Stage 2 Flood Risk Assessment

Land at 48-50 London Road, Northgate, Crawley

Client

Living Danish Developments Ltd

Ref: 12896

Date: December 2024

Consulting Engineers

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Issue	Issue date	Compiled	Checked
First Issue	08 November 2024	FVV	MR
Second Issue	06 December 2024	FVV	MR

1 Introduction

1.1 This report has been prepared for Living Danish Developments Ltd in relation to the land at 48-50 London Road, Northgate, Crawley.

1.2 The client's ultimate objective is to submit an application for Full Planning Permission to build a series of homes on this currently vacant plot. This Stage 2 Flood Risk Assessment (FRA) follows on from the pre-application discussions with the Lead Local Flood Authority (LLFA) and the Stage 1 FRA previously prepared (September 2024). The LLFA for this scheme is West Sussex County Council (WSCC).

1.3 This Stage 2 FRA aims to demonstrate compliance with the 2024 National Planning Policy Framework (NPPF) and latest Planning Practice Guidance (PPG).

2 Existing Site and Current Flood Conditions

2.1 The application site located to the north of Crawley, in an area situated just off London Road, to the south of the Tushmore Gyratory and the A2011-A23. It is centred on approximate Ordnance Survey grid reference 526970, 137640. The site is within the area administered by WSCC & Crawley Borough Council (CBC). A location plan is included in **Appendix A.**

2.2 The site measures approximately 0.22 hectares and is accessed from London Road. It currently comprises grassland, bordered by mature tree planting to the north and west and surrounded by residential properties.

2.3 Topography: The site topographical survey (see **Appendix B**) indicates an initial fall from the boundary with London Road (67.65m AOD) down to the larger grassland area at 66.49m AOD. The western half of the grassed area sits lower than the surrounding ground, with levels sitting approximately at 66.30m AOD and localised depressions down to 65.96m AOD. The eastern half of the grassed area on the other hand is raised roughly 400mm, with levels between 66.75 and 67.30, dropping back down to 66.16 to the north towards Bader Court car park.

2.4 Geology: The published geology for the site consists of Wealden Clay Formation with no superficial deposits. There is a band of Alluvium (clay, silt, sand and gravel) passing immediately east of the site. The site does not lie within a Source Protection Zone (SPZ).

2.5 Groundwater vulnerability: Groundwater vulnerability at the site is defined as "unproductive "for most of the site, with small extents to the east being defined as "Low".

2.6 Infiltration testing to BRE365 was undertaken at the site in September 2024. This found the site is underlain by a thick layer of made ground, followed by clayey alluvium. Groundwater was observed in the trial pit at a depth of 1.17m below ground. During testing, whilst the water level was observed to fall in the first 60min, it then appeared to remain static at a depth of around 1.07m below ground. This seems to indicate the water table observed at the base of the pit may have been rising during the testing. For this reason, an infiltration rate could not be calculated in accordance with BRE365 digest. It was however estimated to be between $8.07x10^{-6}$ and $3.85x10^{-5}$ m/s. Further detail can

be found in the infiltration report in **Appendix C**.

2.7 Hydrology: The nearest open watercourse is an opened section of the Crawter's Brook (EA Main River), located approximately 850m to the southeast of the site, within Northgate Playing Field. This flows northwards and eventually joins with the River Mole near Gatwick Airport. A stream also used to historically bisect the site, in line with the localised depressions identified on the topographic survey.

2.8 Sewers: Thames Water records (in **Appendix D**) indicate the presence of two main foul sewers and one surface water sewer within London Road, flowing northwards towards Tushmore Gyratory. There is also a separate main surface water sewer located adjacent to the site's eastern boundary. This a significant surface water sewer in terms of size, and it is likely that the historical stream discussed in section 2.7 has been directed to it.

2.9 Flood zone: The EA's Flood Map for Planning shows the entirety of the application site is within Flood Zone 1 – Low Probability, having less than a 1 in 1,000 (0.1%) AEP of river flooding (See **Appendix E**).

2.10 Surface Water Flooding: The EA data for surface water flooding is mapped on the Site Constraint Plan (12896-1000) in **Appendix E.** In the 1 in 30-year storm event (High Risk), the flooding is limited to the existing localised depression – in other words, the rainfall falling over the site area accumulates in the low point leading to ponding. The low velocities (<0.1 m/s) corroborate this assessment. Similarly, in the 1 in 100-year storm event (Medium Risk), ponding originates within the site itself local to the existing depressions.

2.11 However, in the 1 in 1000-year storm event (Low Risk), a more significant flow path issuing southwest of the site (behind House number 44 and 46) crosses through the centre of the site and continues on towards Five Acres to the northeast. Flood depths are below 300mm within the site, with velocities around 0.25-0.3 m/s. This corresponds to a Low hazard rating ("Danger for Some").

2.12 Historical Flooding: The EA's historical flood map shows the site to be removed from any such events.

2.13 Reservoir Flood Risk: The site is not located within the breach extent of any reservoir or artificial water body.

3 Proposed Flood Risk Mitigations

3.1 The assessment undertaken in Section 2 of this report indicates that the flood risk profile of the site is generally low, with the exception of the surface water flood risks.

3.2 The Local Planning Authority (CBC) has been consulted to confirm the requirements for a sequential test. They have confirmed the following (see correspondence in **Appendix H**):

> *"There isn't a practical way to apply the sequential test to non-fluvial sources. From our perspective a sequential test isn't required, but we would want the flood risk and drainage strategy to pick up on how the site would be planned/designed to avoid/minimise surface water flood risk."*

3.3 As discussed in Section 2, it is contended that the surface water flooding shown in the High and Medium risk scenarios is originating within the site as a result of the existing localised depressions. It is contended that the flooding in this scenario will therefore be adequately managed by carefully designing the site levels and through the proposed SuDS strategy for the scheme (see Section 4).

3.4 The predicted flood level in the Low-Risk scenario (1 in 1000 year event – equivalent to the 1 in 100 + climate change event), has been estimated at 66.5mAOD based on the flood extent within the site in relation to the existing contour lines (see Figure 1 below).

Figure 1: Risk of Flooding from Surface Water Flooding (1 in 1000 year event) from EA data, in relation to existing contours.

3.5 The proposed Finished Floor Levels shall therefore be set to minimum 300mm above

the predicted flood levels: 66.800. This is shown on the layout included in **Appendix F**.

3.6 The overland flow paths have been modelled using SCALGO Live in order to assess the impact of the proposals on the flow routes. This is a high-level volumetric model which enables the assessment of ponding locations and flow paths for a set rainfall depth, based on the terrain data. The SCALGO mapping is included in **Appendix E**.

3.7 The existing flow paths were first mapped for the existing scenario based on the topographic survey levels – with LIDAR levels retained beyond the topographic survey extent – to provide a baseline scenario (Map 1). The proposed building blocks were then added onto the model to assess their impact on the flow routes should no mitigations be proposed. This is shown on Map 2, which clearly illustrates a significant increase in ponding offsite, due to the main flow paths through the site being cut off by the buildings.

3.8 A localised depression has thus been added through the development in order to provide an alternate route for the overland flow and ensure any ponding off site is not exacerbated by the proposals. The proposed depression is mapped on the drainage layout in **Appendix F**, with the resulting overland flow mapping (Map 3) in **Appendix E**. A map showing both the existing flooding (in purple) and proposed flooding (in blue) is also included (Map 4); which illustrates that the proposed mitigation ensures that the flow patterns upstream of the site remain unchanged compared to the pre-development scenario.

3.9 The localised depression routing has been coordinated with the architect to ensure it does not create an increased risk to the proposed buildings, including retaining sufficient path widths to ensure a safe access/egress route from all buildings away from the main flow path.

4 Proposed Drainage Strategy

4.1 The proposed surface water drainage for the scheme follows the drainage hierarchy, as below:

- Store rainwater for later use
- Infiltration to ground
- Discharge to surface water body
- Discharge to a surface water sewer or highway drain
- Discharge to a combined sewer

4.2 A rainwater harvesting system shall be included for each of the proposed blocks, to meet some of their water demands in line with latest guidance. Indicative tank sizes and locations have been shown on the drainage layout in **Appendix E**, based on a preliminary assessment of likely water demand and roof areas. The systems themselves shall be designed by a specialist in due course. The rainwater harvesting tanks will have overflows to the main drainage network described below – for the purpose of this report, it is assumed the tanks are full at the start of the design storm event (i.e. all runoff overflow to the proposed drainage network).

4.3 As discussed in paragraph 2.6, the infiltration testing conducted at the site demonstrated good infiltration potential but also indicated a high groundwater table (approximately 1m below surface). On this basis, soakaways and other formal infiltration measures have been discarded for managing the roof runoff, as it would not be possible to maintain the required minimum buffer from the base of the soakaway to the groundwater table.

4.4 However, in order to minimise the runoff volumes directed to the existing surface water sewers, it is proposed that all hardstanding be permeably surfaced to allow for direct infiltration into the ground. This is achieved through a combination of permeable surfacing, as shown on the drainage layout (**Appendix E**) and within the separate landscaping report. These will effectively therefore function as landscaped (permeable) areas for the purpose of the drainage calculations.

4.5 Roof runoff in excess of the rainwater harvesting system (as described in paragraph 4.2) shall be directed to the existing Thames Water surface water system at a reduced rate. This corresponds to an impermeable catchment area of 856m^2 (0.086 ha). A pre-planning capacity enquiry has been submitted to Thames Wate, who confirmed they have capacity in their network to accept the new flows (see **Appendix H**). It should be

noted that existing House 48 (to be demolished as part of this application) currently drains to Thames Water network unrestricted.

4.6 Greenfield rates for the site have been calculated in accordance with IH124, as listed below. Calculations are included in **Appendix G**.

1 in 1 year	4.87 l/s/ha
QBAR	5.73 l/s/ha
1 in 30 years	13.17 l/s/ha
1 in 100 years	21.42 l/s/ha

The 1 in 1-year rate corresponding to the impermeable catchment area would therefore be 0.42 l/s. Due to the practical limitations of vortex flow controls and to minimise the risks of blockage, the discharge from the site shall be limited to 1 l/s.

4.7 The attenuation volume required to achieve this (66m^3) shall be provided through two attenuation tanks located beneath the landscaped areas. Green roofs shall also be provided on bin and cycle stores, as shown on the landscape proposals. Other forms of SuDS to manage the roof runoffs have been discarded due to the following two reasons:

- Pitched roofs would reduce the effectiveness of green roofs on the main blocks.
- Provision of raingardens/ponds/swales to manage roof runoff within the landscape feature is constrained by the overland flow route (see section 3.8) and would reduce the available amenity spaces for residents.

4.8 Drainage calculations using FEH2022 and CV values of 1 are included in **Appendix G**. These show that the proposed attenuation storage will offer sufficient volume to cater for the roof runoff in all events up to and including the 1 in 100-year + 40% climate change, in line with the latest climate change allowances for the area.

4.9 Water Quality: The SuDS Manual (CIRIA C753) Simple Index Approach is a method to estimate the efficiency of the proposed SuDS features in relation to the expected pollution levels at the site. The pollution hazard level for the hardstanding areas has been determined as Low, corresponding to low traffic roads/residential car parks. The corresponding indices are: 0.5 (TSS), 0.4 (Metals), and 0.4 (Hydrocarbons). As described in paragraph 4.4, these areas will drain directly to ground – thus mitigations indices in relation to discharging to groundwater shall be used. For permeable pavement, these are 0.7 (TSS), 0.6 (Metals), and 0.7 (Hydrocarbons). The water quality of the underlying groundwater will therefore be suitably protected.

4.10 The roof areas are considered to have a very low pollution hazard level according to

CIRIA guidance. It is therefore considered acceptable to discharge them to the existing surface water sewer with no additional stages of treatment.

4.11 Foul drainage: the nearest existing foul manhole to the site has an invert level of 65.93m AOD within London Road. As the site levels fall away from the road towards the East, the foul drainage for the proposed scheme will need to be pumped back up to the current location of House 48, before connecting into the existing sewer in London Road. This arrangement is shown on the drainage layout in **Appendix E**. The new connections to Thames Water network will be subject to a S106 New Sewer Connection Application in due course.

- End of Report -

Appendix A

Site Location Map

ALL DIMENSIONS MUST BE CHECKED ON SITE. INFORM THE ARCHITECT OF ANY DISCREPANCIES PRIOR TO CONSTRUCTION
INTERNAL LAYOUTS INDICATIVE

NOTES

1. WINDOW MULLION / PATIO GLAZING ARRANGEMENT INDICATIVE SUBJECT TO DETAIL DESIGN
2. SITE FOOTPRINT TAKEN FROM SURVEY. REST OF EXISTING PLAN, ELEVATION RIDGE AND EAVES HEIGHT OF IMMEDIATE NEIGHBOURING BUILDINGS FROM OS & APPROXIMATE
3. DO NOT SCALE OFF THIS DRAWING. FOR CONSTRUCTION ALL DIMENSIONS TO BE CHECKED ON SITE.
4. EXISTING TREES SHOWN INDICATIVELY, PLEASE REFER TO XXX
5. PROPOSED TREE LOCATIONS SHOWN INDICATIVELY
6. INFORM ARCHITECT OF ANY DISCREPANCIES PRIOR TO CONSTRUCTION

SITE BOUNDARY :

0 50 100
10 20 30 40 60 70 80 90
SCALE :

N

REV	DATE	DESCRIPTION	DRN
P02	20.09.24	PLANNING	DG
P01	15.02.24	FIRST DRAFT	DG

Gouldstone and Co.

CLIENT
LIVING DANISH

PROJECT
LONDON ROAD
CRAWLEY

DRAWING TITLE
SITE LOCATION PLAN

SCALE 1:1250@A3 A2 SHEET

STATUS
PLANNING

DRAWING NO REV
LR_P_050 P02

Appendix B

Topographic Survey

GRID NORTH INDICATIVE

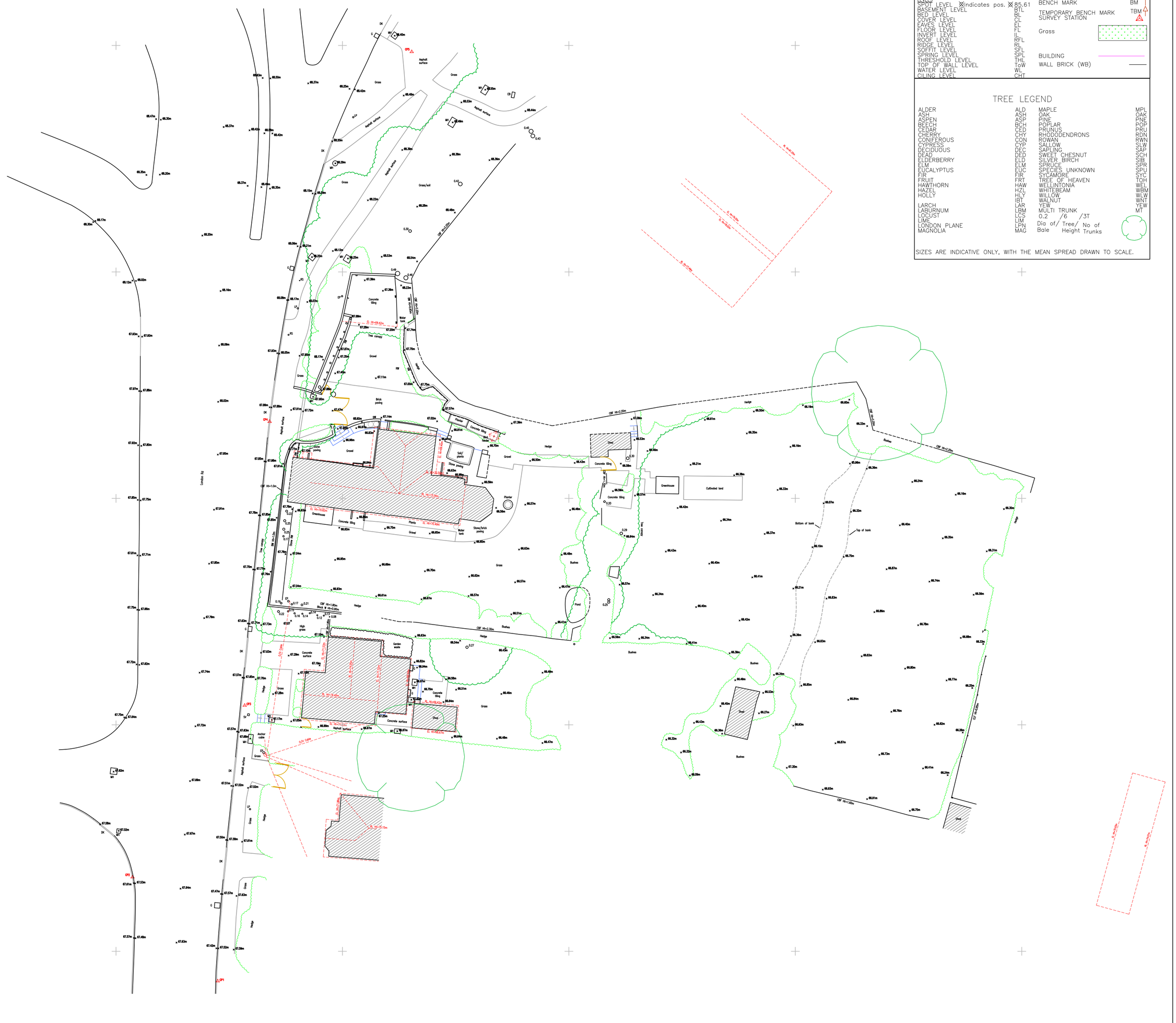
LEGEND

AIR CONDITIONING UNIT	ACU	FENCE DESCRIPTION	
ADVERTISING BOARD	AB	BARBED WIRE FENCE	BWF
AIR VALVE	AV	CHAIN LINK FENCE	CLF
BOLLARD	B	CHESNUT PALING FENCE	CPF
BELISHA BEACON	BC	CLOSE BOARD FENCE	CBF
BASEMENT LIGHT	BL	CONCRETE SLAB FENCE	BL
BOUNDARY POST/PEG	BP	POST AND RAIL FENCE	CIF
BUS STOP	AB	CRASH BARRIER	CBR
CABLE TELEVISION PIT	CATV	IRON RAILINGS	IRF
CHIMNEY LEVEL	CHL	INTERWOVEN FENCE	IWF
CONTROL BOX	CB	LARCH LAP FENCE	LLF
DOWN PIPE	DP	MISCELLANEOUS FENCE	MSF
DOG WASTE BIN	DWB	OPEN BOARD FENCE	OBF
ELECTRICITY CABLE PIT	ELCP	PALING FENCE	PLF
ELECTRICITY CONTROL BOX	CBE	PALISADE FENCE	PAL
ELECTRICITY INSPECTION COVER	AB	PEDESTRIAN SAFETY BARRIER	PSB
ELECTRICITY POLE	EP	POST AND CHAIN FENCE	PCF
ELECTRICITY PYLON	ELPL	POST AND MESH FENCE	PMF
FIRE HYDRANT	FH	POST AND RAIL FENCE	PRF
FLAG STAFF	FS	POST AND WIRE FENCE	PWF
FLOODLIGHT	FLT	TRELLIS	TLS
FLOWER BED	FB	WIRE MESH FENCE	WMF
FOOTPATH	FP	AVERRAGE	Ave
GAS VALVE	GV	HEIGHT	Ht
GUIDE POST	GP		
GULLY	G	DRAINAGE	
INSPECTION COVER	IC	SURFACE WATER PIPE	SW
INSPECTION COVER UNKNOWN	ICU	FOUL WATER PIPE	FW
KERB OUTLET	KO	NO VISIBLE CONNECTION	NVC
DROP KERB	DK	UNABLE TO LIFT	UTL
LAMP POST	LP	UNABLE TO SURVEY	UTS
LIGHTED BOLLARD	LTB	TAKEN FROM RECORDS	TFR
LITTER BIN	LB	DRAINAGE CHANNEL (OPEN)	DC
MANHOLE	MH	DRAINAGE CHANNEL (COVERED)	DC
MILESTONE	MS	OVERHEAD WIRE	O/H/W
NAME PLATE	NP	BANKING	
NOTICE BOARD	NB	EXTENT OF VEGETATION	
PARKING METER	PM	HEDGES	
POST	P	MARSH	
POTS BOX	PB	GATE	SINGLE DOUBLE
RAIN WATER PIPE	RWP	RETAINING WALL	RTW
REFLECTOR POST	RP	SLOPING MASONRY	
ROAD SIGN	RS	STILE	
RODDING EYE	RE	WALL (BRICK SPIRE RAILINGS)	
SERVICE MARKER POST	SMP	GLASS ROOFED ARCHWAY	
SKYLIGHT	SL	CONTOURS	25.50
SLUICE VALVE	SV	ORDNANCE SURVEY	OSBM
SOIL & VENT PIPE	SVP		
SPOTLIGHT (GROUND)	SPLG	LEVELS	
SPOTLIGHT (TOWER)	SPLT	SPOT LEVEL ⊠Indicates pos.	⊠ 85.61
TELECOM CONTROL BOX	CBT	BASEMENT LEVEL	BTL
TELECOM MANHOLE	TMH	BED LEVEL	BL
TELECOM PILLAR	TLP	COVER LEVEL	CL
TELEGRAPGH POLE	TP	EAVES LEVEL	EL
TELEPHONE CALL BOX	TCB	FLOOR LEVEL	FL
TICKET MACHINE	TM	INVERT LEVEL	IL
TRAFFIC LIGHT	TL	ROOF LEVEL	RFL
TRAFFIC LIGHT CONTROL BOX	CBTL	RIDGE LEVEL	RL
TRAFFIC LIGHT CONTROL POST	CPTL	SOFFIT LEVEL	SFL
VENT PIPE	VP	SPRING LEVEL	SPL
WATER METER	WM	THRESHOLD LEVEL	THL
WASH OUT	FB	TOP OF WALL LEVEL	ToW
WATER CONTROL PILLAR	WCP	WATER LEVEL	WL
WATER TAP	Tap	CILING LEVEL	CHT
WATER TROUGH	WT		
		BENCH MARK	BM
		TEMPORARY BENCH MARK SURVEY STATION	TBM
		Grass	
		BUILDING	
		WALL BRICK (WB)	

TREE LEGEND

ALDER	ALD	MAPLE	MPL
ASH	ASH	OAK	OAK
ASPEN	ASP	PINE	PNE
BEECH	BCH	POPLAR	POP
CEDAR	CED	PRUNUS	PRU
CHERRY	CHY	RHODODENDRONS	RDN
CONIFEROUS	CON	ROWAN	RWN
CYPRESS	CYP	SALLOW	SLW
DECIDUOUS	DEC	SAPLING	SAP
DEAD	DED	SWEET CHESNUT	SCH
ELDERBERRY	ELD	SILVER BIRCH	SIB
ELM	ELM	SPRUCE	SPR
EUCALYPTUS	EUC	SPECIES UNKNOWN	SPU
FIR	FIR	SYCAMORE	SYC
FRUIT	FRT	TREE OF HEAVEN	TOH
HAWTHORN	HAW	WELLINTONIA	WEL
HAZEL	HZL	WHITEBEAM	WBM
HOLLY	HLY	WILLOW	WLW
	IBT	WALNUT	WNT
LARCH	LAR	YEW	YEW
LABURNUM	LBM	MULTI TRUNK	MT
LOCUST	LCS	0.2 /6 /3T	
LIME	LIM	Dia of/ Tree/ No of	
LONDON PLANE	LPN	Bale Height Trunks	
MAGNOLIA	MAG		

SIZES ARE INDICATIVE ONLY, WITH THE MEAN SPREAD DRAWN TO SCALE.



NOTES

GRID — THE SURVEY GRID IS BASED ON GNSS COORDINATES

LEVELING — ALL LEVELS ARE BASED ON OS DATUM

DRAINAGE — INVERT LEVELS, PIPE SIZES AND PIPE CONNECTIONS HAVE BEEN SURVEYED BY VISUAL INSPECTION ONLY AND THEREFORE THE COMPLETE ACCURACY OF THIS INFORMATION CANNOT BE GUARANTEED

COORDINATE TABLE

STATION	DESCRIPTION	EASTING	NORTHING	LEVEL
1	HN	526911.23	137596.71	67.50
2	HN	526901.83	137608.19	67.62
3	HN	526914.21	137627.14	67.66
4	HN	526916.96	137658.48	67.89
5	HN	526932.65	137699.31	68.53

HN—Hilti® Nail PKN—Parker Kalon® Nail PGM—Permanent Ground Marker
PM—Punch Mark PN—Pipe Nail PN—Washer (used with PKN and PN)

REV	DESCRIPTION			
01	First Visit	SV	26/07/2022	
REV	DESCRIPTION	Surveyor	SURVEY DATE	
02	Ridge and eave heights of neighboring buildings added	RF	BR	11/08/22
01	First Issue	RF	BR	10/08/22
REV	DESCRIPTION	DRAWN	APPR	DATE

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LAND SURVEYING MEASURED BUILDING SURVEY SETTING OUT

PROJECT TITLE
48-50 London Road Crawley RH10 8JQ

DRAWING DETAIL
Topographical Survey

CLIENT
Lars Graabek

Scale 1:250

Page Size		Checked	Approved	INFORMATION
A1			BR	FINAL

Drawing Number	Rev	Date
MB-SURV-LR-TS-002	2	11/08/2022

Appendix C

Infiltration Report

48-50 London Road
Crawley
West Sussex

In Situ Infiltration Test Report

Report Beneficiary:
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10 Upper Grosvenor Road
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TN1 2EP

Project Reference: P16797

Report Reference: R16355

Document Control				
Issue No.	**Status**	**Issue Date**	**Notes**	
1	Final	17th September 2024		
Report Section		**Prepared By**	**Approved By**	
In Situ Infiltration Testing		Rebecca Webb BSc FGS	Steven McSwiney BA mod Geol MSc FGS	

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Figure 1 Site Location Plan

Figure 2 Site Plan

Proposed Development Layout

Explanatory Notes

Exploratory Hole Record

Trial Pit In Situ Infiltration Test Results

1. INTRODUCTION

Ashdown Site Investigation Ltd was requested to undertake in situ infiltration testing at 48-50 London Road, Crawley, West Sussex to assist others with the design of a sustainable drainage system for the proposed development. A copy of the proposed development layout is presented in the appendices.

The specific objectives of the works were to:
a) Investigate the shallow ground and groundwater conditions at the specified test location; and
b) Undertake in situ infiltration testing and provide calculated infiltration rates to assist others with the drainage design.

The scope of the works covered by this report, and the terms and conditions under which they were undertaken, were set out within the offer letter Q14415Rev2, dated 6th September 2024. The instruction to proceed was received from the client.

2. SITE CONTEXT

2.1 Site Location

The site is located at 48-50 London Road, Crawley, West Sussex, and is centred on the approximate Ordnance Survey national grid reference 526970, 137640. A site location plan and site plan are presented as Figure 1 and Figure 2, respectively.

2.2 Geological Setting

2.2.1 Expected Geology and Aquifer Designation

The stratigraphic succession that may be expected to underlie the site has been established by reference to British Geological Survey (BGS) mapping and the BGS Lexicon of Named Rock Units. The expected stratigraphy is presented in the following table.

Table 1. Expected Strata and Aquifer Designation

Type	Stratum	Aquifer Designation
Superficial	Alluvium	Secondary A Aquifer
Bedrock	Weald Clay Formation	Unproductive Stratum

2.2.2 Groundwater Source Protection Zones (SPZ)

The Environment Agency defines SPZs as those areas where groundwater supplies are at risk from potentially polluting activities and accidental releases of pollutants. SPZs are primarily a policy tool used to control activities close to water supplies intended for human consumption.

The site does not lie within a SPZ.

3. SITE WORKS

The intrusive site works comprised a single hand dug trial pit, designated TP01, which was excavated to an average depth of 1.22m below ground level. The exploratory hole location is shown on Figure 2.

Falling head soakage testing was undertaken in the trial pit in general accordance with the test methodology given by BRE guidance[1].

Descriptions of the strata encountered and comments on groundwater conditions are shown in the appended exploratory hole record, together with explanatory notes to assist in its interpretation.

4. STORMWATER INFILTRATION SYSTEMS

In-situ infiltration testing[2] was carried out in trial pit TP01.

It is noted that prior to the start of the in situ infiltration testing, groundwater was recorded at the base of the trial pit at a depth of 1.17m below ground level. During the first test, whilst the water level was observed to fall initially, after a period of some 60 minutes the water level appeared to remain static at a depth of around 1.07m below ground level. A similar observation was also made during the second fill. It is considered likely therefore that the groundwater noted at the base of the pit on completion of its excavation was not the equalised water table, and that the water table may have been rising during the soakage testing.

Given the presence of shallow groundwater within the test pit, calculation of the soil infiltration rates in accordance with the BRE digest was not possible. For each test, the soil infiltration rate has therefore been calculated by dividing the volume of water lost during the test by the product of the average surface area of the trial pit in contact with water during the test period and the test duration in seconds.

The infiltration rates derived from the tests are summarised in the following table.

Table 2. Calculated Infiltration Rates

Exploratory Hole	Test Response Zone Depth (m)		Stratum	Infiltration Rate (f) (m/sec)
	Top	Bottom		
TP01 Test 1	0.72	1.22	Made Ground and Alluvium	8.07×10^{-6}
TP01 Test 2	0.73	1.22	Made Ground and Alluvium	1.20×10^{-5}
TP01 Test 3	0.71	1.22	Made Ground and Alluvium	3.85×10^{-5}

The value 'f' is equivalent to the soil infiltration coefficient 'q' quoted in the Construction Industry Research and Information Association (CIRIA) Report 156.

The results from the infiltration tests should be provided to engineers responsible for the design of the drainage system. It is noted that the presence of a high groundwater table may restrict the storage capacity of the system.

[1] Section 3.2.3 of Building Research Establishment (BRE) Digest 365, 2016.
[2] Conducted in general accordance with the requirements of BRE 365, Soakaway Design.

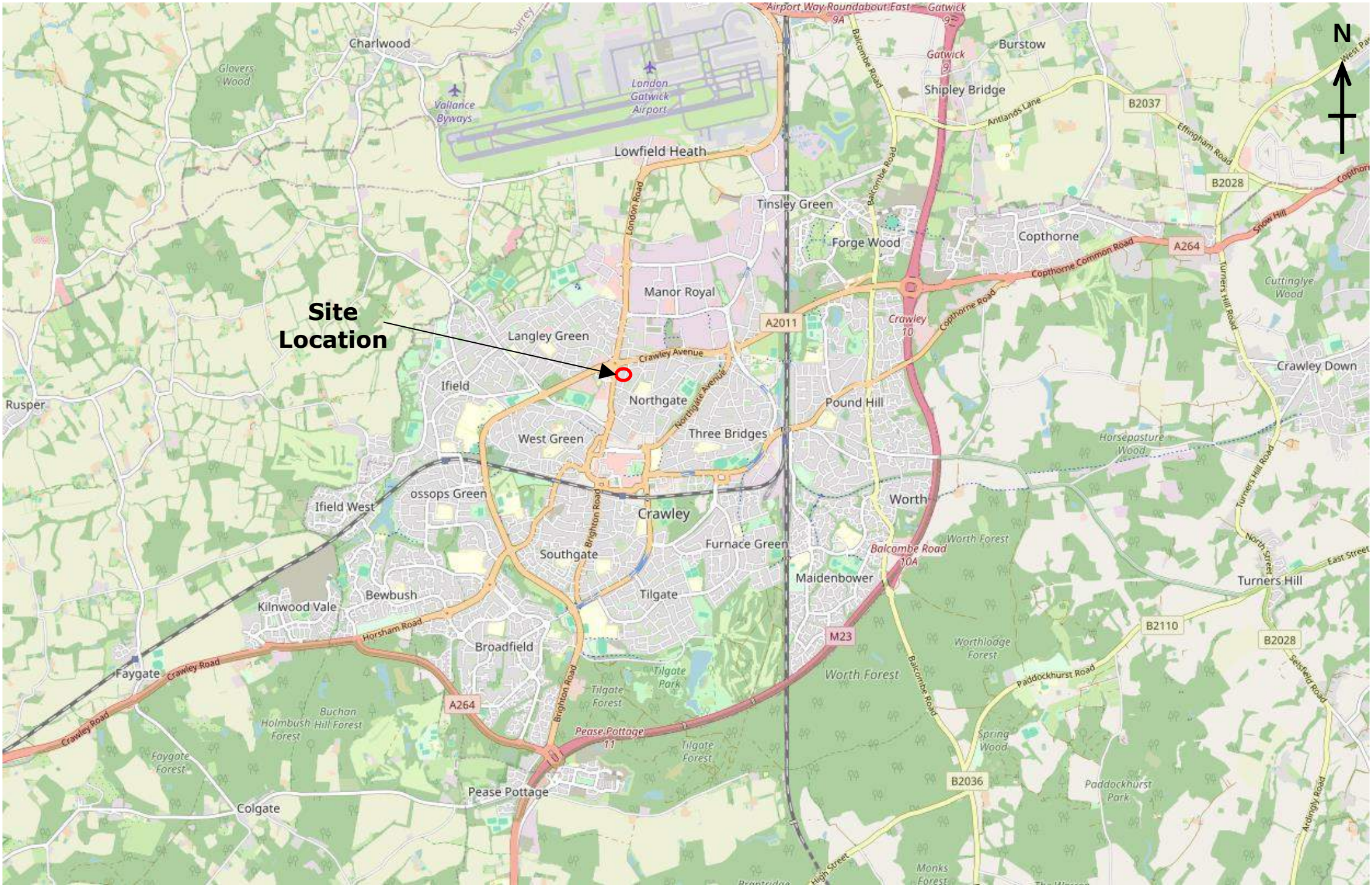
To comply with building regulations[3], point discharging infiltration systems (conventional ring or trench soakaways) are required to be constructed a minimum of 5.0m away from proposed or existing buildings.

Ashdown Site Investigation Ltd.

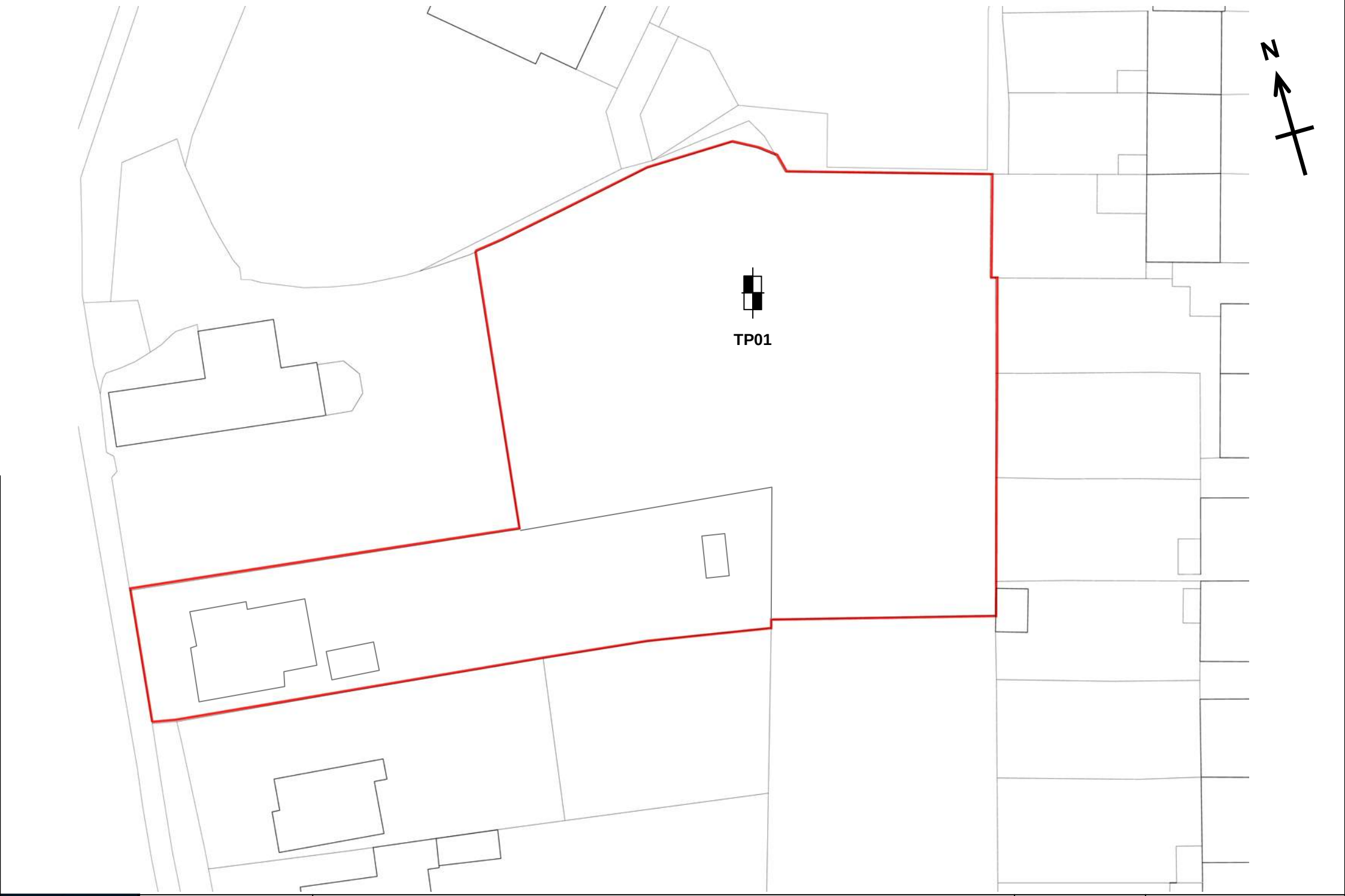
[3] The Building Regulations 2010; Part H; Drainage and Waste Disposal

FIGURES AND APPENDICES

Figure 1 Site Location Plan
Figure 2 Site Plan
Proposed Development Layout
Explanatory Notes
Exploratory Hole Record
Trial Pit In Situ Infiltration Test Results



ASHDOWN SITE INVESTIGATION LIMITED	Site Location Plan	Site Name	Figure No.	Project Reference
		48-50 London Road, Crawley, West Sussex	1	P16797



ASHDOWN SITE INVESTIGATION LIMITED	Site Plan NTS	Site Name	Figure No.	Project Reference
		48-50 London Road, Crawley, West Sussex	2	P16797

Explanatory Notes

Symbols and abbreviations on Exploratory Hole Records

Samples

U 'Undisturbed' Sample: - 100mm diameter by 450mm long. The number of blows to drive in the sampling tube is shown after the test index letter in the SPT column.
Pi Piston Sample: 'Undisturbed' sample 100mm diameter by 600mm long.
D Disturbed Sample
R Root Sample
B Bulk Disturbed Sample
W Water Sample
ES Environmental Suite (on older records may be referenced J T)

In Situ Testing

S Standard penetration test (SPT): Using the split spoon sampler.
C Standard Penetration Test (SPT): Using a solid cone instead of the sampler – conducted usually in coarse grained soils or weak rocks.
V Shear Vane Test: Undrained shear strength (cohesion) (kN/m^2) shown within the Vane/Pen Test and N Value column.
H Hand penetrometer Test: Undrained shear strength (cohesion) (kN/m^2) shown within the Vane/Pen Test and N Value column.
P Perth Penetrometer Test: Number of blows for 300mm penetration shown under Vane/Pen Test and N Value column.

Excavation Method

CP Cable Percussion Borehole
RC Rotary Cored Borehole
WLS Dynamic Sampler Borehole using windowless sampler tubes
WS Dynamic Sampler Borehole using window sampler tubes
TP Trial Pit excavated using mechanic excavator
HDP Trial Pit excavated using hand tools

Soil Description

Description and classification of soils has been carried out using as a general basis the British Standard Geotechnical investigation and testing – Identification and classification of soil, Part 1 Identification and description (BS EN ISO 14688-1) and Part 2 Principles of classification (BS EN 14688-2) as well as the BS5930 code of Practice for Ground Investigations.

Rock Description

Description and classification of rocks has been carried out using as a general basis the British Standard Geotechnical investigation and testing – Identification and classification of rock, Part 1 Identification and classification (BS EN ISO 14689-1) as well as the BS5930 code of Practice for Ground Investigations. TCR – Total Core Recovery, SCR – Solid Core Recovery, RQD – Rock Quality Designation, NI – Non Intact, If – indicative fracture spacing (min/ave/max), FI – Fracture Index.

Chalk Description

Chalk description is based on BS EN ISO 14688, BS EN ISO 14689 and BS5930. The classification of chalk generally follows the guidance offered by the Construction Industry Research and Information Association (CIRIA) C574, 'Engineering in Chalk'. This is based on assessment of chalk density, discontinuity and aperture spacing, and the proportion of intact chalk to silt of chalk.

In Situ Strength Testing

Standard penetration testing (SPT) carried out in accordance with BS EN ISO 22476-3:2005.

Continuous dynamic probe testing conducted using a super heavy DPSH-B (As defined by BS EN ISO 22476-2:2005) probing geometry. The DPSH-B configuration is similar to that of the standard penetration test (SPT); the main differences being that the tip comprises a 90° cone, the driving rods are lighter than those used for SPT testing and the blow counts are recorded over 100mm increments rather than 300mm, as is the case for the SPT.

Perth penetrometer tests carried out in accordance with Australian Standard AS 1289:6.3.3-1997, Method of Testing Soils for Engineering Purposes; no equivalent European or British Standard having been published to date.

Undrained shear strength determinations made in-situ using a Geonor hand shear vane or a hand penetrometer.

Testing to determine the in-situ California Bearing Ratio (CBR) of soils conducted at shallow depths using a hand-held Transport Research Laboratory (TRL) cone penetrometer.

ASHDOWN SITE INVESTIGATION LIMITED
E-mail: contact@ashdownsi.co.uk
Web: www.ashdownsi.co.uk
Tel: 01273 483119

Site Name: 48-50 London Road, Crawley, West Sussex

Job Number: P16797

Start Date: 11/09/2024

End Date: 11/09/2024

Trial Pit Number: **TP01**

Samples and In Situ Testing				Legend	Depth/ Reduced Level	Stratum Description
Sample/ Test Type	Depth From (m)	Depth To (m)	Test Result			
					0.00	Topsoil over,
D	0.30				0.20	MADE GROUND: Dark brown slightly gravelly silty clay. Gravel is subangular to subrounded fine to coarse brick, flint and charcoal-like material.
D	0.50				0.50	MADE GROUND: Dark brown and brown mottled slightly gravelly slightly sandy clay with occasional bands/veins/pockets of light brown slightly sandy clay. Gravel is subangular to subrounded fine to coarse brick and flint with rare metal, charcoal-like material and aerated stone.
D	0.75				0.70	MADE GROUND: Light brown, grey and red brown clay.
D	1.00				0.90	MADE GROUND: Brown and dark brown mottled gravelly clay. Gravel is subangular to rounded fine to coarse flint with occasional brick and glass.
						Brown and dark brown mottled gravelly CLAY. Gravel is subangular to rounded fine to coarse flint. (Alluvium)
					1.22	End of trial pit at 1.22m

Remarks

Groundwater: Groundwater recorded at 1.17m depth on completion of trial pit.

Stability: Trial pit stable on completion.

Notes: n/a

Excavation Method: HDP

Pit Length: 1.00m

Pit Width: 0.33m

Made By: GRD

Infiltration Test Results

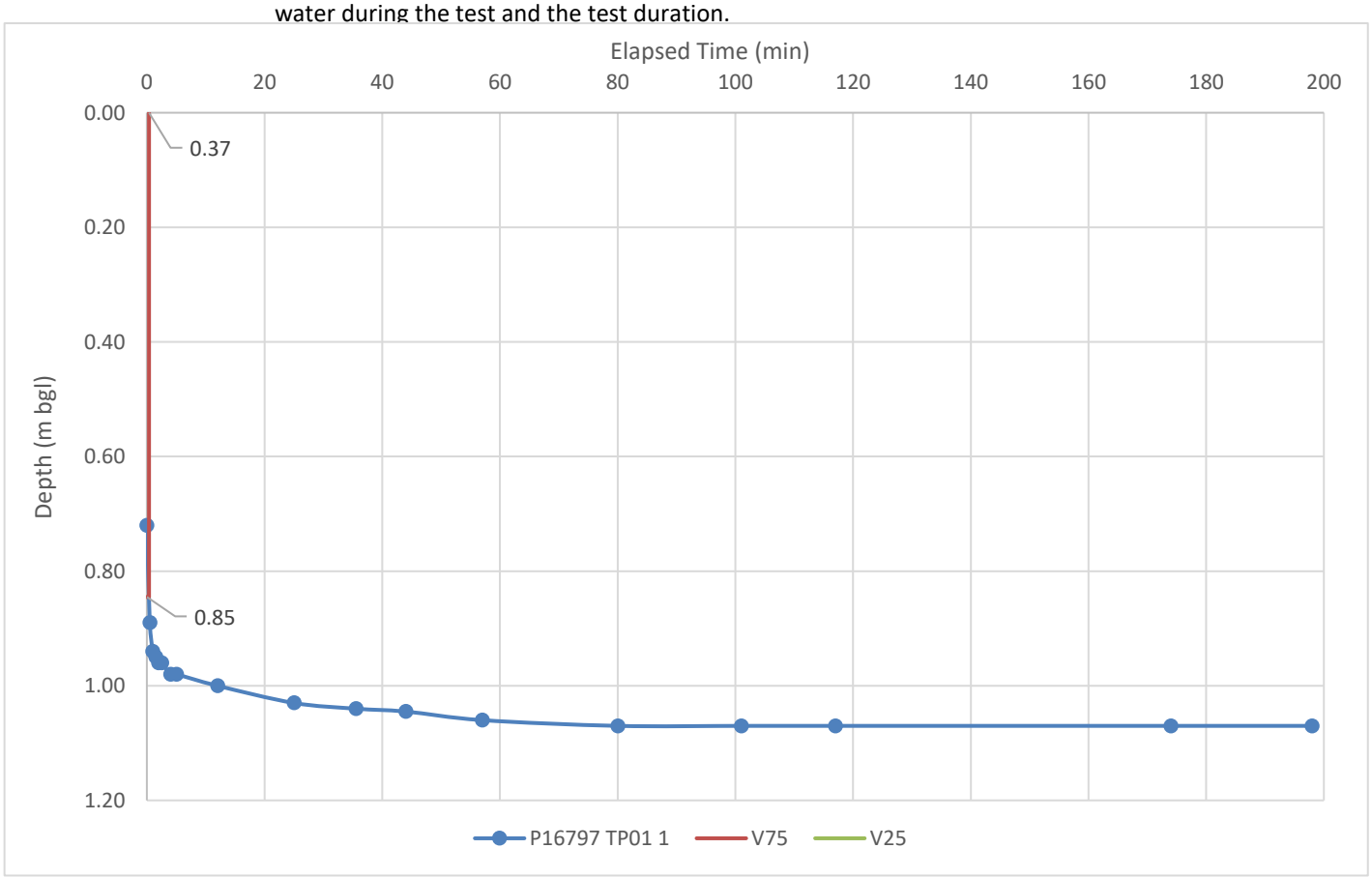
Test Position	TP01
Test No.	1
Project No.	P16797
Project Name	48-50 London Road, Crawley, West Sussex

Width of Pit	0.33	m	W
Length of Pit	1.00	m	L
Depth of Pit	1.22	m	D
Pit type	Open		

Volume of water introduced into pit	0.163	m^3	
Initial head of water	0.50	m	h_o
Water level at start of test	0.72	m	
Water level at end of test	1.07	m	
Volume of water discharged from pit	0.114	m^3	
Duration of test	198	min	
Average soaked surface area	1.19	m^2	
Time for water level to fall to 75% of initial head	0.37	min	t_{p75}
Time for water level to fall to 25% of initial head	Not reached	min	t_{p25}
Depth to water at 75% of initial head	0.85	m	d_{75}
Depth to water at 25% of initial head	Not reached	m	d_{25}
Time for the water level to fall from 75% to 25% of initial head	Not reached	min	t_{p75-25}
Effective storage volume of water in the soakage trial pit between 75% and 25% of initial head	Not reached	m^3	V_{p75-25}
Internal surface area of the soakage trial pit up to 50% of initial head and including the base area	0.99	m^2	a_{s50}

Infiltration rate **8.07E-06 m/sec f**

Calculation method: The water level did not fall below 25% of the effective storage depth. 'f' has been calculated by dividing the volume of water lost during the test by the product of the average surface area in contact with water during the test and the test duration.



Infiltration Test Results

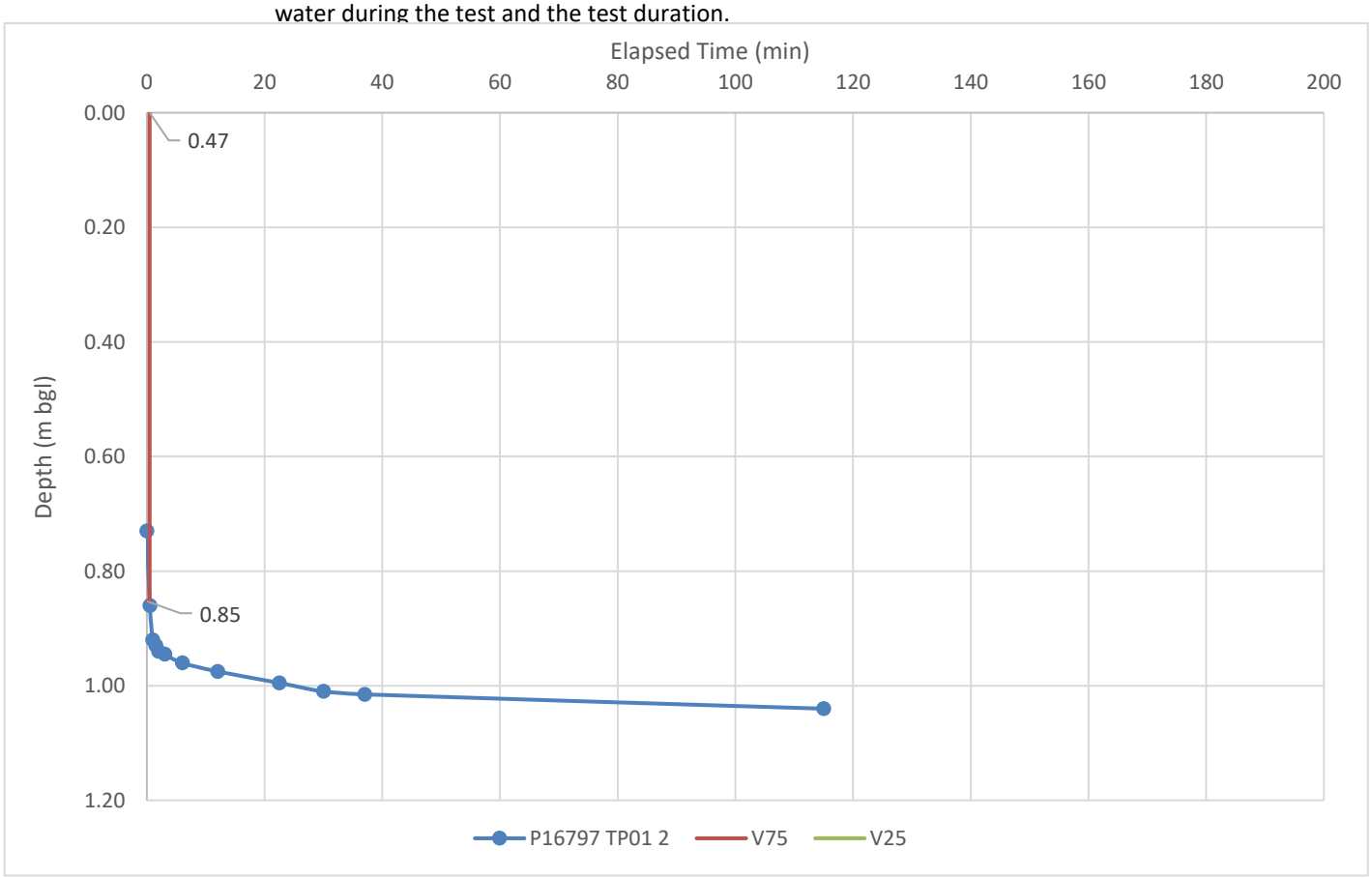
Test Position	TP01
Test No.	2
Project No.	P16797
Project Name	48-50 London Road, Crawley, West Sussex

Width of Pit	0.33	m	W
Length of Pit	1.00	m	L
Depth of Pit	1.22	m	D
Pit type	Open		

Volume of water introduced into pit	0.159	m^3	
Initial head of water	0.49	m	h_o
Water level at start of test	0.73	m	
Water level at end of test	1.04	m	
Volume of water discharged from pit	0.101	m^3	
Duration of test	115	min	
Average soaked surface area	1.21	m^2	
Time for water level to fall to 75% of initial head	0.47	min	t_{p75}
Time for water level to fall to 25% of initial head	Not reached	min	t_{p25}
Depth to water at 75% of initial head	0.85	m	d_{75}
Depth to water at 25% of initial head	Not reached	m	d_{25}
Time for the water level to fall from 75% to 25% of initial head	Not reached	min	t_{p75-25}
Effective storage volume of water in the soakage trial pit between 75% and 25% of initial head	Not reached	m^3	V_{p75-25}
Internal surface area of the soakage trial pit up to 50% of initial head and including the base area	0.97	m^2	a_{s50}

Infiltration rate **1.20E-05 m/sec f**

Calculation method: The water level did not fall below 25% of the effective storage depth. 'f' has been calculated by dividing the volume of water lost during the test by the product of the average surface area in contact with water during the test and the test duration.



Infiltration Test Results

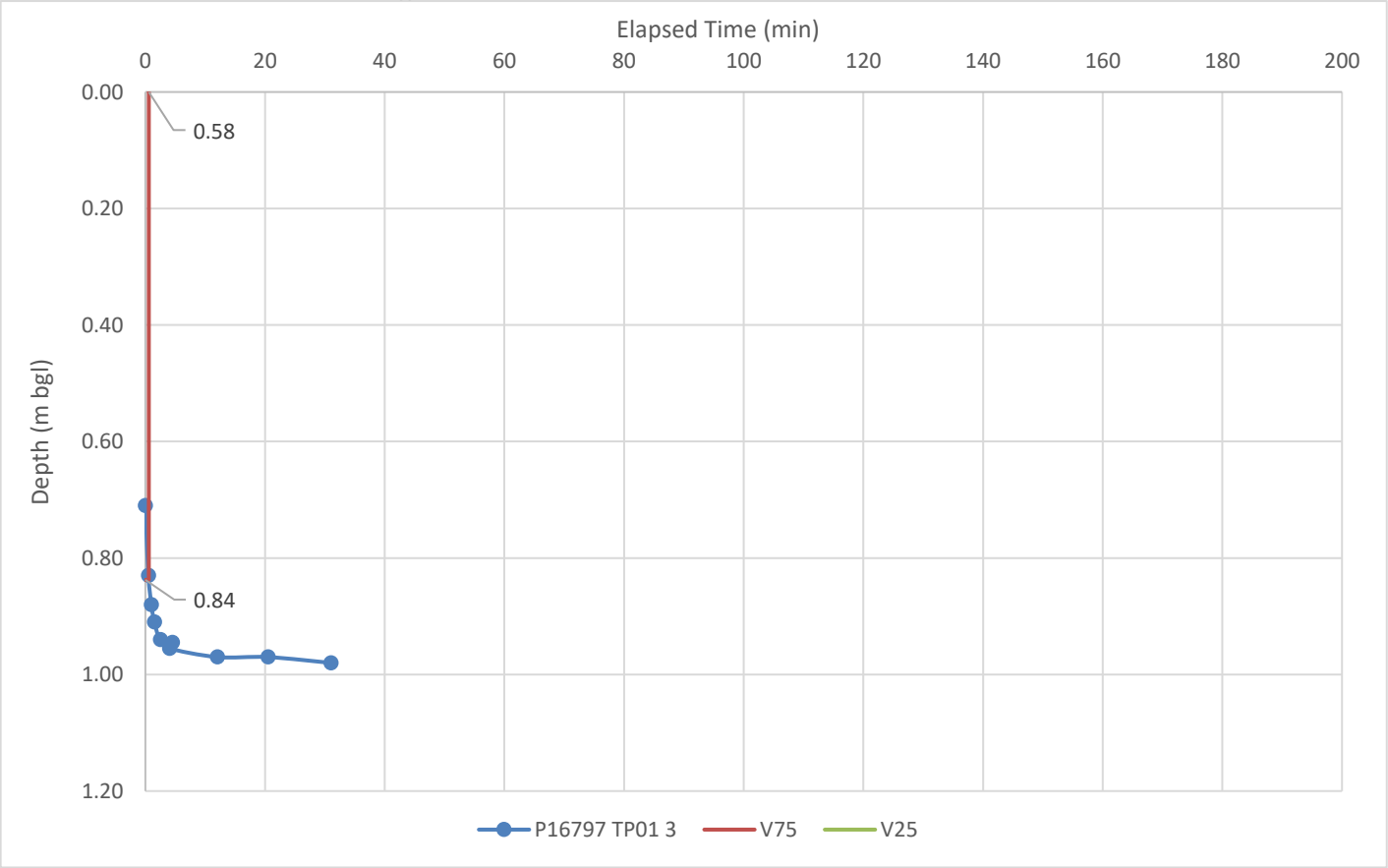
Test Position	TP01
Test No.	3
Project No.	P16797
Project Name	48-50 London Road, Crawley, West Sussex

Width of Pit	0.33	m	W
Length of Pit	1.00	m	L
Depth of Pit	1.22	m	D
Pit type	Open		

Volume of water introduced into pit	0.166	m^3	
Initial head of water	0.51	m	h_o
Water level at start of test	0.71	m	
Water level at end of test	0.98	m	
Volume of water discharged from pit	0.088	m^3	
Duration of test	31	min	
Average soaked surface area	1.32	m^2	
Time for water level to fall to 75% of initial head	0.58	min	t_{p75}
Time for water level to fall to 25% of initial head	Not reached	min	t_{p25}
Depth to water at 75% of initial head	0.84	m	d_{75}
Depth to water at 25% of initial head	Not reached	m	d_{25}
Time for the water level to fall from 75% to 25% of initial head	Not reached	min	t_{p75-25}
Effective storage volume of water in the soakage trial pit between 75% and 25% of initial head	Not reached	m^3	V_{p75-25}
Internal surface area of the soakage trial pit up to 50% of initial head and including the base area	1.00	m^2	a_{s50}

Infiltration rate **3.58E-05 m/sec f**

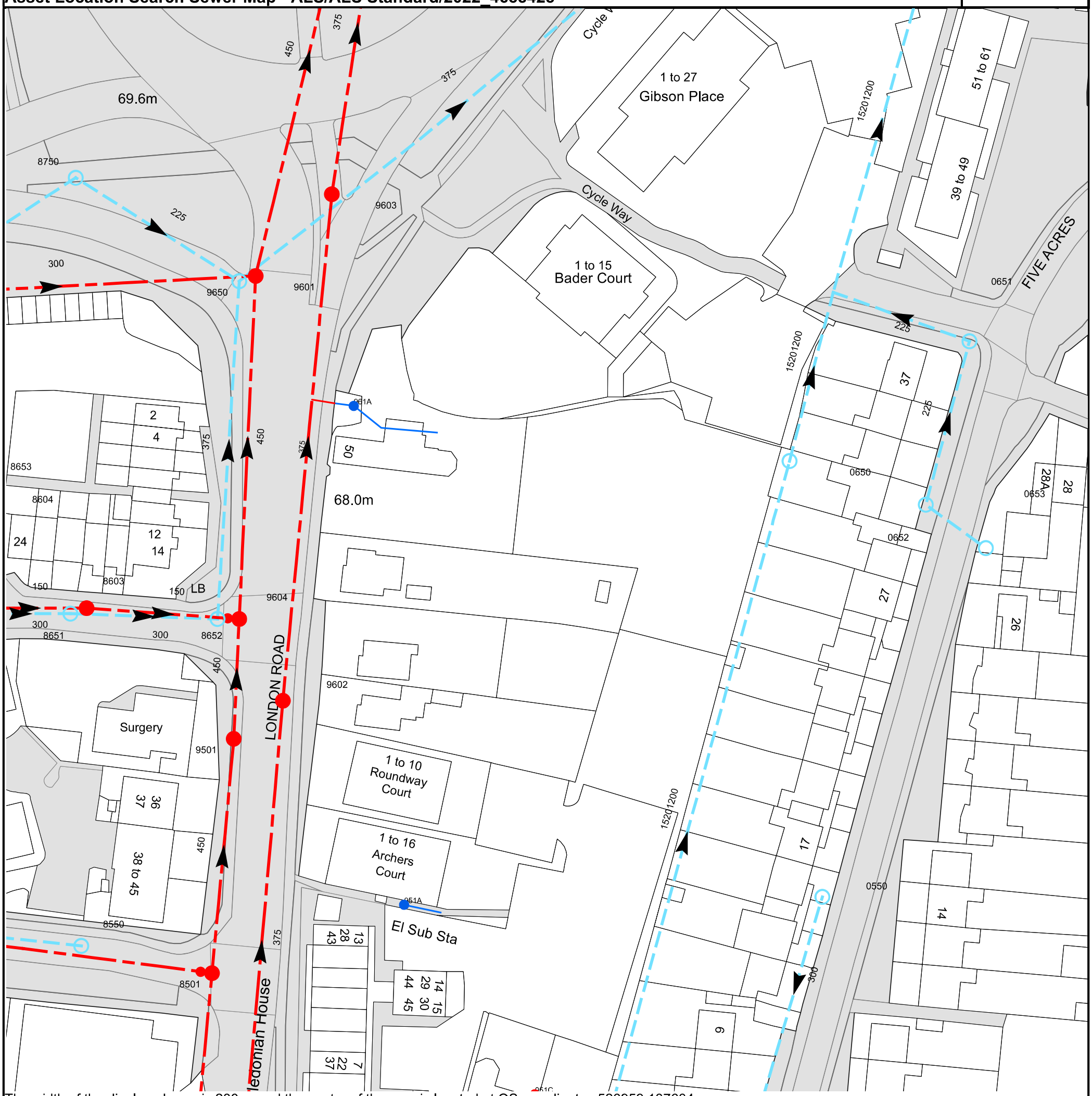
Calculation method: The water level did not fall below 25% of the effective storage depth. 'f' has been calculated by dividing the volume of water lost during the test by the product of the average surface area in contact with water during the test and the test duration.



Appendix D

Sewer Records

Asset Location Search Sewer Map - ALS/ALS Standard/2022_4658425



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 526959,137634

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
0652	66	64.72
0651	65.8	64.65
0653	65.98	64.78
8651	68.13	66.28
8750	69.98	67.52
8603	68.11	65.99
8652	67.56	65.8
9501	67.64	63.04
9604	67.56	62.97
9650	68.34	65
9601	68.13	62.79
9602	67.51	65.93
9603	n/a	n/a
961A	n/a	n/a
0650	66.28	63.66
8550	67.79	66.07
8501	67.41	63.07
951A	n/a	n/a
0550	66.18	65.11

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Asset Location Search - Sewer Key

Public Sewer Types (Operated and maintained by Thames Water)

Foul Sewer: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water Sewer: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined Sewer: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Storm Sewer

Sludge Sewer

Foul Trunk Sewer

Surface Trunk Sewer

Combined Trunk Sewer

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Vacuum

Thames Water Proposed

Vent Pipe

Gallery

Other Sewer Types (Not operated and maintained by Thames Water)

Sewer

Culverted Watercourse

Proposed

Decommissioned Sewer

Content of this drainage network is currently unknown

Ownership of this drainage network is currently unknown

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

Air Valve

Meter

Dam Chase

Vent

Fitting

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

Ancillary

Drop Pipe

Control Valve

Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol. Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

Inlet

Outfall

Undefined End

Other Symbols

Symbols used on maps which do not fall under other general categories.

Change of Characteristic Indicator

Public / Private Pumping Station

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Chamber

Operational Site

Ducts or Crossings

Casement

Ducts may contain high voltage cables. Please check with Thames Water.

Conduit Bridge

Subway

Tunnel

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plan are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate the direction of flow.
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
5) 'na' or '0' on a manhole indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimeters. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement.

If you are unsure about any text or symbology, please contact Property Searches on 0800 009 4540.

Appendix E

Flood Maps and Constraints

Flood map for planning

Your reference	Location (easting/northing)	Created
<Unspecified>	**526959/137638**	**3 Sep 2024 10:35**

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

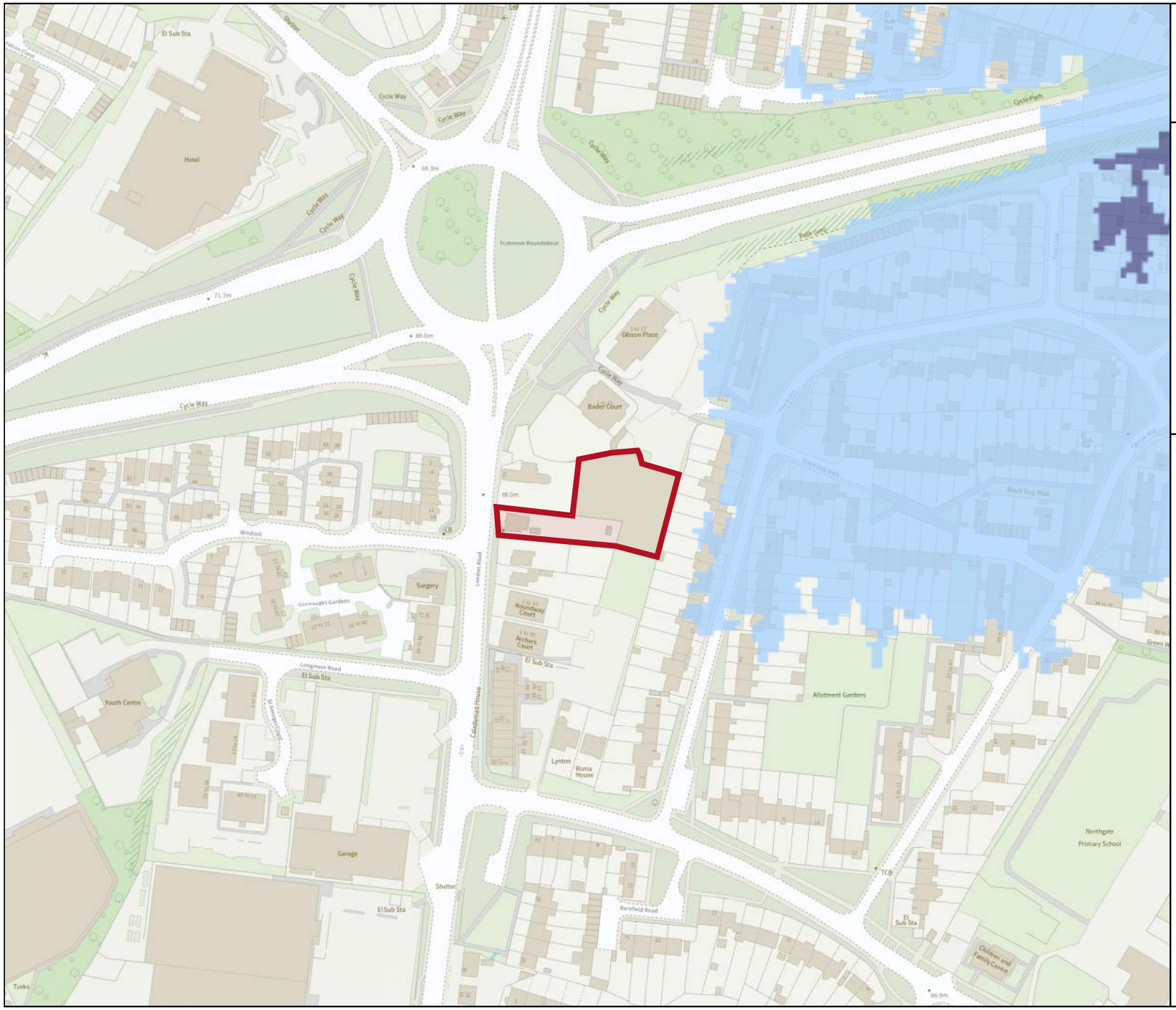
You will need to do a flood risk assessment if your site is **any of the following:**

- bigger that 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

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
<Unspecified>

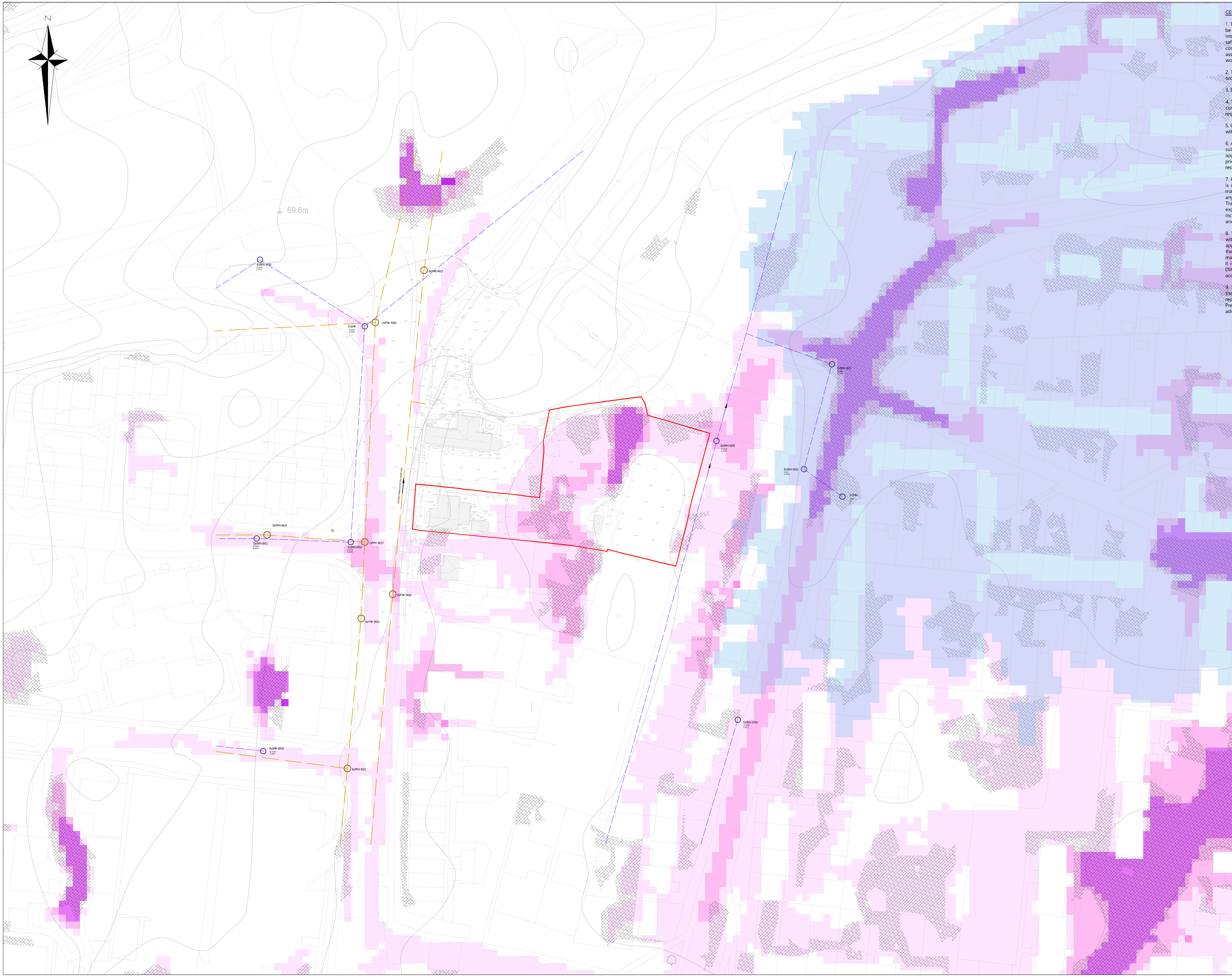
Location (easting/northing)
526959/137638

Scale
1:2500

Created
3 Sep 2024 10:35

- Selected area
- Flood zone 3
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Water storage area

0 20 40 60m



GENERAL NOTES

1. The location, size, depth and identification of existing services that may be shown or referred to on this drawing have been assessed from non intrusive observations , record drawings or the like. The contractor shall safely carry out intrusive investigations, trial holes or soundings prior to commencing work to satisfy himself that it is safe to proceed and that the assessments are accurate. any discrepancies shall be notified to gta prior to works commencing.

2. Tender or billing drawings shall not be used for construction or the ordering of materials.

3. Do not scale. All dimensions and levels to be site confirmed.

4. This drawing shall be read in conjunction with all relevant architects, consultants drawings and specifications, together with H&S plan requirements.

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It is your responsibility to ensure that the correct issue or revision of the DWG data file is being used and requests for updated information made accordingly.

9. Should any apparent discrepancies between the data contained within the DWG file and the current contract drawings become evident, it must be reported back to GTA Civils & Transport as soon as reasonably practicable. Precedence should be given to the current contract drawings (PDF) unless advised otherwise.

LEGEND

Flood zone

Flood Zone 2
Flood Zone 3

Surface water flood risk

Surface Water Flood Risk - 1 in 30yr
Surface Water Flood Risk - 1 in 100yr
Surface Water Flood Risk - 1 in 1000yr

Site

Ground level depressions - Gathered from LiDAR data
Surface Contours - Gathered from LiDAR data
Proposed Site Area
Existing Foul Drainage
Existing Storm Drainage

Rev	Amendments	Date	Dsn	Chk
P3	PROPOSED SITE LAYOUT REMOVED	08/11/24	NG	FVV
P2	UPDATED TO LATEST SITE LAYOUT	24/09/24	NG	FVV
P1	INITIAL ISSUE	05/09/24	NG	FVV

Status: FOR INFORMATION

Client: LIVING DANISH

Architect:

Project: LONDON ROAD CRAWLEY

Title: SITE CONSTRAINT PLAN

Date: SEPTEMBER 2024

Scale @ A1: 1:500

Clients Ref.:

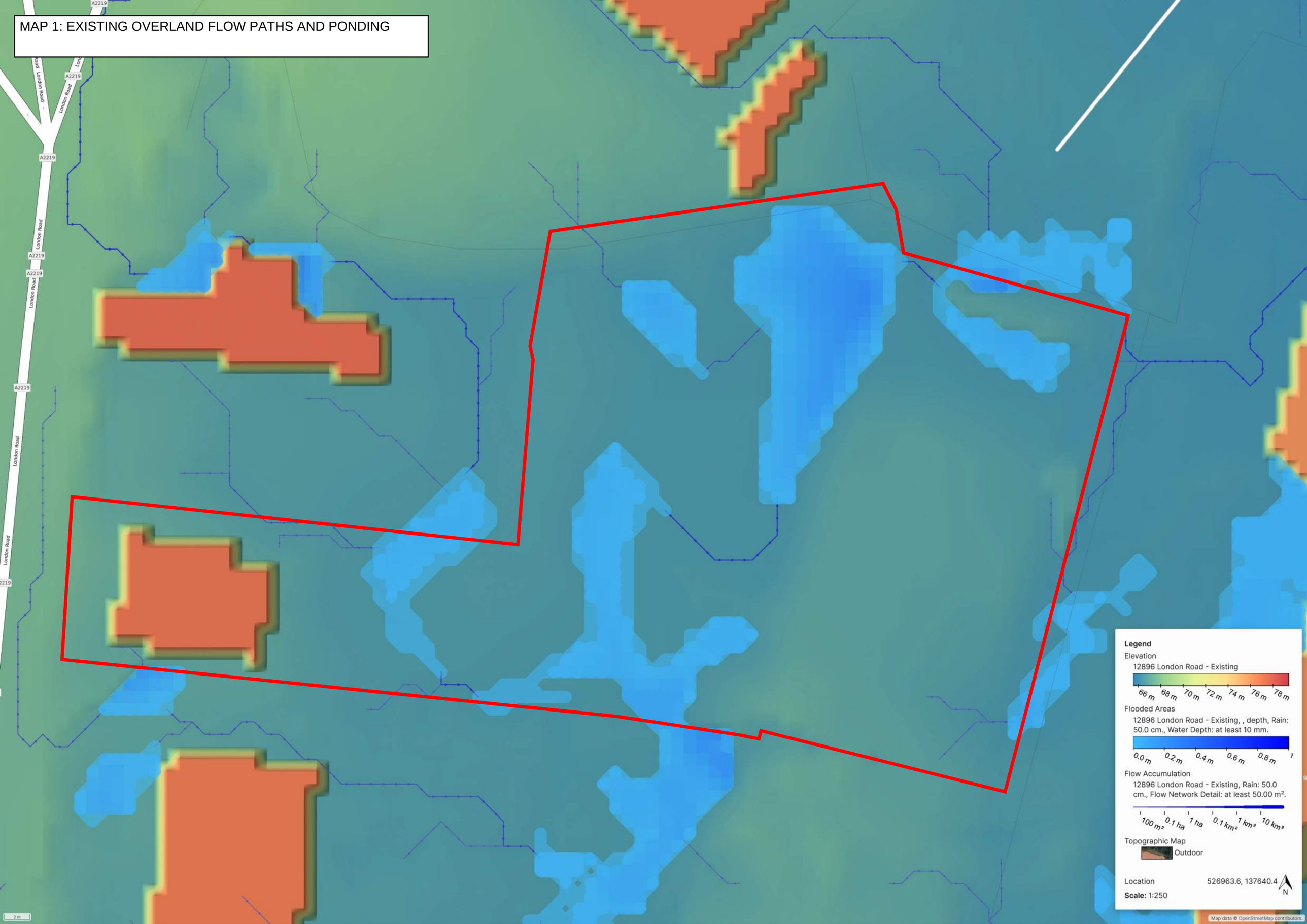
Project Ref.: 12896

gta Civils & Transport
Maple House, 192-198 London Road,
Burgess Hill, West Sussex, RH15 9RD
Tel.01444 871444 Web: www.gtacivils.co.uk

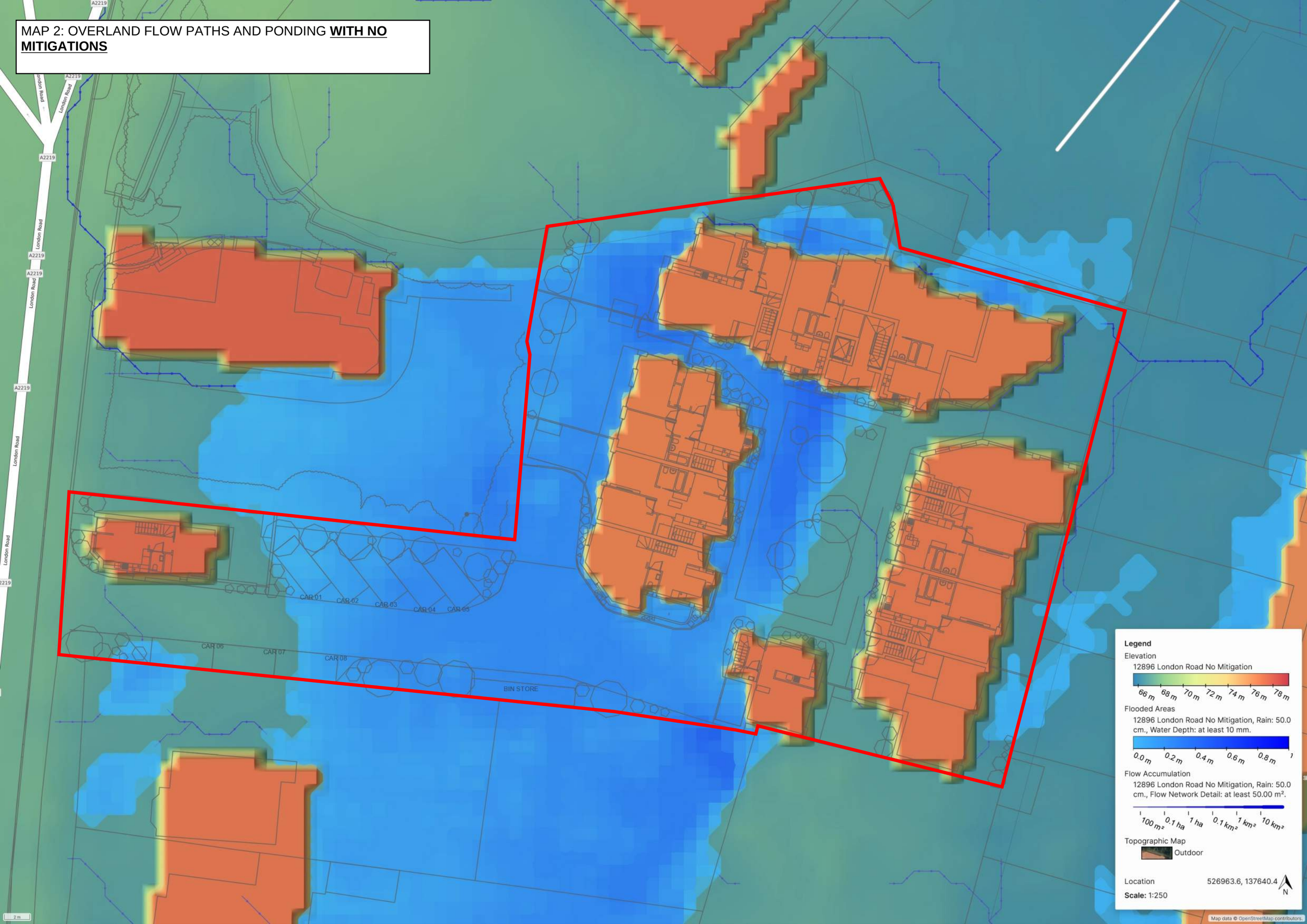
Drawing Number: 12896-1000

Rev.: P3

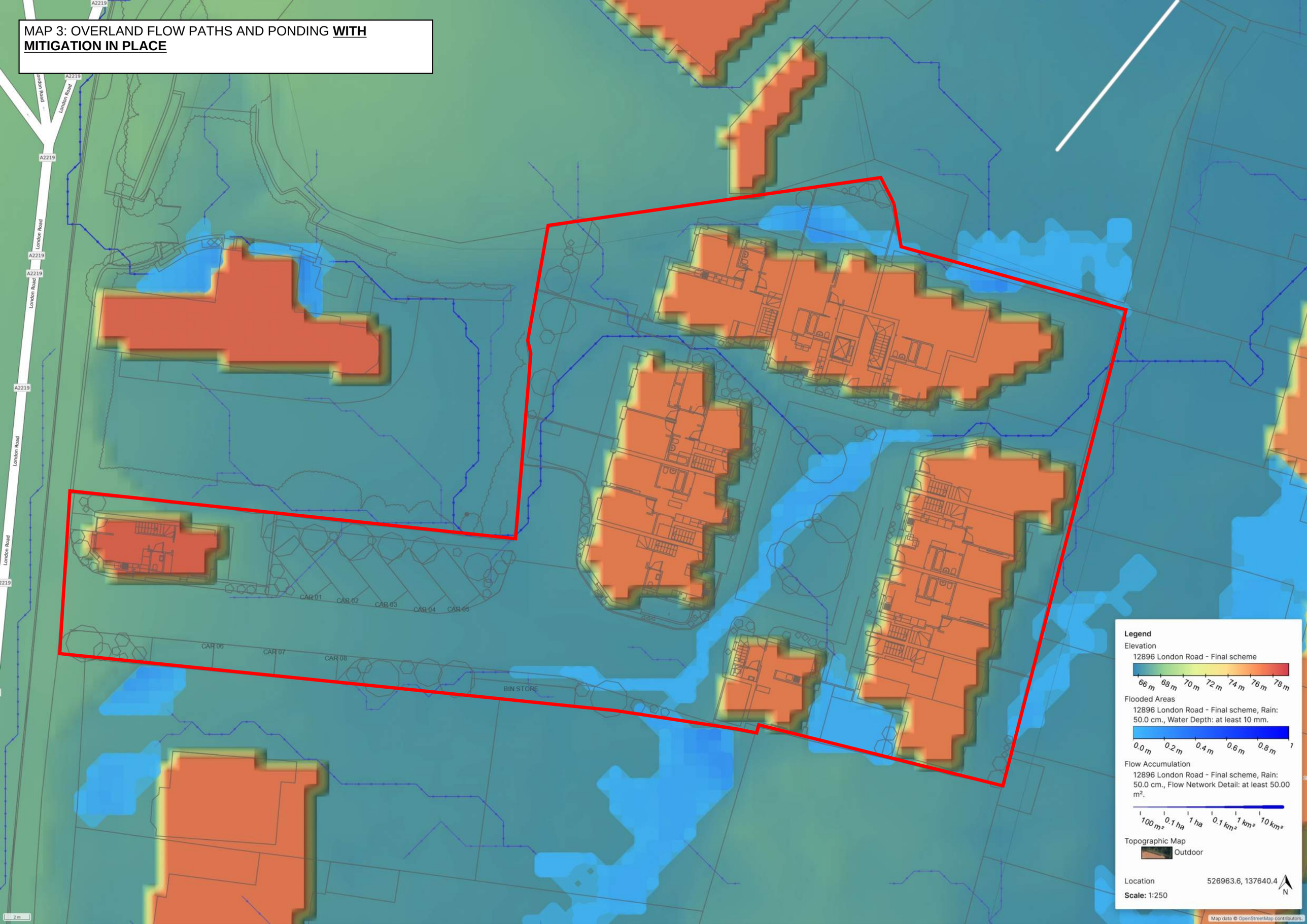
MAP 1: EXISTING OVERLAND FLOW PATHS AND PONDING



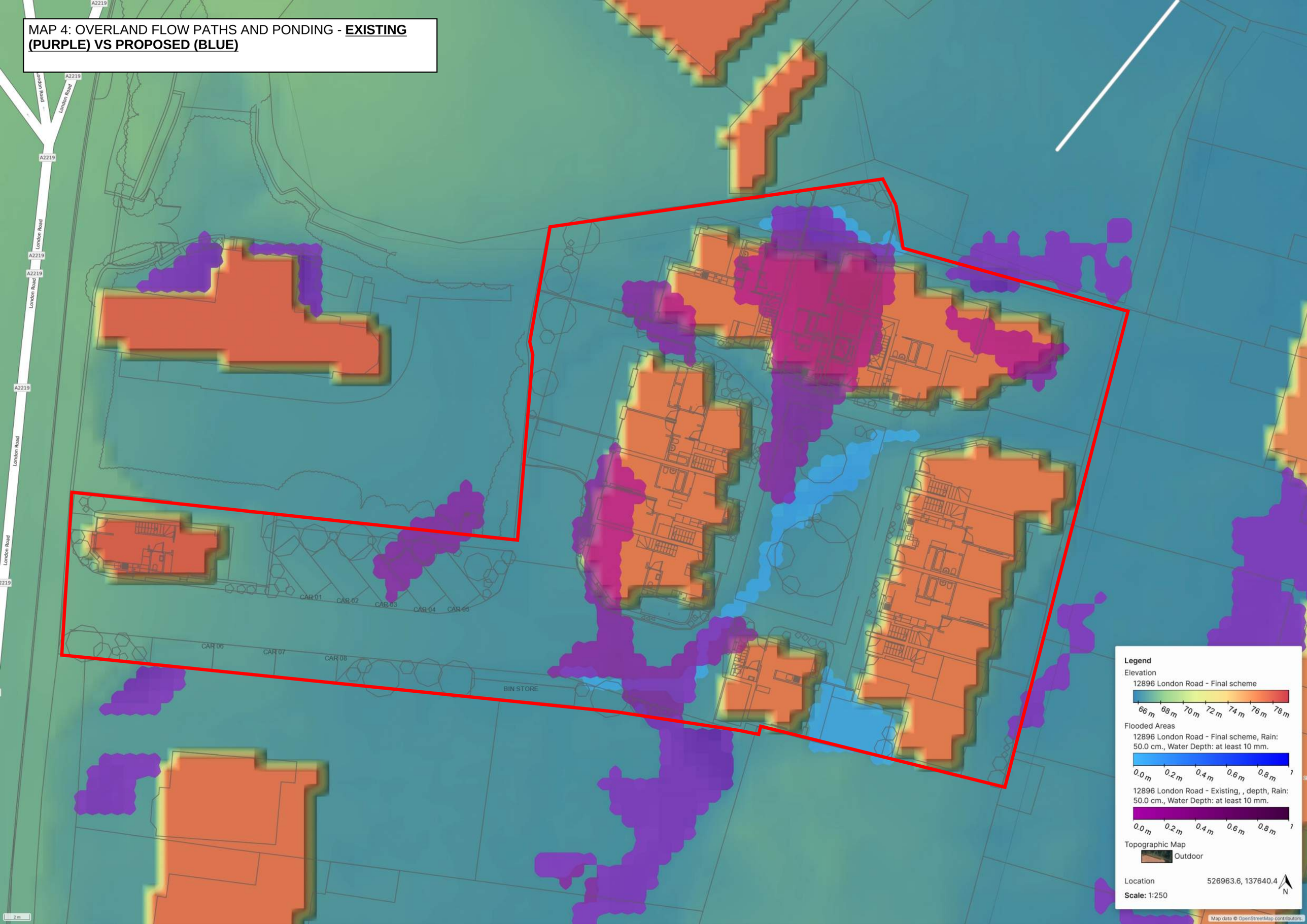
MAP 2: OVERLAND FLOW PATHS AND PONDING **WITH NO MITIGATIONS**



MAP 3: OVERLAND FLOW PATHS AND PONDING **WITH MITIGATION IN PLACE**

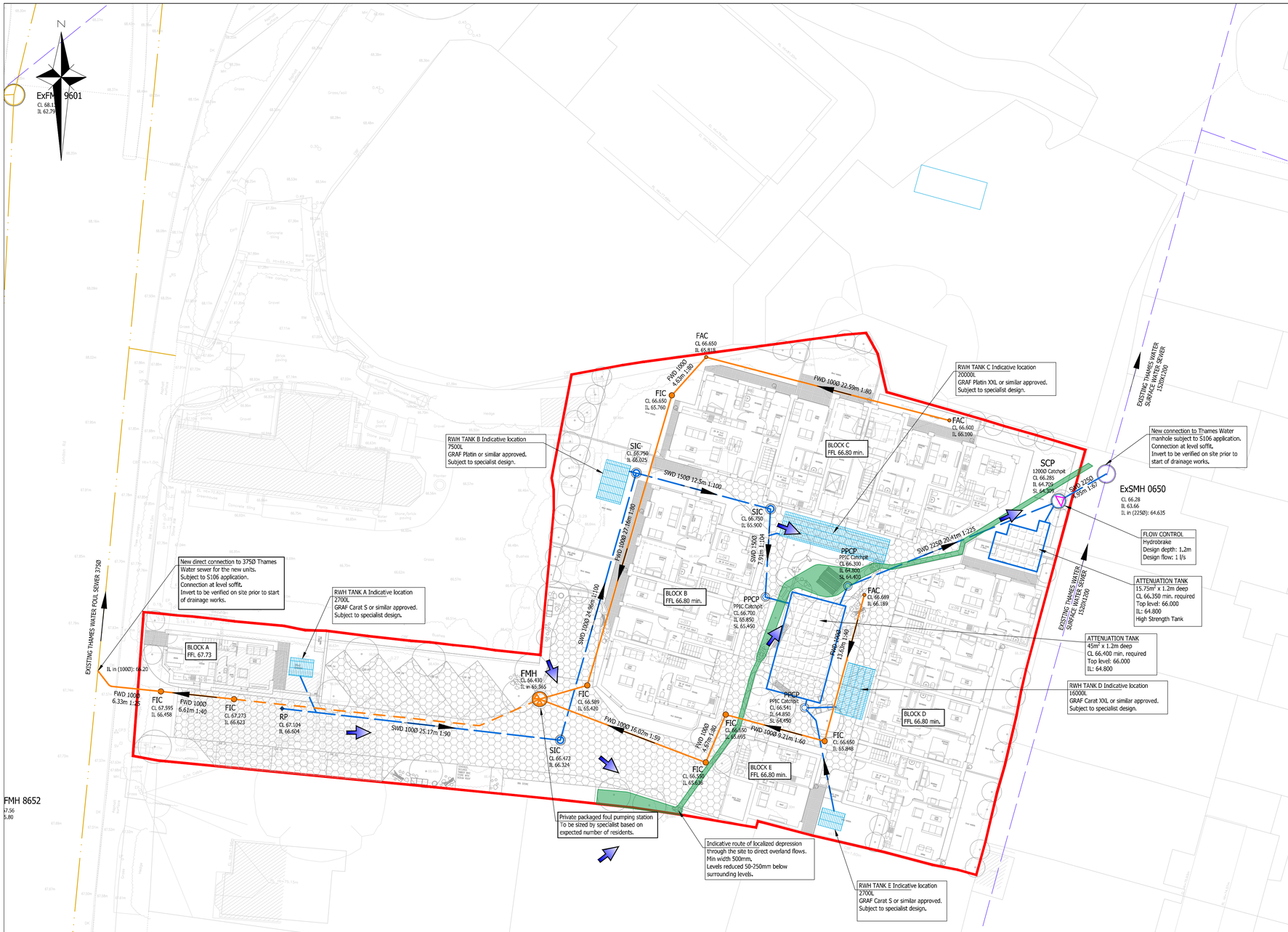


MAP 4: OVERLAND FLOW PATHS AND PONDING - **EXISTING (PURPLE) VS PROPOSED (BLUE)**



Appendix F

Drainage Strategy Drawing



DESIGN NOTES

1. STORAGE DESIGN BASED ON 1 IN 100 YR STORM + 45 %.

2. DRAIN POINTS AND LOCATIONS TO BE CONFIRMED BY ARCHITECT. ALL LEVELS SUBJECT TO DETAILED DESIGN.

3. ALL HARDSTANDING TO BE PERMEABLY SURFACED AS SHOWN, WITH DIRECT INFILTRATION TO THE GROUND (DESIGN RATE $8.0X10^{-6}$ m/s BASED ON BRE365 TESTING CONDUCTED SEPTEMBER 2024). NO POINT INFLOWS.

4. DISCHARGE TO EXISTING SURFACE WATER SEWER LIMITED TO 1l/s (PRACTICAL LIMIT TO REDUCE RISK OF BLOCKAGE). ONLY TAKING ROOF RUNOFFS.

5. RAINWATER HARVESTING TANK LOCATIONS SHOWN INDICATIVELY. SUBJECT TO DETAIL DESIGN BY SPECIALIST.

6. EXISTING TREES TO BE PROTECTED WHERE EXCAVATIONS RUN CLOSE.

7. APPROVAL TO BE GAINED FROM THAMES WATER FOR CONNECTIONS TO SEWERS AND DISCHARGE RATES

SPECIFICATION NOTES

All drainage shall be constructed and commissioned in accordance with BS EN 295 & BS EN752, Building Regulations Doc. H and any particular requirements of the Building Control Officer.

Drainage pipelines shall be in PVC-u below ground as Marley or similar approved, or vitrified clay.
All sewer pipelines to be VC only.

This drawing shall be read in conjunction with all other relevant drainage drawings, architectural drawings and structural drawings.

For manhole details, gully details, bedding etc, refer to gta detail sheets.

All foul water drain runs shall have a fall of 1:40 or steeper, unless noted otherwise.

All cement used for concrete drainage installations shall be sulphate resistant to class 3 of BRE Digest 363. (Grade ST5)

The use of short radius or 90º bends for changes in direction is not permitted, only long or medium radius 45º bends shall be used. All junctions shall be 45º.

All drains shall have granular bed and surround as class `S` bedding, unless noted otherwise.

All drainage works shall commence from the downstream end first unless agreed otherwise. Outfall level to be checked by contractor prior to any works commencing and any discrepancy identified to engineer prior to laying and drainage.

KEY

- Existing surface water drain
- Existing foul water drain
- Private surface water drain
- Private foul drain
- Private Foul Water Manhole
- Private Surface Water Manhole
- FIC — Foul Plastic Inspection Chamber
- SIC — Surface Water Plastic Inspection Chamber
- SAC — 300mm diameter Surface Water Access Chamber
- FAC — 300mm diameter Foul Water Access Chamber
- Permeable surfaces (refer to landscape architect plan) with direct infiltration
- Attenuation tank
- Rainwater harvesting tank
- Depression for overland flow

GENERAL NOTES

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2. Tender or billing drawings shall not be used for construction or the ordering of materials.

3. Do not scale. All dimensions and levels to be site confirmed.

4. This drawing shall be read in conjunction with all relevant architects, consultants drawings and specifications, together with H&S plan requirements.

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8. Your attention is also drawn to the fact that the information contained within this file may be subject to alteration at any time, pending technical approval from an approving authority or at the client's instruction. It is therefore strongly recommended that multiple and regular cross checks are made against the current contract drawings.
It is your responsibility to ensure that the correct issue or revision of the DWG data file is being used and requests for updated information made accordingly.

9. Should any apparent discrepancies between the data contained within the DWG file and the current contract drawings become evident, it must be reported back to GTA Civils & Transport as soon as reasonably practicable. Precedence should be given to the current contract drawings (PDF) unless advised otherwise.

ABBREVIATIONS

D307.0	DETAIL NUMBER - SEE DRAINAGE DETAIL SHEET
FD	FOUL DRAIN
SWD	SURFACE WATER DRAIN
FWS	ADOPTABLE FOUL WATER SEWER
SWS	ADOPTABLE SURFACE WATER SEWER
MH	MANHOLE
IC	INSPECTION CHAMBER
SA	SOAKAWAY
FIC	450mm DIA. FOUL INSPECTION CHAMBER - D202.6
SIC	450mm DIA. SURFACE WATER INSPECTION CHAMBER - D202.6
FAC	300mm DIA. FOUL ACCESS CHAMBER - D202.18
SAC	300mm DIA. SURFACE WATER ACCESS CHAMBER - D202.18
CI	CAST IRON
VC	VITRIFIED CLAY
CONC	CONCRETE
PVC-U	POLYVINYL CHLORIDE - UNPLASTICISED
G	SMALL GULLY - D209.0
YG	YARD GULLY - D209.2
RG	ROAD GULLY - D208.1
CPG	CAR PARK GULLY - D208.2
DP	BELOW GROUND DRAIN POINT
SVP	SOIL VENT PIPE DROP
SS	STUB STACK OR DIRECT DRAIN CONNECTION
RP	EXTERNAL RODDING POINT - D213.1
DT	SURFACE WATER DISTRIBUTION TANK
FFL	FINISHED FLOOR LEVEL
SSL	STRUCTURAL SLAB LEVEL
GL	GROUND LEVEL
CL	COVER LEVEL
IL	INVERT LEVEL
SL	SUMP LEVEL
BL	BASE LEVEL
HL	HIGH LEVEL
BD	BACKDROP
CBS	CONCRETE BED & SURROUND
CLASS S	GRANULAR BED & SURROUND
CLASS B	GRANULAR BED

NOT FOR CONSTRUCTION

Rev	Amendments	Date	Dsn	Chk
P2	UPDATED TO LATEST LAYOUT	05/12/24	FVV	MR
P1	INITIAL ISSUE	07/11/24	FVV	MR

Status: FOR INFORMATION

Client: LIVING DANISH

Architect:

Project: LONDON ROAD CRAWLEY

Title: DRAINAGE LAYOUT

Date: NOVEMBER 2024 | Scale @ A1: 1:200

Clients Ref. | Project Ref.: 12896

gta Civils & Transport
Maple House, 192-198 London Road,
Burgess Hill, West Sussex, RH15 9RD
Tel.01444 871444 Web: www.gtacivils.co.uk

Drawing Number: 12896-1600 | Rev.: P2

Appendix G

Drainage Calculations

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Florence Van Vaerenbergh
Site name:	London Road
Site location:	London Road, Crawley

Site Details

Latitude:	51.12399° N
Longitude:	0.18691° W
Reference:	1152138561
Date:	Sep 24 2024 12:04

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

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 1

Methodology

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

Soil characteristics

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

Hydrological characteristics

	Default	Edited
SAAR (mm):	810	810
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

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

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

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

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

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	5.73	5.73
1 in 1 year (l/s):	4.87	4.87
1 in 30 years (l/s):	13.17	13.17
1 in 100 year (l/s):	18.27	18.27
1 in 200 years (l/s):	21.42	21.42

Design Settings

Rainfall Methodology	FEH-22	Maximum Time of Concentration (mins)	30.00	Preferred Cover Depth (m)	1.200
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0	Include Intermediate Ground	✓
Additional Flow (%)	40	Minimum Velocity (m/s)	1.00	Enforce best practice design rules	✓
CV	1.000	Connection Type	Level Soffits		
Time of Entry (mins)	5.00	Minimum Backdrop Height (m)	0.200		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Depth (m)
Storage	0.086	5.00	66.490	1.690

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Detailed	Additional Storage (m³/ha)	20.0
Summer CV	1.000	Skip Steady State	✓	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	240	Check Discharge Volume	x

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 %)
2	0	0	0	100	40	0	0
30	35	0	0				

Node Storage Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	64.800	Product Number	CTL-SHE-0045-1000-1200-1000
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.0	Min Node Diameter (mm)	1200

Node Storage Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	64.800
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	60.0	0.0	1.200	60.0	0.0	1.210	0.0	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute summer	Storage	256	65.036	0.236	4.2	13.6902	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
360 minute summer	Storage	Hydro-Brake®	0.7

Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 99.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	Storage	344	65.632	0.832	7.3	48.2613	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
360 minute winter	Storage	Hydro-Brake®	0.9

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	Storage	464	65.925	1.125	7.5	65.2433	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
480 minute winter	Storage	Hydro-Brake®	1.0

Appendix H

Correspondence

Eleanor Read
Flood Risk Management Officer
Highways, Transport and Planning Directorate
03302 227048
Eleanor.read@westsussex.gov.uk
www.westsussex.gov.uk

Ground Floor
Northleigh
County Hall
Chichester
PO19 1RH

Florence Van Vaerenbergh
GTA Civils & Transport Ltd

Lars Graabek
Living Danish Developments Limited

6th November 2024

Dear Florence and Lars,

LLFA/PLAN/PREAPP/24/006-Land Adjacent to 48-50 London Road, Northgate, Crawley, RH10 8JQ

WSCC Flood Risk Management Team Level 2 Pre-Application Advice has been sought for a 0.22ha site in Northgate, Crawley. Following a MS Teams meeting on Thursday 17th September we have the following comments to make following discussions of the current proposals:

1. The application may need a sequential test due to the surface water flow path through the site as described in paragraph 2.10 to 2.11. It is recommended this is discussed with the Local Planning Authority who are responsible for this.

2. For this site SCALGO modelling is appropriate and detailed hydraulic modelling is not needed. We support the proposals in paragraph 3.3, in particular maintaining flow paths, as long as they are safe and don't prevent safe access and egress when using Flood Hazard Rating (Microsoft Word - Sub-Guidance of Safe Access and Exit).

3. As the application progresses we'd expect full winter groundwater monitoring and potentially shallow infiltration testing depending on what the full winter monitoring results show.

4. It is good to see rainwater harvesting and open SuDS being proposed.

5. It is strongly suggested where connecting to a surface water sewer, the responsible authority is contacted for a capacity check to ensure they are ok with proposals to discharge into their system. It is recommended to do this as soon as possible in the planning process to reduce issues with draining the site later on.

6. The contaminated land strip will need to be considered water quality wise when designing the SuDS scheme.

7. For surface water plus climate change mapping, this should be within the Crawley Strategic Flood Risk Assessment.

A surface water drainage strategy/layout has not been included as part of the submission. I'm happy to review this and any final documents as part of the pre-app service, before the application is submitted to Crawley Borough Council. Please email me directly with them.

For the drainage layout, we strongly suggest using open, source control SuDS features where possible. This includes features such as filter strips, swales, permeable paving, rain gardens, bioretention areas, rainwater harvesting and green roofs. This is because open features are easier to maintain than traditional piped systems and helps meet the 4 pillars of SuDS design (water quality, water quantity, amenity and biodiversity). For design criteria please follow guidance in the SuDS Manual.

Please note we are only statutory consultee for surface water/drainage, therefore have no comments to make in relation to foul drainage or water neutrality.

We strongly recommend SuDS proforma and validation checklist are used before submitting the application: Flood Risk Management: Pre-application advice - West Sussex County Council. Please note the LPA might have separate validation lists, although they should be similar.

Yours sincerely,

Ellie Read

Flood Risk Management Team

Documents reviewed:

Stage 1 Flood Risk Assessment by GTA Civils & Transport Limited, September 2024

Pre-App letter from Crawley BC

Completed Application Form

Illustrative Masterplan by Match Landscape Architects, 30th August 2024

Florence Van Vaerenbergh

From: [redacted]
Sent: 04 November 2024 08:48
To: Florence Van Vaerenbergh
Cc: 'Jonathan Buckwell'; 'David Gouldstone'; 'Lauren Sinden'
Subject: FW: 48-50 London Road, Crawley - 1 of 2

Good morning Florence

I hope you had a lovely weekend

Below is the comments from Crawley on sequential test, which all seems good.

Jonathan – thanks for checking

Many thanks

Lars Graabek
Director
Email: [redacted]
Mobile [redacted]

From: Sanders, Alex <[redacted]>
Sent: 04 November 2024 08:39
To: Jonathan Buckwell <j[redacted]>
Cc: Lauren Sinden <[redacted]>; Lars Graabek <[redacted]>
Subject: RE: 48-50 London Road, Crawley - 1 of 2

Hi Jonathan

I have received the below from our policy team:

The 2021 update to the NPPF requires that the sequential test considers the risk of flooding from all sources, as opposed to just fluvial and tidal flood risks, though there is no national guidance detailing how the sequential test should be applied for non-fluvial and tidal flood risk sources. The 2023 SFRA advises that for surface water flooding, the 1 in 1000 surface water flood extent should be used to define the areas at highest risk, with development directed to lower risk areas. The SFRA recognises that the surface water flood maps are conceptually different to the fluvial flood extents, as they are more 'dendritic' (i.e. along defined flow corridors) rather than the 'blanket' extents associated with fluvial flooding. Due to the nature of surface water flooding, it is not anticipated that the Sequential Test for surface water would normally require the consideration of alternative sites at lower risk, as in practical terms it is unlikely to be a primary factor that demonstrates that the principle of development could not be supported.

There isn't a practical way to apply the sequential test to non-fluvial sources. From our perspective a sequential test isn't required, but we would want the flood risk and drainage strategy to pick up on how the site would be planned/designed to avoid/minimise surface water flood risk.

I trust this answers your query.

Thanks

Alex

Alex Sanders

Florence Van Vaerenbergh

GTA Civils & Transport Ltd
192-198 London Road
Burgess Hill
RH15 9RD

Wastewater pre-planning
Our ref DS6129520

25 November 2024

Pre-planning enquiry: Confirmation of sufficient capacity

Site address: Land at 48-50 London Road, Northgate, Crawley RH10 8JQ

Dear Florence,

Thank you for providing information on your development.

Proposed site: 27 residential units (flats). Proposed foul water pumped at 1.25l/s from the site low point to the location of existing plot 48. From that point it will discharge via gravity into 375mm in dia foul water sewer in London Road. Proposed surface water connection into a surface water sewer located to the east of the development at restricted max 1l/s.

We have completed the assessment of the foul water flows and surface water run-off based on the information submitted in your application with the purpose of assessing sewerage capacity within the existing Thames Water sewer network.

Foul Water

If your proposals progress in line with the details you've provided, we're pleased to confirm that there will be sufficient sewerage capacity in the adjacent foul wate sewer network to serve your development.

This confirmation is valid for 12 months or for the life of any planning approval that this information is used to support, to a maximum of three years.

You'll need to keep us informed of any changes to your design – for example, an increase in the number or density of homes. Such changes could mean there is no longer sufficient capacity.

Surface Water

In accordance with the Building Act 2000 Clause H3.3, positive connection of surface water to a public sewer will only be consented when it can be demonstrated that the hierarchy of disposal methods have been examined and proven to be impracticable. Before we can consider your surface water needs, you'll need written approval from the lead local flood authority that you have followed the sequential approach to the disposal of surface water and considered all practical means.

When developing a site, policy SI 13 of the London Plan states “Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible. There should also be a preference for green over grey features, in line with the following drainage hierarchy:”.

The disposal hierarchy being:

1) rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)
2) rainwater infiltration to ground at or close to source
3) rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)
4) rainwater discharge direct to a watercourse (unless not appropriate)
5) controlled rainwater discharge to a surface water sewer or drain
6) controlled rainwater discharge to a combined sewer.

Where connection to the public sewerage network is required to manage surface water flows we will accept these flows at a discharge rate in line with CIRIA’s best practice guide on SuDS or that stated within the sites planning approval.

If the above surface water hierarchy has been followed and if the flows are restricted to a total of 1 l/s then Thames Water would not have any objections to the proposal.

Consider slowly emptying the tank before storms for better rainwater storage. There are some automatic sensors that talk to the met office telemetry for efficiency.

Please see our FAQ’s leaflet for additional information.

What happens next?

Please make sure you submit your connection application, giving us at least 21 days’ notice of the date you wish to make your new connection/s.

If you’ve any further questions, please contact me on number below

Yours sincerely

Natalya Bacon
Adoption & Pre-planning Engineer
Waste Adoptions London
Service Delivery
T: +44 800 009 3921
E: developer.services@thameswater.co.uk
W: https://www.thameswater.co.uk/developers
Thames Water Utilities Ltd, Clearwater Court, Vastern Road, Reading RG1 8DB

Civil Engineering - Transport Planning - Flood Risk

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