.

All control stations have been fixed to a Scale Factor of 1.

All Dimensions are In metres.

Parts of the Survey labeled as overgrown have been surveyed as best possible. Some features may not have been surveyed.

Trees are not drawn to scale. Trunk size diameter and spread are estimated and should be used as a guide only.

All building descriptions and construction type are indicative only and taken externally from ground level.

Drainage runs between inspection covers have not been investigated. Any shown are estimated and not confirmed. All pipe sizes and connections should also be confirmed with your local drainage authority before commencing any design work.

There may be inspection covers on site which were not visible at the time of survey. It Is possible that they are buried or covered by dense vegetation. Please consult your local drainage authority If you have any doubts.

All below ground details 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.

Features may not have been surveyed if obstructed or not reasonably visible at the time of the survey.

General Notes

Please check and verify all site and building dimensions, levels, utilities and drainage details and connections prior to commencing work. Any errors or discrepancies must be notified to Parish Land Surveys.

The accuracy of the digital data is the same as the plotting scale implies.

Do not scale from this drawing.

PARISH LAND SURVEYS
P.L.S

REV	Survey Date	Created By	First Issue	Comments
-	27.11.20	PLS	01.12.20	Full Topographical Survey

Scale at A1	Project Number
NTS	PLS - 575

Drawing Status

X	Topographical Survey
	Revised Survey
	Drainage Survey

36 St Peters Way, Spixworth, Norwich, NR10 3NS

office: 01603 898950
mob: 07810 726138
email: nick@parishlandsurveys.co.uk
web: www.parishlandsurveys.co.uk

Client

Rapleys

Project

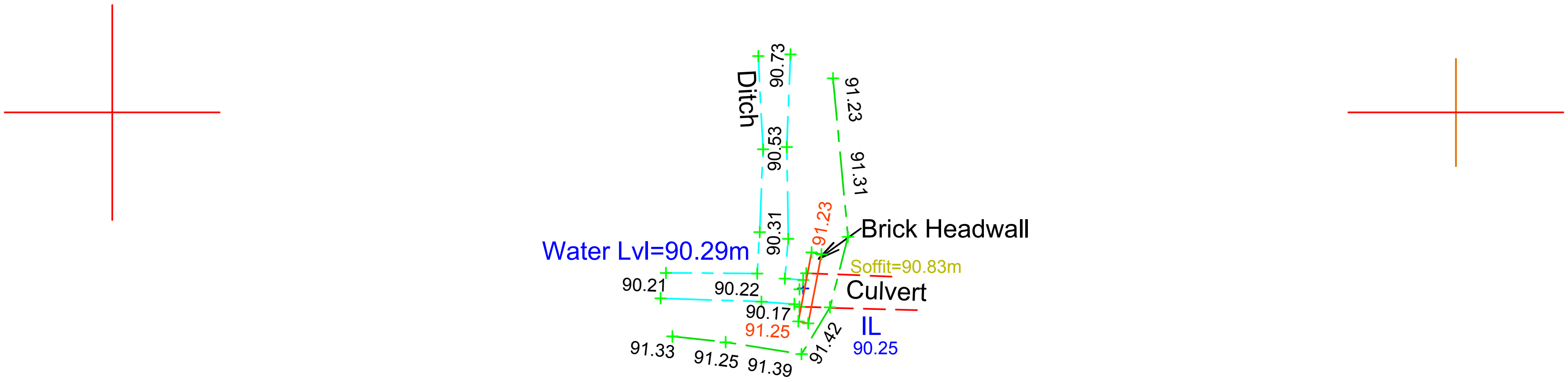
Little Court, Haverhill Road, Little Wratting, CB9 7UD

Title

Topographical Survey
OVERVIEW

PLS - NP - FT - TS - 00 | -

Originator | Initials | Detail | Type | Number | Revision



Ditch
90.73
90.53
90.31
91.23
91.31
91.23
Brick Headwall
Water Lvl=90.29m
Soffit=90.83m
90.21
90.22
Culvert
90.17
91.25
IL
90.25
91.42
91.33
91.25
91.39

Date: 26/11/20 | Scale: 1:1250 | Map Centre: 568318,246949 | Data updated: 31/10/20 | Our Ref: 462857 - 2 | Wastewater Plan A0

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)

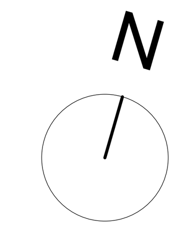
jenni.askew@cannonce.co.uk

Haverhill

love every drop
anglianwater

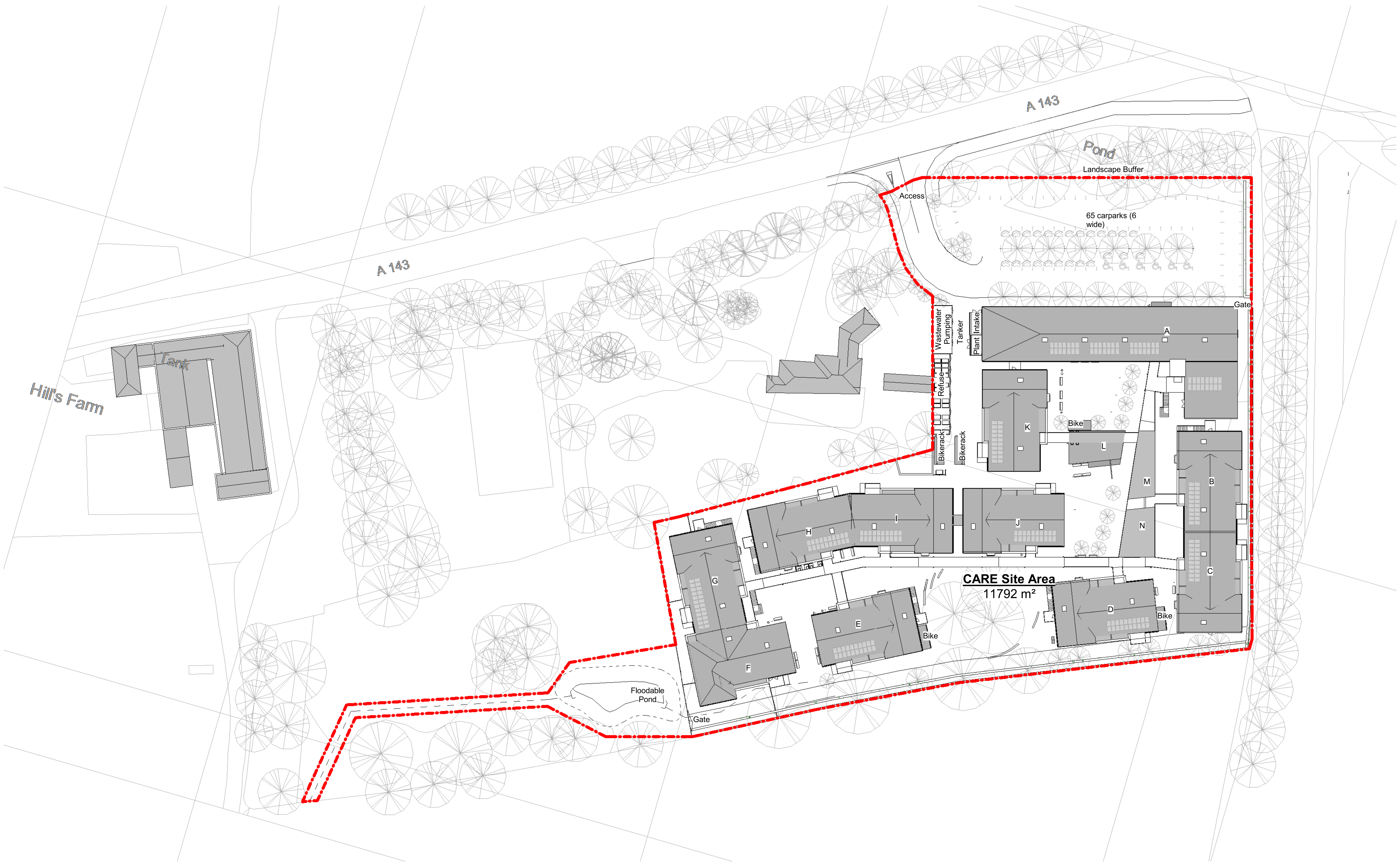
B. Proposed Site

This drawing is the copyright of the architect JBA.
All dimensions and conditions to be verified on site by the relevant Contractor prior to proceeding.
...
Standard industry solutions apply unless otherwise stated.
All dimensions are in millimeters and are to structural faces or centres unless otherwise stated.
not to finishes unless unless otherwise stated.
Survey by others.
This drawing must be read in conjunction with all other relevant drawings and specifications from the Architect and other consultants.
If in doubt, ask.

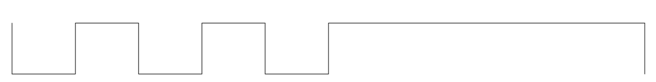


Proposed Site Boundary

Building



1 Site Plan Proposed
1 : 500



Rev.	DD/MM/YY	Initials - Description

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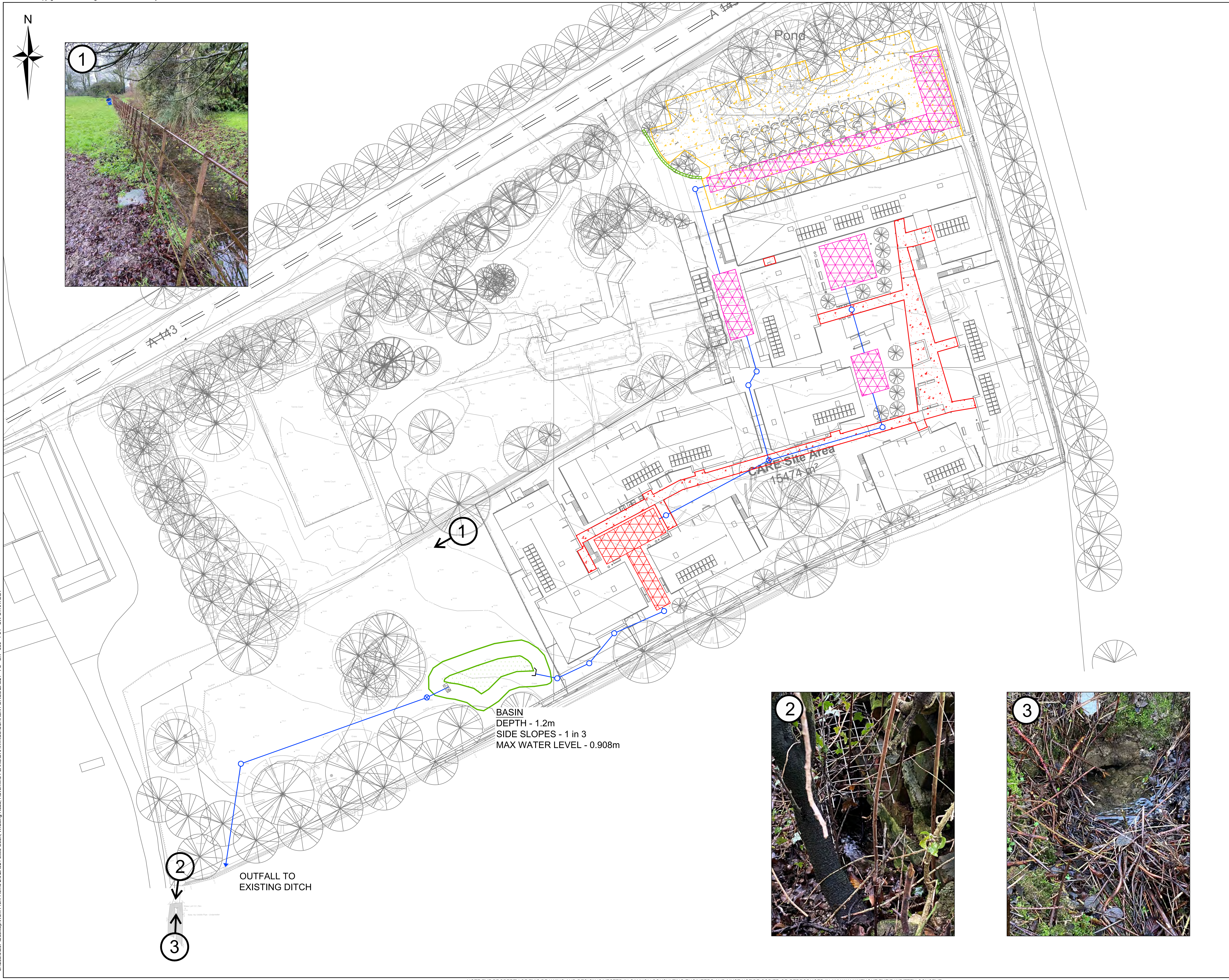
Project:	Little Court
Client:	CARE (Little Court) Ltd
Drawing:	Site Plan Proposed
Date:	29/01/21
Scale:	As indicated @ A1
Drawn By:	LE
Drawing No:	410_ 00_00_PL_A_ 1010
Revision	

Preliminary [X] Tender [ ] Construction [ ]

Site Plan Proposed



KEY

3 x 0.40m HIGH AQUACELL CELLULAR STORAGE CRATES

2 x 0.15m HIGH PERMAVOID CELLULAR STORAGE CRATES

PERMEABLE MACADAM

PERMEABLE RESIN BOUND AGGREGATE FINISH

GRASSED FILTER DRAIN

SPINE NETWORK

ORIFICE CONTROL CHAMBER

DEBRIS FILTER

HEADWALL

NOTES

REV	DESCRIPTION	DE	DR	CH	DATE
P04	CLIENT NAME UPDATED	-	DP	-	02/2021
P03	OUTFALL RELOCATED	-	DP	-	02/2021
P02	SW STRATEGY REVISED	-	DP	-	02/2021
P01	SW STRATEGY REVISED	-	DP	-	01/2021

DESIGNED BY	DRAWN BY	CHECKED BY
-	DP	-

SCALE @ A1 SIZE	DATE
D.N.S.	13/01/2021

PROJECT TITLE
LITTLE COURT, WRATTING ROAD, HAVERHILL

DRAWING TITLE
OUTLINE SURFACE WATER MANAGEMENT STRATEGY

CLIENT
CARE (LITTLE COURT) LTD

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DRAWING NUMBER	REV.
ZA921 - PL - SK - 300	P04

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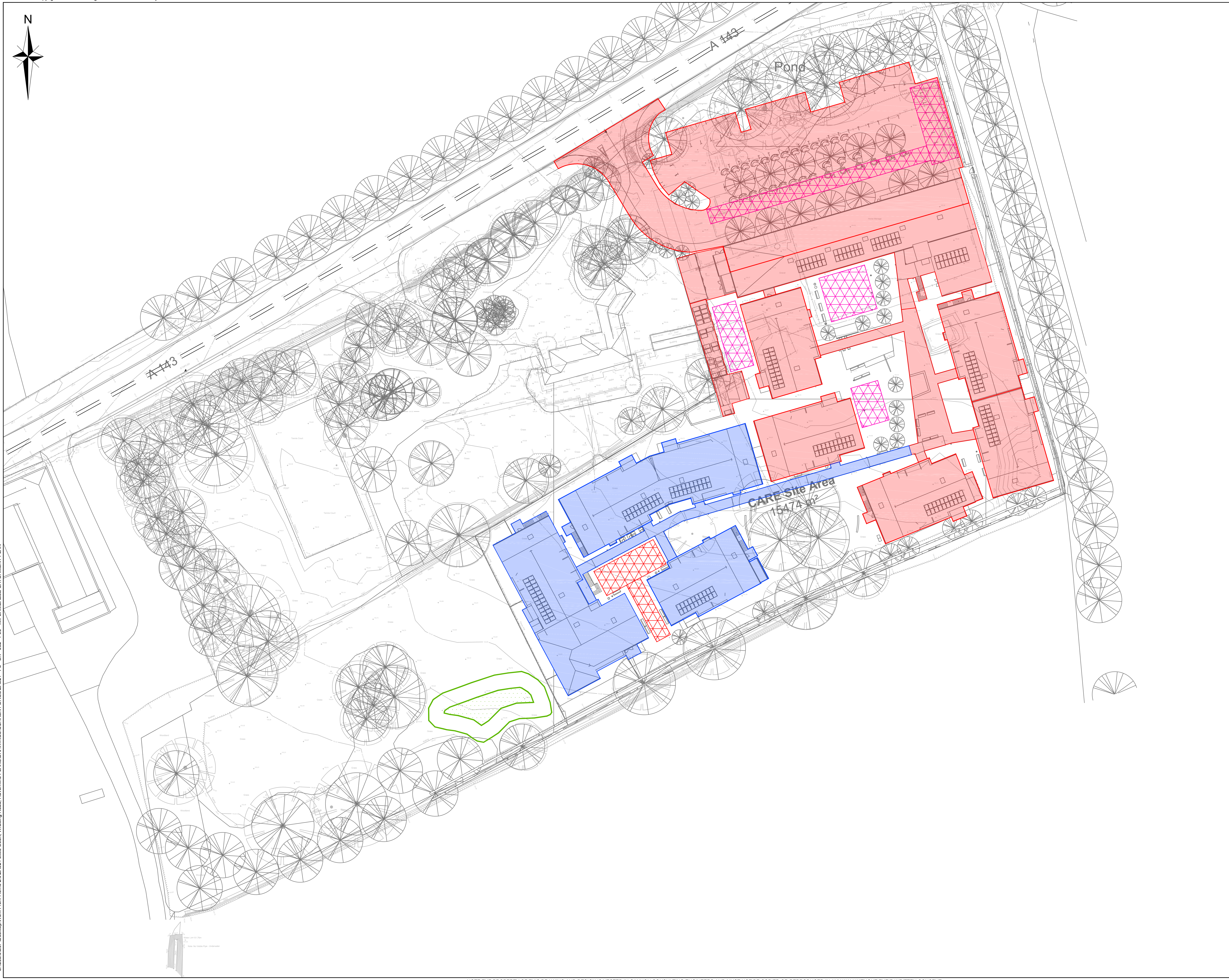

KEY

IMPERMEABLE CATCHMENT AREA FOR AQUACELL CELLULAR STORAGE

IMPERMEABLE CATCHMENT AREA FOR PERMAVOID CELLULAR STORAGE AND BASIN

NOTES

REV	DESCRIPTION	DE	DR	CH	DATE
P03	CLIENT NAME UPDATED	-	DP	-	02/2021
P02	SW STRATEGY REVISED	-	DP	-	02/2021
P01	SW STRATEGY REVISED	-	DP	-	02/2021

DESIGNED BY	DRAWN BY	CHECKED BY
-	DP	-

SCALE @ A1 SIZE: D.N.S.

DATE: 22/01/2021

PROJECT TITLE

LITTLE COURT, WRATTING ROAD, HAVERHILL

DRAWING TITLE

IMPERMEABLE CATCHMENT PLAN

CLIENT

CARE (LITTLE COURT) LTD

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DRAWING NUMBER: ZA921 - PL - SK - 302

REV.: P03

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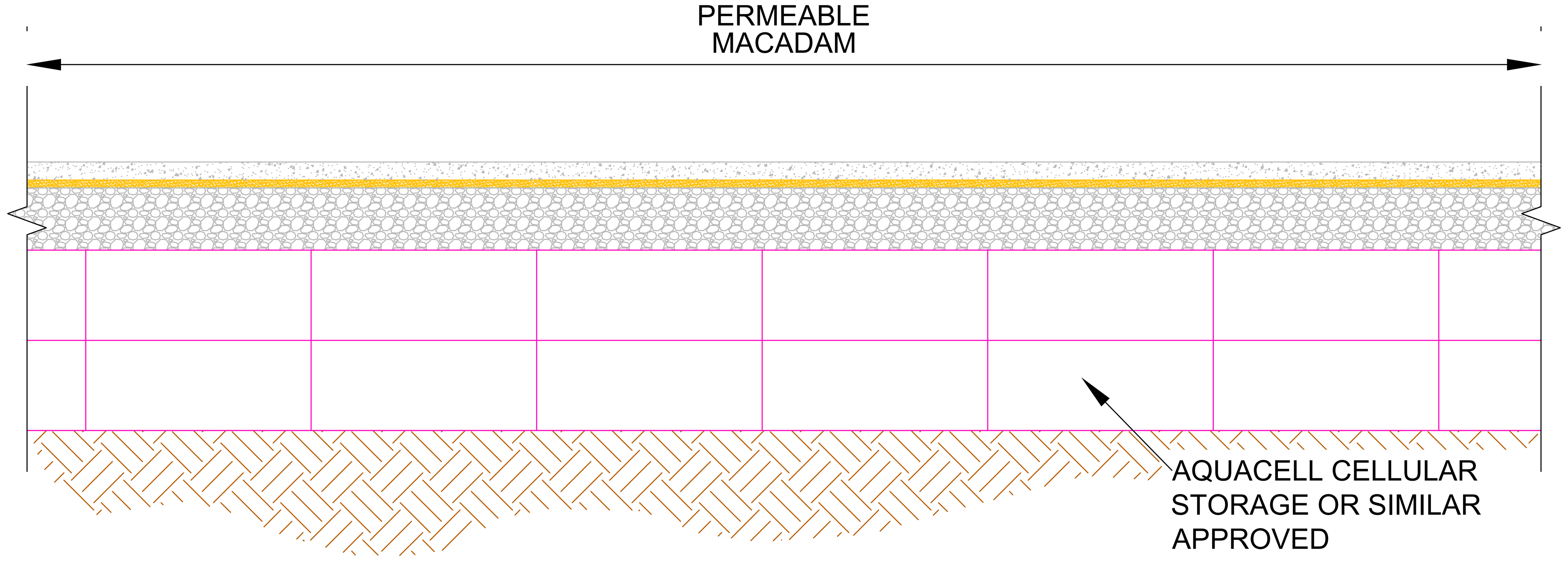
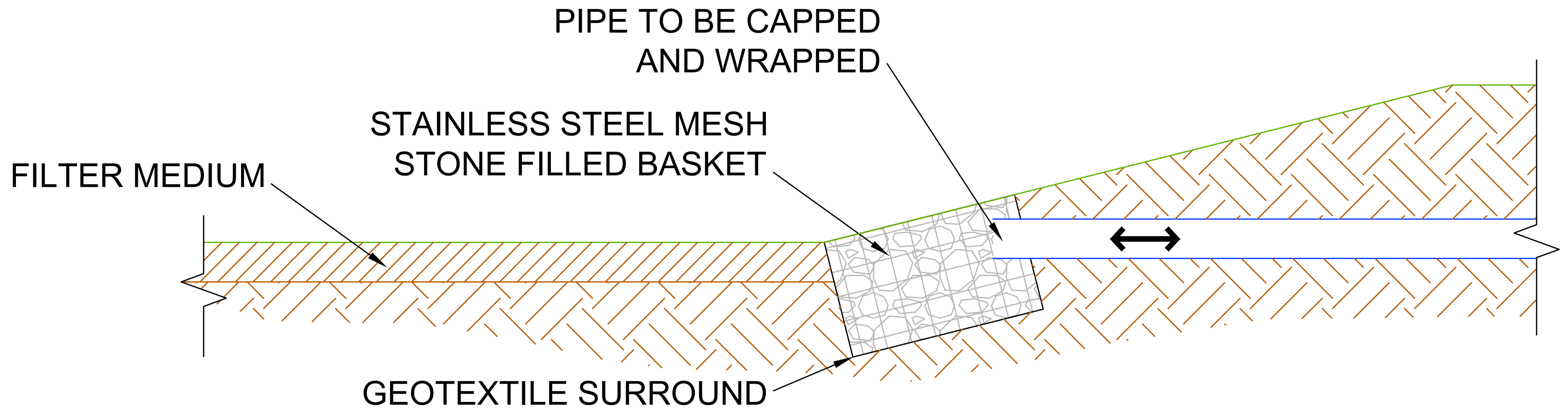


TYPICAL SECTION THROUGH PERMEABLE MACADAM OVER CELLULAR STORAGE



TYPICAL SECTION THROUGH DEBRIS FILTER

KEY

NOTES

REV	DESCRIPTION	DE	DR	CH	DATE
P02	CLIENT NAME UPDATED	-	DP	-	02/2021
P01	SECTION REMOVED	-	DP	-	02/2021

DESIGNED BY	DRAWN BY	CHECKED BY
-	DP	-

SCALE @ A1 SIZE	DATE
D.N.S.	22/01/2021

PROJECT TITLE
LITTLE COURT, WRATTING ROAD, HAVERHILL

DRAWING TITLE
SECTIONS

CLIENT
CARE (LITTLE COURT) LTD

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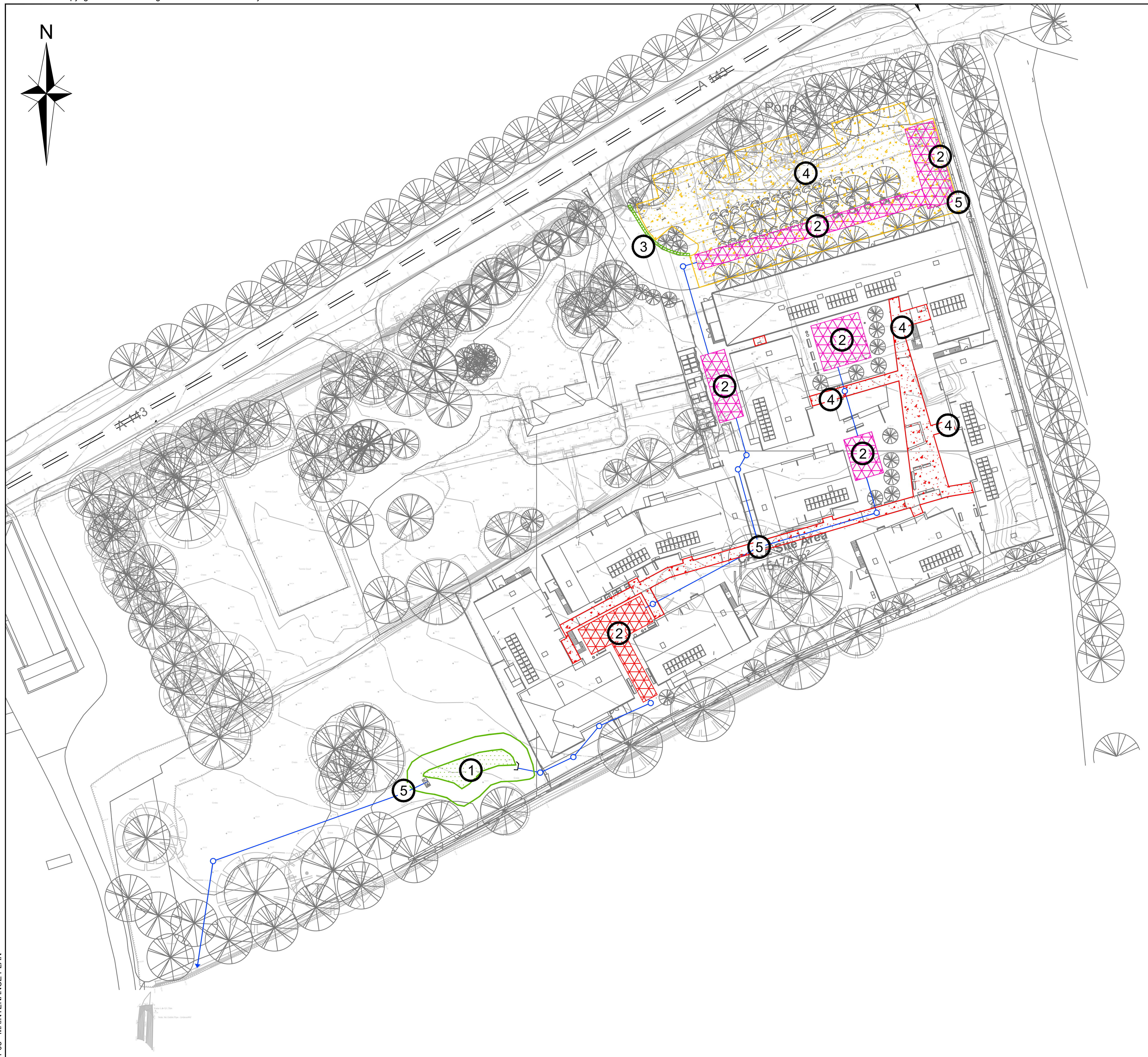
DRAWING NUMBER	REV.
ZA921 - PL - SK - 301	P02



KEY

1. ATTENUATION BASIN
2. CELLULAR STORAGE
3. ROADSIDE SWALE/GRASSED FILTER DRAIN
4. PERMEABLE PAVING
5. ORIFICE CONTROL CHAMBER

NOTES

1 Basin Maintenance

Maintenance schedule	Required action	Frequency
Regular maintenance	Removal of litter and debris	Monthly
	Cut grass	Half yearly
	Manage other vegetation	Monthly then as required
	Inspect and clear inlets, outlets, overflows etc	Monthly
	Inspect and repair banks, pipes, headwalls etc	Monthly
	Inspect inlets and basin for silt accumulation	Monthly until able to establish the required silt removal frequency, then in accordance with established frequency
	Manage vegetation in wetter areas (micro-pools etc)	Annually or as established by ecologist/landscape architect
	Tidy dead growth	Annually (as per growing season)
	Remove sediment from traps, forebays etc	Annually
Occasional maintenance	Reseed	As required.
	Prune adjacent trees	Every 2 years, or as otherwise advised
	Silt removal	Every 5 years (depending on the requirement for regular maintenance)
Remedial actions	Repair erosion or other damage	As required
	Repair inlets, outlets and overflows	As required

2 Crate Maintenance

Maintenance schedule	Required action	Frequency
Regular maintenance	Inspect to identify any area of underperformance and correct (repair, improve etc)	Monthly for 3 months then annually
	Remove debris from drained area to prevent entry to the system	Monthly
	Check any infiltration surfaces which allow water to percolate into the tanks for blockages, correct as necessary	Annually
	Remove sediment from traps	Annually/as required
Remedial actions	Repair/replace inlets, outlets, overflows, and vents	As required.
Monitoring	Check that outlets, inlets, vents, and overflows are in good condition and working as intended	Annually
	Inspect tank internally, remove any sediment if present and if required	Every 5 years (or more frequently if necessary)

3 Swale / Grassed Filter Drain Maintenance

Maintenance schedule	Required action	Frequency
Regular maintenance	Litter and debris removal	Monthly, as required
	Grass cutting	Monthly, as required by season
	Upkeep of any other planting	Monthly, then decreasing in frequency, as required by season
	Inspect the swale bed for any ponding (a possible indication of reduced infiltration).	Monthly, as required
	Inspect inlets, outlets, overflows for debris and condition	Monthly
	Inspect system for silt (traps, chambers and surfaces)	Half yearly
Occasional maintenance	Reseed and replant bare areas, consider reasons for poor growth and failure of plants to establish and amend planting, improve soil etc	As required
Remedial actions	Repair erosion or other damage (reseed or re-turf)	As required.
	Relevel uneven surfaces	As required.
	Scarify topsoil, remediate soil to improve any reduction in infiltration	As required.
	Remove notable accumulations of sediment	As required.
	Remove and safely dispose of any oils or petrol residues.	As required

4 Pervious Pavement Maintenance

Maintenance schedule	Required action	Frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Remedial actions	Remedial work to any depressions, rutting and cracked surfacing considered detrimental to the structure performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required
Monitoring	Initial inspection	Annually
	Inspect tank internally, remove any sediment if present and if required	Every 5 years (or more frequently if necessary)
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 hours after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

5 Orifice Maintenance

Maintenance schedule	Required action	Frequency
Remedial actions	Repair/replace inlets, outlets, overflows.	As required
Monitoring	Check that controls, protection, outlets, inlets and overflows are in good condition and working as intended	Half Yearly

REV	DESCRIPTION	DE	DR	CH	DATE
P03	CLIENT NAME UPDATED	-	DP	-	02/2021
P02	OUTFALL RELOCATED	-	DP	-	02/2021
P01	SW STRATEGY REVISED	-	DP	-	02/2021

DESIGNED BY	DRAWN BY	CHECKED BY
-	DP	-

SCALE @ A1 SIZE: D.N.S.
DATE: 22/01/2021

PROJECT TITLE
LITTLE COURT, WRATTING ROAD, HAVERHILL

DRAWING TITLE
MAINTENANCE PLAN

CLIENT
CARE (LITTLE COURT) LTD

CANNON
CONSULTING ENGINEERS
Highways, Transport & Infrastructure Planning

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Newmarket, CB8 7PN
Tel: 01638 555107
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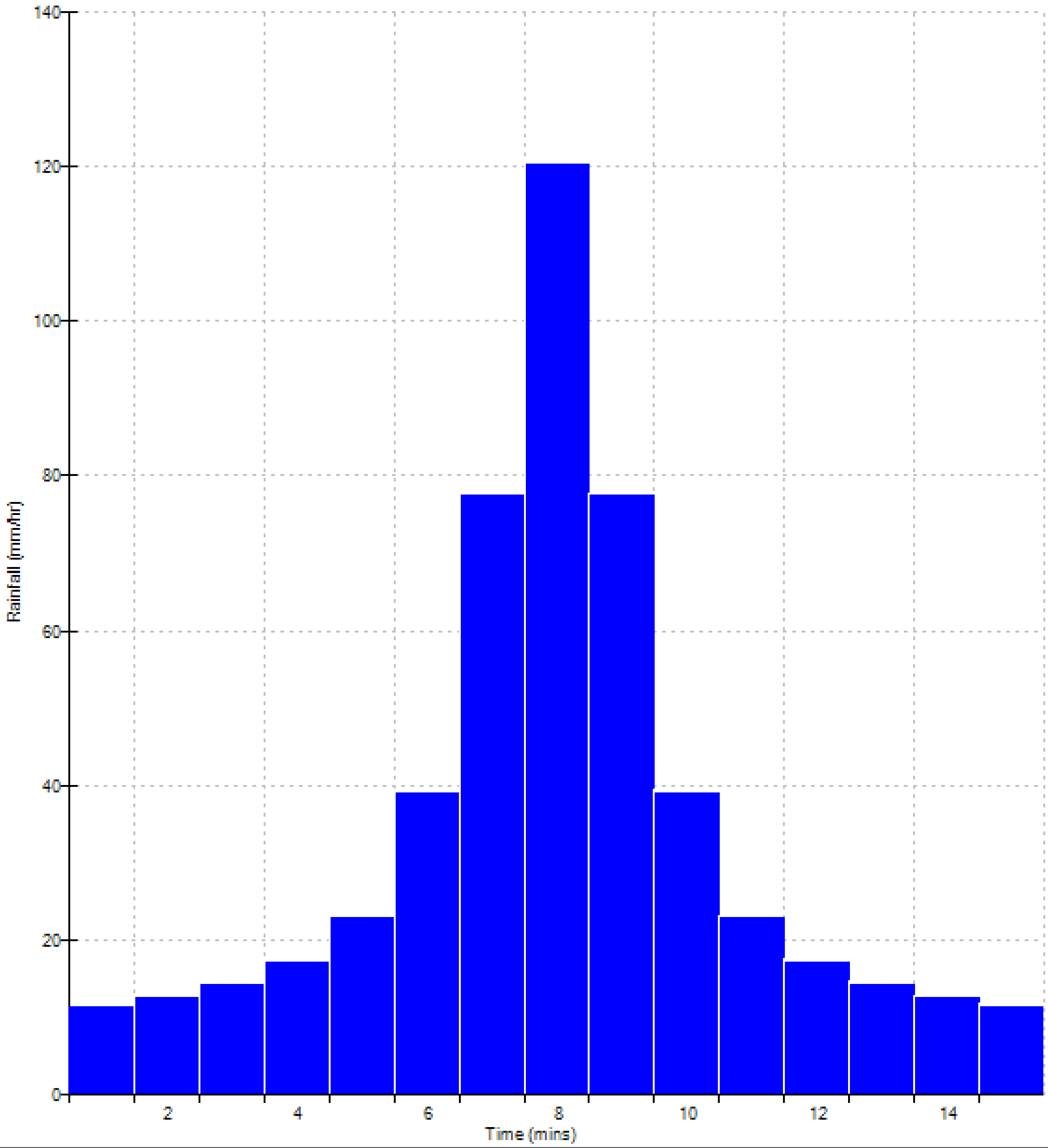
DRAWING NUMBER: ZA921 - PL - SK - 303
REV.: P03

Rainfall profile

Storm duration (mins) 15

FEH Data

FEH Rainfall Version	2013
Site Location	GB 568536 246997 TL 68536 46997
Data Type	Point
Peak Intensity (mm/hr)	120.402
Ave. Intensity (mm/hr)	34.070
Return Period (years)	2.0



Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.950	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
BASIN	0.068	5.00	103.500	1350	1.350
CRATES 1	0.255	5.00	105.450	1200	1.910
CRATES 2	0.072	5.00	105.400	1200	1.860
CRATES 3	0.161	5.00	105.250	1200	1.750
CRATES 4	0.045	5.00	105.000	1200	1.500
CRATES 5	0.122	5.00	104.100	1200	1.200
ORIFICE 1			104.750	1200	1.350
ORIFICE 2			103.500	1350	1.365

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)
1.000	CRATES 1	CRATES 4	25.000	0.600	103.540	103.500	0.040	625.0	300	5.67	50.0
2.000	CRATES 2	CRATES 3	16.000	0.600	103.540	103.500	0.040	400.0	225	5.41	50.0
2.001	CRATES 3	ORIFICE 1	35.000	0.600	103.500	103.400	0.100	350.0	300	6.11	50.0
1.001	CRATES 4	ORIFICE 1	30.000	0.600	103.500	103.400	0.100	300.0	300	6.22	50.0
1.002	ORIFICE 1	CRATES 5	28.000	0.600	103.400	102.900	0.500	56.0	300	6.45	50.0
1.003	CRATES 5	BASIN	34.000	0.600	102.900	102.300	0.600	56.7	300	6.72	50.0
1.004	BASIN	ORIFICE 2	6.000	0.600	102.150	102.135	0.015	400.0	450	6.82	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)
1.000	0.621	43.9	43.8	1.610	1.200	0.255	0.0	246	0.705
2.000	0.648	25.7	12.4	1.635	1.525	0.072	0.0	109	0.640
2.001	0.834	59.0	40.0	1.450	1.050	0.233	0.0	181	0.895
1.001	0.902	63.8	51.5	1.200	1.050	0.300	0.0	205	1.000
1.002	2.105	148.8	91.5	1.050	0.900	0.533	0.0	170	2.208
1.003	2.092	147.9	112.4	0.900	0.900	0.655	0.0	197	2.295
1.004	1.010	160.7	124.1	0.900	0.915	0.723	0.0	298	1.111

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	25.000	625.0	300	CIRCULAR	105.450	103.540	1.610	105.000	103.500	1.200
2.000	16.000	400.0	225	CIRCULAR	105.400	103.540	1.635	105.250	103.500	1.525
2.001	35.000	350.0	300	CIRCULAR	105.250	103.500	1.450	104.750	103.400	1.050
1.001	30.000	300.0	300	CIRCULAR	105.000	103.500	1.200	104.750	103.400	1.050
1.002	28.000	56.0	300	CIRCULAR	104.750	103.400	1.050	104.100	102.900	0.900
1.003	34.000	56.7	300	CIRCULAR	104.100	102.900	0.900	103.500	102.300	0.900
1.004	6.000	400.0	450	CIRCULAR	103.500	102.150	0.900	103.500	102.135	0.915

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	CRATES 1	1200	Manhole	Adoptable	CRATES 4	1200	Manhole	Adoptable
2.000	CRATES 2	1200	Manhole	Adoptable	CRATES 3	1200	Manhole	Adoptable
2.001	CRATES 3	1200	Manhole	Adoptable	ORIFICE 1	1200	Manhole	Adoptable
1.001	CRATES 4	1200	Manhole	Adoptable	ORIFICE 1	1200	Manhole	Adoptable
1.002	ORIFICE 1	1200	Manhole	Adoptable	CRATES 5	1200	Manhole	Adoptable
1.003	CRATES 5	1200	Manhole	Adoptable	BASIN	1350	Manhole	Adoptable
1.004	BASIN	1350	Manhole	Adoptable	ORIFICE 2	1350	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
BASIN	103.500	1.350	1350	1	1.003	102.300	300
				0	1.004	102.150	450
CRATES 1	105.450	1.910	1200	0	1.000	103.540	300
CRATES 2	105.400	1.860	1200	0	2.000	103.540	225
CRATES 3	105.250	1.750	1200	1	2.000	103.500	225
				0	2.001	103.500	300
CRATES 4	105.000	1.500	1200	1	1.000	103.500	300
				0	1.001	103.500	300
CRATES 5	104.100	1.200	1200	1	1.002	102.900	300
				0	1.003	102.900	300
ORIFICE 1	104.750	1.350	1200	1	2.001	103.400	300
				2	1.001	103.400	300
				0	1.002	103.400	300

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
ORIFICE 2	103.500	1.365	1350	1	1.004	102.135	450

Simulation Settings

Rainfall Methodology	FEH-13	Skip Steady State	x	1 year (l/s)	2.0
Summer CV	0.950	Drain Down Time (mins)	240	30 year (l/s)	5.6
Winter CV	0.950	Additional Storage (m³/ha)	20.0	100 year (l/s)	7.5
Analysis Speed	Normal	Check Discharge Rate(s)	✓	Check Discharge Volume	x

Storm Durations

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

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

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)	1.000	Betterment (%)	0
SAAR (mm)	587	QBar	2.3
Soil Index	1	Q 1 year (l/s)	
SPR	0.37	Q 30 year (l/s)	
Region	6	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

Node ORIFICE 1 Online Orifice Control

Flap Valve	x	Design Depth (m)	1.200	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	1.5		
Invert Level (m)	103.400	Diameter (m)	0.025		

Node ORIFICE 2 Online Orifice Control

Flap Valve	x	Design Depth (m)	1.000	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	3.1		
Invert Level (m)	102.135	Diameter (m)	0.038		

Node BASIN Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	102.300
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	81.0	0.0	1.200	295.0	0.0

Node CRATES 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	103.540
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	306.0	0.0	1.200	306.0	0.0	1.201	0.0	0.0

Node CRATES 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	103.540
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	115.5	0.0	1.200	115.5	0.0	1.201	0.0	0.0

Node CRATES 3 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	103.500
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	61.8	0.0	1.200	61.8	0.0	1.201	0.0	0.0

Node CRATES 4 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	103.500
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	85.3	0.0	1.200	85.3	0.0	1.201	0.0	0.0

Node CRATES 5 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	102.900
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	40

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	151.9	0.0	0.300	151.9	0.0	0.301	0.0	0.0

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	BASIN	472	103.058	0.908	16.5	114.8814	0.0000	SURCHARGED
1440 minute winter	CRATES 1	1410	104.441	0.901	8.6	265.3222	0.0000	SURCHARGED
1440 minute winter	CRATES 2	1410	104.441	0.901	3.3	100.5679	0.0000	SURCHARGED
1440 minute winter	CRATES 3	1410	104.441	0.941	5.2	58.0358	0.0000	SURCHARGED
1440 minute winter	CRATES 4	1410	104.441	0.941	2.8	77.8753	0.0000	SURCHARGED
480 minute winter	CRATES 5	472	103.058	0.158	11.0	23.3110	0.0000	OK
1440 minute winter	ORIFICE 1	1410	104.441	1.041	2.5	1.1772	0.0000	SURCHARGED
480 minute winter	ORIFICE 2	472	103.058	0.923	3.1	1.3211	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
480 minute winter	BASIN	1.004	ORIFICE 2	3.1	0.110	0.019	0.9507	
1440 minute winter	CRATES 1	1.000	CRATES 4	0.9	0.169	0.022	1.7605	
1440 minute winter	CRATES 2	2.000	CRATES 3	-1.0	0.111	-0.037	0.6363	
1440 minute winter	CRATES 3	2.001	ORIFICE 1	2.5	0.158	0.042	2.4647	
1440 minute winter	CRATES 4	1.001	ORIFICE 1	-1.4	-0.036	-0.022	2.1126	
480 minute winter	CRATES 5	1.003	BASIN	10.9	0.739	0.074	1.8368	
1440 minute winter	ORIFICE 1	Orifice	CRATES 5	1.3				
480 minute winter	ORIFICE 2	Orifice		2.9				101.0