

APPENDICES

Appendix A ECE Architectural Development Proposals

Accommodation Schedule				
Main Site				
Plot 1	3-Bedroom House	Semi-Detached	1,120 sqft	2CPS
Plot 2	3-Bedroom House	Semi-Detached	1,120 sqft	2CPS
Plot 3	4-Bedroom House	Detached	1,996 sqft	G + 2CPS
Plot 4	5-Bedroom House	Detached	2,111 sqft	G + 2CPS
Plot 5	4-Bedroom House	Detached	1,996 sqft	G + 2CPS
Total; 5 Dwellings				

Site Boundary

Rev	Date	Revision Details	Dr	Ch
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Client's Name
JW Stratton

Job Title
Stetton Works, Turners Hill Road,
Crawley Down

Drawing Title
Proposed Site Plan

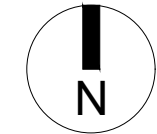
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Drawn	Checked	Date
AX	AK	05.09.24

Job No	Drawing No	Rev
7504	PL 03	-

Status
PRELIMINARY





Appendix B Engineering Land & Building Surveys Topographic Survey

Appendix C Albury S.I. Ltd Site Investigation

PHASE 2 REPORT ON A SITE INVESTIGATION

Site

**PALMERS AUTOCENTRE TYRES,
TURNERS HILL ROAD, CRAWLEY DOWN,
WEST SUSSEX RH10 4HQ**

Client

J W STRATTON LTD

Report Ref

24/12836/A/GO

Issued

MAY 2024



ALBURY S.I. LTD

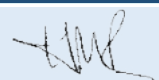
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DOCUMENT CONTROL			
Report Title	Phase 2 Report on a Site Investigation		
Contract	Tuners Hill Road, Crawley Down		
Report Reference	24/12836/A/GO		
Client	J W Stratton Ltd		
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Revision No.	Status	Date of Issue	Final Issue Check
0	Final	08/05/2024	

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This Report is prepared for the specific purpose stated and in relation to the development proposals or usage indicated to Albury S.I. Limited at the time of preparation. The recommendations should not be used for adjacent schemes and may not be appropriate for alternative proposals.

The recommendations made and opinions expressed in this Report are based on the strata conditions revealed by the fieldworks as indicated on the exploratory records, together with an assessment of the data from in situ and laboratory tests. No liability can be accepted for conditions which have not been revealed by the fieldworks, for example, between exploratory positions. While this Report may offer opinions on the possible configuration of strata, both between the excavations and below the maximum depth achieved by the investigation, these comments are for guidance only and no liability can be accepted for their accuracy. The data obtained relate to the conditions which are relevant at the time of the investigation.

The groundwater observations entered on exploratory records are those noted at the time of the investigation. The normal rate of progress does not usually permit the recording of any equilibrium water level for any one water strike. It should be noted that groundwater levels are prone to seasonal variation and to changes in local drainage conditions. The word 'none' indicates that groundwater was sealed off by the borehole casing or that no water was observed in the exploratory hole upon completion.

REPORT REF: 24/12836/A/GO

CONTRACT: TURNERS HILL ROAD, CRAWLEY DOWN

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LIST OF ABBREVIATIONS

FIGURES

- 1 Site Plan
- 2 Proposed Layout

APPENDICES

- 1 Exploratory Records
- 2 Calibration Certificates
- 3 Laboratory Test Results
- 4 Desiccation
- 5 Waste
- 6 Monitoring Data

SYNOPSIS

This investigation has demonstrated that made ground overlies soils associated with the Upper Tunbridge Wells Sand Formation of Cretaceous age. Strip or spread foundations located at a minimum depth of 1.00m and in accordance with NHBC criteria, on the basis of medium volume change potential, can be designed to apply a maximum increase in load of 150kPa. The groundwater observations made at the time of the investigation suggest that problems with respect to shallow depth excavations are unlikely.

The contamination testing has recorded isolated high levels of PAH and remedial measures will be necessary as part of the proposed redevelopment. However, the ground gas monitoring has not detected any significant levels of ground gases and, coupled with the anticipated ground conditions, specific remedial measures in this regard are not necessary as part of the proposed redevelopment.

1 INTRODUCTION

1.1 Aims and Objectives

The Client proposes to construct 4 no two storey detached dwellings following the demolition of the existing structures at Palmers Autocentre Tyres, Turners Hill Road, Crawley Down ("the site"). Accordingly, an exploratory investigation into ground conditions has been made to assess the impact from historical usage and to obtain data to inform a land contamination risk assessment. The data obtained will also assist in the formulation of a safe and economic foundation solution.

A previous Phase 1 Desk Study with walkover survey, undertaken by Albury S.I. Ltd in March 2024, identified potentially contaminative past uses and should be read in conjunction with this report. Briefly, the site has historical use as a motor repairs garage and earlier a wheelwright. An historic landfill has also been identified within 250m north west of the site. Accordingly, recommendations were made for a targeted intrusive investigation and long-term ground gas monitoring.

1.2 Scope of Works

The programme of this investigation comprised the construction of seven boreholes using hand-held window sampling techniques, with the installation of three standpipes to enable long-term ground gas monitoring. During this work samples were recovered for further examination and laboratory testing. In addition, screening of samples for volatile organic compounds (VOC) and in situ hand shear vane testing was performed. A small scale falling

head test was conducted within one of the boreholes. This report describes the work undertaken, presents the information obtained and discusses the ground conditions with respect to foundation design and the long-term risks from land contamination.

2 FIELDWORKS

2.1 Site Works

The boreholes were constructed on 2nd April 2024 at locations as shown on the site plan, drawing no. 24/12836/A/1, which is presented as Figure 1. The exploratory positions were located targeting potential sources of contamination identified within the Desk Study, taking account of the proposed layout and areas of private garden. Specifically, boreholes 4 and 6 were located adjacent to above ground storage tanks and borehole 1 was located in the area of a former vehicle inspection pit.

The depths and descriptions of the strata encountered in the boreholes are given on the records which comprise Appendix 1 to this report. These records note the depths at which samples were taken, the results of in situ tests and the groundwater observations noted at the time of the fieldworks.

The ground levels at the exploratory locations range between 111.0mOD to 111.7mOD and are based upon the levels contained within the topographical survey dated November 2021. The internal floor level at borehole 7 is not known, however, it appears visually to be level with the remainder of the site.

2.2 Installations

Upon completion of boreholes 3, 5 and 6 standpipes were installed in order to carry out long-term ground gas monitoring. These comprised of plain pipe between ground level and 0.50m extended by slotted pipe with geosock filter to depths of 1.60m, 2.50m and 2.70m. Each position was provided with a gas valve and upright plastic cover at surface.

3 GROUND CONDITIONS

3.1 Geology

Reference to the earlier Desk Study indicates the site as being underlain by the Upper Tunbridge Wells Sand Formation of Cretaceous age.

3.2 Stratigraphy

Consideration of the borehole records indicates that either leaf mould, block paving, asphalt over dark reddish brown sandy gravel of stone or made ground was encountered at surface at the exploratory positions. This concealed made ground of variable composition, which was proved to depths of between 0.20m and 0.80m. A further layer of concrete, 100mm in thickness, was encountered within boreholes 4 and 5 from 0.40m to 0.50m.

Orangish brown and light very silty clay with occasional siltstone fragments was generally exposed beneath the made ground and was proved to depths of 1.25m and 1.70m within boreholes 3 and 2, extending to 2.40m and 2.70m within boreholes 6 and 4. These cohesive soils contain interbedded buff fine very silty sand and brownish grey very sandy fine silt at depth within boreholes 1 and 5, which is typical of the variable lithology of the Upper Tunbridge Wells Sand Formation. Buff and light grey sandy silt with rare siltstone fragments was encountered below the cohesive soils within boreholes 2, 3, 4 and 6. The boreholes were concluded within this stratum at depths of between 1.60m and 3.10m due to limited penetration.

3.3 In Situ Testing

During the sampling measurement of soil vapours [VOC] was carried out on the samples of the soils taken using a PhoCheck Tiger PID meter. The composite sample is placed within a sealed plastic bag with a limited air space (headspace) which allows vapours to enter following agitation of the sample bag. The headspace is then measured using the PID meter and the results recorded in ppm as an indicative total VOC. The maximum TVOC recorded during this work was 5.1ppm and 5.4ppm at 1.50m and 3.00m depth within borehole 6, possibly indicating some residual or historic hydrocarbon contamination within this area of the site.

The remaining locations typically ranging between zero to 1.2ppm, which is indicative of normal background concentrations. Moreover, no visual or olfactory evidence of contamination was apparent during the sampling. The calibration certification for the instrument is included in Appendix 2.

During the construction of the boreholes a series of in situ hand shear vane tests were performed using the Geonor Shear Vane test equipment. Shear strengths ranging between 100kPa and >220kPa were recorded reflecting the stiff to very stiff in situ condition for a cohesive soil.

A small-scale falling head test was attempted within borehole 2 to assess drainage characteristics, however, after 60 minutes no dissipation of water was apparent and the test was abandoned.

3.4 Groundwater

During the construction of boreholes 3, 6 and 7 groundwater was struck at depths of 1.55m, 2.70m and 1.55m, with corresponding standing water levels also observed at these depths upon completion. The remaining locations were observed to remain dry throughout.

3.5 Monitoring

Return visits were made on 16th April and 3rd May 2024 to monitor the standpipes installed as part of the intrusive investigation. The monitoring data is included as Appendix 6 and the water levels are summarised in tabular form below.

Table 1 – Summary of Groundwater Levels		
Date	Position	Water Level m
16/04/2024	3	0.56
	5	1.14
	6	0.71
03/05/2024	3	0.49
	5	0.64
	6	0.56

4 LABORATORY TESTING

A programme of laboratory testing has been undertaken and the results are presented as Appendix 3 to this report. The geotechnical soil testing was undertaken by Albury S.I. Ltd, whilst representative samples were submitted for geochemical testing at the UKAS accredited laboratories operated by i2 Analytical Ltd. Each type of test is summarised below and the results obtained have been used to assist in the formulation of the discussion.

4.1 Water Content

The water contents of samples of the soils encountered at this site have been determined. Water contents within the range 16.2% to 22.0% have been recorded.

4.2 Index Properties

The liquid and plastic limits of samples of the clay soils have been determined. The results of this work indicate that the samples tested can generally be described as inorganic clays of variable plasticity and of low to medium volume change potential.

4.3 Particle Size Distribution

Two samples of the soils encountered at this site have been subjected to sieve and sedimentation analysis in order to determine the soils' particle size distribution. The results of this work are presented in the form of grading curves.

4.4 Chemical Testing – Soluble Sulphates & pH

Five samples of the soils encountered at this site have been subjected to chemical analyses in order to determine their soluble sulphate contents and pH values. Under the conditions of this work low concentrations of soluble sulphate of less than 0.25mg/L have been recorded in association with pH values of 4.7 to 6.7.

4.5 Geochemical Testing

Six samples of the made ground from between 0.10m and 0.50m depth have been submitted to the UKAS accredited laboratories operated by i2 Analytical Ltd. The testing comprises a suite of typical inorganic and organic priority contaminants including metals, PAH, TPH CWG and an asbestos screen. Based upon the in-situ PID results, the samples from borehole 6 at depths of 0.50m, 1.50m and 2.50m and borehole 7 at 0.20m were subjected to SVOC and VOC analysis.

Based upon the initial round of testing further samples from boreholes 3 and 6 at 0.30m and 0.50m depth were subjected to heavy metal analysis, with an additional sample from borehole 4 at 0.75m subjected to speciated PAH analysis.

5 GEOTECHNICAL DISCUSSION

5.1 Foundations

The Client proposes to construct 4 no detached two storey dwellings and the proposed layout is shown in Figure 2. At the time of the preparation of this report the anticipated structural loads were not known.

It cannot be recommended that major structural foundations be located within the made ground revealed by this investigation. Soils of this origin are frequently present in a weak and variable condition such that unacceptable settlement could occur even under the action of light loading intensities. Therefore, it will be necessary to continue foundation excavations through these undesirable materials where they are of less than 1.00m in thickness to this minimum depth in order to avoid that zone of soil which is subject to normal seasonal moisture variation or frost action. The above precautions need not necessarily be applied to

light ancillary structures, which will be formed structurally discrete from the main development and in which a greater degree of settlement can be tolerated.

It is known that a number of mature trees are present around the perimeter of the site, in the vicinity of the proposed structures. These include several Horse Chestnuts along the north east boundary and a Poplar on the southern boundary. A discussion of the causes, effects and classification of desiccation in clay soils is included in Appendix 4 to this report. Consideration of the results of the laboratory testing suggests that moisture deficiency may have developed at 1.00m depth within borehole 3 and within borehole 4. It will be necessary, therefore, to locally extend foundations in these areas to depths of 1.50m and 2.50m, with soils at and below this level being of low volume change potential. The final foundation depths should be in agreement with NHBC criteria, taking into account any existing or proposed trees, on the basis that the upper margins of these soils are of medium volume change potential.

Strip or spread foundations constructed within the Upper Tunbridge Wells Sand Formation, at a minimum depth of 1.00m and in accordance with NHBC criteria, can be designed to accept a maximum increase in load of 150kPa. At this loading intensity a factor of safety of 3 against general shear failure will be operative. Moreover, settlements should remain within tolerable limits for the type of structure proposed and occur an extended period post construction.

5.2 Stability of Excavations

Excavations of less than 1.00m depth should not require temporary support to their sides. Where foundation excavations are to be extended below this level, then adequate temporary support or shoring should be provided in order to comply with current statutory safety regulations and to maintain the stability of the excavation sides.

5.3 Groundwater

The groundwater observations made at the time of the fieldworks suggest that significant engineering problems with respect to shallow depth excavations are unlikely. However, the subsequent monitoring has recorded high groundwater levels, possibly perched within the made ground. It should be appreciated that groundwater levels can vary with season and recent months have experienced increased levels of rainfall.

A series of trial excavations should be performed to confirm whether groundwater will be encountered and whether these minor amounts can be controlled by pumping from sumps.

The cohesive soils revealed in this investigation are susceptible to rapid softening in the unconfined state. Where excavations are to be left open for extended periods then the bases

should be blinded using leanmix concrete following final trimming to prevent deterioration of the founding medium.

5.4 Drainage

The near surface drainage characteristics of the underlying soils have been considered as part of this investigation. It is believed that these would be a poor drainage medium and alternative means of surface water disposal should be considered.

5.5 Ground Floor Slabs

The thickness of made ground revealed by this investigation, commonly in excess of 0.60m, infers that a system of fully suspended floor slabs should be incorporated within the proposed structures in accordance with NHBC criteria.

5.6 Buried Concrete

The information obtained from this investigation has been compared with the criteria proposed in BRE Special Digest 1, 2005 Edition, Concrete in Aggressive Ground. Using the information in C2 (brownfield locations) of this publication the Aggressive Chemical Environment for Concrete Classification (ACEC) is AC-1s, which coincides with a Design Sulphate Class DS-1. The ACEC Class above can be used to determine the Design Chemical Class for concrete for general cast-in-situ use as required in Part D of the Digest.

6 GROUND CONTAMINATION

A Conceptual Site Model (CSM) was formulated for this site as part of the Phase 1 Desk Study, which informed the current Phase 2 intrusive investigation. The CSM produced as part of the Desk Study has been revised and is presented in tabular form below.

Table 2 - Conceptual Site Model			
Source(s)	Potential Pathway(s)	Receptor(s)	Risk Level
Landfill within 80m north of site <i>Ground Gases</i> (CO ₂ and CH ₄) - Degradation of hydrocarbons - Ingress of volatile hydrocarbons (VOC, CO ₂ & CH ₄)	Migration, ingress and accumulation	Proposed and existing buildings	Negligible

Made ground associated with demolition of previous structures Former Orchard <i>Asbestos/ACM</i> <i>Heavy Metals</i> <i>PAH</i>	Dermal contact, ingestion and inhalation	Site Workers, Future Residents,	Moderate
Motor Repairs Garage Used Engine Oil <i>Mineral Oil range hydrocarbons, heavy metals</i> Dead Can Store – Petrol <i>BTEX Compounds & Lead</i> Paint Spraying, Cleaners/Degreasers <i>SVOC & VOC</i>	Dermal contact, ingestion and inhalation	Site Workers, Future Residents,	Moderate
	Leaching/migration through shallow soils	Groundwater (Secondary Aquifer)	Low
		Potable Water Supply Pipes	Moderate

6.1 Human Health

A generic assessment of the chronic or long-term risk to human health from soil contamination has been made using the available generic screening criteria. The screening values include the Category 4 Screening Levels [C4SLs] (DEFRA, 2014) and Suitable for Use Levels [S4ULs] (LQM/CIEH, 2014) derived using the CLEA software. It should be appreciated that these do not consider the short-term or acute risks, such as to construction workers or SI personnel.

The results have been compared against the GAC for the proposed land-use criteria Residential (with homegrown produce) and 2.5% SOM. A summary table of the results and highlighted exceedances is included in Appendix 3. A study of the data reveals a single highly elevated level of PAH and associated aromatic hydrocarbons at the location of borehole 4 at 0.50m depth. Consideration of the PAH double ratio plot infers that the source is coal tar derived, as opposed to petroleum oils or fuels. There are also elevated levels of lead of 610mg/kg at borehole 3 at 0.10m and 300 mg/kg at borehole 6 at 0.30m depth, which exceed the C4SL GAC of 200mg/kg. The results of the additional testing at these locations indicate that these exceedances are restricted to the near surface and that the soils at depth are suitable for Residential use.

No measurable concentrations of volatile compounds (VOC) were recorded within the testing and the majority of the results are below the limits of detection, with the exception of dibutyl phthalate and butyl benzene phthalate (plasticizers). No vapour risk is evident from these results and specialist protection measures not necessary.

The site presently has little or no useable topsoil and it will be necessary to import clean soils to form a growing medium in areas of soft landscaping and private garden amenity. A minimum thickness of 150mm clean topsoil is suggested, however, this will be dependent upon any specific landscaping requirements. Any imported soils should be certified clean and from an approved source. The use of topsoil and/or subsoil from non-greenfield sources such as screened, blended or recycled sources are discouraged. The details should be outlined within a formal Remediation Method Statement.

6.2 Discovery Strategy

Given most of the external areas are covered by existing structures or asphalt, any visual evidence of historical contamination can be concealed. Thus, it would be advisable that the site manager maintain a discovery strategy or watching brief during the lifting of hardstanding. Should any potential sources of contamination be identified following the enabling works, they should be fully investigated by a competent person to ensure that the correct remedial measures are employed if considered necessary. The watching brief would comprise the regular inspection of all excavations. If any materials suspected of containing contamination, such as oily material or soils of unusual colouration or odour are identified, then the following procedures should be adopted.

- Work to cease in that area.
- Notify the geoenvironmental engineer to attend site and carry out sampling and testing of suspected contaminated material, which should be segregated and stockpiled within a bunded area and covered to prevent rainfall infiltrating.
- Notify the Local Authority Contaminated Land Officer, where appropriate, or if amendments to the remediation plan area are necessary.
- Soil sampling of excavated area from bases and sides to demonstrate the area of contamination has been excavated.
- Photographic evidence of all stages of the development, particularly of any excavations, should be routinely kept and retained. Detailed records of any stockpiled material, its size and location, together with any duty of care transfer notes. Where necessary, this information should be incorporated within the final validation report.

6.3 Groundwater

The site is underlain by a minor or Secondary A aquifer, which is of low sensitivity and is not at risk from the recorded concentrations of heavy metals and semi-volatile PAH compounds.

6.4 Vegetation

The metals boron, copper, nickel and zinc are phytotoxic at certain levels, with their availability being dependent upon soil pH. These levels may not pose a significant long-term health risk to humans, but could be detrimental to plant growth or function. The results obtained suggest that problems in this regard are not anticipated.

6.5 Preliminary Waste Assessment

It is likely that, if excavated soils cannot be re-used or retained on site, these surplus materials will require off-site disposal. It may be possible to divert the unwanted material to a soil treatment hub where it can be recycled. Where material cannot be re-used or recycled then disposal at a licensed landfill site can be considered. It will then be necessary to classify the spoil as inert, non-hazardous or hazardous. A discussion of the current regime for the classification and treatment of waste soils is included in Appendix 5.

An initial assessment of the geochemical results obtained from this investigation has been carried out to provide a preliminary classification of the surplus materials. The HazWaste Online tool determines whether waste soil should be classified as being non-hazardous or hazardous. The output from the HazWaste assessment is located in Appendix 5. Asbestos was not detected in any of the samples screened. Based on the output waste soil arisings from borehole 4 are deemed to be hazardous for disposal purposes, due to the concentration of hydrocarbons. If hazardous material is to be disposed at a licensed waste landfill site then supplementary waste acceptance criteria [WAC] testing may also be required. Confirmation should be sought from the relevant licensed waste handler or landfill operator. The remaining locations are considered to be non-hazardous for disposal purposes. The underlying natural soils are considered to be inert for disposal purposes.

This assessment is preliminary and based upon the information obtained from the investigation. Where made ground is excavated then these materials should be stockpiled and segregated. Further sampling, testing and characterisation to accurately classify waste soil arisings may be required. It should be appreciated that it is the responsibility of the waste producer to sufficiently characterise their waste. Moreover, the agreement of the waste acceptor should be sought.

6.6 Potable Water Supply Pipes

The requirements of the water supply company should be sought with regard to an incoming potable water supply pipes. Given the historical use of the site and presence of elevated levels of petroleum hydrocarbons it would be prudent to incorporate hydrocarbon resistance barrier pipe for incoming water supply pipes.

6.7 Ground Gases

The Desk Study highlighted a limited potential risk posed by ground gas generation from historic landfill within 80m of the site. Accordingly, three standpipes were installed across the site and a regime of ground gas monitoring undertaken. The calibration certification for the instrument is included in Appendix 2.

Two visits have been made to date to monitor the standpipes and the results of the monitoring are included in Appendix 6. The results have been reviewed in accordance with BS 8485 (2015) Code of Practice for the characterisation and remediation of ground gas in effected developments.

The hazardous gas flow rate has been determined based upon the worst case from these monitoring visits, which are a carbon dioxide of 1.1% together with zero flow (0.0l/h). No methane was recorded on either visit.

Q_{hg}	=	$(C_{hg}/100)q$
Q_{hg}	=	$(1.1/100) \times 0.0$
Q_{hg}	=	0.0l/h
where:		
Q_{hg}	=	calculated hazardous gas flow rate/gas screening value
C_{hg}	=	measured hazardous gas concentration
q	=	measured flow rate

Based upon the calculated gas screening value of 0.0 litres/hour, the hazard potential of the site can be considered very low or characteristic gas situation 1. Therefore, no remedial or specific protection measures will be required regarding ground gas.

Current guidance indicates that six monitoring rounds should be undertaken to fully classify this site in terms of its ground gas regime. However, in view of the ground conditions revealed, the low levels of ground gases recorded over the visits and zero flow, further monitoring visits are not warranted.

REFERENCES

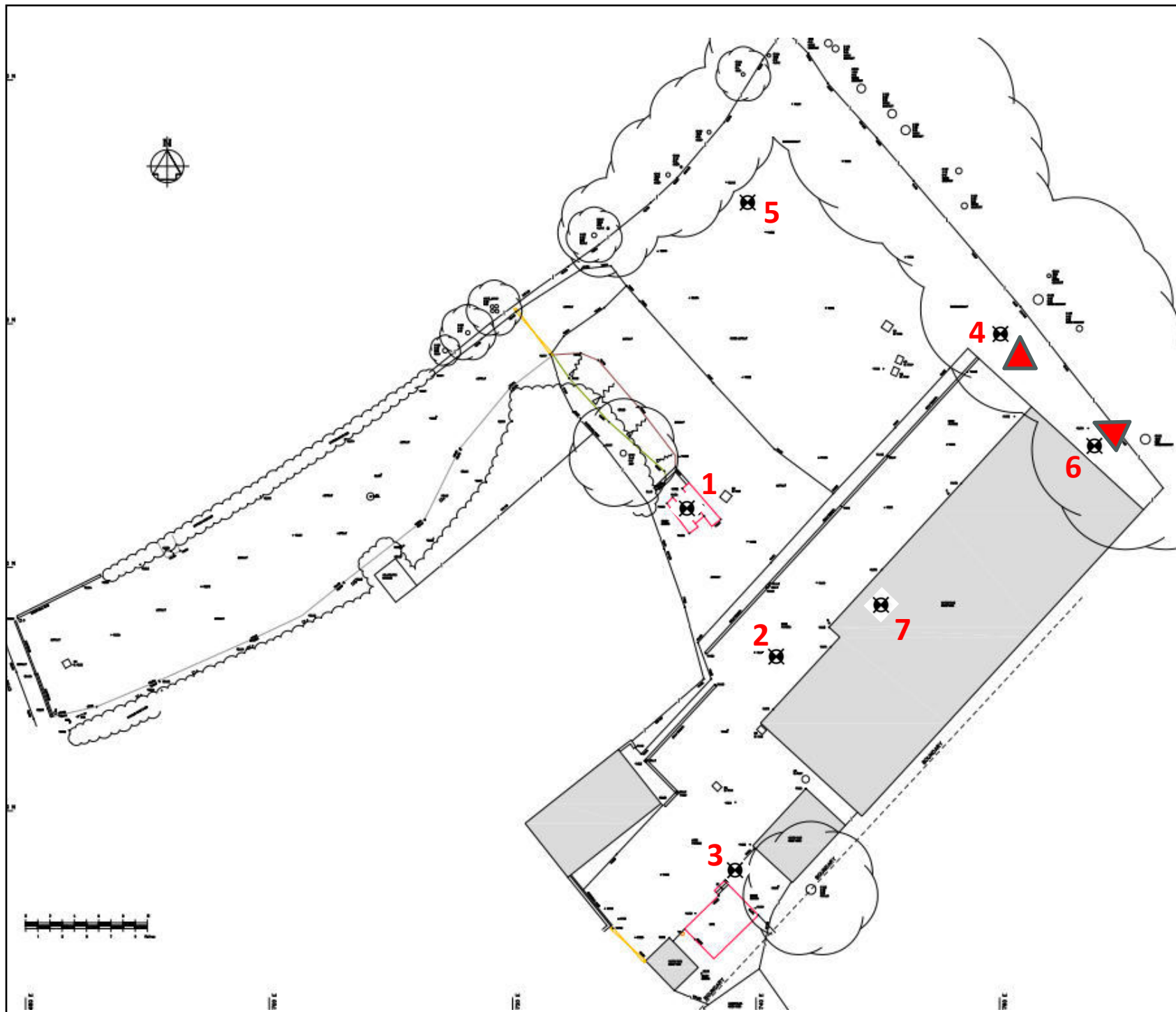
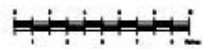
- British Standards (2016). Methods of test for soils for civil engineering purposes, BS 1377-1:2016. *British Standard Institution, London.*
- British Standards (2011). Investigation of potentially contaminated sites. Code of Practice. BS 10175+A2:2017. *British Standard Institution, London.*
- British Standards (2013). Guidance on investigations for ground gas. Permanent gases and Volatile Organic Compounds (VOCs). BS 8576. *British Standard Institution, London.*
- British Standards (2015). Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings. BS 8485+A1:2019. *British Standard Institution, London.*
- British Standards (2015). Code of practice for ground investigations, BS 5930:2015. *British Standard Institution, London.*
- Building Research Establishment [BRE] (2004). *Cover systems for land regeneration: Thickness of cover systems for contaminated land (BR 465).* BRE Watford, UK.
- Building Research Establishment [BRE] (2005). *Concrete in aggressive ground: Special Digest 1* (3rd Ed.). BRE Watford, UK.
- Building Research Establishment [BRE] (2015). *Guidance on protective measures for new buildings. (BR 212).* BRE Watford, UK.
- Contaminated land: Applications in Real Environments. (2013). *SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Final Project Report.*
- Chartered Institute of Environmental Health and Contaminated Land: Applications in Real Environments (2008). *The Guidance on Comparing Soil Contamination Data with Critical Concentration.* London, UK.
- Environment Agency (2004). *Model Procedures for the Management of Contaminated Land.* Contaminated Land Report (CLR) 11, SC02000028, Environment Agency, Bristol, UK.
- Environment Agency (2015). Interpretation of the definition and classification of hazardous waste. 1st edition. Technical Guidance WM3. *Environment Agency, UK.*
- Nathanail, C.P., McCaffrey, C., Gillett, A.G., Ogden, R.C. and Nathanail, J.F. (2015). *The LQM/CIEH S4ULs for Human Health Risk Assessment.* Land Quality Press, Nottingham. Publication Number S4UL3073.
- Stroud, M. A. (1974). The standard penetration test in insensitive clays and soft rocks. *Proceedings of the European Symposium on Penetration Testing, Stockholm, 2, 367-375.*

LIST OF ABBREVIATIONS

AOD	-	Above Ordnance Datum
ACM	-	Asbestos-containing Material
AST	-	Above-ground Storage Tank
BGS	-	British Geological Survey
BH	-	Borehole
BRE	-	Building Research Establishment
BSI	-	British Standards Institution
BS	-	British Standard
C4SL	-	Category Four Screening Level
CIRIA	-	Construction Industry Research and Information Association
CP	-	Cable Percussive
DPH	-	Dynamic Probing Heavy
DPSH	-	Dynamic Probing Super Heavy
EA	-	Environment Agency
GAC	-	Generic Assessment Criteria
LL	-	Liquid Limit
mAOD	-	Metres Above Ordnance Datum
mBGL	-	Metres Below Ground Level
mOD	-	Metres Ordnance Datum
OS	-	Ordnance Survey
PAH	-	Polycyclic Aromatic Hydrocarbons
PCB	-	Polychlorinated Biphenyl
PID	-	Photo Ionisation Detector
PL	-	Plastic Limit
PSD	-	Particle Size Distribution
SGV	-	Soil Guideline Value
SOM	-	Soil Organic Matter
SPT	-	Standard Penetration Test
SPZ	-	Source Protection Zone
SVOC	-	Semi-volatile Organic Compounds
TPH	-	Total Petroleum Hydrocarbon
UST	-	Underground Storage Tank
UXB	-	Unexploded Bombs
UXO	-	Unexploded Ordnance
VOC	-	Volatile Organic Compound

FIGURE 1

SITE PLAN



Legend:



Above ground tanks



Borehole location

Title: Site Plan

Dwg No: 24/12836/A/1

Drawn by: GO

Client: J W Stratton Ltd

Contract: Turners Hill Road,
Crawley Down

Job Ref: 24/12836/A/GO

Scale: NTS

Revision: 0

Issue Date: 08/05/2024

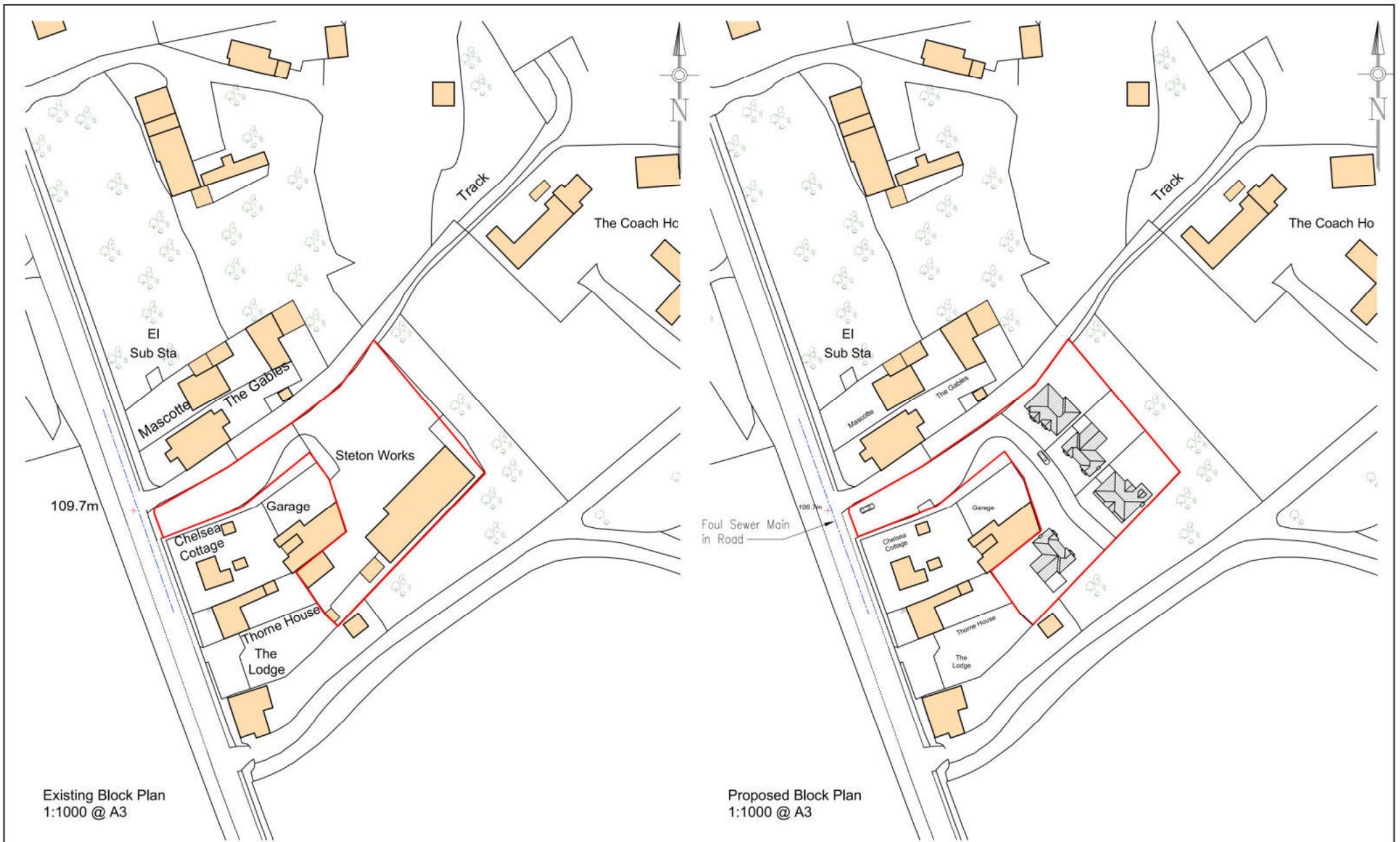


ALBURY S.I. LTD

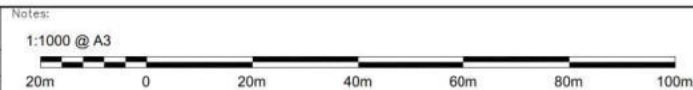
Miltons Yard, Petworth Road,
Witley, Surrey GU8 5LH
www.alburysi.co.uk

FIGURE 2

PROPOSED LAYOUT



Project: Redevelopment of Steton Works Turners Hill Rd Crawley Down		Client:	
Date:	Revision:	Scale: 1:1000 @ A3	Date: 9/3/22
Drawing Title: Existing Block Plan Proposed Block Plan		Drawing No: CSW: 348/101	
Rev:			



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Pipbrook Mill
London Road
Dorking
RH4 1JE
Telephone
01306 897568
E-Mail info@redwoodland.co

Redwood Land Investments Ltd

APPENDIX 1

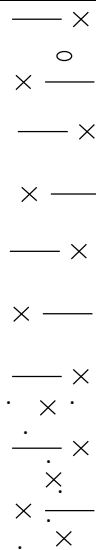
EXPLORATORY RECORDS

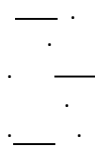
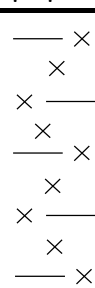
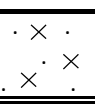
 ALBURY S.I. LTD Miltons Yard, Petworth Road, Witley, Surrey GU8 5LH		BOREHOLE		1			
Contract		Turners Hill Road, Crawley Down		Report Ref		24/12836/A/GO	
Client		J W Stratton Ltd		Date		02/04/2024	
Site Address		Palmers Autocentre Tyres, Turners Hill Road, Crawley Down, West Sussex RH10 4HQ		Ground Level		111.7mOD	
Type of excavator		Window Sampler		Water level after completion, m		dry	
Water strikes, m		Dimensions, m		Ease of excavation, m			
1 none		Diameter 0.06		Very easy		Difficult GL-2.20	
2				Moderate		Very hard 2.20-2.60	
Remarks							
Samples or tests		Shear Strength kPa	PID TVOC ppm	Depth m		Legend	Strata Description
Type	Depth, m						
D	0.10		0	0.05			MADE GROUND (asphalt)
D	0.30		0.1				MADE GROUND (dark brown silty SAND and GRAVEL of stones and occasional flints)
D	0.50		0.3	0.40			MADE GROUND (dark brown slightly gravelly sandy CLAY. Gravel is of flint)
				0.70			Very stiff orangish brown and light grey very silty CLAY with interbedded buff fine very silty sand and brownish grey very sandy (fine) SILT with black veining at 2.00m and 2.50m
D	1.00	180	0.1				
							
							
D	1.50	220	0				
							
							
D	2.00		0				
							
							
D	2.50		0				
							
				2.60			END OF BOREHOLE

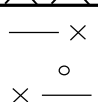
 ALBURY S.I. LTD Miltons Yard, Petworth Road, Witley, Surrey GU8 5LH					BOREHOLE		2				
Contract		Turners Hill Road, Crawley Down					Report Ref		24/12836/A/GO		
Client		J W Stratton Ltd					Date		02/04/2024		
Site Address		Palmers Autocentre Tyres, Turners Hill Road, Crawley Down, West Sussex RH10 4HQ					Ground Level		111.49mOD		
Type of excavator		Window Sampler			Water level after completion, m			dry			
Water strikes, m		Dimensions, m			Ease of excavation, m						
1 none		Diameter 0.06			Very easy			Difficult		GL-2.00	
2					Moderate			Very hard		2.00-2.10	
Remarks Falling head soakage test attempted. Test hole filled to 0.57m below ground level and no dissipation observed after 60 minutes											
Samples or tests		Shear Strength kPa	PID TVOC ppm	Depth m		Legend	Strata Description				
Type	Depth, m										
D	0.40	100	0.1	0.35							

 ALBURY S.I. LTD Miltons Yard, Petworth Road, Witley, Surrey GU8 5LH					BOREHOLE		3			
Contract		Turners Hill Road, Crawley Down					Report Ref		24/12836/A/GO	
Client		J W Stratton Ltd					Date		02/04/2024	
Site Address		Palmers Autocentre Tyres, Turners Hill Road, Crawley Down, West Sussex RH10 4HQ					Ground Level		111.5mOD	
Type of excavator		Window Sampler			Water level after completion, m			1.55		
Water strikes, m		Dimensions, m			Ease of excavation, m					
1 1.55		Diameter 0.06			Very easy			Difficult 0.50-1.30		
2					Moderate GL-0.50			Very hard 1.30-1.60		
Remarks Standpipe installed to 1.60m upon completion										
Samples or tests		Shear Strength kPa	PID TVOC ppm	Depth m		Legend	Strata Description			
Type	Depth, m									
D	0.10	>250	0.3	0.20			MADE GROUND (crushed brown sandy GRAVEL of stone over brown slightly gravelly flint clayey SAND with occasional roots) Orangish brown and grey very silty CLAY with occasional roots			
D	0.30		0.1							
D	0.50		0.2	0.70			Brown friable slightly gravelly sandy SILT with occasional roots. Gravel is of weak siltstone fragments			
D	1.00		0.4							
D	1.30		0.4	1.25				Orangish brown and grey very silty fine SAND with occasional clayey partings, interbedded very silty clay (1.50m) becoming very sandy SILT below 1.65m		
D	1.50		0.5							
D	1.65		0.3	1.70						
								END OF BOREHOLE - NO PENETRATION		

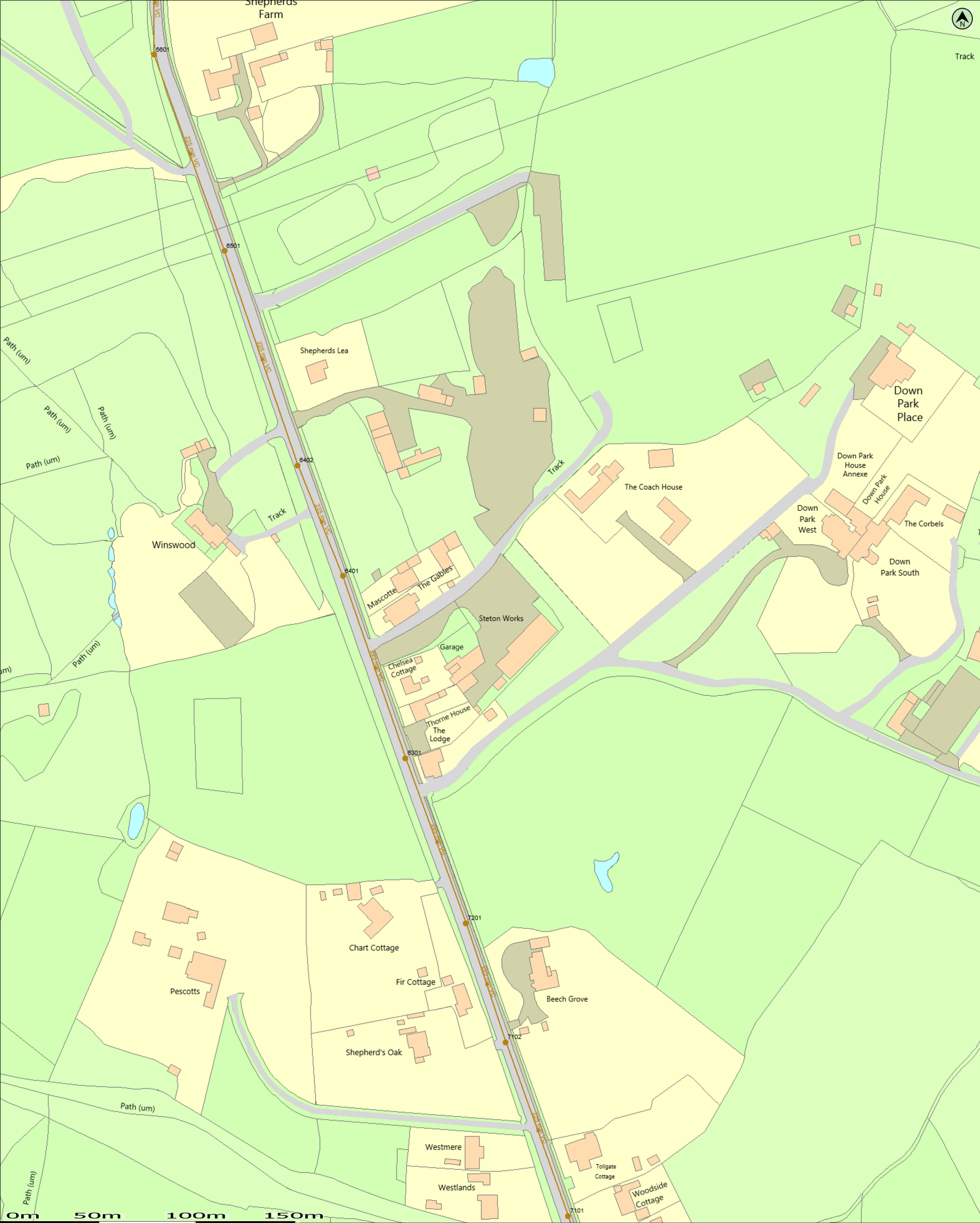
 ALBURY S.I. LTD Miltons Yard, Petworth Road, Witley, Surrey GU8 5LH					BOREHOLE		4							
Contract		Turners Hill Road, Crawley Down					Report Ref		24/12836/A/GO					
Client		J W Stratton Ltd					Date		02/04/2024					
Site Address		Palmers Autocentre Tyres, Turners Hill Road, Crawley Down, West Sussex RH10 4HQ					Ground Level		111.4mOD					
Type of excavator		Window Sampler			Water level after completion, m			dry						
Water strikes, m		Dimensions, m			Ease of excavation, m									
1 none		Diameter 0.06			Very easy			Difficult		GL-0.65				
2					Moderate			Very hard		0.65-3.10				
Remarks														
Samples or tests		Shear Strength kPa	PID TVOC ppm	Depth m		Legend	Strata Description							
Type	Depth, m													
D	0.10	180	0				MADE GROUND (brown silty SAND and GRAVEL of stones and occasional brick fragments, with occasional pockets of sandy clay and roots)							
D	0.30		0	0.40										
D	0.50		0.3	0.50							MADE GROUND (concrete)			
D	0.75		0.2	0.65										
D	1.00		0.1	0.90							Orangish brown and light grey friable sandy SILT			
D	1.50	>250	0			Very stiff orangish brown and light grey very silty CLAY with pockets of silt, rare roots (1.00m and 1.50m) and some black mottling at depth (2.00m)								
D	2.00	>250	0							Brown slightly gravelly very silty CLAY, dark brown and yellowish brown mottling. Gravel is of siltstone .				
D	2.50			2.10			Orangish brown sandy SILT with pockets of very silty clay							
D	3.00			2.70							END OF BOREHOLE			
				3.10										

 ALBURY S.I. LTD Miltons Yard, Petworth Road, Witley, Surrey GU8 5LH		BOREHOLE		5			
Contract		Turners Hill Road, Crawley Down		Report Ref		24/12836/A/GO	
Client		J W Stratton Ltd		Date		02/04/2024	
Site Address		Palmers Autocentre Tyres, Turners Hill Road, Crawley Down, West Sussex RH10 4HQ		Ground Level		111.0mOD	
Type of excavator		Window Sampler		Water level after completion, m		dry	
Water strikes, m		Dimensions, m		Ease of excavation, m			
1 none		Diameter 0.06		Very easy		Difficult 0.70-2.00	
2				Moderate		Very hard GL-0.70, 2.00-2.60	
Remarks Standpipe installed to 2.50m upon completion							
Samples or tests		Shear Strength kPa	PID TVOC ppm	Depth m		Legend	Strata Description
Type	Depth, m						
D	0.10	200	0.1				MADE GROUND (asphalt over dark reddish brown sandy GRAVEL of stone)
D	0.30		0.1	0.40			
				0.50			
D	0.60		0.4	0.70			
		>250	0.1				MADE GROUND (dark brown very silty CLAY) Very stiff orangish brown and light grey very silty CLAY with black veining at depth and rare coarse siltstone fragments
D	1.00						
D	1.50		0.1				
D	2.00		0.2				
							~interbedded buff fine SAND/SILT below 2.00m
D	2.50						
				2.60			END OF BOREHOLE

 ALBURY S.I. LTD Miltons Yard, Petworth Road, Witley, Surrey GU8 5LH		BOREHOLE		6			
Contract		Turners Hill Road, Crawley Down		Report Ref		24/12836/GO	
Client		J W Stratton Ltd		Date		02/04/2024	
Site Address		Palmers Autocentre Tyres, Turners Hill Road, Crawley Down, West Sussex RH10 4HQ		Ground Level		111.7mOD	
Type of excavator		Window Sampler		Water level after completion, m		2.70	
Water strikes, m		Dimensions, m		Ease of excavation, m			
1 2.70		Diameter 0.06		Very easy		Difficult	GL-0.80
2				Moderate 0.80-2.40		Very hard	2.40-2.70
Remarks Standpipe installed to 2.70m upon completion							
Samples or tests		Shear Strength kPa	PID TVOC ppm	Depth m		Legend	Strata Description
Type	Depth, m						
D	0.10	100	0				Leafmould over MADE GROUND (dark brown silty SAND and GRAVEL of stone cobbles, brick and metal fragments)
D	0.30		0	0.25			
D	0.50		0.2				
			0.2	0.80			
D	1.00	>250	1.2				Stiff bluish grey and yellowish brown fine sandy CLAY with occasional roots and root hairs
				1.40			
D	1.50		5.1				
D	2.00		1.8				Very stiff orangish brown and light grey friable very silty CLAY with occasional siltstone fragments at depth
				2.40			
D	2.50		5.4				
				2.70			Light grey fine sandy SILT
							END OF BOREHOLE

 ALBURY S.I. LTD Miltons Yard, Petworth Road, Witley, Surrey GU8 5LH		BOREHOLE		7			
Contract		Turners Hill Road, Crawley Down		Report Ref		24/12836/A/GO	
Client		J W Stratton Ltd		Date		02/04/2024	
Site Address		Palmers Autocentre Tyres, Turners Hill Road, Crawley Down, West Sussex RH10 4HQ		Ground Level			
Type of excavator		Window Sampler		Water level after completion, m		1.55	
Water strikes, m		Dimensions, m		Ease of excavation, m			
1 1.55		Diameter 0.06		Very easy		Difficult GL-1.60	
2				Moderate		Very hard	
Remarks Internal position							
Samples or tests		Shear Strength kPa	PID TVOC ppm	Depth m		Legend	Strata Description
Type	Depth, m						
D	0.20		0.2	0.15			MADE GROUND (reinforced concrete (5mm reinforcement)
D	0.50		0.2	0.35			MADE GROUND (brown silty SAND and GRAVEL of coarse stone and brick)
							Orangish brown and light grey very silty CLAY with occasional siltstone in the upper margins
D	1.00		0.1				
							
D	1.50		0.1	1.60			
							
							
							
							
							
							
							
							
							
							
							
							
							
							
							
							
							
							
							
							
							
							
							
							

Appendix D Southern Water Public Sewer Records



(c) Crown copyright and database rights 2025 Ordnance Survey AC0000808122
Data updated: 21/01/25

Scale: 1:1250
Map Centre: 533738.138415

Date: 07/02/25
Our Ref: 1683870 - 1

Wastewater Plan A2
Powered by digdat

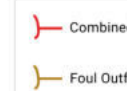
 Foul Gravity Sewer

 Combined Gravity Sewer

 Culverted Water Course or Treated Effluent

 Surface Water Gravity Sewer

 Rising Main, Vacuum or Syphon

 Combined Outfall

 Foul Outfall

 Surface Water Outfall

 Surface Water Inlet

 Combined Pumping Station

 Surface Water Pumping Station

 Foul Pumping Station

 Water Treatment Works

 Section 104 Area

 Building Over Agreement Area

 Foul Manhole

 Combined Manhole

 Surface Water Manhole

 Side Entry Manhole, Demarcation Chamber, Dummy Manhole or Surface Water Soakaway

searches@bpcivils.co.uk

D2348 Steton Works



The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2025 Ordnance Survey AC0000808122. This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

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

Appendix E Flood Maps for Planning Extracts

Get a boundary report

 [Edit](#)

 [Delete](#)

Datasets

- ☒ Flood zones 2 and 3
- ☐ River and sea with defences
- ☐ River and sea without defences
- ☐ Surface water
- ☐ None

Map features

- ☐ Water storage
- ☐ Flood defence
- ☐ Main Rivers

Key



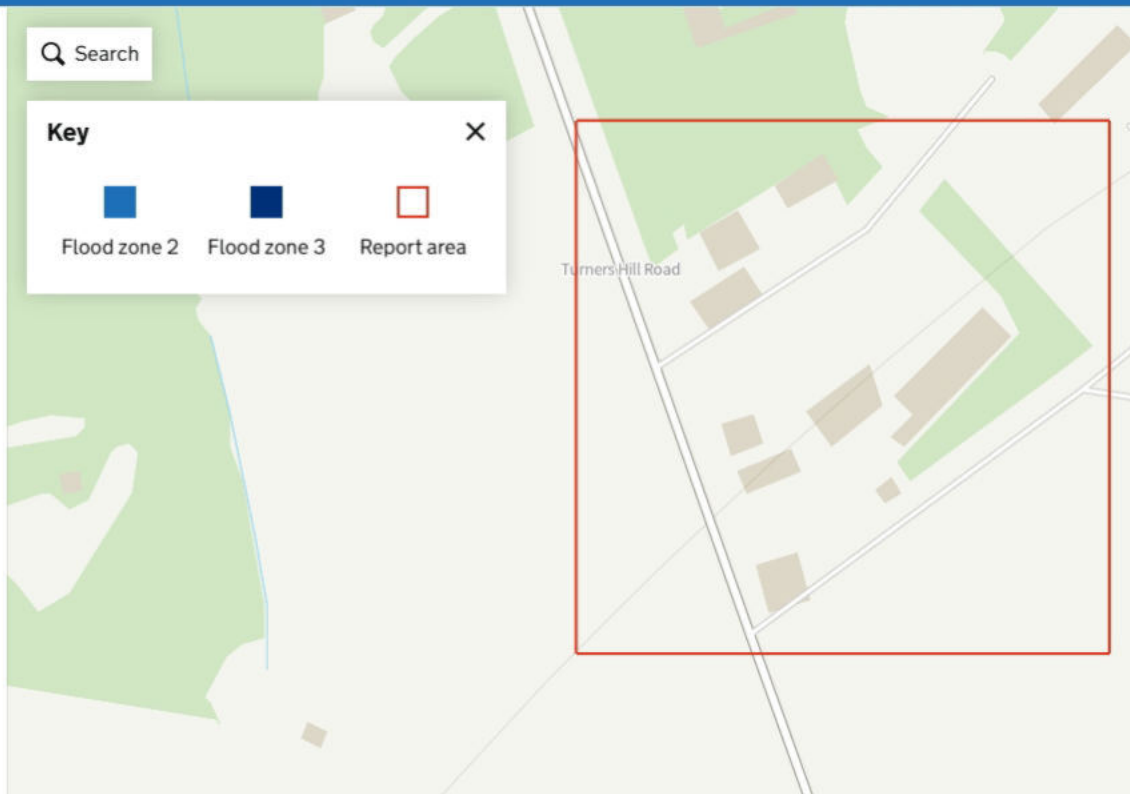
Flood zone 2



Flood zone 3



Report area



Get a boundary report

[Edit](#)
[Delete](#)

Datasets

- ☐ Flood zones 2 and 3
- ☒ River and sea with defences
- ☐ River and sea without defences
- ☐ Surface water
- ☐ None

Time frame

- ☒ Present day
- ☐ Climate change

Annual likelihood of flooding

- ☒ Rivers and sea 1 in 30
- ☐ Rivers 1 in 100, Sea 1 in 200
- ☐ Rivers and sea 1 in 1000

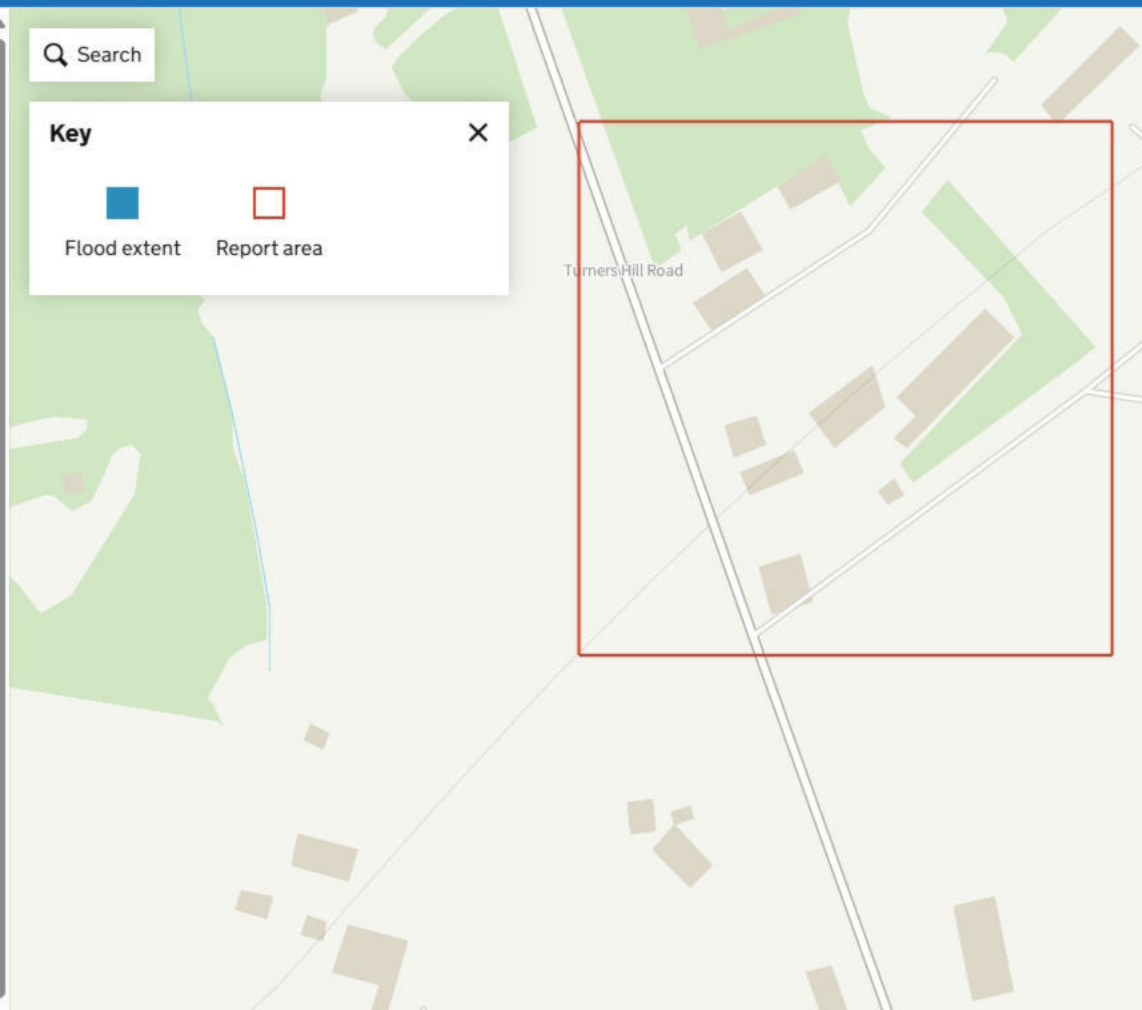
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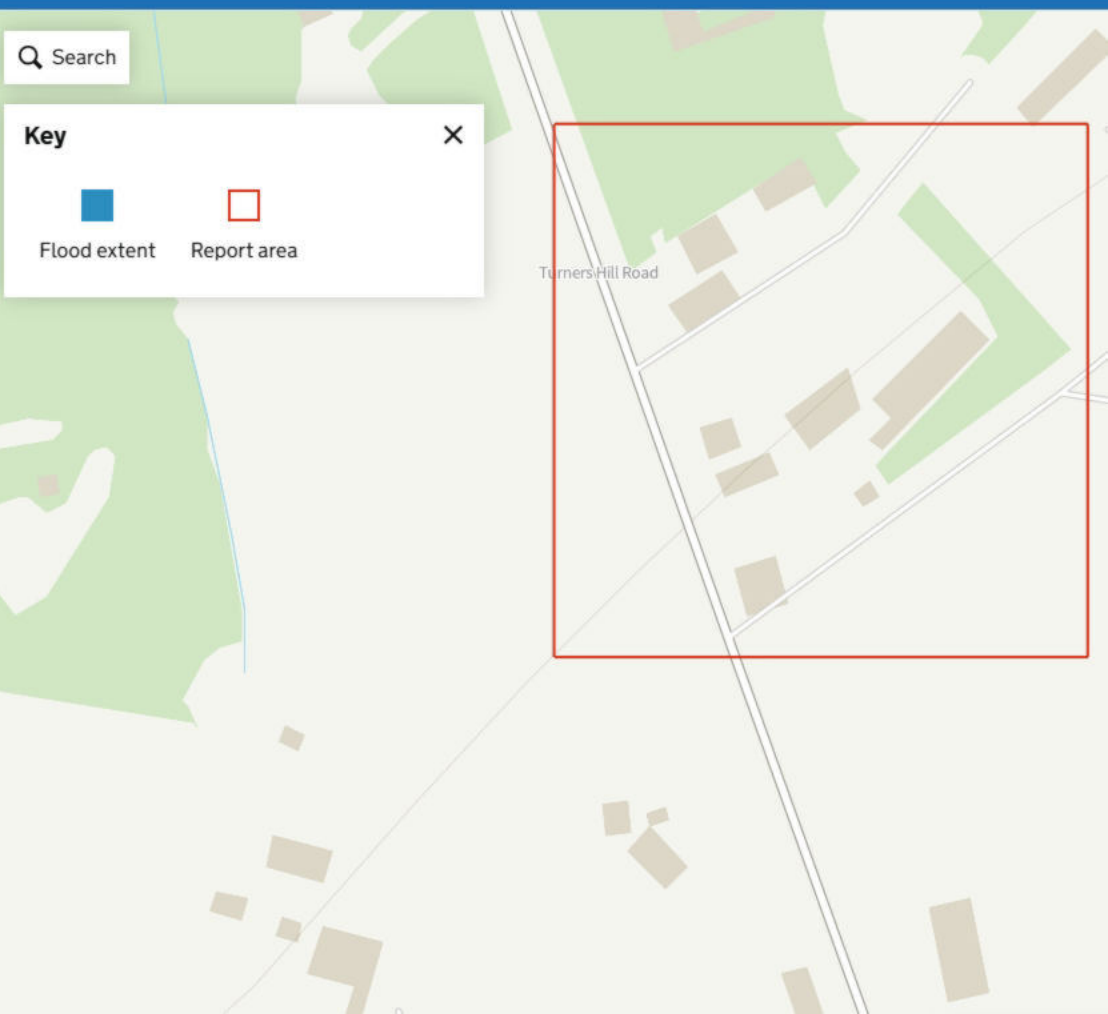


Flood extent



Report area





Key

×

■

Flood extent

□

Report area

Get a boundary report

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Datasets

- ☐ Flood zones 2 and 3
- ☒ River and sea with defences
- ☐ River and sea without defences
- ☐ Surface water
- ☐ None

Time frame

- ☒ Present day
- ☐ Climate change

Annual likelihood of flooding

- ☐ Rivers and sea 1 in 30
- ☒ Rivers 1 in 100, Sea 1 in 200
- ☐ Rivers and sea 1 in 1000

Get a boundary report
 [Edit](#)
 [Delete](#)
Datasets

- ☐ Flood zones 2 and 3
- ☒ River and sea with defences
- ☐ River and sea without defences
- ☐ Surface water
- ☐ None

Time frame

- ☒ Present day
- ☐ Climate change

Annual likelihood of flooding

- ☐ Rivers and sea 1 in 30
- ☐ Rivers 1 in 100, Sea 1 in 200
- ☒ Rivers and sea 1 in 1000

Key


Flood extent



Report area

Turners Hill Road

Get a boundary report

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Datasets

- ☐ Flood zones 2 and 3
- ☒ River and sea with defences
- ☐ River and sea without defences
- ☐ Surface water
- ☐ None

Time frame

- ☐ Present day
- ☒ Climate change

Annual likelihood of flooding

- ☒ Rivers and sea 1 in 30
- ☐ Rivers 1 in 100, Sea 1 in 200
- ☐ Rivers and sea 1 in 1000

Key



Flood extent



Report area

Turners Hill Road

Get a boundary report

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Datasets

☐ Flood zones 2 and 3

☒ River and sea with defences

☐ River and sea without defences

☐ Surface water

☐ None

Time frame

☐ Present day

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Annual likelihood of flooding

☐ Rivers and sea 1 in 30

☒ Rivers 1 in 100, Sea 1 in 200

☐ Rivers and sea 1 in 1000

 Search

Key



Flood extent



Report area

Turners Hill Road

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Datasets

- ☐ Flood zones 2 and 3
- ☒ River and sea with defences
- ☐ River and sea without defences
- ☐ Surface water
- ☐ None

Time frame

- ☐ Present day
- ☒ Climate change

Annual likelihood of flooding

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- ☐ Rivers 1 in 100, Sea 1 in 200
- ☒ Rivers and sea 1 in 1000

 Search

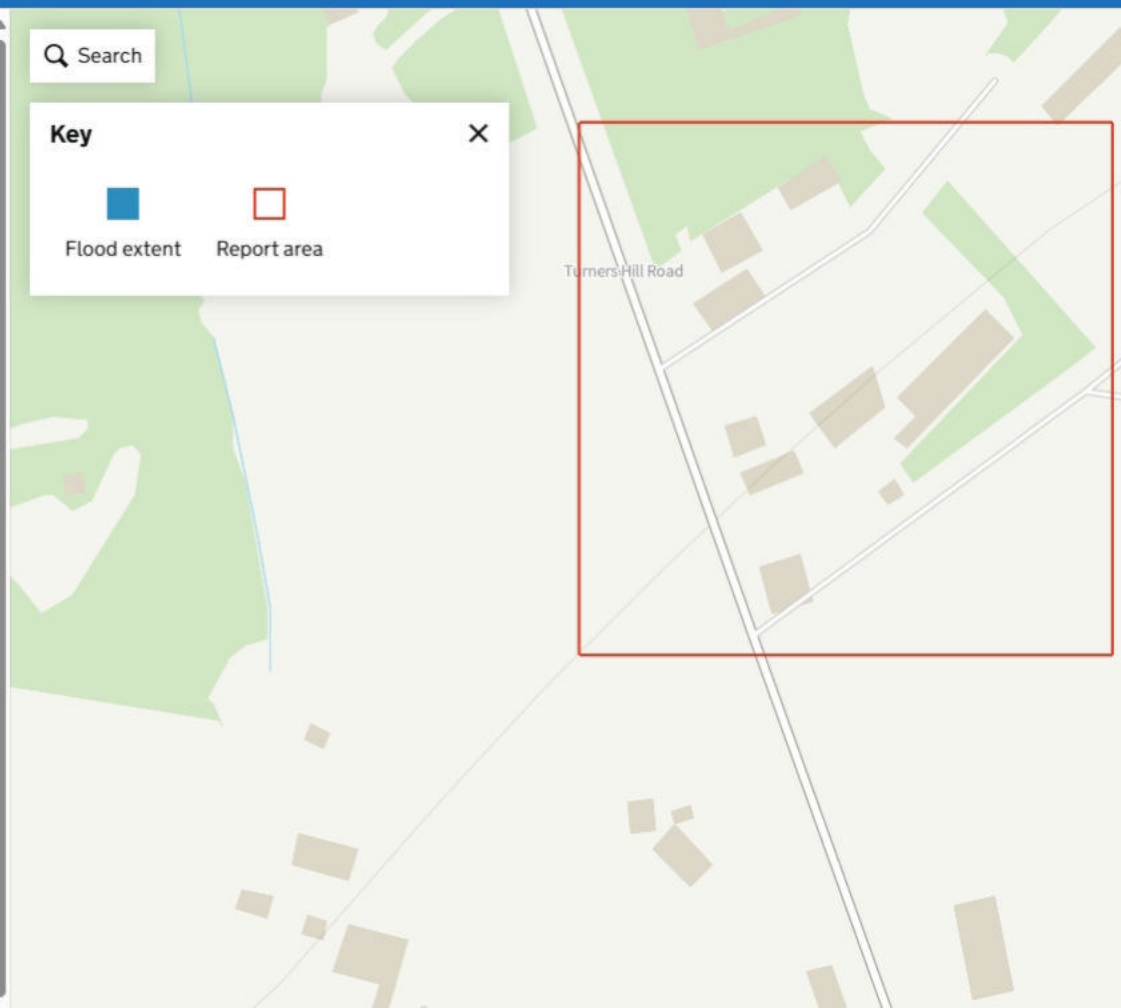
Key



Flood extent



Report area



Get a boundary report

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Datasets

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- ☐ River and sea with defences
- ☒ River and sea without defences
- ☐ Surface water
- ☐ None

Time frame

- ☒ Present day
- ☐ Climate change

Annual likelihood of flooding

- ☒ Rivers 1 in 100, Sea 1 in 200
- ☐ Rivers and sea 1 in 1000

 Search

Key



Flood extent



Report area

Turners Hill Road

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Datasets

☐ Flood zones 2 and 3

☐ River and sea with defences

☒ River and sea without defences

☐ Surface water

☐ None

Time frame

☒ Present day

☐ Climate change

Annual likelihood of flooding

☐ Rivers 1 in 100, Sea 1 in 200

☒ Rivers and sea 1 in 1000

 Search

Key



Flood extent



Report area

Turners Hill Road

Get a boundary report

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Datasets

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- ☐ River and sea with defences
- ☒ River and sea without defences
- ☐ Surface water
- ☐ None

Time frame

- ☐ Present day
- ☒ Climate change

Annual likelihood of flooding

- ☒ Rivers 1 in 100, Sea 1 in 200
- ☐ Rivers and sea 1 in 1000

 Search

Key



Flood extent



Report area

Turners Hill Road

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- ☐ River and sea with defences
- ☒ River and sea without defences
- ☐ Surface water
- ☐ None

Time frame

- ☐ Present day
- ☒ Climate change

Annual likelihood of flooding

- ☐ Rivers 1 in 100, Sea 1 in 200
- ☒ Rivers and sea 1 in 1000

 Search

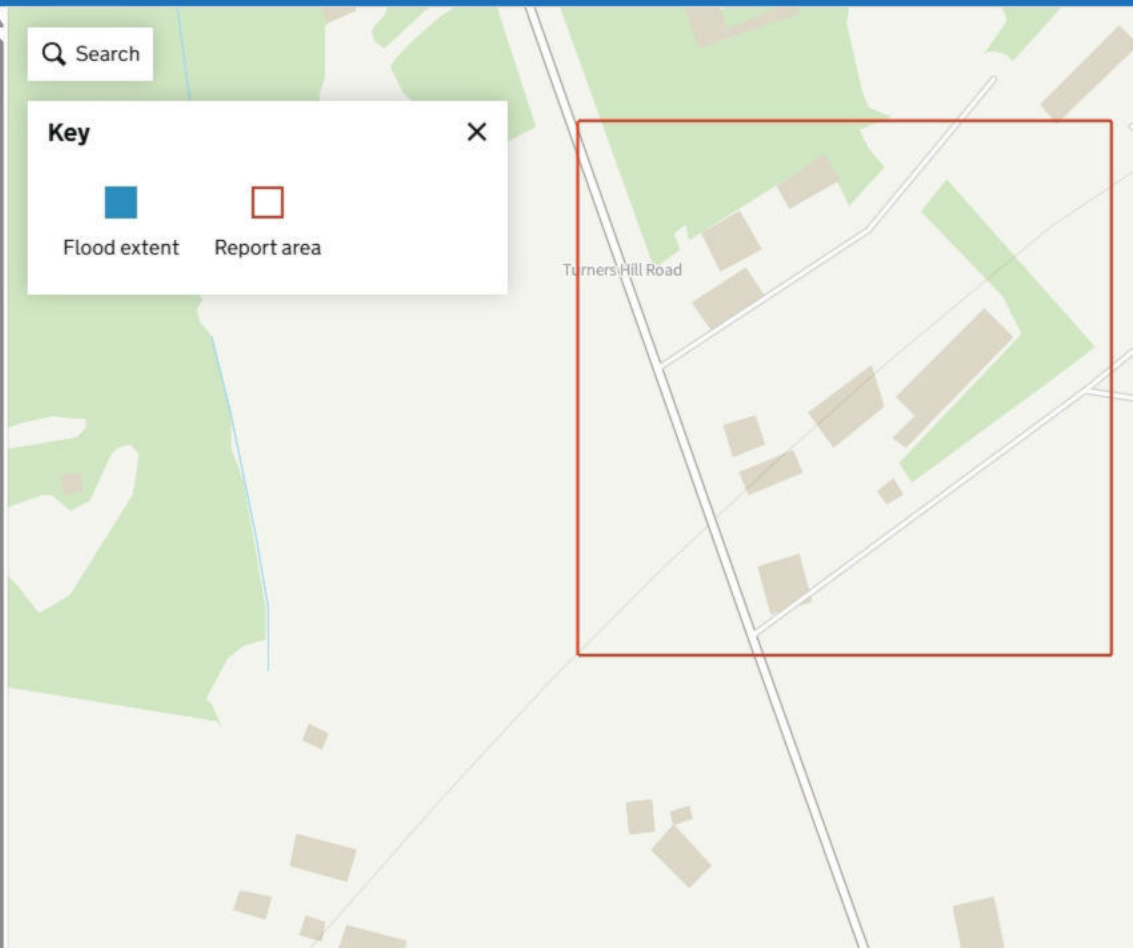
Key



Flood extent



Report area



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Datasets

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 Search

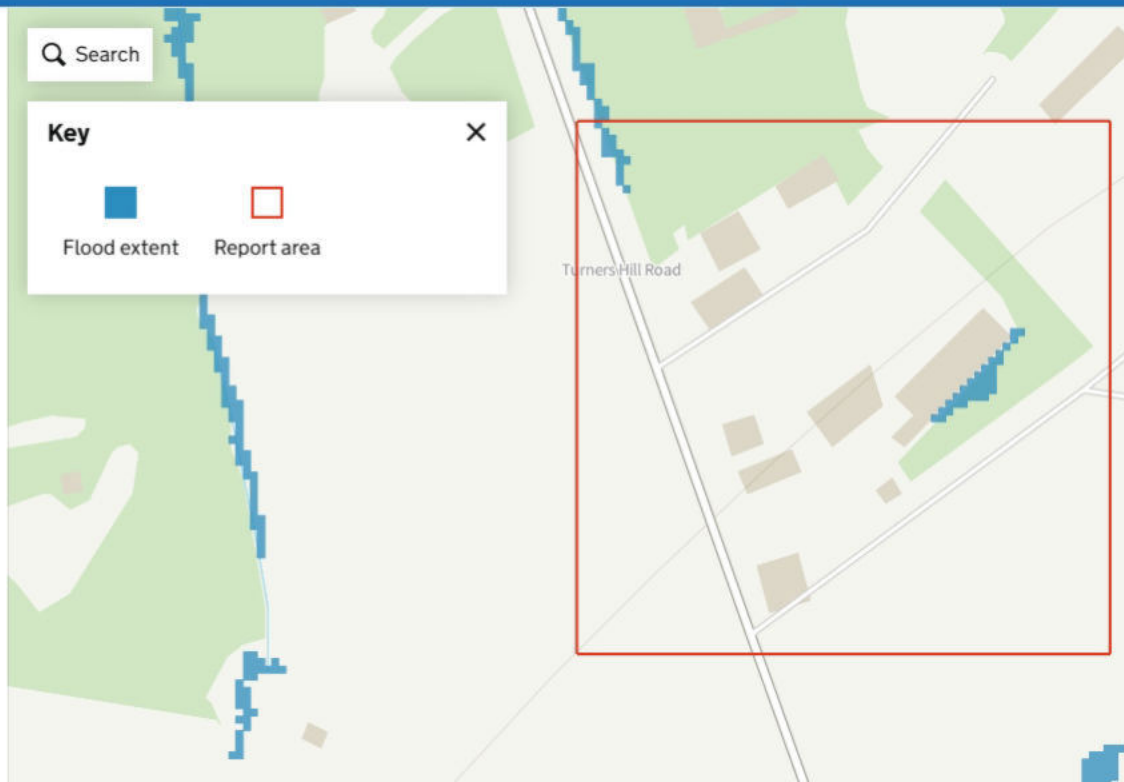
Key



Flood extent



Report area



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 Search

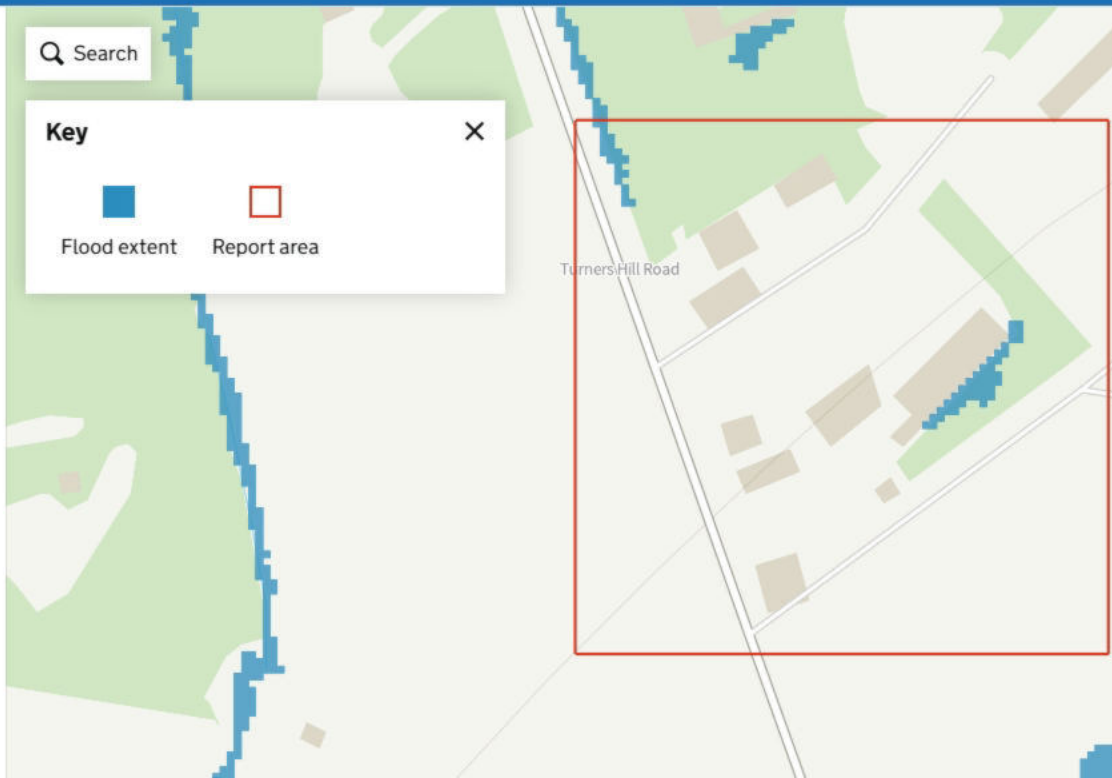
Key



Flood extent



Report area



Get a boundary report

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Datasets

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- ☐ River and sea with defences
- ☐ River and sea without defences
- ☒ Surface water
- ☐ None

Annual likelihood of flooding

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 Search

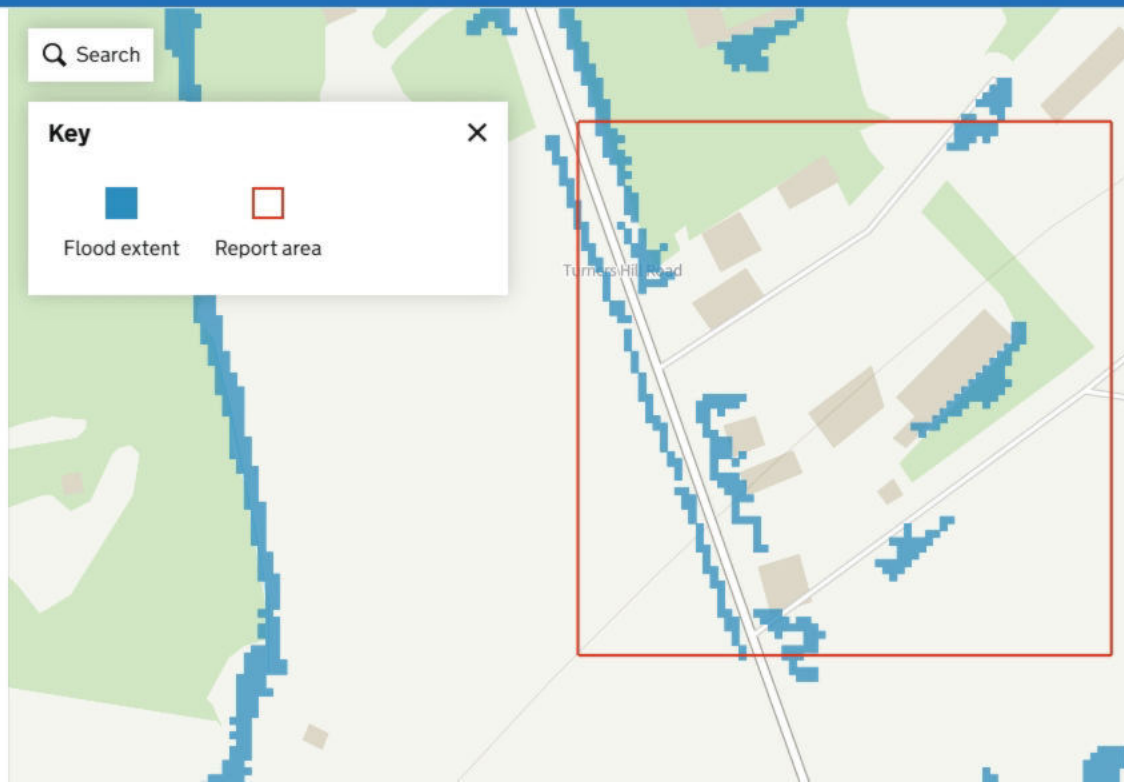
Key



Flood extent



Report area



Appendix F Wallingford Greenfield Run-off Calculations

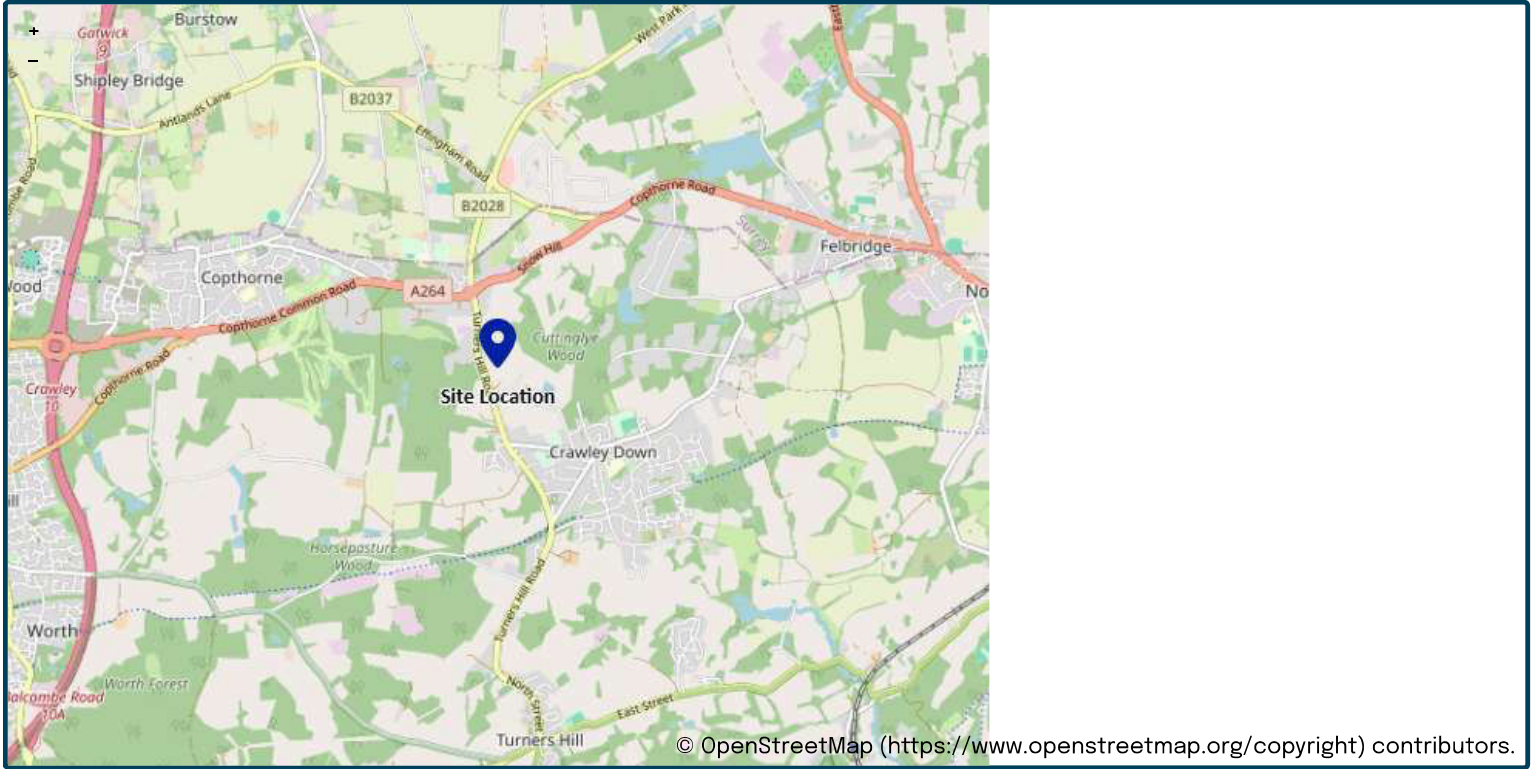
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015).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

Project details

Date	26/03/2025
Calculated by	S Burnett
Reference	D2348 Steton Works
Model version	0.6.5

Location

Site name	D2348 Steton Works
Site location	Turners Hill Road, Crawley Down



Site easting	533753
Site northing	138409

Site details

Total site area (ha)	0.2780	ha
----------------------	-------------------------------------	----

Greenfield runoff

Method

Method	IH124		
	<u>My value</u>	☐	<u>Map value</u>
SAAR (mm)	819mm		819
How should SPR be derived?	WRAP soil type		
WRAP soil type	4	☐	4
SPR	0.47	☐	0.47
QBar (IH124) (l/s)	1.6l/s		

Growth curve factors

	<u>My value</u>	☐	<u>Map value</u>
Hydrological region	6		6
1 year growth factor	0.85		
2 year growth factor	0.88		
10 year growth factor	1.62		
30 year growth factor	2.3		
100 year growth factor	3.19		
200 year growth factor	3.74		

Results

Method	IH124
Flow rate 1 year (l/s)	1.4l/s
Flow rate 2 year (l/s)	1.4l/s
Flow rate 10 years (l/s)	2.6l/s
Flow rate 30 years (l/s)	3.7l/s
Flow rate 100 years (l/s)	5.1l/s
Flow rate 200 years (l/s)	6l/s

Disclaimer

This report was produced using the Greenfield runoff rate estimation tool (0.6.5) developed by HR Wallingford and available at uksuds.com (<https://www.uksubs.com/>).

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Appendix G Causeway Flow Existing Surface Water Drainage Calculations

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Width (mm)	Easting (m)	Northing (m)	Depth (m)
Ex. MH7	0.036	5.00	111.480	450		533736.783	138382.007	0.650
Ex. MH6			111.510	1200		533737.515	138405.816	1.200
Ex. MH5	0.066	5.00	111.490	750	675	533751.419	138416.073	1.000
Ex. MH4			111.490	750	675	533751.780	138417.031	1.010
Ex. MH3			111.480	1200		533750.776	138419.788	1.030
Ex. MH2			110.200	750	675	533683.387	138392.097	0.990
Ex. MH1			110.534	750	675	533708.326	138405.813	1.000
Ex. MH1A			110.725	750	675	533722.150	138418.158	0.803
Outfall			110.050			533678.244	138389.210	2.110

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	Ex. MH7	Ex. MH5	37.077	0.600	110.830	110.490	0.340	109.1	100	5.84	50.0
1.001	Ex. MH5	Ex. MH4	1.024	0.600	110.490	110.480	0.010	102.4	100	5.86	50.0
1.002	Ex. MH4	Ex. MH3	2.934	0.600	110.480	110.450	0.030	97.8	100	5.93	50.0
1.003	Ex. MH3	Ex. MH6	19.263	0.600	110.450	110.310	0.140	137.6	100	6.42	49.5
1.004	Ex. MH6	Ex. MH1A	19.708	0.600	110.310	109.922	0.388	50.8	100	6.72	48.5
1.005	Ex. MH1A	Ex. MH1	18.534	0.600	109.922	109.534	0.388	47.8	100	7.00	47.5
1.006	Ex. MH1	Ex. MH2	28.462	0.600	109.534	109.210	0.324	87.8	100	7.57	45.8
1.007	Ex. MH2	Outfall	5.898	0.600	109.210	107.940	1.270	4.6	100	7.60	45.7

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	0.736	5.8	6.5	0.550	0.900	0.036	0.0
1.001	0.760	6.0	18.4	0.900	0.910	0.102	0.0
1.002	0.777	6.1	18.4	0.910	0.930	0.102	0.0
1.003	0.654	5.1	18.3	0.930	1.100	0.102	0.0
1.004	1.084	8.5	17.9	1.100	0.703	0.102	0.0
1.005	1.118	8.8	17.5	0.703	0.900	0.102	0.0
1.006	0.821	6.4	16.9	0.900	0.890	0.102	0.0
1.007	3.613	28.4	16.8	0.890	2.010	0.102	0.0

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	37.077	109.1	100	Circular	111.480	110.830	0.550	111.490	110.490	0.900
1.001	1.024	102.4	100	Circular	111.490	110.490	0.900	111.490	110.480	0.910
1.002	2.934	97.8	100	Circular	111.490	110.480	0.910	111.480	110.450	0.930
1.003	19.263	137.6	100	Circular	111.480	110.450	0.930	111.510	110.310	1.100
1.004	19.708	50.8	100	Circular	111.510	110.310	1.100	110.725	109.922	0.703
1.005	18.534	47.8	100	Circular	110.725	109.922	0.703	110.534	109.534	0.900
1.006	28.462	87.8	100	Circular	110.534	109.534	0.900	110.200	109.210	0.890
1.007	5.898	4.6	100	Circular	110.200	109.210	0.890	110.050	107.940	2.010

Link	US Node	Dia (mm)	Width (mm)	Node Type	MH Type	DS Node	Dia (mm)	Width (mm)	Node Type	MH Type
1.000	Ex. MH7	450		Manhole	Adoptable	Ex. MH5	750	675	Manhole	Adoptable
1.001	Ex. MH5	750	675	Manhole	Adoptable	Ex. MH4	750	675	Manhole	Adoptable
1.002	Ex. MH4	750	675	Manhole	Adoptable	Ex. MH3	1200		Manhole	Adoptable
1.003	Ex. MH3	1200		Manhole	Adoptable	Ex. MH6	1200		Manhole	Adoptable
1.004	Ex. MH6	1200		Manhole	Adoptable	Ex. MH1A	750	675	Manhole	Adoptable
1.005	Ex. MH1A	750	675	Manhole	Adoptable	Ex. MH1	750	675	Manhole	Adoptable
1.006	Ex. MH1	750	675	Manhole	Adoptable	Ex. MH2	750	675	Manhole	Adoptable
1.007	Ex. MH2	750	675	Manhole	Adoptable	Outfall			Junction	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections	Link	IL (m)	Dia (mm)
Ex. MH7	533736.783	138382.007	111.480	0.650	450					
							0	1.000	110.830	100
Ex. MH6	533737.515	138405.816	111.510	1.200	1200			1	1.003	110.310
							0	1.004	110.310	100
Ex. MH5	533751.419	138416.073	111.490	1.000	750	675		1	1.000	110.490
							0	1.001	110.490	100
Ex. MH4	533751.780	138417.031	111.490	1.010	750	675		1	1.001	110.480
							0	1.002	110.480	100
Ex. MH3	533750.776	138419.788	111.480	1.030	1200			1	1.002	110.450
							0	1.003	110.450	100
Ex. MH2	533683.387	138392.097	110.200	0.990	750	675		1	1.006	109.210
							0	1.007	109.210	100
Ex. MH1	533708.326	138405.813	110.534	1.000	750	675		1	1.005	109.534
							0	1.006	109.534	100

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections	Link	IL (m)	Dia (mm)	
Ex. MH1A	533722.150	138418.158	110.725	0.803	750	675		1	1.004	109.922	100
								0	1.005	109.922	100
Outfall	533678.244	138389.210	110.050	2.110				1	1.007	107.940	100

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	1.000	Drain Down Time (mins)	240	Check Discharge Volume	x
Winter CV	1.000	Additional Storage (m³/ha)	0.0		

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 %)
2	0	0	0
10	0	0	0
30	0	0	0
100	0	0	0

Results for 2 year Critical Storm Duration. Lowest mass balance: 98.55%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	Ex. MH7	13	111.469	0.639	6.6	0.1016	0.0000	FLOOD RISK
30 minute summer	Ex. MH6	24	110.622	0.312	9.3	0.3527	0.0000	SURCHARGED
15 minute summer	Ex. MH5	13	111.285	0.795	15.5	0.4022	0.0000	FLOOD RISK
15 minute summer	Ex. MH4	13	111.207	0.727	13.4	0.3680	0.0000	FLOOD RISK
15 minute summer	Ex. MH3	14	111.088	0.638	11.3	0.7212	0.0000	SURCHARGED
30 minute summer	Ex. MH2	28	109.246	0.036	7.5	0.0184	0.0000	OK
30 minute summer	Ex. MH1	28	109.894	0.360	7.8	0.1820	0.0000	SURCHARGED
30 minute summer	Ex. MH1A	26	110.233	0.311	8.3	0.1574	0.0000	SURCHARGED
30 minute summer	Outfall	28	107.975	0.035	7.5	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	Ex. MH7	1.000	Ex. MH5	4.3	0.586	0.737	0.2901	10.7
30 minute summer	Ex. MH6	1.004	Ex. MH1A	8.3	1.215	0.981	0.1542	
15 minute summer	Ex. MH5	1.001	Ex. MH4	13.4	1.707	2.238	0.0080	
15 minute summer	Ex. MH4	1.002	Ex. MH3	11.3	1.446	1.853	0.0230	
15 minute summer	Ex. MH3	1.003	Ex. MH6	9.5	1.212	1.848	0.1507	
30 minute summer	Ex. MH2	1.007	Outfall	7.5	2.987	0.263	0.0148	
30 minute summer	Ex. MH1	1.006	Ex. MH2	7.5	1.218	1.159	0.1478	
30 minute summer	Ex. MH1A	1.005	Ex. MH1	7.8	1.023	0.886	0.1450	

Results for 10 year Critical Storm Duration. Lowest mass balance: 98.55%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	Ex. MH7	16	111.480	0.650	12.6	0.1034	4.1104	FLOOD
60 minute winter	Ex. MH6	42	110.870	0.560	9.7	0.6331	0.0000	SURCHARGED
15 minute summer	Ex. MH5	10	111.490	1.000	24.8	0.5060	2.0261	FLOOD
60 minute winter	Ex. MH4	37	111.430	0.950	12.9	0.4806	0.0000	FLOOD RISK
60 minute winter	Ex. MH3	38	111.325	0.875	11.3	0.9899	0.0000	FLOOD RISK
60 minute winter	Ex. MH2	46	109.248	0.038	8.3	0.0194	0.0000	OK
60 minute winter	Ex. MH1	46	110.025	0.491	8.4	0.2484	0.0000	SURCHARGED
60 minute winter	Ex. MH1A	45	110.431	0.509	8.7	0.2573	0.0000	FLOOD RISK
60 minute winter	Outfall	46	107.977	0.037	8.3	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	Ex. MH7	1.000	Ex. MH5	3.7	0.513	0.642	0.2901	
60 minute winter	Ex. MH6	1.004	Ex. MH1A	8.7	1.212	1.025	0.1542	
15 minute summer	Ex. MH5	1.001	Ex. MH4	19.2	2.458	3.224	0.0080	
60 minute winter	Ex. MH4	1.002	Ex. MH3	11.3	1.440	1.846	0.0230	
60 minute winter	Ex. MH3	1.003	Ex. MH6	9.7	1.235	1.883	0.1507	
60 minute winter	Ex. MH2	1.007	Outfall	8.3	3.067	0.291	0.0159	22.9
60 minute winter	Ex. MH1	1.006	Ex. MH2	8.3	1.326	1.280	0.1506	
60 minute winter	Ex. MH1A	1.005	Ex. MH1	8.4	1.068	0.952	0.1450	

Results for 30 year Critical Storm Duration. Lowest mass balance: 98.55%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	Ex. MH7	28	111.480	0.650	9.5	0.1034	7.3954	FLOOD
60 minute winter	Ex. MH6	42	110.895	0.585	9.8	0.6612	0.0000	SURCHARGED
30 minute summer	Ex. MH5	16	111.490	1.000	28.7	0.5060	4.7191	FLOOD
60 minute winter	Ex. MH4	40	111.436	0.956	13.7	0.4839	0.0000	FLOOD RISK
60 minute winter	Ex. MH3	41	111.342	0.892	11.7	1.0083	0.0000	FLOOD RISK
120 minute winter	Ex. MH2	80	109.249	0.039	8.3	0.0195	0.0000	OK
120 minute winter	Ex. MH1	78	110.041	0.507	8.4	0.2565	0.0000	SURCHARGED
120 minute winter	Ex. MH1A	78	110.453	0.531	8.6	0.2689	0.0000	FLOOD RISK
120 minute winter	Outfall	80	107.977	0.037	8.3	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	Ex. MH7	1.000	Ex. MH5	3.8	0.491	0.665	0.2901	38.0
60 minute winter	Ex. MH6	1.004	Ex. MH1A	8.7	1.212	1.027	0.1542	
30 minute summer	Ex. MH5	1.001	Ex. MH4	17.9	2.290	3.004	0.0080	
60 minute winter	Ex. MH4	1.002	Ex. MH3	11.7	1.500	1.922	0.0230	
60 minute winter	Ex. MH3	1.003	Ex. MH6	9.8	1.259	1.919	0.1507	
120 minute winter	Ex. MH2	1.007	Outfall	8.3	3.076	0.294	0.0160	
120 minute winter	Ex. MH1	1.006	Ex. MH2	8.3	1.339	1.295	0.1510	
120 minute winter	Ex. MH1A	1.005	Ex. MH1	8.4	1.071	0.955	0.1450	

Results for 100 year Critical Storm Duration. Lowest mass balance: 98.55%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	Ex. MH7	25	111.480	0.650	11.9	0.1034	11.3727	FLOOD
120 minute winter	Ex. MH6	74	110.910	0.600	9.4	0.6782	0.0000	SURCHARGED
30 minute summer	Ex. MH5	15	111.490	1.000	36.7	0.5060	8.4231	FLOOD
120 minute winter	Ex. MH4	74	111.438	0.958	11.7	0.4850	0.0000	FLOOD RISK
120 minute winter	Ex. MH3	74	111.347	0.897	10.5	1.0141	0.0000	FLOOD RISK
120 minute winter	Ex. MH2	78	109.249	0.039	8.4	0.0196	0.0000	OK
120 minute winter	Ex. MH1	78	110.050	0.516	8.4	0.2609	0.0000	SURCHARGED
120 minute winter	Ex. MH1A	76	110.467	0.545	8.7	0.2756	0.0000	FLOOD RISK
120 minute winter	Outfall	78	107.977	0.037	8.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	Ex. MH7	1.000	Ex. MH5	3.7	0.483	0.634	0.2901	
120 minute winter	Ex. MH6	1.004	Ex. MH1A	8.7	1.195	1.018	0.1542	
30 minute summer	Ex. MH5	1.001	Ex. MH4	17.1	2.186	2.867	0.0080	
120 minute winter	Ex. MH4	1.002	Ex. MH3	10.5	1.347	1.726	0.0230	
120 minute winter	Ex. MH3	1.003	Ex. MH6	9.4	1.200	1.828	0.1507	
120 minute winter	Ex. MH2	1.007	Outfall	8.4	3.081	0.296	0.0161	42.2
120 minute winter	Ex. MH1	1.006	Ex. MH2	8.4	1.345	1.302	0.1511	
120 minute winter	Ex. MH1A	1.005	Ex. MH1	8.4	1.075	0.958	0.1450	

Appendix H Site 3D Proposed Surface Water Drainage Calculations

Network Details

Manhole Schedule

Manhole	Catchment Area (ha)	Diameter (m)	Type	CL (m)	IL (m)	Depth To Soffit (m)	Easting (m)	Northing (m)
S1	0.000	1.350	Type C	111.488	110.137	1.200	533750.427	138387.729
S2	0.000	1.350	Type C	111.459	110.017	1.291	533742.723	138396.929
S3	0.000	1.350	Type C	111.278	109.856	1.272	533735.904	138411.529
S4	0.000	1.350	Type C	111.167	109.784	1.232	533731.253	138417.014
S5	0.000	1.350	Type C	110.972	109.622	1.200	533721.038	138418.411
S45	0.002	0.450	Unknown	110.575	109.975	0.450	533707.146	138409.437
S46	0.000	1.350	Unknown	110.518	109.938	0.430	533701.564	138404.761
S44	0.115	1.350	Unknown	110.420	109.690	0.580	533703.887	138401.131
S6	0.011	1.350	Type C	110.378	109.028	1.200	533698.913	138400.368
S8	0.002	0.450	Unknown	110.472	109.872	0.450	533698.348	138402.941
S9	0.000	1.350	Unknown	110.300	109.720	0.430	533692.802	138399.076
S7	0.000	1.350	Type C	110.047	108.697	1.200	533684.401	138393.555
S47	0.000	1.350	Type C	-999.000	108.608	-1107.758	533678.530	138391.378

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Shape	Dimension (m)	Length (m)	Gradient (1:x)	Roughness (mm)	US Depth To Soffit (m)	DS Depth To Soffit (m)
1.000	S1	110.137	S2	110.018	Circ	0.15mØ	12.000	100.0	0.600	1.200	1.291
1.001	S2	110.017	S3	109.856	Circ	0.15mØ	16.114	100.0	0.600	1.291	1.272
1.002	S3	109.856	S4	109.784	Circ	0.15mØ	7.192	100.0	0.600	1.272	1.232
1.003	S4	109.784	S5	109.622	Circ	0.15mØ	10.310	63.3	0.600	1.232	1.200
1.004	S5	109.622	S6	109.028	Circ	0.15mØ	28.550	48.1	0.600	1.200	1.200
2.000	S45	109.975	S46	109.938	Circ	0.15mØ	7.282	198.4	0.600	0.450	0.430
2.001	S46	109.938	S6	109.028	Circ	0.15mØ	5.131	5.6	0.600	0.430	1.200
3.000	S44	109.690	S6	109.028	Circ	0.15mØ	5.032	7.6	0.600	0.580	1.200
1.005	S6	109.028	S7	108.697	Circ	0.15mØ	16.032	48.4	0.600	1.200	1.200
4.000	S8	109.872	S9	109.720	Circ	0.15mØ	6.760	44.4	0.600	0.450	0.430
4.001	S9	109.720	S7	108.697	Circ	0.15mØ	10.053	9.8	0.600	0.430	1.200
1.006	S7	108.697	S47	108.608	Circ	0.15mØ	6.261	70.0	0.600	1.200	-1107.758

Permeable Paving Schedule

Permeable Paving	Assigned Manhole	Effective Storage Volume (m3)	CL (m)	IL (m)	Storage Infil Rate (m/hr)	Safety Factor	Easting (m)	Northing (m)
Permeable Paving 2	S45	2.125	110.575	109.995	0.00000000	2.00	533704.604	138407.573
Permeable Paving 1	S44	102.460	110.420	109.690	0.00000000	2.00	533744.123	138397.337
Permeable Paving 3	S8	2.101	110.472	109.892	0.00000000	2.00	533697.069	138401.949

Outfall Details

Outfall Manhole S47 : Free Discharge

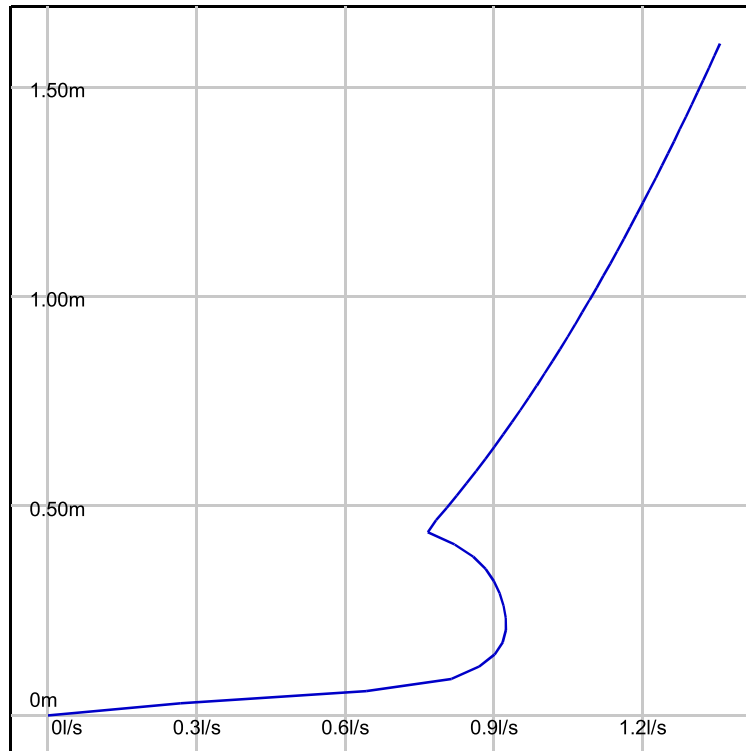
Flow Control Details

Controls within Manhole S6

Hydro-Brake® Optimum Control at Manhole S6

Model Ref	Design Depth (m)	Design Flow (l/s)	Depth Above Invert (m)	FF Head (m)	FF Flow (l/s)	KF Head (m)	KF Flow (l/s)
SHE-0049-1250-1350-1250	1.350	1.250	0.000	0.216	0.925	0.438	0.763

Hydro-Brake® Optimum Control at S6

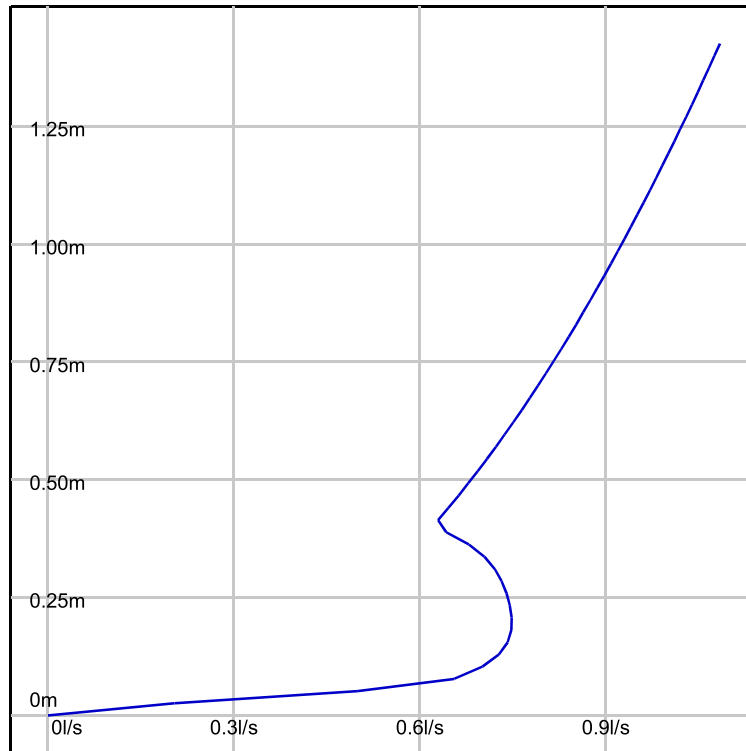


Controls within Manhole S7

Hydro-Brake® Optimum Control at Manhole S7

Model Ref	Design Depth (m)	Design Flow (l/s)	Depth Above Invert (m)	FF Head (m)	FF Flow (l/s)	KF Head (m)	KF Flow (l/s)
SHE-0045-1000-1200-1000	1.200	1.000	0.000	0.197	0.748	0.401	0.620

Hydro-Brake® Optimum Control at S7



Simulation Settings

FEH2022 (point): Filename=FEH_Point_Descriptors_533738_138413_v5_0_1.xml

Summer (Cv: 1.00), Winter (Cv: 1.00)

Global Time of Entry: 5.0 mins

Durations (mins): 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080

Return Periods (yrs) + Climate Change: (2, +0%), (10, +0%), (30, +35%), (100, +40%)

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
2Yr 15Min Winter	31.821	0.00	1.54	30Yr+35% 15Min Summer	111.814	0.00	3.00
2Yr 15Min Summer	31.821	0.00	1.65	30Yr+35% 15Min Winter	111.814	0.00	3.03
2Yr 30Min Winter	20.910	0.00	5.77	30Yr+35% 30Min Summer	74.280	0.00	2.65
2Yr 30Min Summer	20.910	0.00	5.76	30Yr+35% 30Min Winter	74.280	0.00	2.64
2Yr 60Min Winter	13.200	0.00	5.22	30Yr+35% 60Min Summer	47.209	0.00	2.36
2Yr 60Min Summer	13.200	0.00	5.20	30Yr+35% 60Min Winter	47.209	0.00	2.35
2Yr 120Min Winter	9.158	0.00	4.35	30Yr+35% 120Min Summer	28.415	0.00	2.11
2Yr 120Min Summer	9.158	0.00	4.38	30Yr+35% 120Min Winter	28.415	0.00	2.11
2Yr 180Min Winter	7.302	0.00	3.98	30Yr+35% 180Min Summer	20.954	0.00	1.94
2Yr 180Min Summer	7.302	0.00	3.97	30Yr+35% 180Min Winter	20.954	0.00	1.95
2Yr 240Min Winter	6.027	0.00	3.56	30Yr+35% 240Min Summer	16.927	0.00	1.81
2Yr 240Min Summer	6.027	0.00	3.57	30Yr+35% 240Min Winter	16.927	0.00	1.82
2Yr 360Min Summer	4.594	0.00	1.26	30Yr+35% 360Min Summer	12.425	0.00	1.60
2Yr 360Min Winter	4.594	0.00	1.04	30Yr+35% 360Min Winter	12.425	0.00	1.61
2Yr 480Min Winter	3.774	0.00	0.00	30Yr+35% 480Min Summer	9.957	0.00	1.43
2Yr 480Min Summer	3.774	0.00	0.00	30Yr+35% 480Min Winter	9.957	0.00	1.44
2Yr 600Min Winter	3.217	0.00	0.00	30Yr+35% 600Min Summer	8.382	0.00	1.29
2Yr 600Min Summer	3.217	0.00	0.00	30Yr+35% 600Min Winter	8.382	0.00	1.29
2Yr 720Min Winter	2.813	0.00	0.00	30Yr+35% 720Min Summer	7.280	0.00	1.16
2Yr 720Min Summer	2.813	0.00	0.00	30Yr+35% 720Min Winter	7.280	0.00	1.17
2Yr 960Min Summer	2.278	0.00	0.00	30Yr+35% 960Min Summer	5.837	0.00	0.94
2Yr 960Min Winter	2.278	0.00	0.00	30Yr+35% 960Min Winter	5.837	0.00	0.96
2Yr 1440Min Summer	1.691	0.00	0.00	30Yr+35% 1440Min Summer	4.294	0.00	0.00
2Yr 1440Min Winter	1.691	0.00	0.00	30Yr+35% 1440Min Winter	4.294	0.00	0.00
2Yr 2160Min Summer	1.267	0.00	0.00	30Yr+35% 2160Min Summer	3.171	0.00	0.00
2Yr 2160Min Winter	1.267	0.00	0.00	30Yr+35% 2160Min Winter	3.171	0.00	0.00
2Yr 2880Min Winter	1.041	0.00	0.00	30Yr+35% 2880Min Summer	2.559	0.00	0.00
2Yr 2880Min Summer	1.041	0.00	0.00	30Yr+35% 2880Min Winter	2.559	0.00	0.00
2Yr 4320Min Summer	0.802	0.00	0.00	30Yr+35% 4320Min Summer	1.900	0.00	0.00
2Yr 4320Min Winter	0.802	0.00	0.00	30Yr+35% 4320Min Winter	1.900	0.00	0.00
2Yr 5760Min Summer	0.676	0.00	0.00	30Yr+35% 5760Min Summer	1.545	0.00	0.00
2Yr 5760Min Winter	0.676	0.00	0.00	30Yr+35% 5760Min Winter	1.545	0.00	0.00
2Yr 7200Min Winter	0.597	0.00	0.00	30Yr+35% 7200Min Summer	1.322	0.00	0.00
2Yr 7200Min Summer	0.597	0.00	0.00	30Yr+35% 7200Min Winter	1.322	0.00	0.00
2Yr 8640Min Summer	0.543	0.00	0.00	30Yr+35% 8640Min Summer	1.169	0.00	-0.01
2Yr 8640Min Winter	0.543	0.00	0.00	30Yr+35% 8640Min Winter	1.169	0.00	0.00
2Yr 10080Min Summer	0.504	0.00	0.00	30Yr+35% 10080Min Summer	1.057	0.00	0.00
2Yr 10080Min Winter	0.504	0.00	0.00	30Yr+35% 10080Min Winter	1.057	0.00	0.00
10Yr 15Min Summer	62.966	0.00	4.27	100Yr+40% 15Min Summer	146.493	0.00	2.63
10Yr 15Min Winter	62.966	0.00	4.33	100Yr+40% 15Min Winter	146.493	0.00	2.65
10Yr 30Min Summer	41.483	0.00	3.66	100Yr+40% 30Min Summer	98.241	0.00	2.33
10Yr 30Min Winter	41.483	0.00	3.67	100Yr+40% 30Min Winter	98.241	0.00	2.33
10Yr 60Min Summer	26.241	0.00	3.22	100Yr+40% 60Min Summer	62.952	0.00	2.16
10Yr 60Min Winter	26.241	0.00	3.24	100Yr+40% 60Min Winter	62.952	0.00	2.16
10Yr 120Min Summer	16.348	0.00	2.79	100Yr+40% 120Min Summer	37.107	0.00	2.00
10Yr 120Min Winter	16.348	0.00	2.78	100Yr+40% 120Min Winter	37.107	0.00	2.00
10Yr 180Min Summer	12.297	0.00	2.47	100Yr+40% 180Min Summer	27.068	0.00	1.88
10Yr 180Min Winter	12.297	0.00	2.47	100Yr+40% 180Min Winter	27.068	0.00	1.88
10Yr 240Min Summer	9.967	0.00	2.25	100Yr+40% 240Min Summer	21.853	0.00	1.78
10Yr 240Min Winter	9.967	0.00	2.25	100Yr+40% 240Min Winter	21.853	0.00	1.79
10Yr 360Min Winter	7.375	0.00	1.93	100Yr+40% 360Min Summer	16.042	0.00	1.61
10Yr 360Min Summer	7.375	0.00	1.93	100Yr+40% 360Min Winter	16.042	0.00	1.62
10Yr 480Min Summer	5.939	0.00	1.86	100Yr+40% 480Min Summer	12.897	0.00	1.46
10Yr 480Min Winter	5.939	0.00	1.87	100Yr+40% 480Min Winter	12.897	0.00	1.47
10Yr 600Min Summer	5.003	0.00	1.71	100Yr+40% 600Min Summer	10.919	0.00	1.32

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
10Yr 600Min Winter	5.003	0.00	1.72	100Yr+40% 600Min Winter	10.919	0.00	1.33
10Yr 720Min Winter	4.341	0.00	0.63	100Yr+40% 720Min Summer	9.544	0.00	1.21
10Yr 720Min Summer	4.341	0.00	0.68	100Yr+40% 720Min Winter	9.544	0.00	1.21
10Yr 960Min Summer	3.474	0.00	0.00	100Yr+40% 960Min Summer	7.736	0.00	0.98
10Yr 960Min Winter	3.474	0.00	0.00	100Yr+40% 960Min Winter	7.736	0.00	1.14
10Yr 1440Min Summer	2.546	0.00	0.00	100Yr+40% 1440Min Summer	5.767	0.00	0.68
10Yr 1440Min Winter	2.546	0.00	0.00	100Yr+40% 1440Min Winter	5.767	0.00	0.68
10Yr 2160Min Summer	1.878	0.00	0.00	100Yr+40% 2160Min Summer	4.295	0.00	0.00
10Yr 2160Min Winter	1.878	0.00	0.00	100Yr+40% 2160Min Winter	4.295	0.00	0.00
10Yr 2880Min Summer	1.519	0.00	0.00	100Yr+40% 2880Min Summer	3.469	0.00	0.00
10Yr 2880Min Winter	1.519	0.00	0.00	100Yr+40% 2880Min Winter	3.469	0.00	0.00
10Yr 4320Min Summer	1.140	0.00	0.00	100Yr+40% 4320Min Summer	2.552	0.00	0.00
10Yr 4320Min Winter	1.140	0.00	0.00	100Yr+40% 4320Min Winter	2.552	0.00	0.00
10Yr 5760Min Summer	0.939	0.00	0.00	100Yr+40% 5760Min Summer	2.043	0.00	0.00
10Yr 5760Min Winter	0.939	0.00	0.00	100Yr+40% 5760Min Winter	2.043	0.00	0.00
10Yr 7200Min Summer	0.814	0.00	0.00	100Yr+40% 7200Min Summer	1.724	0.00	0.00
10Yr 7200Min Winter	0.814	0.00	0.00	100Yr+40% 7200Min Winter	1.724	0.00	0.00
10Yr 8640Min Winter	0.729	0.00	0.00	100Yr+40% 8640Min Summer	1.504	0.00	0.00
10Yr 8640Min Summer	0.729	0.00	0.00	100Yr+40% 8640Min Winter	1.504	0.00	0.00
10Yr 10080Min Summer	0.666	0.00	0.00	100Yr+40% 10080Min Winter	1.342	0.00	0.00
10Yr 10080Min Winter	0.666	0.00	0.00	100Yr+40% 10080Min Summer	1.342	0.00	0.00

Simulation Results

Return Period Yrs: 2.0

Climate Change %: 0

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S1	-	0	110.137	0.000	0.000		OK
S2	-	0	110.017	0.000	0.000		OK
S3	-	0	109.856	0.000	0.000		OK
S4	480 min Summer	351	109.798	0.013	0.000		OK
S5	480 min Summer	354	109.798	0.176	0.001		Surcharged
S45	120 min Summer	66	109.986	0.012	0.131		OK
S46	120 min Summer	66	109.943	0.005	0.131		OK
S44	480 min Summer	354	109.798	0.107	0.036		OK
S6	480 min Summer	354	109.798	0.769	0.799		Surcharged
S8	120 min Summer	66	109.880	0.008	0.130		OK
S9	120 min Summer	66	109.725	0.005	0.131		OK
S7	960 min Winter	737	109.638	0.942	0.892		Surcharged
S47	960 min Winter	737	108.628	0.021	0.892		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	0	S1	S2	0.000	0.000	0.000	0.000	OK
1.001	15 min Winter	0	S2	S3	0.000	0.000	0.000	0.000	OK
1.002	480 min Summer	351	S3	S4	0.007	0.000	0.000	0.000	OK
1.003	480 min Summer	351	S4	S5	0.082	0.003	0.026	0.001	OK
1.004	360 min Summer	649	S5	S6	0.150	0.017	0.163	0.006	Surcharged
2.000	120 min Summer	66	S45	S46	0.008	0.349	0.131	0.010	OK
2.001	120 min Summer	66	S46	S6	0.077	0.014	0.131	0.002	OK
3.000	480 min Summer	354	S44	S6	0.129	0.236	2.580	0.040	OK
1.005	240 min Summer	185	S6	S7	0.150	0.320	0.955	0.037	Surcharged
4.000	120 min Summer	66	S8	S9	0.007	0.471	0.131	0.005	OK
4.001	180 min Summer	96	S9	S7	0.077	0.012	0.112	0.002	OK
1.006	960 min Winter	737	S7	S47	0.021	0.600	0.892	0.042	OK

Permeable Paving Storage

Permeable Paving	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
Permeable Paving 2	120 min Summer	65	110.004	0.009	0.139		OK
Permeable Paving 1	480 min Summer	352	109.798	0.108	0.712		OK
Permeable Paving 3	60 min Summer	36	109.901	0.009	0.134		OK

Return Period Yrs: 10.0

Climate Change %: 0

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S1	-	0	110.137	0.000	0.000		OK
S2	-	0	110.017	0.000	0.000		OK
S3	480 min Winter	424	109.903	0.047	0.017		OK
S4	480 min Winter	420	109.903	0.119	0.011		OK
S5	480 min Winter	433	109.903	0.281	0.027		Surcharged
S45	30 min Summer	23	109.993	0.018	0.338		OK
S46	30 min Summer	23	109.945	0.007	0.341		OK
S44	480 min Winter	446	109.902	0.212	0.106		Surcharged
S6	480 min Winter	428	109.903	0.875	0.698		Surcharged
S8	30 min Summer	22	109.885	0.012	0.340		OK
S9	30 min Summer	23	109.728	0.008	0.337		OK
S7	960 min Winter	831	109.702	1.005	0.919		Surcharged
S47	960 min Winter	831	108.629	0.021	0.919		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Summer	0	S1	S2	0.000	0.000	0.000	0.000	OK
1.001	480 min Winter	424	S2	S3	0.023	0.000	0.000	0.000	OK
1.002	480 min Winter	420	S3	S4	0.083	0.013	0.077	0.004	OK
1.003	480 min Winter	728	S4	S5	0.134	0.016	0.205	0.009	OK
1.004	240 min Winter	456	S5	S6	0.150	0.023	0.399	0.016	Surcharged
2.000	30 min Summer	23	S45	S46	0.013	0.478	0.341	0.027	OK
2.001	30 min Summer	23	S46	S6	0.079	0.036	0.341	0.005	OK
3.000	120 min Winter	85	S44	S6	0.150	0.352	3.745	0.058	Surcharged
1.005	120 min Summer	108	S6	S7	0.150	0.413	0.990	0.039	Surcharged
4.000	30 min Summer	22	S8	S9	0.010	0.633	0.339	0.013	OK
4.001	60 min Summer	37	S9	S7	0.079	0.037	0.316	0.006	OK
1.006	960 min Winter	831	S7	S47	0.021	0.605	0.919	0.043	OK

Permeable Paving Storage

Permeable Paving	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
Permeable Paving 2	30 min Summer	22	110.012	0.018	0.342		OK
Permeable Paving 1	480 min Winter	426	109.903	0.213	0.863		OK
Permeable Paving 3	30 min Summer	22	109.910	0.017	0.338		OK

Return Period Yrs: 30.0

Climate Change %: 35

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S1	-	0	110.137	0.000	0.000		OK
S2	600 min Winter	575	110.112	0.095	0.000		OK
S3	720 min Winter	668	110.112	0.256	0.017		Surcharged
S4	600 min Winter	574	110.112	0.327	0.027		Surcharged
S5	600 min Winter	570	110.112	0.490	0.045		Surcharged
S45	600 min Winter	571	110.112	0.137	0.062		OK
S46	600 min Winter	576	110.112	0.174	0.022		Surcharged
S44	600 min Winter	571	110.112	0.421	0.053		Surcharged
S6	720 min Winter	659	110.112	1.084	0.732		Flood Risk
S8	30 min Summer	21	109.889	0.017	0.616		OK
S9	1440 min Summer	865	109.787	0.067	0.032		OK
S7	1440 min Summer	865	109.787	1.090	0.953		Flood Risk
S47	1440 min Summer	865	108.629	0.021	0.953		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	600 min Winter	575	S1	S2	0.047	0.000	0.000	0.000	OK
1.001	600 min Winter	575	S2	S3	0.122	0.005	0.072	0.004	OK
1.002	960 min Winter	560	S3	S4	0.150	0.008	0.115	0.007	Surcharged
1.003	960 min Summer	1916	S4	S5	0.150	0.024	0.298	0.013	Surcharged
1.004	120 min Summer	56	S5	S6	0.150	0.027	0.468	0.018	Surcharged
2.000	720 min Winter	780	S45	S46	0.144	0.297	0.106	0.008	OK
2.001	480 min Summer	377	S46	S6	0.150	0.037	0.347	0.005	Surcharged
3.000	120 min Winter	64	S44	S6	0.150	0.357	3.803	0.059	Surcharged
1.005	60 min Summer	60	S6	S7	0.150	0.503	1.031	0.040	Surcharged
4.000	1440 min Summer	862	S8	S9	0.036	0.395	0.075	0.003	OK
4.001	1440 min Summer	865	S9	S7	0.109	0.008	0.072	0.001	OK
1.006	1440 min Summer	865	S7	S47	0.022	0.612	0.953	0.045	OK

Permeable Paving Storage

Permeable Paving	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
Permeable Paving 2	600 min Winter	576	110.112	0.117	0.123		OK
Permeable Paving 1	600 min Winter	575	110.112	0.422	0.885		OK
Permeable Paving 3	30 min Summer	21	109.918	0.026	0.608		OK

Return Period Yrs: 100.0

Climate Change %: 40

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S1	960 min Winter	831	110.290	0.152	0.001		Surcharged
S2	960 min Winter	831	110.290	0.272	0.038		Surcharged
S3	960 min Winter	855	110.289	0.433	0.077		Surcharged
S4	960 min Winter	832	110.290	0.505	0.009		Surcharged
S5	960 min Winter	832	110.290	0.668	0.006		Surcharged
S45	960 min Winter	856	110.290	0.315	0.058		Flood Risk
S46	960 min Winter	832	110.289	0.351	0.026		Flood Risk
S44	960 min Winter	858	110.289	0.599	0.930		Flood Risk
S6	960 min Winter	832	110.290	1.261	0.841		Flood Risk
S8	30 min Summer	20	109.892	0.019	0.869		OK
S9	960 min Summer	555	109.828	0.108	0.072		OK
S7	960 min Summer	555	109.828	1.131	0.969		Flood Risk
S47	960 min Summer	555	108.629	0.022	0.969		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	960 min Winter	862	S1	S2	0.150	0.006	0.091	0.005	Surcharged
1.001	720 min Summer	701	S2	S3	0.150	0.007	0.125	0.007	Surcharged
1.002	960 min Winter	858	S3	S4	0.150	0.006	0.110	0.006	Surcharged
1.003	4320 min Summer	4885	S4	S5	0.150	0.025	0.317	0.014	Surcharged
1.004	120 min Winter	49	S5	S6	0.150	0.030	0.527	0.021	Surcharged
2.000	180 min Summer	131	S45	S46	0.150	0.498	0.404	0.032	Surcharged
2.001	180 min Summer	117	S46	S6	0.150	0.041	0.385	0.005	Surcharged
3.000	120 min Winter	59	S44	S6	0.150	0.343	3.645	0.056	Surcharged
1.005	60 min Winter	50	S6	S7	0.150	0.505	1.040	0.041	Surcharged
4.000	960 min Summer	553	S8	S9	0.057	0.445	0.131	0.005	OK
4.001	960 min Summer	555	S9	S7	0.129	0.011	0.115	0.002	OK
1.006	960 min Summer	555	S7	S47	0.022	0.615	0.969	0.046	OK

Permeable Paving Storage

Permeable Paving	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
Permeable Paving 2	960 min Winter	856	110.289	0.295	0.012		OK
Permeable Paving 1	960 min Winter	832	110.290	0.600	0.926		OK
Permeable Paving 3	30 min Summer	20	109.925	0.033	0.911		OK